

### 8.3.3 TET 3

#### *Site Coordinates:*

S 28.09226

E 26.73654

#### *Site Description:*

The site comprises an extensive rectangular stone walled-enclosure, which is sub-divided into two main sections. The rectangular shape of the stone-walled enclosure indicates that it dates from the Historic Period rather than the Late Iron Age. It seems more than likely that this rectangular structure was the main cattle enclosure for the original farmstead of John Adamson.

The walls of the structure are in a poor state of preservation. Although the foundations and lower wall sections are still *in situ*, the remainder of these stone walls appear to have been deliberately damaged. Although this is not certain, it is possible that these upper wall sections were bulldozed at an unknown point in time. The presence of vegetation growth on disturbed wall sections indicates that this mechanical disturbance is not a recent event.

Although the exact age of the structure is not presently known, it is certainly older than 60 years and more than likely older than 100 years as well. The extent of the structure is approximately 60m x 60m.

*Site position and impact:* Both the In-Field Pipeline North (HDR1) and In-Field Pipeline (Alt 4) cut through the south-eastern corner of the site.

#### *Current Protection Status:*

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act 25 of 1999. Additionally, in terms of Section 35(4) of the National Heritage Resources Act (25 of 1999), man-made features and artefacts older than 100 years are defined as being archaeological. In the same section, the act also states that such archaeological sites and objects may not be disturbed, altered, modified or destroyed without a suitable permit.

#### *Site Significance:*

The site possesses moderate levels of historic and architectural significance and has the potential to represent a unique tangible remnant of the early history of the farm Adamsonsvlei. The site has a **Generally Protected B – Medium Significance**.



*Figure 66—General view of a section of the site. Scale is in 10cm increments.*



*Figure 67—This view along the southern wall of the structure depicts the disturbance, which had taken place at the site. Although the original foundation of the wall is located on left, the dispersed stones from the actual stone wall itself can be seen on the right. Scale is in 10cm increments.*

#### 8.3.4 TET 4

##### *Site Coordinates:*

S 28.10289

E 26.72654

##### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on both sides of the fence between the farms Adamsonsvlei and Blaauwdrift. The remains of structures and associated rubbish heaps were observed. The site has been abandoned for a number of years and as a result was found to be quite overgrown by vegetation. According to an elderly member of the community still living at Adamsonsvlei further to the north, a cemetery is located in the general surroundings of this site. An intensive walkthrough of the surrounding of the site was made to attempt to locate the cemetery. No evidence for a cemetery was identified within a distance of 100m from the site.

The exact age of the site is not known. However, based on the artefacts observed at the various middens from the site, it is not very old. These middens revealed a significant number of recent and modern items, including plastics. It is therefore quite clear that the site is not older than 60 years. However, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn baby graves are indeed located here.

*Site position and impact:* Both the In-Field Pipeline North (HDR1) and In-Field Pipeline (Alt 4) cut through the south-eastern corner of the site.

##### *Current Protection Status:*

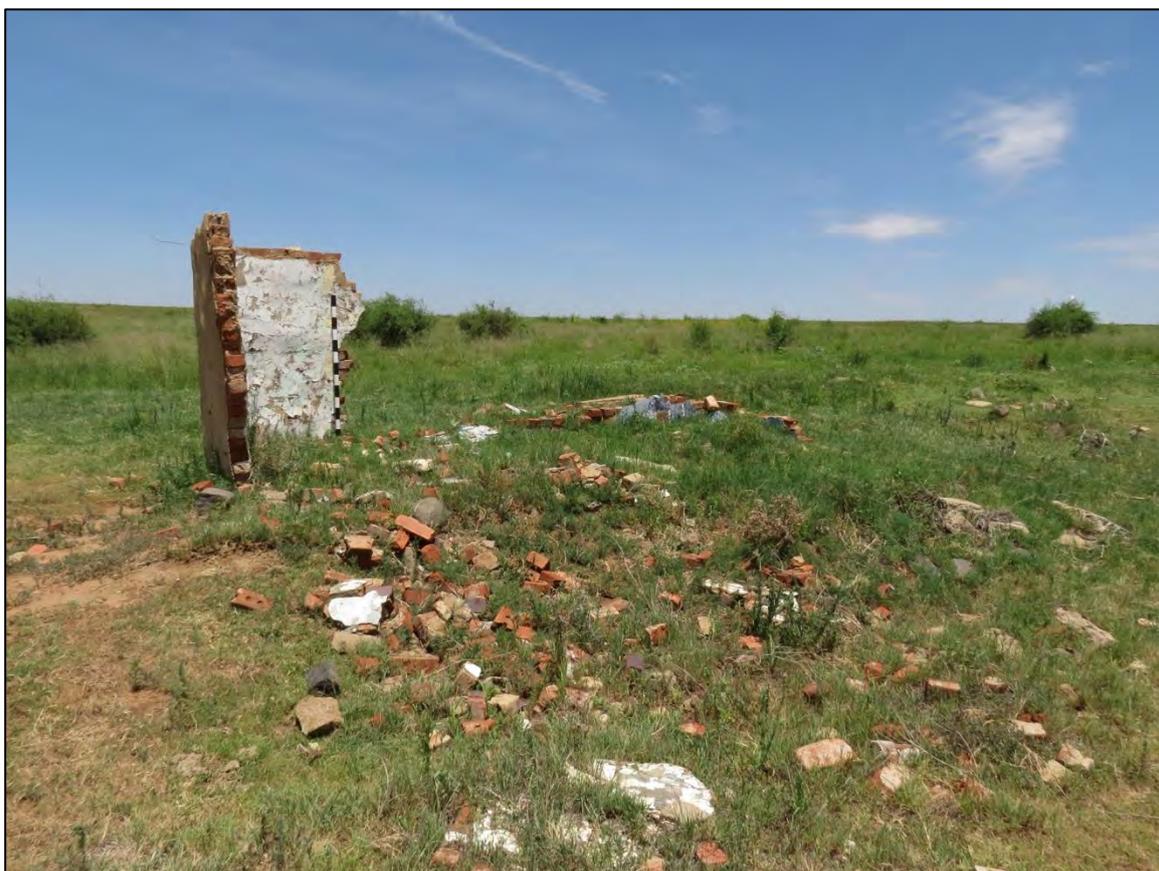
Depending on numerous factors, graves and burial grounds fall under various legislative protections. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

##### *Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of significance. It has a **Generally Protected A – Medium to High Significance**.



*Figure 68—General view of the site. Scale is in 10cm increments.*



*Figure 69—One of the poorly preserved structures from the site. Scale is in 10cm increments.*

### 8.3.5 TET 5

#### *Site Coordinates:*

S 28.11244

E 26.72668

#### *Site Description:*

The site comprises three irregularly shaped stone concentrations associated with a low density scatter of cultural material of different ages. The stone concentrations can presently be viewed as possible graves only. The cultural material observed in proximity to the stone concentrations include Later Stone Age lithics as well as a hammerstone, undecorated potsherds that may be associated with either the Late Iron Age or Historic Period as well as glass artefacts from the Historic Period. The site is located within an agricultural field. As a result, the context of the artefacts observed here is not known.

*Site size:* Approximately 30m x 30m.

*Site position and impact:* The In-Field Pipeline North (HDR1) and In-Field Pipeline (Alt 4) cut through the south site.

#### *Current Protection Status:*

In terms of Section 35(4) of the National Heritage Resources Act (25 of 1999), man-made features and artefacts older than 100 years are defined as being archaeological. In the same section, the act also states that such archaeological sites and objects may not be disturbed, altered, modified or destroyed without a suitable permit.

Graves and burial grounds fall under various legislative protections. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

#### *Site Significance:*

Until such time that the presence of graves at the site has been tested, the three stone concentrations must be viewed as graves. Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The cultural material identified at the site is of low significance.



*Figure 70—One of the stone concentrations identified at the site. Scale is in 10cm increments.*



*Figure 71—The lithics and hammerstone identified at the site. Scale is in 1cm increments.*

### 8.3.6 TET 6

#### *Site Coordinates:*

S 28.11325

E 26.72337

#### *Site Description:*

The site comprises a rectangular stone concentration that is orientated along the east-west axis. The rectangular structure is approximately 1.6m long and 1m wide. Despite the absence of a formal headstone and grave goods, the structure does have the appearance of a grave.

Two irregularly shaped stone concentrations were observed 5m and 8m respectively west of the rectangular stone concentration described first. These stone concentrations may also be graves.

Site size: Approximately 20m x 20m.

*Site position and impact:* The site is located 6m south of the In-Field Pipeline North (HDR1) as well as the In-Field Pipeline (Alt 4).

#### *Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

#### *Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**.



*Figure 72—General view of the rectangular stone concentration at TET 6. Scale is in 10cm increments.*

### 8.3.7 TET 7

#### *Site Coordinates:*

S 28.11344

E 26.72257

#### *Site Description:*

The site comprises a loose pile of stones and headstones. One of these headstones is firmly placed in the ground in an upright position, with the remainder of the headstones that could be observed at the site scattered around. All the headstones from the site were found to be broken.

It is not presently known whether the site represents the original position of a cemetery comprising roughly four graves, or whether disturbed graves from another site had been dumped here. This said, the fact that at least one of the headstone fragments was found to be still firmly placed in the ground, suggest that this site represents the original location of the cemetery.

The following headstones could be identified:

- Loose broken cement headstone on which the name ELISA can still be read. This stone was lying flat and was partially covered by soil;
- Loose upper section of a broken gothic-shaped cement headstone containing the name DICK SWAR (?). The headstone does contain a date of death, but this was illegible;
- Base of broken cement headstone that was still firmly placed in the ground in an upright position. Only the date of death section could be read from the headstone, namely DIED 8 – 9 – 35; and
- Two broken cement headstone fragments found lying next to each other. The following sections could be read from the two headstone fragments: LYDIA...THLAHO 1923...HLOKAHALA...10 SEPTEMBER 1933 ROBALE KA KHOTSO. In terms of this headstone, the only component of the name that could be deciphered is LYDIA. The remaining words have reference to aspects such as Born (Date of Birth), Died (Date of Death) and Rest in Peace. From this it is clear that a 10 year old girl named Lydia was buried here.

It is clear from the dates appearing on two of the headstones, namely 1933 and 1935 that these graves appear to date from the 1930s and are as a result certainly older than 60 years.

Site size: Approximately 10m x 10m.

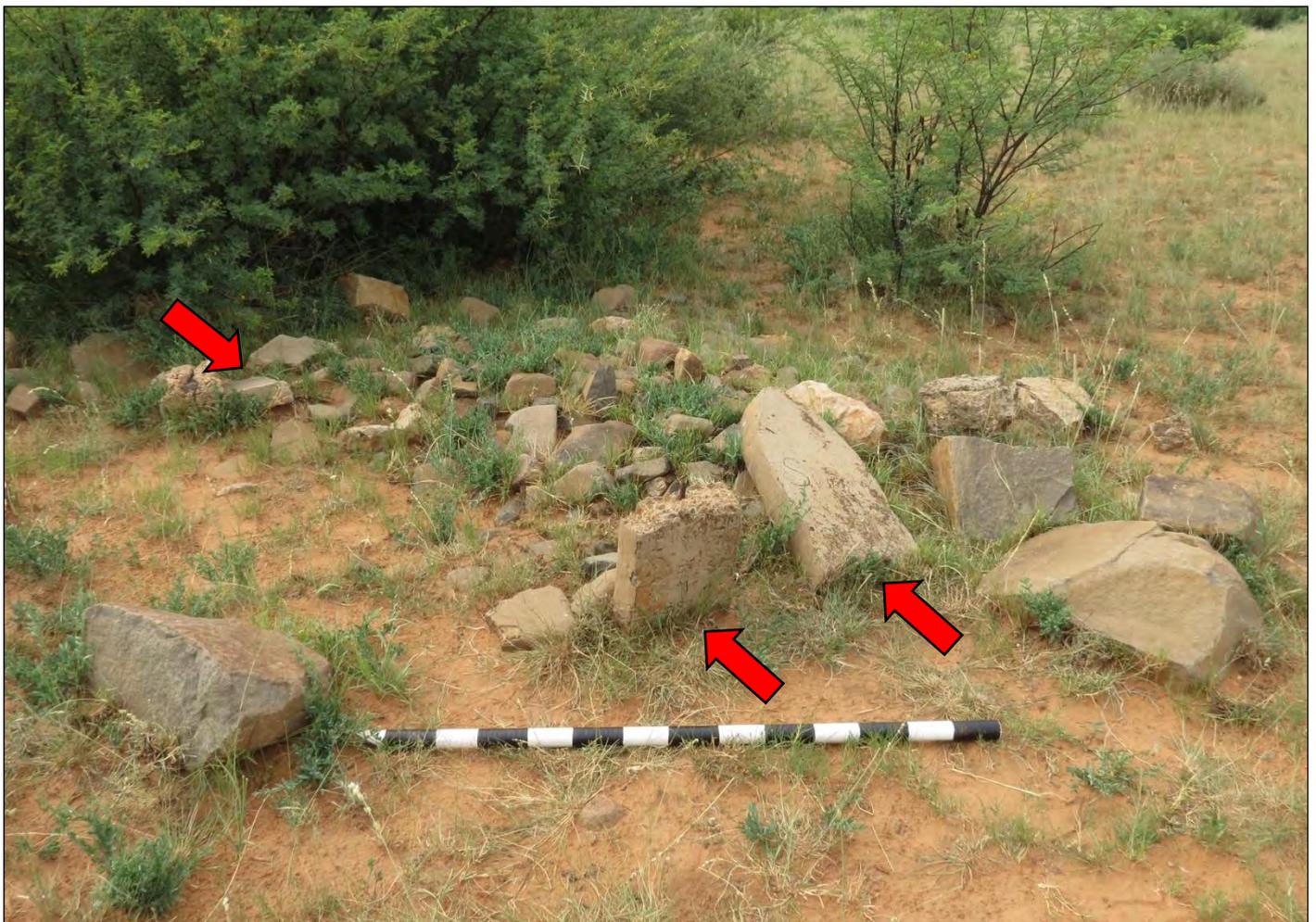
*Site position and impact:* The site is located 6m south of the In-Field Pipeline North (HDR1) as well as the In-Field Pipeline (Alt 4).

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**.



*Figure 73–General view of the cemetery at TET 7. The positions of three of the four headstones identified at the site, which can be seen on this image, are marked with red arrows. Scale is in 10cm increments.*



*Figure 74—One of the broken headstones at the cemetery at TET 7. Scale is in 10cm increments.*



*Figure 75—Another view of one of the broken headstones from the cemetery at TET 7. Scale is in 10cm increments.*

8.3.8 TET 8

See Site 36

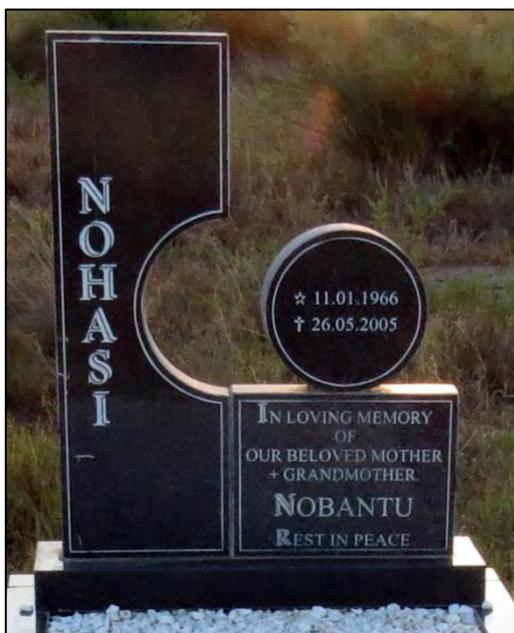
*Site Coordinates:*

S 28.11458

E 26.71827

*Site Description:*

An informal cemetery comprising eight graves is located here. One grave has a granite headstone with a granite-lined dressing, six of the graves have soil heaps with small upright stones at the head and foot whereas the remaining grave has a stone packed dressing. The inscription on the granite grave dressing reads as follows:



*NOHASI*  
*11.01.1966*  
*26.05.2005*  
*IN LOVING MEMORY*  
*OF*  
*OUR BELOVED MOTHER*  
*+ GRANDMOTHER*  
*NOBANTU*  
*REST IN PEACE*

The cemetery may be associated with the small settlement located 140m to the west.

*Site size:* Approximately 25m x 25m.

*Site position and impact:* The site is located approximately 35m south of the In-Field Pipeline North (HDR1) as well as the In-Field Pipeline (Alt 4).

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 76—General view of the cemetery at TET 8.*



*Figure 77—Closer view of one of the graves at TET 8. Scale is in 10cm increments.*



*Figure 78—Closer view of one of the graves at TET 8. This particular grave dressing consists of a soil heap with small upright stones marking the head and foot of the grave. Scale is in 10cm increments.*

### 8.3.9 TET 9

#### *Site Coordinates:*

S 28.11755

E 26.71946

#### *Site Description:*

The site comprises the concrete drift and adjacent bridge over the Sand River at Blaauwdrift. According to information obtained during the desktop study, this drift was also known as the Du Preez Leger Drift. The drift pre-dates the bridge and was embedded by two rocks. The drift is depicted on the First Edition of the 2826BA Topographical Sheet that was surveyed in 1945, whereas the concrete bridge is depicted for the first time on the Second Edition of the 2826BA Topographical Sheet that was surveyed in 1954. As a result, both structures are older than 60 years.

As revealed during the archival and historical desktop study, the following historic events associated with the Battle of Zand River can be associated with the Du Preez Leger Drift:

- On the morning of 9 May 1900, Lieutenant-Colonel Thomas William Porter with the 1s Cavalry Brigade departed from Smaldeel to reconnoitre the two drifts at Du Preez Leger and De Klerks Kraal. They were assisted in this task by Major-General J.B.B. Dickson with the 4<sup>th</sup> Cavalry Brigade;
- At 11 am, Major-General John French with his advance guard reached Kalkoenkrans, a section of which farm is located within the present study area. Here he received word from the reconnaissance units on the river that the Du Preez Leger Drift was not held by the enemy. Seizing the opportunity to outflank the Boer positions, French immediately ordered a squadron of the Scots Greys forward to take possession of the drift, and ordered the remainder of the 1<sup>st</sup> Cavalry Brigade to follow and assist in this task; and
- By 15h30 that afternoon the Du Preez Leger Drift was occupied by the British force.

*Site size:* Approximately 100m x 50m.

*Site position and impact:* The In-Field Pipeline North (HDR1) as well as the In-Field Pipeline (Alt 4) cross over the site.

#### *Current Protection Status:*

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act 25 of 1999.

*Site Significance:*

The site possesses moderate levels of historic and architectural significance. Although events associated with the Battle of Zand River appears to have taken place at the drift where the site is located, the drift was not held by the Boer forces and as a result no shots were actually fired here. The site has a **Generally Protected B – Medium Significance**.



*Figure 80 – General view of the site with the older drift visible on the right and the more modern concrete bridge dominating the landscape on the left.*

*Figure 79 – View along the older drift with the more modern concrete bridge on the left.*

### 8.3.10 TET 10

#### *Site Coordinates:*

S 28.18147

E 26.75419

#### *Site Description:*

A long rectangular brick silage pit structure (60m x 8m) is located here, and encloses a 10m deep pit. The walls of the structure were built using baked red bricks and slope at an angle downward into the pit. This angle is quite steep along the long sides of the rectangular structure, and much less so along the two shorter sides. The reason for the latter lesser angle is to allow vehicles (i.e. tractors) to drive safely into the pit to deposit silage. Steel drums were placed on the corners of each short end to act as barriers and stop damage to the structure from vehicles crashing into it.

The entire silage pit would originally have been covered by a flat corrugated iron roof. All that remains of this roof are the lower sections of the original supporting steel poles along the two long sides of the structure.

Although the exact age of the structure is not presently known, significant sections of its brick walls had evidently been eroded away by wind and sand. This erosion of the brick walls suggests that the structure has existed here for quite some time. As a result, it is certainly older than 60 years.

*Site size:* Approximately 70m x 10m.

*Site position and impact:* The In-Field Pipeline (Alt 4) passes immediately south of the site.

#### *Current Protection Status:*

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act 25 of 1999.

#### *Site Significance:*

The site possesses moderate levels of historic and architectural significance and represents a unique tangible remnant of historic farming activities in this area. The site has a **Generally Protected B – Medium Significance**.



*Figure 81—General view of the silage pit as seen from the west. Scale is in 10cm increments.*



*Figure 82—View of a section of the northern wall of structure. Scale is in 10cm increments.*

### 8.3.11 TET 11

#### *Site Coordinates:*

S 28.18559

E 26.73656

#### *Site Description:*

An extensive cemetery comprising 112 graves of black people is located here. The cemetery is located on the boundary fence between the farms Palmietkuil 328 and Kalkoenkrans 225, and is situated in its entirety within the latter farm's property. The cemetery was included in a previous heritage report undertaken by Van der Walt (2013).

The cemetery had been fenced and is located 26m from Eskom power line pylons. The cemetery is not maintained and a number of headstones were seen in a fallen-down state.

Eight different grave dressing types could be identified at the cemetery. For the most part, these grave dressing were orientated along the east-west axis. The following grave dressings were identified at the cemetery:

- Upright stones at the head and foot of the grave (n = 57)
- Stone packed grave dressing with upright unmarked stone as headstone (n = 39)
- Stone packed grave dressing with metal marker as headstone (n = 1)
- Rectangular brick-line dressing with granite headstone (n = 6)
- Rectangular brick-lined dressing with cement headstone (n = 2)
- Rectangular granite-lined dressing with granite headstone (n = 1)
- Metal marker without any other dressing components (n = 4)
- Cement headstone without any other dressing components (n = 2)

The oldest date that could be identified on any of the graves from the cemetery, is 1956. Of course, this does not mean that 1956 can be considered the *terminus post quem* for the site. A large number of graves from the site do not possess any inscriptions or details of the deceased. It is therefore quite likely for the cemetery to be considerably older than the 1950s.

The extensive size of the cemetery suggests that it was associated with a reasonably large community. Approximately 340m south-east of the cemetery the remains of an old farm school is located. It seems more than likely that the school and cemetery were associated with the same reasonably large farm worker community residing on the farm

Kalkoenkrans.

*Site size:* Approximately 60m x 60m.

*Site position and impact:* The In-Field Pipeline (Alt 4) passes through the site.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Until such time that the presence of graves at the site has been tested, the three stone concentrations must be viewed as graves. Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The cultural material identified at the site is of low significance.



*Figure 83—General view of the cemetery at TET 11. The boundary fence between the farms Kalkoenkrans (left of the fence) and Palmietkuil (right of the fence) can clearly be seen.*



Figure 84—General view of some of what is believed to be some of the older graves from the cemetery comprising stone concentrations with unmarked upright stones as headstones. Scale is in 10cm increments.



Figure 85—Granite headstone from one of the graves with a brick-lined dressing and granite headstone. Scale is in 10cm increments.

### 8.3.12 TET 12

#### *Site Coordinates:*

S 28.18613

E 26.73433

#### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on the farm Palmietkuil 328. All that remains of the farm worker accommodation at this site are two rectangular stone foundations (TET 12a & TET 12b) associated with cultural material in the form of glass and metal fragments. A concentration of cultural material in the form of a midden (TET 12c) is also located nearby.

The three components of the site can be described as follows:

- TET 12a comprises the remnants of a rectangular stone foundation that is located in close proximity to an Eskom pylon. As indicated above, glass and metal fragments were found associated with this structure;
- TET 12b comprises a rectangular stone foundation (5m x 4m) with glass and metal fragments found associated with the structure. Two of these glass fragments are from the same clear container and have embossed letters on them. One of these glass fragments contains the embossed word section "...EUR..." and the second fragment the word section "...ON..." It is not presently possible to identify the particular bottle or brand; and
- TET12c represents a midden located roughly 5m from the previous structure. The fragments observed on the surface of the site include the lid of a Consol glass jar, a writing slate fragment as well as the shoulder, neck and rim of a small brown medicine bottle.

The exact age of the site is not known. However, the only time that huts are depicted in proximity to this site on the available topographical map sheets, is on the Second Edition of the 2826BA sheet that was surveyed in 1954. It seems likely therefore for the site to be potentially just older than 60 years. Furthermore, the presence of a Consol glass item provides a *terminus post quem* for this section of the midden in that Consolidated Glass Works was started in May 1946 ([www.consol.co.za](http://www.consol.co.za)).

The site may be just older than 60 years with some remnants of its stone structures remaining. The cultural material identified here is not older than 100 years and as a result not protected by the available heritage legislation. However, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn

baby graves are indeed located here.

*Site size:* Approximately 70m x 70m.

*Site position and impact:* The site is located 8m east of the proposed In-Field Pipeline (Alt 4) as well as the Trunkline (ST23 to Sibanye).

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place. Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act 25 of 1999.

*Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The structural remains have a relatively low significance with the cultural material of low significance.



Figure 86–General view of the structure at TET 12a. Scale is in 10cm increments.



Figure 87—Three examples of glass fragments observed in proximity to TET 12a. Scale is in 1cm increments.



Figure 88—General view of the structure at TET 12b. Scale is in 10cm increments.



*Figure 89—Some of the glass fragments that were found near the structure at TET 12b. Scale is in 1cm increments.*



*Figure 90—The midden identified at TET 12c. Scale is in 10cm increments.*

### 8.3.13 TET 13

#### *Site Coordinates:*

S 28.18746

E 26.73452

#### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on the farm Palmietkuil 328. All that remains of the farm worker accommodation is a rectangular stone foundation (5m x 3m) and four stone corner posts of a small camp (5m x 5m). Cultural material in the form of glass, metal and imported ceramic fragments were identified in association with the rectangular foundation structure.

As indicated above, the four stone posts appear to be all that remains of a small camp, possibly for the keeping of livestock. Only one of the stone posts are still in an upright position, with another one leaning over and the remaining two posts lying flat on the ground.

The exact age of the site is not known. However, the only time that huts are depicted in proximity to this site on the available topographical map sheets, is on the Second Edition of the 2826BA sheet that was surveyed in 1954. It seems likely therefore for the site to be potentially just older than 60 years.

The site may be just older than 60 years with some remnants of its stone structures remaining. The cultural material identified here is not older than 100 years and as a result not protected by the available heritage legislation. However, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn baby graves are indeed located here.

Site size: Approximately 70m x 50m.

*Site position and impact:* The site is located 7m west of the proposed In-Field Pipeline (Alt 4) as well as the Trunkline (ST23 to Sibanye).

#### *Current Protection Status:*

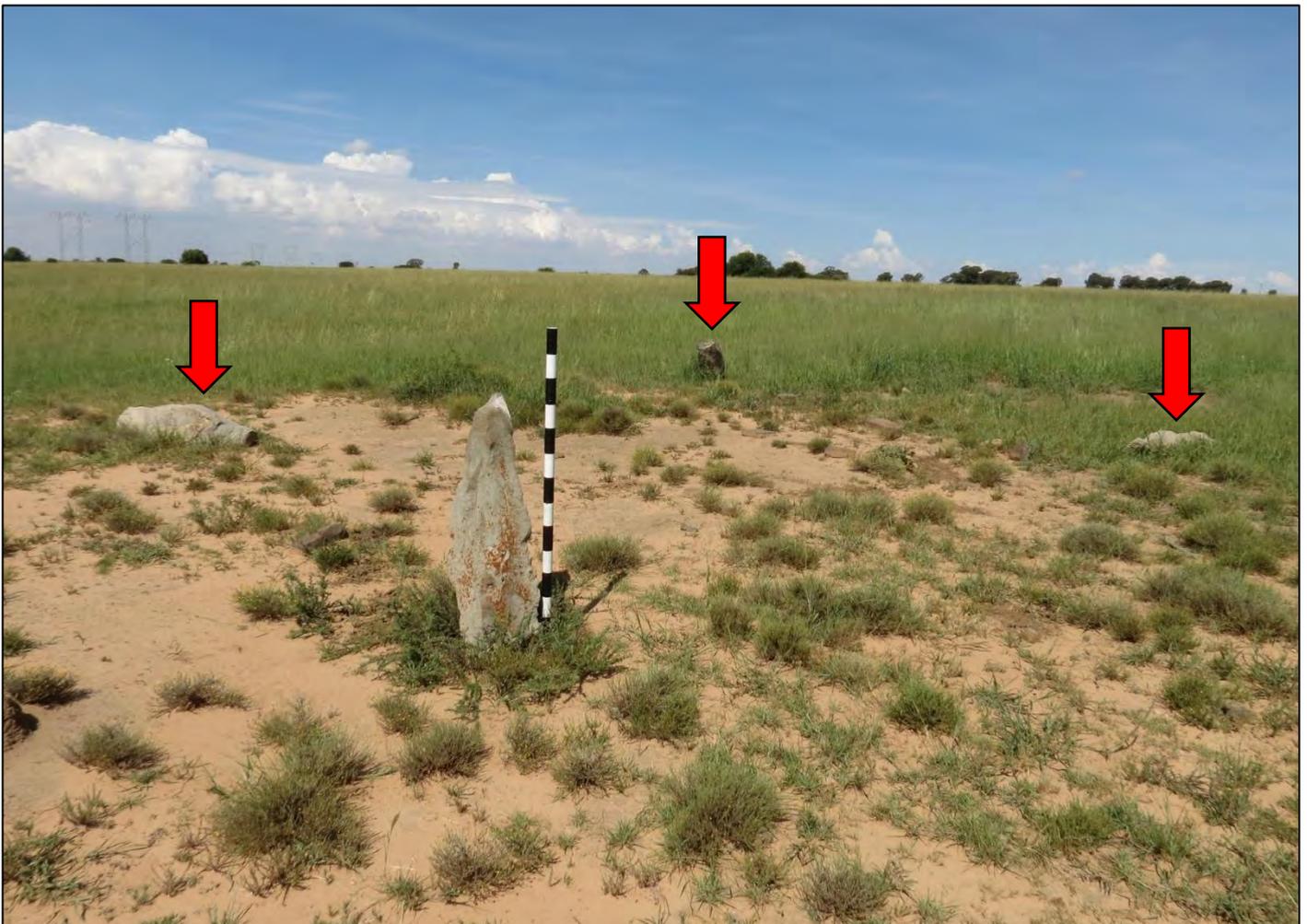
Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves

are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act 25 of 1999.

*Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The structural remains have a relatively low significance with the cultural material identified at the site of low significance.



*Figure 91–View of the remnants of what appears to have been a livestock camp. Apart from the upright corner post visible in the front, the positions of the corner posts are marked with red arrows. Scale is in 10cm increments.*



*Figure 92—General view of the remains of the structure. Scale is in 10cm increments.*



*Figure 93—Another view of the remains of the structure. Scale is in 10cm increments.*

### 8.3.14 TET 14

#### *Site Coordinates:*

S 28.18959

E 26.73541

#### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on the farm Palmietkuil 328. All that remains of the farm worker accommodation are scatters of cultural material such as glass and metal fragments. The extent of the site is approximately 120m x 70m. The exact age of the site is not known. However, the only time that huts are depicted in proximity to this site on the available topographical map sheets, is on the Second Edition of the 2826BA sheet that was surveyed in 1954. It seems likely therefore for the site to be potentially just older than 60 years.

Although the site may be just older than 60 years, none of the structures have remained preserved. Furthermore, the cultural material identified here is not older than 100 years and as a result not protected by the available heritage legislation. However, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn baby graves are indeed located here.

*Site position and impact:* The In-Field Pipeline (Alt 4) and Trunkline (ST23 to Sibanye) cut through the site.

#### *Current Protection Status:*

Graves and burial grounds fall under various legislative protections. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

#### *Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The cultural material identified at the site is of low significance.



*Figure 94—General view of the site. Scale is in 10cm increments.*



*Figure 95—Cultural material in the form of glass and metal fragments is found across the surface of the site. Scale is in 10cm increments.*

### 8.3.15 TET 15

*See Site 18*

*Site Coordinates:*

S 28.22097

E 26.75365

*Site Description:*

An informal cemetery comprising two black graves is located immediately adjacent to a farm road. The cemetery is enclosed by a fence.

The two graves are located adjacent to each other and their dressings are both orientated along the east-west axis. One of the graves has a granite headstone with a granite lined dressing. The second grave is stone packed with a metal plaque. From the information found on the granite headstone, it is evident that the graves from this cemetery include the deceased of the Mokati family. This grave dates to 1978. The site may have been a small farmworker cemetery.

*Site size:* Approximately 5m x 5m.

*Site position and impact:* The proposed Trunkline (ST23 to Sibanye) cuts through the cemetery.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 96—General view of the cemetery at TET 15.*



*Figure 97—Closer view of one of the graves at TET 15.*

### 8.3.16 TET 16

*See Site 25*

*Site Coordinates:*

S 28.25846

E 26.75136

*Site Description:*

An informal cemetery comprising approximately 62 black graves is located here. The cemetery is enclosed by a fence. Four of the graves have cement headstones and brick linings, four have metal headstones and two are stone concentrations with upright stones, two of the graves have concrete linings and headstones and one has a metal marker with 23 graves comprising soil heaps. The remainder have packed stone dressings.

From information found on the headstones, it is evident that the graves from this cemetery include the deceased of the Marema and Masita families. The site appears to have been a farmworker cemetery.

*Site size:* Approximately 60m x 50m.

*Site position and impact:* The In-Field Pipeline (Alt 4) and Trunkline (ST23 to Sibanye) pass a few meters north of the cemetery.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 98—General view of the cemetery at TET 16. Scale is in 10cm increments.*



*Figure 99—Another general view of the cemetery at TET 16.*

### 8.3.17 TET 17

*Site Coordinates:*

S 28.25369

E 26.68232

*Site Description:*

A single broken lower grinder was identified adjacent to a fence. It seems likely that the lower grinder originated from a historic to recent farm worker homestead. This said, no associated structures or cultural material could be identified in proximity to the lower grinder.

*Site size:* Approximately 5m x 5m.

*Site position and impact:* The In-Field Pipeline (Alt 4) passes two meters north of the site.

*Current Protection Status:*

The lower grinder is an artefact of unknown age. If it was older than 100 years, it would have been defined as an archaeological artefact. In terms of Section 35(4) of the National Heritage Resources Act (25 of 1999), man-made features and artefacts older than 100 years are defined as being archaeological. In the same section, the act also states that such archaeological sites and objects may not be disturbed, altered, modified or destroyed without a suitable permit from the South African Heritage Resources Agency (SAHRA).

*Site Significance:*

As the site only comprises a single lower grinder, it is deemed to be of **Generally Protected C – Low Significance**.



*Figure 100—General view of the site where the lower grinder was found. The red arrow marks the position of the grinder. Scale is in 10cm increments.*



*Figure 101—Closer view of the broken lower grinder. Scale is in 1cm increments.*

### 8.3.18 TET 18

#### *Site Coordinates:*

S 28.271924

E 26.672234

#### *Site Description:*

A long rectangular brick building (20m x 4m) is located here. The walls of the building comprise baked red stock bricks placed on a stone foundation. The bricks were primarily laid with alternating stretching and heading courses, which can be described as English bond. One exception to the use of English bond could be identified in line with the top of the doors where three courses of stretchers were placed in between courses of headers.

The building is subdivided into five rooms of equal size with five doors providing access to these rooms along the eastern façade of the building. Stone steps provide access to these five doors. Three of the doors still have wooden door frames whereas small wooden framed windows are located on the western face of the building. All five rooms have slate floors.

No roof remains on the building with only sections of the original two-inch wooden beams still found in association with the building.

Six steel crossties each were erected on the eastern and western ends of the building, with two each observed on the northern and southern walls as well. These steel crossties were cut from plough shares and bolted to the walls. The letters S.A.F.I.M. were stamped into the cross ties, which indicates that these plough shares were made by the company South African Farm Implement Manufacturers. This company was established in 1939 (Anderson & Lessing, 1966). It is not known whether this company still exists today.

The building was certainly associated with the nearby diamond mining activities, and may have been built as accommodation for mine workers. It is not presently exactly known how old the building is, although it is certainly older than 60 years.

A few meters south by south-east of the building a circular brick and cement drinking trough is located. It is not presently known how old this structure is. A midden was also identified a short distance east of the building and can clearly be associated with it. Artefacts observed at the midden include the following:

- A clear jar with threaded top which may have been a petroleum jelly container;

- Small cylindrical pill bottle of clear glass with no embossing;
- A broken rim from a large threaded jar; and
- A four-hole button, possibly of Bakelite.

The midden is certainly not older than 100 years, but may very well be older than 60 years.

*Site size:* Approximately 40m x 40m.

*Site position and impact:* The In-Field Pipeline (Alt 4) passes through the drinking trough and approximately 7m south of the old building.

*Current Protection Status:*

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act.

*Site Significance:*

The site possesses moderate levels of historic and architectural significance and represents one of only a handful tangible remains of the historic mining of diamonds in this area. The site has a **Generally Protected B – Medium Significance**.



*Figure 102–General view of the building as seen from the north-east. In the background, the remains of historic to recent diamond mining activities can be seen.*



*Figure 103—General view of a section of the building's eastern wall showing one of five doors. Note the steel crossbar to the left of the door. Scale is in 10cm increments.*



*Figure 104—General view of a section of the building's western wall showing one of the windows. Scale is in 10cm increments.*



*Figure 105—General view of the circular drinking trough. Scale is in 10cm increments.*



*Figure 106—This midden was identified a short distance east of the building and is clearly associated with it. Scale is in 10cm increments.*

### 8.3.19 TET 19

*See Site 13*

*Site Coordinates:*

S 28.13652

E 26.72375

*Site Description:*

An informal cemetery comprising approximately 26 black graves is located here. The cemetery is situated along a boundary fence. All the grave dressings from this cemetery are orientated along the East-West axis. Six of the grave dressings are stone concentrations, with unmarked upright stones on their western ends. Two of the grave dressings have cement brick linings, one has a clay baked lining with a cement headstone and one grave dressing has a brick lining with a granite headstone. The only surface markings on the remainder of the graves are small upright stones or concrete fragments. From information found on the headstones, it is evident that the graves from this cemetery include the deceased of the Nhlapo and Nondela families. The site appears to have been a farmworker cemetery.

*Site size:* Approximately 40m x 20m.

*Site position and impact:* The site is located within the 1km radius area surrounding the proposed F1 well. The site is located roughly 540 m east of the centre of this circular area.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 107—One of the graves from the cemetery at TET19. Scale is in 10cm increments.*



*Figure 108—Another view of one of the graves from the cemetery at TET 19.*

### 8.3.20 TET 20

*See Site 15A*

*Site Coordinates:*

S 28.15576

E 26.71384

*Site Description:*

An informal cemetery comprising approximately 40 black graves is located here. The site is a farmworker cemetery. All the grave dressings from this cemetery are orientated along the East-West axis. The largest majority of the graves from this cemetery have rectangular brick dressings and metal plaques. One of the graves has an oval stone packed grave dressing with an old bicycle frame placed on top of the dressing, whereas another grave is fenced off and has a welded metal railing enclosing the grave. From information found on the headstones, it is evident that the graves from this cemetery include the deceased of the Ramalefane, Mutale and Makhoro families.

*Site size:* Approximately 50m x 50m.

*Site position and impact:* The site is located within the 1km radius area surrounding the proposed F2 and F3 wells. The site is located roughly 956 m south-west of the centre of the circular area for F2 and 363 m west by south-west of the centre of the circular area for F3.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 109—General view of some of the graves from the cemetery at TET 20.*



*Figure 110—Another general view of some of the graves from the cemetery at TET 20.*

### 8.3.21 TET 21

*See Site 15B*

*Site Coordinates:*

S 28.15547

E 26.71390

*Site Description:*

An informal cemetery comprising approximately 20 black graves is located here. The site appears to be a farmworker cemetery that is still used. All the grave dressings from this cemetery are orientated along the East-West axis. Several of the graves have rectangular brick dressings and metal plaques, whereas others comprise large sand mounds, with metal plaques and grave goods. From information found on the headstones, it is evident that the graves from this cemetery include the deceased of the Zwane, Mphuthi, Moleko and Ramalefane families. The site appears to be a farm

*Site size:* Approximately 40m x 20m.

*Site position and impact:* The site is located within the 1km radius area surrounding the proposed F2 and F3 wells. The site is located roughly 928 m south-west of the centre of the circular area for F2 and 351 m west of the centre of the circular area for F3.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



*Figure 111—General view of some of the graves from the cemetery at TET 21.*



*Figure 112—One of the graves from the cemetery at TET 21.*

### 8.3.22 TET 22

See Site 45

*Site Coordinates:*

S 28.14997

E 26.72474

*Site Description:*

The site comprises the burial place for the ashes of Mr. Lourens Lourens snr. The burial site is located in the garden of the deceased's son, Mr. Lourens Lourens (jnr.). The place where the ashes were buried is marked with a cross.

*Site size:* Approximately 5m x 5m.

*Site position and impact:* The site is located within the 1km radius area surrounding the proposed F2 and F3 wells. The site is located roughly 647 m north-west of the centre of the circular area for F2 and 917 m south-west of the centre of the circular area for F3.

*Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

*Site Significance:*

Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance.**



### 8.3.23 TET 23

#### *Site Coordinates:*

S 28.16900

E 26.73808

#### *Site Description:*

The site is located on the western bank of the Boschluis Spruit in an extensively eroded area marked by various depressions and dongas. The site comprises a high density scatter of Middle and Later Stone Age lithics exposed by erosion activities. The highest density of lithics identified at the site was estimated to be 15 lithics per m<sup>2</sup>.

*Site size:* Approximately 70m x 60m.

*Site position and impact:* The site is located within the 1km radius areas surrounding the proposed F4 and F5 wells. The site is located roughly 860m south by southeast of the centre of the circular area for F4 and approximately 540m north-west of the centre of the circular area for F5.

#### *Current Protection Status:*

In terms of Section 35(4) of the National Heritage Resources Act (25 of 1999), man-made features and artefacts older than 100 years are defined as being archaeological. In the same section, the act also states that such archaeological sites and objects may not be disturbed, altered, modified or destroyed without a suitable permit.

#### *Site Significance:*

The site represents one of only four known Stone Age sites from the entire study area. The relatively high density of lithics identified at the site increases its significance. As a result, the site has a **Generally Protected A – Medium to High Significance**.



Figure 115—General view along the western bank of the Boschluis Spruit where the Stone Age site was identified.



Figure 116—Sample of lithics observed on the surface of the site. Scale is in 1cm and 5cm increments.

### 8.3.24 TET 24

#### *Site Coordinates:*

S 28.17894

E 26.73330

#### *Site Description:*

The site is located on the western bank of the Boschluis Spruit in an extensively eroded area marked by various depressions and dongas. The site comprises a medium density scatter of Middle and Later Stone Age lithics exposed by erosion activities. The highest density of lithics identified at the site was estimated to be 15 lithics per m<sup>2</sup>.

*Site size:* Approximately 100m x 100m.

*Site position and impact:* The site is located within the 1km radius areas surrounding the proposed F6 well and ST23 compressor plant. The site is located roughly 790m north-west of the centre of the circular area for F6 and approximately 650m north by north-west of the centre of the circular area for the proposed ST23 compressor plant.

#### *Current Protection Status:*

In terms of Section 35(4) of the National Heritage Resources Act (25 of 1999), man-made features and artefacts older than 100 years are defined as being archaeological. In the same section, the act also states that such archaeological sites and objects may not be disturbed, altered, modified or destroyed without a suitable permit.

#### *Site Significance:*

The site represents one of only four known Stone Age sites from the entire study area. The site has a **Generally Protected B – Medium Significance**.



*Figure 117—General view of the site.*



*Figure 118—Sample of lithics observed on the surface of the site. Scale is in 1cm and 5cm increments.*

### 8.3.25 TET 25

#### *Site Coordinates:*

TET 25a	TET 25b
S 28.17803 E 26.74283	S 28.17977 E 26.74080

#### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on the farm Kalkoenkrans 225. All that remains of the farm worker accommodation are scatters of cultural material such as glass and metal fragments that were identified between the two waypoints shown above. This cultural material was observed over a corridor roughly 400m. While the exact age of the site is not known, a number of huts are depicted in this area on both the First and Second Editions of the 2826BA topographical sheets surveyed in 1945 and 1954 respectively. It seems likely therefore for the site to be older than 60 years.

Although the site may be just older than 60 years, none of the structures have remained preserved. Furthermore, the cultural material identified here is not older than 100 years and as a result not protected by the available heritage legislation. However, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn baby graves are indeed located here.

*Site position and impact:* The site is located within the 1km radius areas surrounding the proposed F6 well and ST23 compressor plant. The site is located roughly 270m north by north-east of the centre of the circular area for F6 and approximately 870m north-east of the centre of the circular area for the proposed ST23 compressor plant.

#### *Current Protection Status:*

Graves and burial grounds fall under various legislative protections. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place.

#### *Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of emotional, religious and historical significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The cultural material identified at the site is of low significance.



*Figure 119—General view of a section of the area where cultural material was identified.*



*Figure 120—Cultural material in the form of glass and metal fragments is found across the surface of the site. Scale is in 1cm and 5cm increments.*

### 8.3.26 TET 26

#### *Site Coordinates:*

S 28.17983

E 26.74406

#### *Site Description:*

The site comprises the poorly preserved remains of farm worker accommodation on the farm Kalkoenkrans 225. All that remains of the farm worker accommodation at the site is a poorly preserved structure of mud and baked red clay bricks. Only three of the walls of this structure still remains preserved, with no roof present.

The poorly preserved structure is located within a cluster of modern farm worker accommodation units. The exact age of the structure is not known. However, huts are depicted in proximity to this structure on both the First and Second Editions of the 2826BA topographical sheets that were surveyed in 1945 and 1954 respectively. It seems likely therefore for the site to be potentially older than 60 years.

While the structure itself is too poorly preserved to have any heritage significance, the risk does exist for stillborn babies to have been buried here. Until the presence of such possible graves at the site has been proven or disproven, a worst case scenario will be adopted within which it is assumed that such stillborn baby graves are indeed located here.

*Site size:* Approximately 20m x 20m.

*Site position and impact:* The site is located within the 1km radius areas surrounding the proposed F5 and F6 wells. The site is located roughly 440m north-east of the centre of the circular area for F6 and approximately 960m south by south-east of the centre of the circular area for the proposed F5 well.

#### *Current Protection Status:*

Graves and burial grounds fall under various legislative protections, depending on factors such as where the graves are located as well as their age. Such legislation may include the National Heritage Resources Act 25 of 1999, the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissue Act 65 of 1983, the Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws that may be in place. Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage

Resources Act 25 of 1999.

*Site Significance:*

Until such time that the presence of graves at the site has been tested, the site must be viewed as containing stillborn graves. Graves and burial grounds have high levels of significance. As a result, the site has a **Generally Protected A – Medium to High Significance**. The structural remains have a relatively low significance.



*Figure 121–General view of the structure at TET 26.*

### 8.3.27 TET 27

#### *Site Coordinates:*

S 28.18286

E 26.74164

#### *Site Description:*

A poorly preserved east-facing farm dwelling is located here. The building originally had a hipped roof construction, and was built of cement bricks.

The building is poorly preserved with most of the roof and all the window and door frames missing. Sections of the walling are also disintegrating.

A brick reservoir is associated with the building.

.

Although the exact age of the structure is not presently known, a building is depicted for the first time here on the Second Edition of the 2826BA that was surveyed in 1954. This building is not depicted on the First Edition of the same topographical sheet that was surveyed in 1945. As a result, it would appear that the building is between 72 and 63 years old.

*Site size:* Approximately 60m x 60m.

*Site position and impact:* The site is located within the 1km radius areas surrounding the proposed F6 and ST23 compressor site. The site is located roughly 150m south-east of the centre of the circular area for F6 and approximately 780m north-east of the centre of the circular area for the proposed ST23 compressor site.

#### *Current Protection Status:*

Structures older than 60 years fall under the protection of Section 34(1) of the National Heritage Resources Act.

#### *Site Significance:*

Although the structure is older than 60 years, it is poorly preserved. As a result, the site is deemed to be of **Generally Protected C – Low Significance**.



*Figure 122—General view of a section of the building.*



*Figure 123—View of a section of the interior of the building.*

## 8.4 Field-Based Palaeontological Impact Assessment

Dr. Lloyd Rossouw of Palaeo Field Services was appointed to carry out a Field-Based Palaeontological Impact Assessment of the exploration footprint area. The sections that follow below were obtained from this report. Refer **Annexure D** for a copy of this report.

### 8.4.1 Palaeontological Background

According to the SAHRIS palaeo-sensitivity map the study area is located within an area considered to be of high to moderate palaeontological sensitivity. The geology underlying the footprint area is underlain by Karoo Supergroup rocks (see 1: 250 000 geological map 2826 Winburg, Council for Geoscience, Pretoria, **Fig. 124**) (Nolte 1995). These sedimentary rocks form the base on which younger, superficial deposits of late Cenozoic age (*Qs*) has been deposited (**Fig. 124**). Dykes and sills of resistant Jurassic dolerites (*Jd*) largely determine landscape topography as indicated by the distinctive koppies and flat-topped inselbergs in the region.

From oldest to youngest, the deposits of the Karoo Supergroup in the region are assigned to Upper Ecca and Lower Beaufort Group rocks, respectively represented by the Middle Permian Volksrust Formation (*Pvo*) and the overlying Late Permian Adelaide Subgroup (*Pa*). The predominantly argillaceous Volksrust Formation consists of a monotonous sequence of grey marine shales with thin, bioturbated, siltstone and sandstone lenses, exposed towards the northwest of the study area. It represents a transgressive sequence consisting largely of mud deposited from suspension when large, swampy deltas were formed after Gondwana started to drift from the Antarctic region and rivers flowing into the inland Karoo Sea, deposited huge amounts of sediment along its shorelines consisting of alternating sandstone and mudstone layers. It consists of a monotonous sequence of grey shale and fossils are significant, but rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant remains, petrified wood, and low-diversity marine to non-marine trace fossil assemblages.

The Volksrust Formation interfingers with an overlying sequence of Adelaide Subgroup sandstone and mudrock towards the east of the study area. The Adelaide Subgroup contains some of the richest Permo-Triassic tetrapod fauna from Pangaea/Gondwana and provides key evidence for evolution of mammalian characteristics among therapsids. The rocks in this outcrop area are assigned to one of eight different biostratigraphic units or assemblage zones (Rubidge 1995), namely the *Dicynodon* Assemblage Zone, recently revised (Kitching 1995; Van der Walt *et al.* 2010; Viglietti *et al.* 2016). The sediments assigned to this AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel sandstones (McCarthy and Rubidge, 2005; Johnson *et al.*, 2006). The biozone is characterized by the presence of a distinctive and fairly common dicynodont genus *Dicynodonts* are well-known herbivorous therapsids from the Karoo Basin with at least 35 dicynodont genera recorded in the Beaufort Group. Therapsids from this biozone occur generally well-preserved in mudrock horizons and are usually found as dispersed and isolated specimens associated with an abundance of calcareous nodules. Other vertebrate fossils

include fish, amphibians and amniotes. Molluscs, insects, plant (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) also occur.

Another palaeontologically significant sequence in the region is represented by late Cenozoic (Plio-Pleistocene) floodplain deposits (overbank sediments) associated with the Sand, Doring Vals and Vet River systems as well as pan sites, which contain localized but abundant mammal vertebrate fossil localities. The discovery of *in situ* proboscidian fossil material, consisting of a lower molar, the proximal half of an ulna and a large part of a tusk from fine to pebbly channel-fill sediments 40 meters above the current riverbed of the Sand River near Virginia, has highlighted the potential antiquity of the floodplain deposits flanking the river (**Fig. 125 no. 1**). Originally described as *Archidiskodon scotti* (Meiring 1955) the proboscidean fossil material was subsequently assigned to the Pliocene species *Mammuthus subplanifrons* (Coppens et al. 1978). Subsequent investigations at the site yielded a diverse fauna that include fish, amphibians, reptiles, birds and an array of proboscideans, perissodactyls and artiodactyls (De Ruiter 2010; pers. obs.) (**Fig. 125 no. 2**). Pliocene fossil occurrences have also been identified in terrace gravels above the Vet River southwest of Welkom (pers. obs.) (**Fig. 125 no. 3**). More recent exploratory surveys along the Doring, Sand, Vals and Vet Rivers indicate moderately fossiliferous overbank sediments and erosional gullies that frequently contain fossil remains of a variety of Quaternary-aged mammals (Brink et al. 1999; De Ruiter et al. 2011; pers. obs.) (**Fig. 125 nos. 4 – 10**) Ancient pan sites in the region, such as the one near Whites have equally produced abundant Quaternary-aged mammal fossil remains (pers. obs.) (**Fig. 125 no. 11**).

#### 8.4.2 Palaeontological Field Assessment

A palaeontological field assessment was undertaken by Dr. Lloyd Rossouw by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes during the field assessment.

The 13 existing and 6 new well sites are underlain by Adelaide Subgroup rocks capped by well-developed superficial overburden (wind-blown sand, residual soils) that are currently being used for agricultural purposes (**Fig. 126**).

All the pipeline route options and associated infrastructure are underlain by Adelaide Subgroup rocks that are capped by well-developed superficial sediments made up of wind-blown sand and residual soils as well as late Quaternary alluvial floodplain deposits associated with the Sand and Doring Rivers.

Both site options for the combined helium and CNG gas conditioning plant are underlain by Adelaide Subgroup rocks, capped by well-developed superficial overburden.

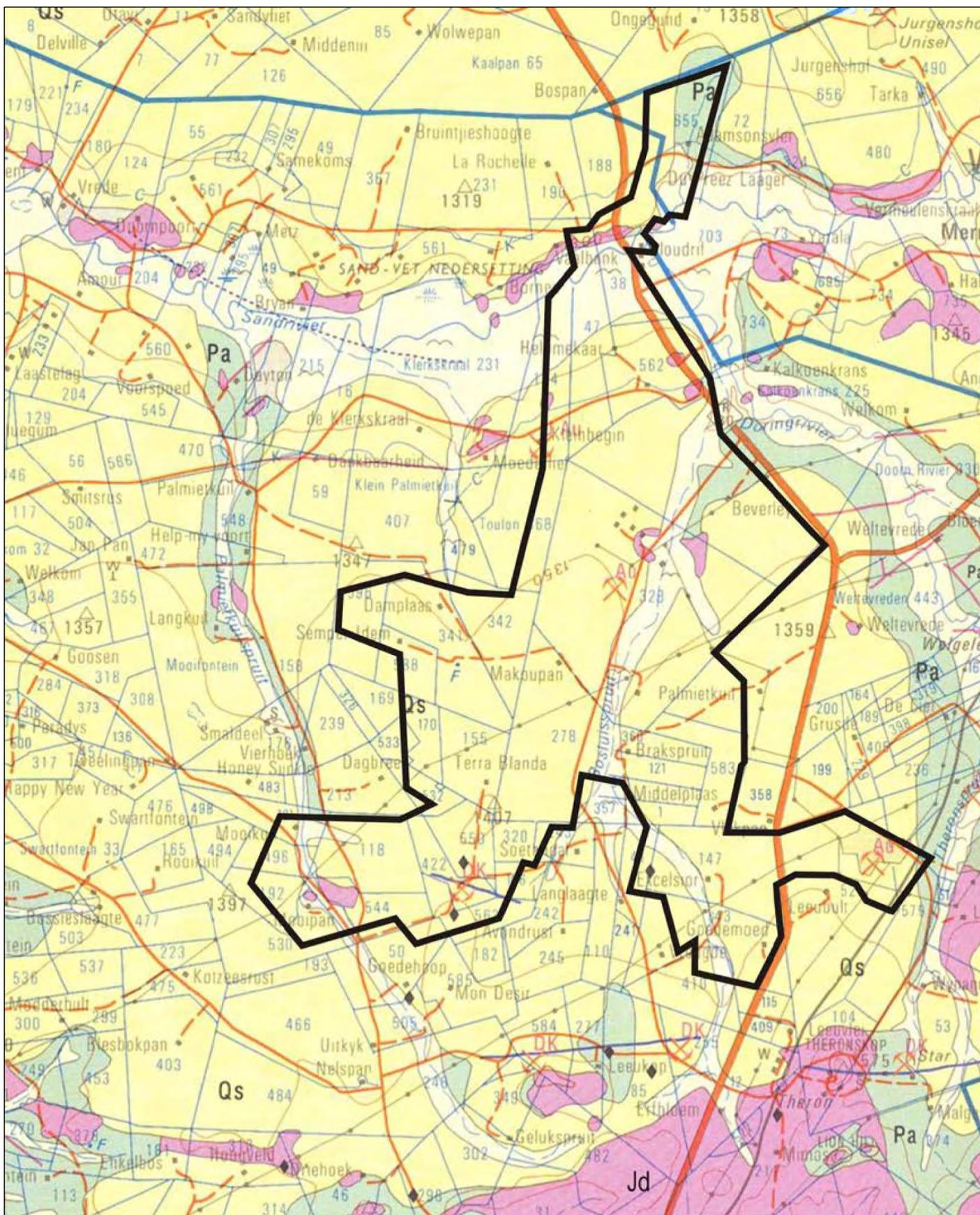


Figure 124 – Portion of 1:250 000 scale geological map 2826 Winburg. The geology underlying the study area is underlain by Karoo Supergroup rocks of the Adelaide Subgroup (Pa). These sedimentary rocks form the base on which younger, superficial deposits of late Cenozoic age (Qs) has been deposited. Sedimentary bedrock is intruded by dykes and sills of Jurassic dolerites (Jd) (Rossouw, 2017:13).

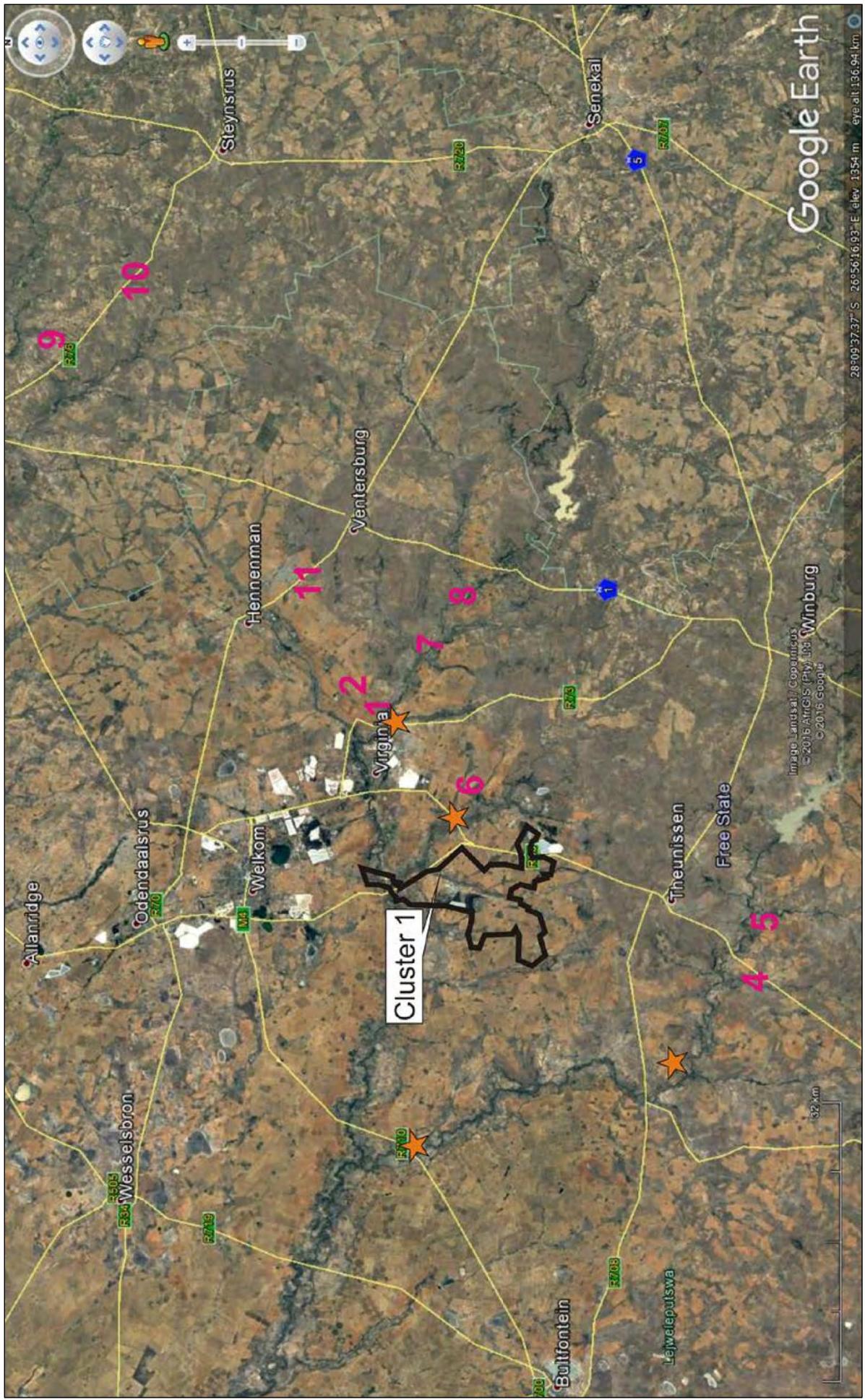


Figure 125 – General map of late Cenozoic palaeontological localities in the region. Highly sensitive alluvial (floodplain) sediments and associated overbank deposits are indicated by stars (Rossouw, 2017:14).

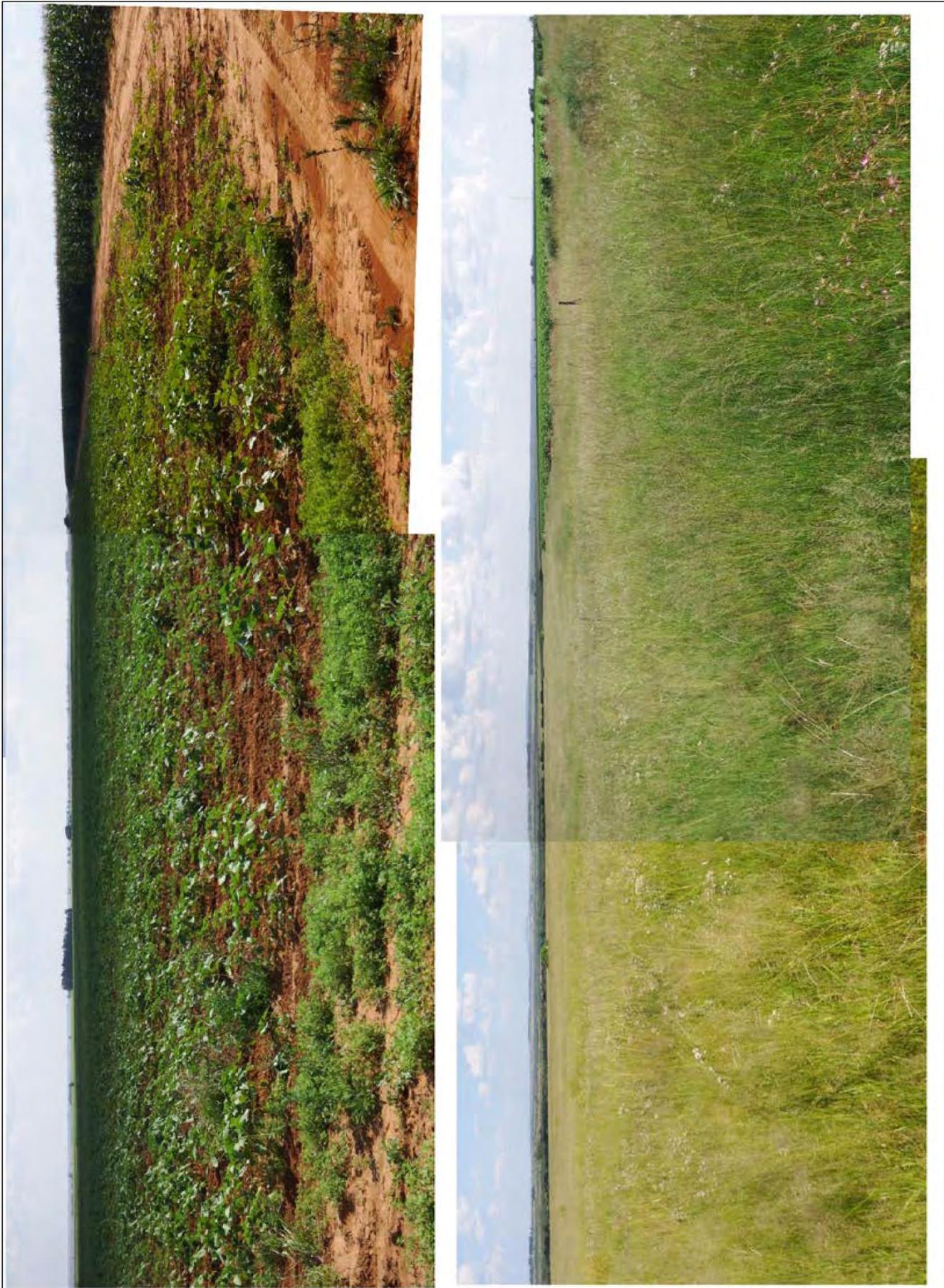


Figure 126 – The well sites are primarily located on farmland and are currently being used for agricultural activities (Rossouw, 2017:15).



Figure 127 – General view of the palaeontologically sensitive overbank sediments of the Bosluisspruit at GPS coordinates S 28.184572 E 26. 731733 (Rossouw, 2017:16).



Figure 128 – Aerial view of the potential fossil locality on the Bosluisspruit (Rossouw, 2017:17).



Figure 129 – General view of the palaeontologically sensitive overbank sediments underlying the pipeline route across the Sand River (southern bank), looking east towards the Doring River confluence (Rossouw, 2017:18).



Figure 130 – Well-developed floodplain deposits, looking south towards the Sand River (northern bank, top). Palaeontologically sensitive alluvium exposed by erosional gullies (dongas) along the northern bank immediately east of the proposed pipeline route across the river (Rossouw, 2017:19).



Figure 131 – Aerial view of the potential fossil locality on the Sand River (Rossouw, 2017:20).

### 8.4.3 Palaeontological Impact Statement and Recommendations

Some of the most significant fossil-bearing rocks in the study are associated with Permian deposits of the Karoo Supergroup, in this case represented by the Ecca Group Volksrust Formation and the lower Adelaide Subgroup of the Beaufort Group. These deposits are allocated a moderate to very high palaeontological significance respectively and represent one of the richest assemblages of vertebrate, invertebrate and plant fossils in the world. Other palaeontologically significant sediments include late Quaternary floodplain deposits associated with the Sand and Doring Rivers.

The well sites are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. The palaeontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units.

For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

All the pipeline route options are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Areas associated with late Quaternary alluvial deposits (erosional gullies flanking river crossings) were investigated but no aboveground evidence of Quaternary fossil remains were found. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit (GPS coordinates S 28.184572 E 26.731733) (**Fig. 127 & 128**) and the Sand River (GPS coordinates S 28.117869 E 26.719411) (**Fig. 129-131**). Any excavation exceeding a depth of 1m into these overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

Both site options for the combined helium and CNG gas conditioning plant are underlain by palaeontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance. Any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

As for the author's personal view with regards to the potential impact of drilling on groundwater aquifers, the following recommendations are offered for consideration:

- It is necessary to provide a clear explanation of the drilling procedures and the methods that will be used to prevent hydrocarbons and associated gas from the Ecca and Beaufort Groups from entering these linear aquifers and polluting them or to avoid the creation of conduits through which deep-seated groundwater could migrate to shallow aquifers. The information must be disseminated to the South African heritage community as well as to all affected communities going forward in reviewing the EIA process; and
- The applicant should appoint a suitably qualified groundwater specialist to establish beforehand that groundwater aquifers will not be negatively affected before the construction phase of the project commences.

## **9. BASELINE RECEIVING ENVIRONMENT**

### **9.1 Baseline Receiving Environment of the Application Area**

The application area is located between Welkom and Theunissen and falls within the Matjhabeng and Masilonyana Local Municipalities, Lejweleputswa District Municipality, Free State Province. It covers an area of approximately 14 316 hectares, with an approximate boundary circumference of 95 734 m.

Significant components of the study area are characterized by extensive farming activities in the form of extensive agricultural fields with pivot irrigation also present. For the most part, maize production is undertaken within this area, although other crops such as soya beans are also grown. The central and south-eastern components of the study area are associated with mines and mining activities of the Beatrix Mine of Sibanye Gold, with both the Beatrix Mine Shaft 2 and Beatrix Mine Shaft 4 located within the study area.

Apart from the agricultural and mining activities, infrastructural disturbance in the form of tar roads (the R30 between Welkom and Theunissen cuts through the area), provincial gravel roads, farm roads, electricity transmission lines, telephone lines, fences, buildings and structures are found within the study area. In terms of buildings and structures, a number of farmsteads are located within the study area. These farmsteads can be expected to comprise farmhouses of varying ages as well as farm worker accommodation, sheds, barns, silos, livestock enclosures etc.

In a topographic sense, the entire study area apart from the river valleys can be described a relatively flat. The Sand River cuts across the northern component of the application area with the Boschluis Spruit running across a significant component of the study area further to the south. A number of water pans and man-made dams are also located within this area.

Significant sections of the undisturbed components of the study area comprise open grassland, interposed by scattered pockets of trees. Planted vegetation, which includes exotic trees and plants, are found in proximity to farmsteads and human occupation areas. Lanes of such planted exotic trees were also strategically planted as wind-breaks and are found all over the study area.

Various photograph depicting aspects of the overall study area can be seen on the next page.



*Figure 132 – General view of a section of the study area. A pipeline is proposed to be built along this fence.*



*Figure 133 – Agricultural lands as the one shown here characterise significant sections of the study area.*



*Figure 134 – Agricultural field with a lane of trees comprising planted exotic trees in the back.*



*Figure 135 – Old trees such as this eucalyptus tree are found across the study area.*



*Figure 136 – General view of a section of the study area with the Sibanye (Beatrix) Mine 4 Shaft visible in the back.*



*Figure 137 – Gravel roads such as the one shown here are found across the study area.*

## 9.2 Baseline Receiving Environment of the Development Footprint Area

The Tetra4 Cluster 1 project entails the extraction of gas from 13 existing wells or blowers that have been previously drilled. These wells comprise the following:

- 2057
- 1629
- 1307
- DBE01
- ST23
- HDR1
- BEI02
- HZON1
- 1400
- EX01
- 2033
- RETREAT
- SPG03

In many cases the only tangible aspect relating to these gas well positions are short vertical metal pipes sticking out of the ground. A number of the wells in proximity to the Sibanye Gold properties are characterised by methane extraction flares enclosed in security fencing. Furthermore, the well position at HDR1 had already been built by Tetra4 (an existing CNG facility). Additionally, six new wells are also proposed. These wells are numbered from F1 to F6. Naturally, these six proposed new wells do not have any visible indications of a well position.

Two location alternatives have been identified for the proposed combined helium and CNG plant, the first being in the vicinity of the existing HDR1 CNG facility (referred to as HP1) and second location option at the Sibanye Gold Shaft 1 complex (referred to as HP2). HP1 and HP2 are each associated with pipeline routes connecting the combined helium and CNG plant to the existing and proposed new wells. Furthermore, centralised compressor locations as per the pipeline route alternatives described below, will be determined from the findings of the EIA phase site specific assessments based on the selected or preferred pipeline route. The compressor locations alternatives were assessed at the following proposed locations: near the existing well ST23, at HDR1 and Sibanye Shaft 1 complex.

Originally, five different pipeline route alternatives were considered. However, due to a number of reasons only two pipeline route alternatives formed part of the present development footprint area addressed in detail during the EIA phase, namely pipeline route alternative P2 and pipeline route alternative P4. These pipeline alternatives have been assessed further in the EIA phase towards determining the preferred pipeline route in conjunction with the preferred combined helium and CNG plant location, new well sites, and associated centralised compressor locations. The two pipeline alternatives are as follows:

- Alternative P2: A pipeline from the existing and new wells to two centralised compressors (proposed to be at HDR1 and ST23), leading to HP1 near HDR1; and
- Alternative P4: A pipeline from the existing and new wells to three centralised compressors (proposed to be at HDR1, ST23, and Sibanye Shaft 1 complex), leading to HP2 at Sibanye Shaft 1 complex.

Significant sections of the pipeline footprints are located along fences and on the edges of agricultural land.



Figure 138 – General view of a section of the footprint area. A pipeline is proposed to be built along this fence.



Figure 139 – An example of a proposed well position at F3 with no tangible evidence for the presence of such a well.



Figure 140 – An existing well at SPG03. Note the low vertical metal pipe. Scale is in 10cm increments.



Figure 141 – An existing well at 1307. The metal pipe protected by a section of concrete piping can be seen.



Figure 142 – One of the methane extraction flares found within the area. This one is located at well position ST23.



Figure 143 – Another methane extraction flare. This one is located at well position EX01.

## 10. SITE SENSITIVITIES

### 10.1 Heritage Sensitivities identified during the Heritage Scoping Assessment

A number of sensitivities were identified during the Heritage Scoping Assessment. These include the following:

- Disturbance / destruction of sections of the Battle of Zand River;
- Disturbance / destruction of tangible remains of the old diamond mine at Welgegund;
- Destruction / damage of archaeological sites;
- Disturbance / destruction of historic buildings and structures;
- Disturbance / destruction of cemeteries and graves;
- Disturbance / destruction of unmarked stillborn graves;
- Disturbance / destruction of palaeontological resources; and
- Disturbance / destruction of Sacred Natural Sites.

### 10.2 Heritage Sensitivities identified during the Heritage Impact Assessments

The field survey undertaken of the exploration footprint areas, have revealed the following heritage sensitivities:

- Disturbance / destruction of the cemetery at TET 1;
- Disturbance / destruction of the historic wall at TET 2;
- Disturbance / destruction of the stone-walled structure at TET 3;
- Disturbance / destruction of possible stillborn graves at TET 4;
- Disturbance / destruction of possible stillborn graves at TET 5;
- Disturbance / destruction of possible graves at TET 6;
- Disturbance / destruction of the cemetery at TET 7;
- Disturbance / destruction of the cemetery at TET 8;
- Disturbance / destruction of the historic drift and bridge at TET 9;
- Disturbance / destruction of the historic silage pit at TET 10;
- Disturbance / destruction of the cemetery at TET 11;
- Disturbance / destruction of possible stillborn graves at TET 12;
- Disturbance / destruction of possible stillborn graves at TET 13;
- Disturbance / destruction of possible stillborn graves at TET 14;
- Disturbance / destruction of the cemetery at TET 15;
- Disturbance / destruction of the cemetery at TET 16;
- Disturbance / destruction of the historic mine building at TET 18;

- Disturbance / destruction of the cemetery at TET 19;
- Disturbance / destruction of the cemetery at TET 20;
- Disturbance / destruction of the cemetery at TET 21;
- Disturbance / destruction of the cemetery at TET 22;
- Disturbance / destruction of the Stone Age site at TET 23;
- Disturbance / destruction of the Stone Age site at TET 24;
- Disturbance / destruction of possible stillborn graves at TET 25; and
- Disturbance / destruction of possible stillborn graves at TET 26.

## 11. SITE CONSTRAINTS

From the site sensitivities above it is evident that a number of site constraints can be identified based on the heritage sensitivities within Cluster 1. These are as follows:

- Disturbance / destruction of sections of the Battle of Zand River;
- Disturbance / destruction of tangible remains of the old diamond mine at Welgegund;
- Destruction / damage of archaeological sites;
- Disturbance / destruction of historic buildings and structures;
- Disturbance / destruction of cemeteries and graves;
- Disturbance / destruction of unmarked stillborn graves;
- Disturbance / destruction of palaeontological resources;
- Disturbance / destruction of Sacred Natural Sites;
- Disturbance / destruction of the cemetery at TET 1;
- Disturbance / destruction of the historic wall at TET 2;
- Disturbance / destruction of the stone-walled structure at TET 3;
- Disturbance / destruction of possible stillborn graves at TET 4;
- Disturbance / destruction of possible stillborn graves at TET 5;
- Disturbance / destruction of possible graves at TET 6;
- Disturbance / destruction of the cemetery at TET 7;
- Disturbance / destruction of the cemetery at TET 8;
- Disturbance / destruction of the historic drift and bridge at TET 9;
- Disturbance / destruction of the historic silage pit at TET 10;
- Disturbance / destruction of the cemetery at TET 11;
- Disturbance / destruction of possible stillborn graves at TET 12;
- Disturbance / destruction of possible stillborn graves at TET 13;
- Disturbance / destruction of possible stillborn graves at TET 14;
- Disturbance / destruction of the cemetery at TET 15;
- Disturbance / destruction of the cemetery at TET 16;
- Disturbance / destruction of the historic mine building at TET 18;
- Disturbance / destruction of the cemetery at TET 19;
- Disturbance / destruction of the cemetery at TET 20;
- Disturbance / destruction of the cemetery at TET 21;
- Disturbance / destruction of the cemetery at TET 22;
- Disturbance / destruction of the Stone Age site at TET 23;

- Disturbance / destruction of the Stone Age site at TET 24;
- Disturbance / destruction of possible stillborn graves at TET 25; and
- Disturbance / destruction of possible stillborn graves at TET 26.

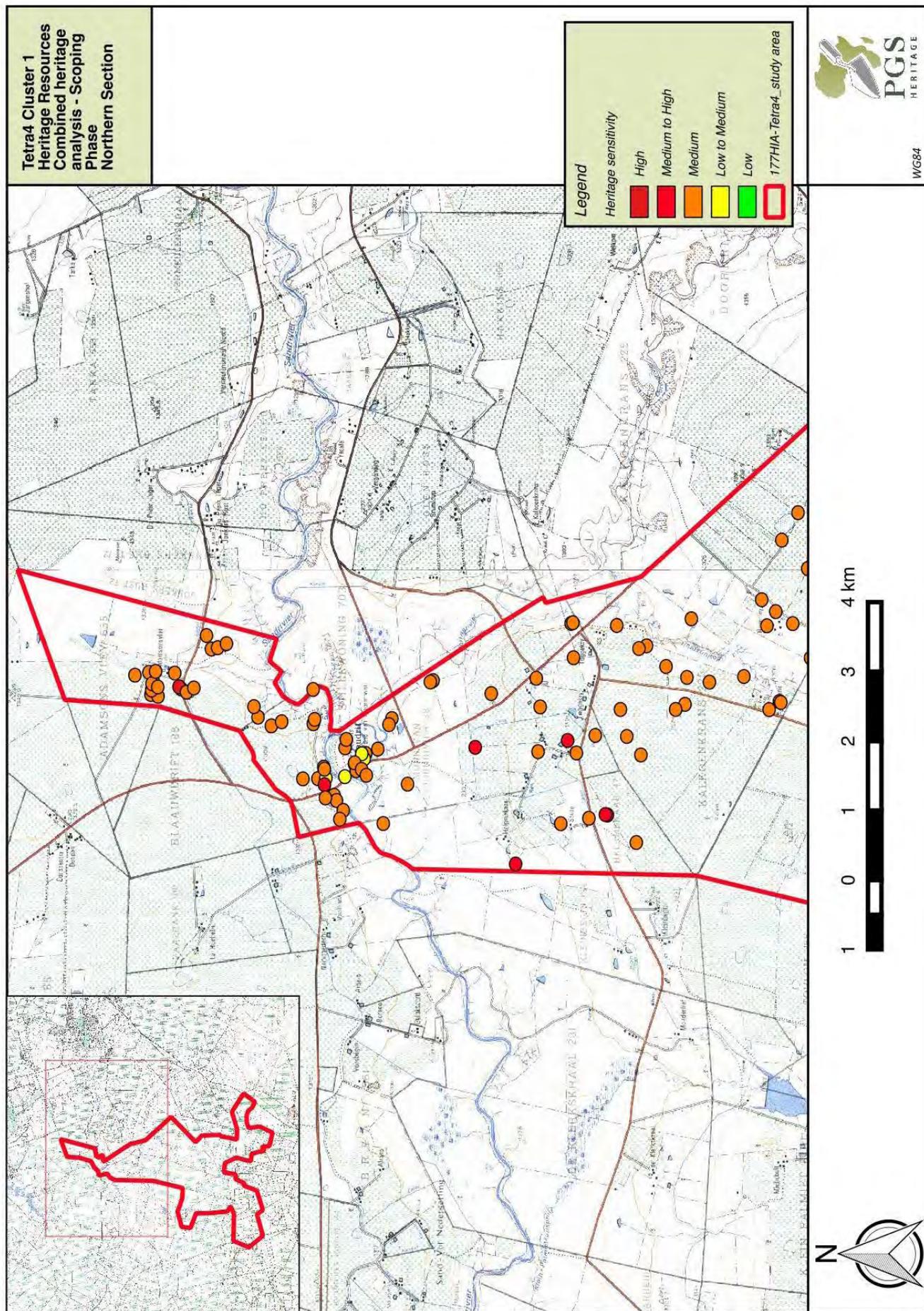


Figure 144 – Map depicting the combined heritage sensitivities for the northern end of the study area.

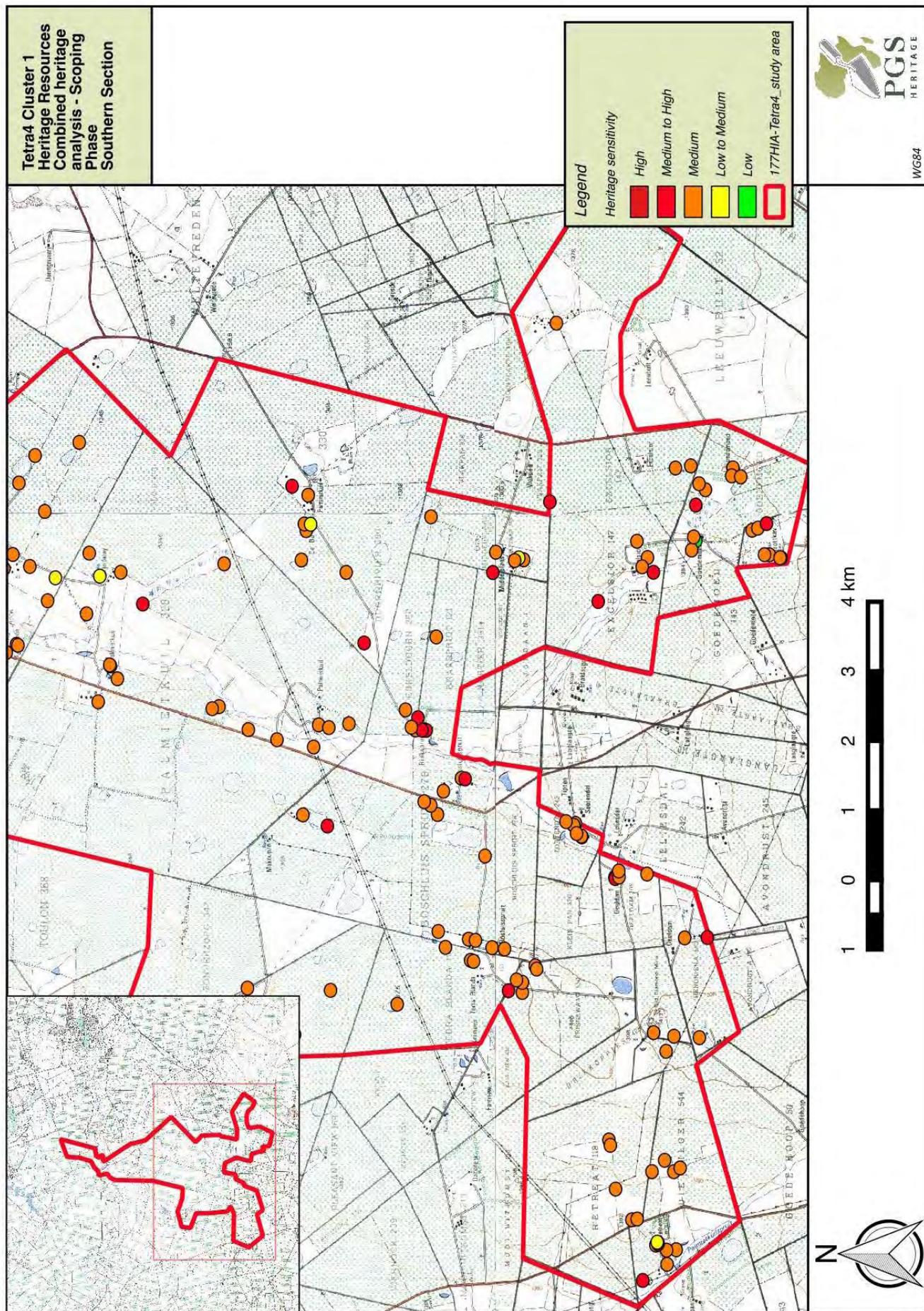


Figure 145 – Map depicting the combined heritage sensitivities for the southern end of the study area.

## 12. IMPACT ASSESSMENT

### 12.1 Introduction

Three development alternatives are proposed for the project. These three development alternatives are briefly outlined below:

- **Alternative 1**

Within this alternative Pipeline 2 (P2) will be utilised. This pipeline will be built to the combined Helium and Compressed Natural Gas (CNG) plant proposed to be located near the existing HDR1 facility, referred to as HP1, with two centralised compressors located at HDR1 and ST23. A trunk line that links Pipeline 2 (in proximity to HDR1) with the centralised compressor at ST23 and leading to Sibanye mine shaft 1. For this development alternative a total of 13 existing wells will be used, namely BE1, BEI02, HDR1, HZOn1, EX1, Retreat, SPG3, ST23, 1307, 1400, 1629, 2033 and 2057. Six new wells are also proposed as part of this alternative, namely F1, F2, F3, F4, F5, and F6.

- **Alternative 2**

Within this alternative Pipeline 4 (P4) will be utilised. This pipeline will be built to the combined Helium and CNG plant proposed to be located at Sibanye mine shaft 1 (Sibanye), referred to as HP2, with three centralised compressors located at HDR1, ST23 and Sibanye. Two trunk lines form part of this development alternative. First of these is a trunk line that links Pipeline 2 (in proximity to HDR1) with the centralised compressor at ST23, whereas the second trunk line is one that links two sections of Pipeline 4 with each other. For this development alternative a total of 13 existing wells will be used, namely BE1, BEI02, HDR1, HZOn1, EX1, Retreat, SPG3, ST23, 1307, 1400, 1629, 2033 and 2057 will be used. Six new wells are also proposed as part of this alternative, namely F1, F2, F3, F4, F5, and F6.

- **Alternative 3**

Within this alternative both Pipelines 2 and 4 (P2 & P4) will be utilised. As no significant differences in terms of envisaged heritage impact between Alternatives 1 and 2 can be discerned, the impact assessments in this section were all based on this Alternative.

As an illustration of the different alternatives, the gas production pipelines and footprints associated with Alternatives 1 and 2 respectively will be illustrated in two maps on the subsequent pages. These maps were obtained from the client.

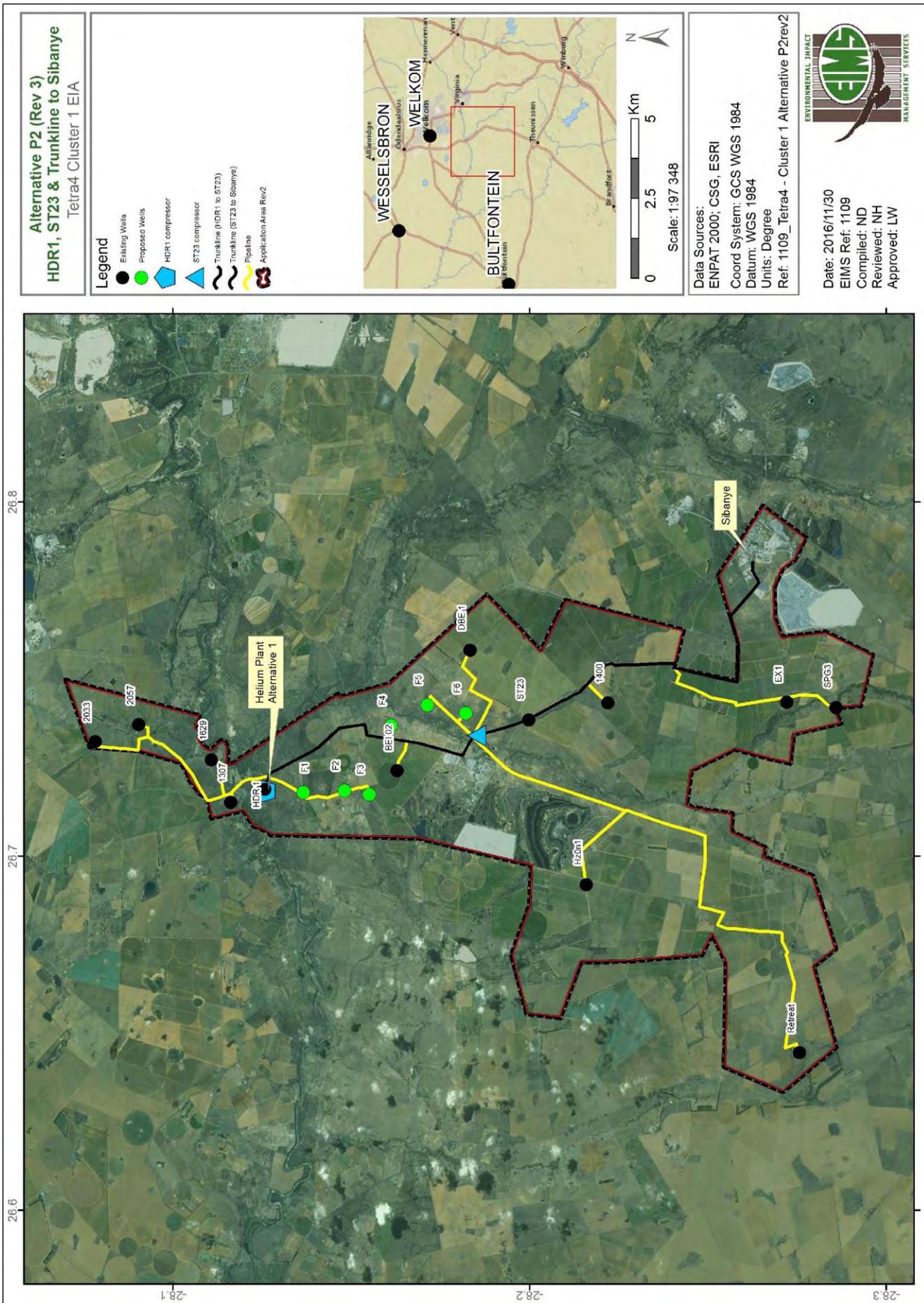


Figure 146 – Map depicting the gas production pipelines, wells and footprints associated with Alternative 1. Map supplied by client.

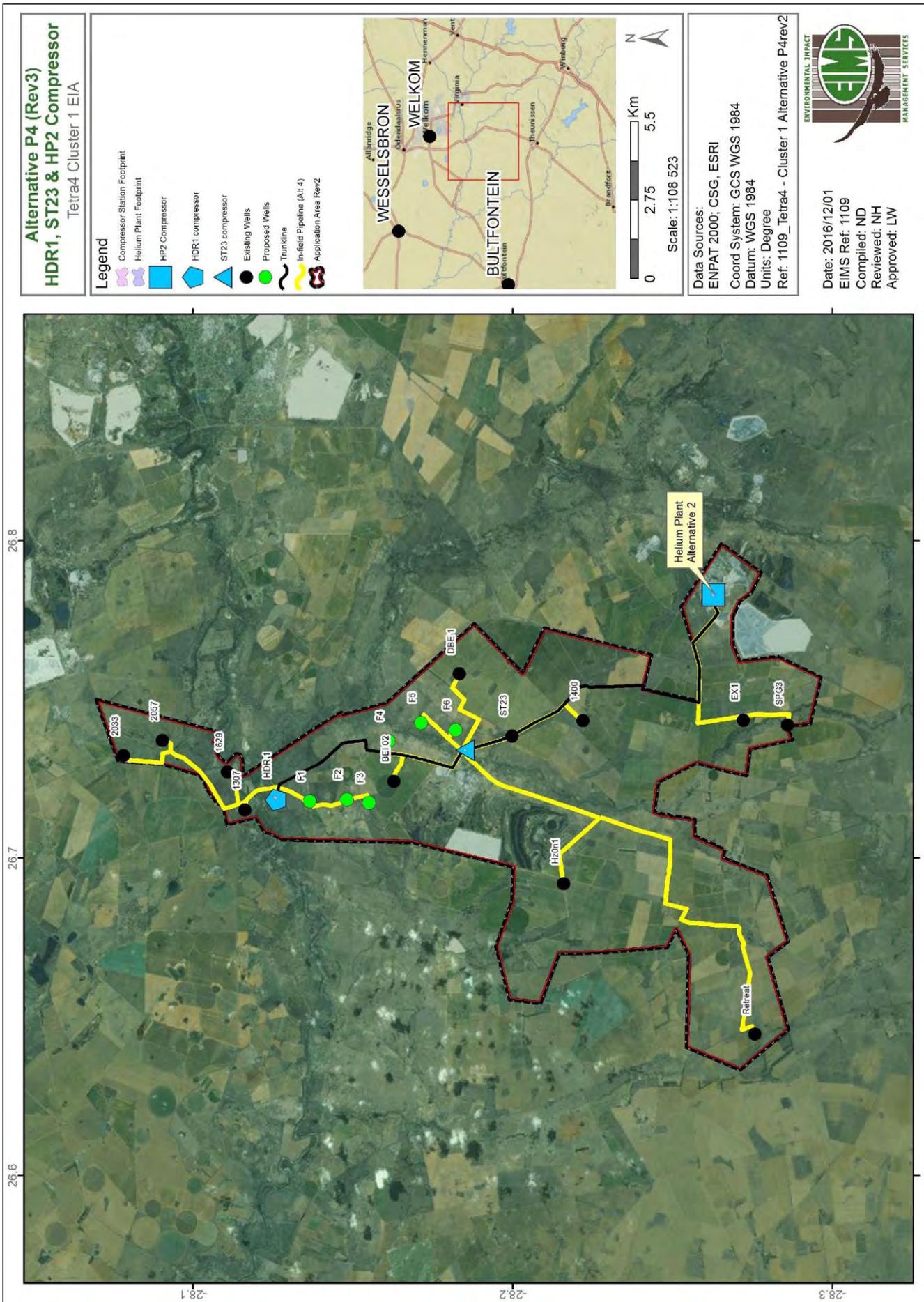


Figure 147 – Map depicting the gas production pipelines, wells and footprints associated with Alternative 2. Map supplied by client.

In the sections that follows, the impact assessment calculations for the envisaged impacts of Alternative 3 will be presented. These calculations were made using the EIMS significance of impact assessment rating scales. The methodology for using these rating scales are presented in **Annexure B** of this report.

While five project phases exist (Planning, Construction, Operation, Decommissioning as well as Rehabilitation and Closure), only impact sheets for the Construction Phases are included here. The reason for this is that limited to no impacts are expected on the identified heritage issues during the other phases of the project.

## 12.2 Impact Assessment in terms of Alternative 3

### 12.2.1 Disturbance / Destruction of TET 1 and TET 8

As outlined in the section dealing with fieldwork findings, the sites comprise cemeteries that are located 35 m and 45 m from the proposed pipeline route. While no direct impacts on these two sites are therefore expected, their relative proximity to the proposed pipeline route means that a low risk exist for some measure of peripheral disturbance.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a medium negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -8.75.

Impact Name	Disturbance/Destruction of Cemeteries at TET 1 and TET 8				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	5	4
Extent	5	5	Reversibility	4	3
Duration	3	3	Probability	3	2
Environmental Risk (Pre-mitigation)					-12.75
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-7.50
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: No public response regarding these two cemeteries is currently known. In general terms, one response regarding graves on another property was recorded during the overall public participation process.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2

Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
<b>Final Significance</b>	<b>-8.75</b>

### 12.2.2 Disturbance / Destruction of TET 2 and TET 3

TET 2 and TET 3 comprise historic structures that will be directly impacted upon by the proposed development of the Alternative 3 pipeline. While the construction of this pipeline may not necessarily destroy both sites, it would certainly disturb the two structures to a significant extent.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a medium negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint, is estimated to be of a Moderate Negative Risk, with a value of -11.38.

Impact Name	Disturbance/Destruction of Historic Structures at TET 2 and TET 3				
Alternative	Alternative 3				
<b>Environmental Risk</b>					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	3	2
Extent	3	3	Reversibility	4	3
Duration	5	5	Probability	4	3
Environmental Risk (Pre-mitigation)					-15.00
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-9.75
Degree of confidence in impact prediction:					Medium
<b>Impact Prioritisation</b>					
Public Response					1
Low: No public response regarding these two historic structures is currently known.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					<b>-11.38</b>

### 12.2.3 Disturbance / Destruction of TET 4 and TET 5

TET 4 and TET 5 comprise historic to recent sites with the potential risk of containing graves. These sites will be directly impacted upon by the proposed development of the Alternative 3 pipelines. While the construction of these pipelines may not necessarily destroy both sites, it would certainly disturb the two structures to a significant extent.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a medium negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint, is estimated to be of a Low Negative Risk, with a value of -9.33.

Impact Name	Disturbance/Destruction of Possible Graves at TET 4 and TET 5				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	4	3
Extent	4	4	Reversibility	5	4
Duration	5	5	Probability	3	2
Environmental Risk (Pre-mitigation)					-13.50
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-8.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: No public response regarding these two sites is currently known. In general terms, one response regarding graves on another property was recorded during the overall public participation process.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					<b>-9.33</b>

### 12.2.4 Disturbance / Destruction of TET 6, TET 7, TET 11, TET 15 and TET 16

Please note that this impact assessment was calculated solely on the expected impact of the proposed pipelines. The expected impact from the position of site TET 11 within the 1km wide circular areas surrounding F6 and ST23 will be discussed separately below.

These sites comprise cemeteries that will be directly impacted upon by the proposed development of the pipelines. While the construction of this pipelines may not necessarily destroy both sites, it would certainly disturb the two cemeteries to a significant extent.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a high negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -9.33.

Impact Name	Disturbance/Destruction of Cemeteries at TET 6, TET 7, TET 11, TET 15 and TET 16				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	5	4
Extent	5	5	Reversibility	5	4
Duration	5	3	Probability	4	2
Environmental Risk (Pre-mitigation)					-20.00
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-8.00
Degree of confidence in impact prediction:					Medium
<b>Impact Prioritisation</b>					
Public Response					1
Low: No public response regarding these cemeteries is currently known. In general terms, one response regarding graves on another property was recorded during the overall public participation process.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					-9.33

#### 12.2.5 Disturbance / Destruction of TET 9, TET 10 and TET18

These sites comprise various historic structures which range from an old concrete bridge (TET 9), to a brick silage dip (TET 10) and a building believed to be related to an old diamond mine (TET 18). All these structures are believed to be older than 60 years. The pipelines proposed for Alternative 3 will be built across a section of the bridge, across the southern edge of the silage pit and between the mine building and a drinking trough. This proposed construction will certainly not destroy any of these sites, with only some level of disturbance expected.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a moderate negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -8.75.

Impact Name	Disturbance/Destruction of the Historic Structures at TET 9, TET 10 and TET 18				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	3	2
Extent	3	3	Reversibility	3	2
Duration	3	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-12.00
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-7.50
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: No public response regarding these structures is known.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					<b>-8.75</b>

#### 12.2.6 Disturbance / Destruction of TET 11, TET 19, TET 20, TET 21 and TET 22

TET 11, TET 19, TET 20, TET 21 and TET 22 comprise cemeteries that are located within the 1 km wide area surrounding the proposed wells at F1, F2, and F3 as well as the proposed compressor site at ST23. At present, the exact positions of these four aspects have not been finalised yet barring for the undertaking that they will be placed within these 1km wide circular areas.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a medium negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3

on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -4.67.

Impact Name	Disturbance/Destruction of Cemeteries at TET 11, TET 19, TET 20, TET 21 and TET 22				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	5	4
Extent	5	5	Reversibility	5	4
Duration	5	3	Probability	3	1
Environmental Risk (Pre-mitigation)					-15.00
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-4.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: No public response regarding these two cemeteries is currently known. In general terms, one response regarding graves on another property was recorded during the overall public participation process.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					<b>-4.67</b>

#### 12.2.7 Disturbance / Destruction of TET 12, TET13, TET 14, TET 25 and TET 26

TET 12, TET 13, TET 14, TET 25 and 26 comprise historic to recent sites with the potential risk of containing graves. These sites are located within the 1 km wide area surrounding the proposed well positions at F5 and F6 as well as the proposed compressor site at ST23. At present, the exact positions of these aspects have not been finalised yet barring for the undertaking that it will be placed within this 1km wide circular areas. Please note that while sites TET 12, TET 13 and TET 14 are also affected by the proposed development of Alternative 3 pipelines and trunk lines, their inclusion in this section is based solely on their location within the 1km wide areas surrounding the proposed well positions at F5 and F6 as well as the ST23 compressor site.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a relatively high low negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a lower impact risk. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -4.67.

Impact Name	Disturbance/Destruction of Possible Graves at TET 12, TET 13, TET 14 and TET 25				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	4	3
Extent	4	4	Reversibility	5	4
Duration	5	5	Probability	2	1
Environmental Risk (Pre-mitigation)					-9.00
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-4.00
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: No public response regarding these two sites is currently known. In general terms, one response regarding graves on another property was recorded during the overall public participation process.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					<b>-4.67</b>

#### 12.2.8 Disturbance / Destruction of TET 23 and TET 24

TET 23 and TET 24 comprise Stone Age sites. The sites are located within the 1 km wide area surrounding the proposed compressor well positions at F4, F5 and F6 as well as the compressor site at ST23. At present, the exact position of these aspects have not been finalised yet barring for the undertaking that it will be placed within these 1km wide circular areas.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a medium negative impact on this sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a lower impact risk. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -4.38.

Impact Name	Disturbance/Destruction of Stone Age sites at TET 23 and TET 24				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation

Nature	-1	-1	Magnitude	5	4
Extent	5	5	Reversibility	4	3
Duration	5	3	Probability	3	1
Environmental Risk (Pre-mitigation)					-14.25
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-3.75
Degree of confidence in impact prediction:					Medium
<b>Impact Prioritisation</b>					
Public Response					1
Low: No public response regarding these two sites is currently known.					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.17
<b>Final Significance</b>					-4.38

#### 12.2.9 Disturbance / destruction of components of the battlefield on which the Battle of Zand River (7-10 May 1900) took place during the South African War

The South African War (1899-1902) had a significant impact across the country, and also within the study area. The archival and historical desktop study has revealed that during the Battle of Zand River (7 May -10 May 1902), units of the British cavalry under command of General John French crossed over the Du Preez Leger Drift to outflank the Boer position on the northern bank of the river. This drift is located within the study area, where the bridge on the road between Welkom and Theunissen is located. This said, no shots were fired here as the drift was not held by the Boer forces.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a moderate negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -7.58.

<b>Impact Name</b>	<b>Disturbance/ Destruction of Sections of the Battle of Zand River</b>				
<b>Alternative</b>	<b>Alternative 3</b>				
<b>Environmental Risk</b>					
<b>Attribute</b>	<b>Pre-mitigation</b>	<b>Post-mitigation</b>	<b>Attribute</b>	<b>Pre-mitigation</b>	<b>Post-mitigation</b>
Nature	-1	-1	Magnitude	3	2
Extent	5	5	Reversibility	3	3
Duration	3	3	Probability	3	2

Environmental Risk (Pre-mitigation)	-10.50
Mitigation Measures	
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.	
Environmental Risk (Post-mitigation)	-6.50
Degree of confidence in impact prediction:	Medium
<b>Impact Prioritisation</b>	
Public Response	1
Low: Issue not raised in public responses.	
Cumulative Impacts	1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
<b>Final Significance</b>	<b>-7.58</b>

#### 12.2.10 Disturbance / destruction of tangible remains relating to the old diamond mine at Welgegund

The archival and historical desktop study has revealed that diamond prospecting and mining activities were already undertaken by the 1890s on the farm Welgegund. This farm is located within the present study area. These mining activities continued intermittently until the 1930s, and based on information presently available, continued here after a hiatus of many decades. No mining activities currently take place on site. Significant tangible remains associated with this mine would include all tangible mining remains older than 100 years and buildings older than 60 years. In fact, one such a building was identified during the site visit in close proximity to the mine (see Site 4 from the Heritage Scoping fieldwork findings).

The continuation of the development in the form of Alternative 3 means that the unmitigated development would represent a moderate negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Low Negative Risk, with a value of -7.58.

Impact Name	Disturbance/ Destruction of Tangible Remains of the Old Diamond Mine at Welgegund				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	3	2
Extent	5	5	Reversibility	3	3
Duration	3	3	Probability	3	2
Environmental Risk (Pre-mitigation)					-10.50
Mitigation Measures					

Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.	
Environmental Risk (Post-mitigation)	-6.50
Degree of confidence in impact prediction:	Medium
<b>Impact Prioritisation</b>	
Public Response	1
Low: Issue not raised in public responses.	
Cumulative Impacts	1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
Medium: Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.17
<b>Final Significance</b>	-7.58

### 12.2.11 Disturbance / destruction of Palaeontology

Dr. Lloyd Rossouw of Palaeo Field Services was appointed to carry out a field-based Palaeontological Impact Assessment of the proposed exploration footprint area. The sections that follow below were obtained from this report. Refer **Annexure D** for report.

Dr. Rossouw's report found that proposed well sites are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. The palaeontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units. For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites. All proposed pipeline route options are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit and the Sand River. Any excavation exceeding a depth of 1m into these overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines. Both site options for the combined helium and CNG gas conditioning plant are underlain by palaeontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance. Any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

The continuation of the development in the form of Alternative 3 means that the unmitigated development would

represent a high negative impact on these sites.

With suitable mitigation measures in place, the expected impact can be mitigated to a moderate negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint is estimated to be of a Moderate Negative Risk, with a value of -16.88.

Impact Name	Disturbance/ Destruction of Tangible Remains of the Old Diamond Mine at Welgegund				
Alternative	Alternative 3				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	5	3
Extent	3	2	Reversibility	5	5
Duration	5	5	Probability	5	3
Environmental Risk (Pre-mitigation)					-22.50
Mitigation Measures					
Refer <b>Chapters 13 &amp; 14</b> for proposed mitigation measures.					
Environmental Risk (Post-mitigation)					-11.25
Degree of confidence in impact prediction:					High
<b>Impact Prioritisation</b>					
Public Response					1
Low					
Cumulative Impacts					2
Medium					
Degree of potential irreplaceable loss of resources					3
High					
Prioritisation Factor					1.50
<b>Final Significance</b>					<b>-16.88</b>

### **13. MITIGATION MEASURES SUGGESTED**

#### **13.1 Introduction**

In this section the mitigation measures to be followed to minimize the impact of the proposed development on heritage, will be outlined and discussed.

#### **13.2 Suggested Measures to Mitigate the impact of the Proposed Development on TET 1 and TET 8**

##### 13.2.1 Mitigation Measures

TET 1 and TET 8 are cemeteries located 45m and 35m from the proposed In-Field (Alt 4) and In-Field North (HDR1) pipelines. The following mitigation measures are required:

- All construction work on the project that is undertaken within 200 m of these sites, must be monitored by a heritage specialist / archaeologist.

##### 13.2.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that a heritage specialist / archaeologist is appointed to undertake the necessary monitoring work for construction work within 200 m of the two cemeteries.

#### **13.3 Suggested Measures to Mitigate the impact of the Proposed Development on TET 2 and TET 3**

##### 13.3.1 Mitigation Measures

TET 2 and TET 3 comprises historic structures associated with the early history of the farm Adamsonsvlei. These sites will be affected by either the In-Field (Alt 4) or In-Field North (HDR1) pipeline. Both these pipeline alternatives are proposed to run through both these sites. The following mitigation measures are required:

- Recording of site by way of measured drawings, photographs and qualitative descriptions;
- Compilation of Phase 2 Heritage Report containing the recorded data; and
- Submission of permit application to SAHRA to allow for the disturbance to the site. A Phase 2 Heritage Report must accompany the permit.

### 13.3.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that an archaeologist is appointed to undertake the necessary monitoring work well in advance of the actual construction.

## 13.4 **Suggested Measures to Mitigate the impact of the Development on TET 4, TET 5, TET 12, TET 13 and TET 14**

### 13.4.1 Mitigation Measures

All these sites comprise historic to recent farm worker accommodation, with the exception of TET 5, which contains possible graves. TET 4 and TET 5 will be affected by the proposed development of either the In-Field (Alt 4) pipeline or alternatively the In-Field North (HDR1) pipeline. Sites TET 12, TET 13 and TET 14 will be affected by the construction of the Trunkline (ST23 to Sibanye) should this alternative be decided upon.

Although the structures and cultural material located at these sites are of little heritage significance, the possibility does exist for unmarked stillborn graves (or in the case of TET 5 possible graves) to be located at these sites as well.

The following mitigation measures are required for those sites that will be affected by the final development footprint:

- Written notification to SAHRA that reconnaissance excavation will be undertaken;
- Reconnaissance excavation of the structures to assess whether any graves are indeed located here; and
- Should evidence for graves be found, a comprehensive grave relocation procedure must be implemented.

### 13.4.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that a suitably accredited archaeologist / heritage specialist is appointed to undertake the necessary mitigation work well in advance of the actual construction.

## 13.5 **Suggested Measures to Mitigate the impact of the Development on TET 6, TET 7, TET 11, TET 15 and TET 16**

### 13.5.1 Mitigation Measures

All five these sites comprise cemeteries located within 10m of the proposed development alternatives. TET 6 and TET 7 are located 6m from the proposed development of either the In-Field (Alt 4) pipeline or alternatively the In-Field North (HDR1) pipeline. The development of the In-Field (Alt 4) pipeline will cross directly over the cemetery at TET 11 whereas the development of Trunkline (ST23 to Sibanye) will pass directly over the cemetery at TET 15. The cemetery at TET 16 will be affected by the development of either (or both) the Trunkline (ST23 to Sibanye) and the In-Field (Alt 4) pipeline. The following mitigation measures are required:

- The final development footprint, whether it entails the In-Field (Alt 4) pipeline, the in-Field North (HDR1) pipeline or the Trunkline (ST23 to Sibanye), must be re-aligned to allow for a buffer area of at least 50m between each cemetery and the development footprint area.

#### 13.5.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that the pipeline routes of the final development footprint are re-aligned to allow for a 50m buffer of undeveloped space between the footprint and these cemeteries.

### 13.6 **Suggested Measures to Mitigate the impact of the Development on TET 9, TET 10 and TET 18**

#### 13.6.1 Mitigation Measures

All three sites listed here comprise historic structures that are older than 60 years. TET 9 consists of the concrete bridge (and adjacent concrete drift) over the Sand River, TET 10 consists of a silage pit whereas a mining-related building was identified at TET 18. TET 9 will be affected by the proposed development of either the In-Field (Alt 4) pipeline or alternatively the In-Field North (HDR1) pipeline whereas TET 10 and TET 18 will be affected by the proposed development of the In-Field (Alt 4) pipeline only. The following mitigation measures are required:

- Recording of site by way of measured drawings, photographs and qualitative descriptions;
- Compilation of Phase 2 Heritage Report containing the recorded data;
- Submission of permit application to SAHRA / Free State Heritage to allow for the disturbance to the site. A Phase 2 Heritage Report must accompany the permit; and
- An archaeological watching brief must be implemented for TET 9 along the banks of the river.

#### 13.6.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that a suitably accredited archaeologist / heritage specialist is appointed to undertake the necessary mitigation work well in advance of actual construction.

### **13.7 Suggested Measures to Mitigate the impact of the Development on TET 11, TET 12, TET 13, TET 14, TET 19, TET 20, TET 21, TET 22, TET 23, TET 24, TET 25 and TET 26**

#### **13.7.1 Mitigation Measures**

This section deals exclusively with the measures required to mitigate the impact of the placement and development of six proposed well positions (F1, F2, F3, F4, F5 and F6) as well as the ST23 compressor site within the 1km wide circular areas assessed in the field. A total of 12 heritage sites of any significance were identified within these circular areas, namely TET 11, TET 12, TET 13, TET 14, TET 19, TET 20, TET 21, TET 22, TET 23, TET 24, TET 25 and TET 26. Of these 12 heritage sites, five are cemeteries (see TET 11, TET 19, TET 20, TET 21 and TET 22), five are structures or former homesteads possessing the risk for containing stillborn graves (see TET 12, TET 13, TET 14, TET 25 and 26) and two are Stone Age sites (TET 23 and TET 24). Despite the fact that these sites are so different, the mitigation measures outlined here all have one aim in mind, namely the avoidance of these identified heritage sites in the placement of the six proposed well positions and one compressor site. The following mitigation measures are required:

- The placement of the development footprints for the six proposed well positions at F1, F2, F3, F4, F5 and F6 as well as the proposed compressor site at ST23 must be done in such a way that a buffer area of at least 50m is allowed between these development footprints and the 12 heritage sites identified within the 1km circular areas.

#### **13.7.2 Functional Responsibilities of the Applicant**

The functional responsibilities of the Applicant are:

- Ensure that the placement of the development footprints of the six proposed well positions as well as the one compressor site at ST23 are done in such a way that a buffer of undeveloped space of at least 50m is maintained between the development footprints and these sites.

### **13.8 Suggested Measures to Mitigate the impact of Additional Gas Production Footprints on Heritage Sites**

#### **13.8.1 Mitigation Measures**

A defined set of development footprints and alternatives were assessed as part of this heritage impact assessment. As the project continues, additional development footprints may be proposed. If left unmitigated, these additional development activities may have a detrimental impact on heritage resources, such as the identified heritage site types identified in this Heritage Impact Assessment namely Graves and Cemeteries, Unmarked Stillborn Graves, Historic Buildings and Structures as well as Archaeological Sites. The following general recommendations are required to mitigate such impacts:

- The planning of all additional footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps in this report (refer Figures 113 to 114). To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints;
- As soon as any additional gas production footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed;
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional footprint areas to identify any heritage sites located there;
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed activities on the identified heritage sites and outlining mitigation measures; and
- The report would be a subsequent heritage impact assessment aimed specifically at the additional footprints, and must be submitted to the heritage authorities to obtain their approval as well.

#### 13.8.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- Ensure that the planning of additional footprints takes cognizance of the heritage sensitivities depicted on the heritage sensitivity maps in this report (refer Figures 113 - 114) and to the extent possible, ensure that identified heritage sensitivities are avoided in the establishment of additional exploration footprints;
- Appoint at their cost a professional heritage specialist to undertake the heritage walkthroughs and to compile the required additional heritage impact assessments;
- Provide the appointed heritage specialist with the necessary footprints and geographic information relating to the additional exploration footprint areas;
- Arrange landowner access permission from the respective landowners before the commencement of the heritage fieldwork; and
- Implement the mitigation measures outlined in the heritage report written by the heritage specialist.

### 13.8.3 Functional Responsibilities of the Heritage Specialist

The functional responsibilities of the Heritage Specialist are:

- To undertake the heritage walkthroughs of the additional footprint areas;
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed development activities on the identified heritage sites and outlining mitigation measures which may be required; and
- To ensure that the heritage report is submitted to the ECO and mining company to make certain that the mitigation measures as recommended in the report are explained and understood.

## 13.9 **Suggested Measures to Mitigate the impact of Development on the Battle of Zand River (7-10 May 1900)**

### 13.9.1 Mitigation Measures

The South African War (1899-1902) had a significant impact across the country, and within the study area. The archival and historical desktop study has revealed that during the Battle of Zand River (7 May -10 May 1902) units of the British cavalry under command of General John French crossed over the Du Preez Leger Drift to outflank the Boer position on the northern bank of the river. This drift is located within the study area, where the bridge on the road between Welkom and Theunissen is located. This said, no shots were fired here as the drift was not held by the Boer forces.

Should any additional development footprints within 1 000 m of the Sand River be proposed, the following mitigation must be undertaken:

- Archaeological field surveys of these proposed development footprint areas should identify any tangible remains of the battle and the associated heritage impact assessment would address any perceived significant impacts on this battle and its associated tangible remains.

### 13.9.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- In cases where any additional footprints are proposed within 1 000 m of the Sand River, the Applicant must appoint a heritage specialist to undertake archaeological field surveys as well as the compilation of a heritage impact assessment report; and
- Any mitigation measures outlined in the heritage impact assessment must be implemented by the Applicant.

## **13.10 Suggested Measures to Mitigate the impact of Development on Tangible Remains of the Old Diamond Mine at Welgegund**

### **13.10.1 Mitigation Measures**

The archival and historical desktop study has revealed that diamond prospecting and mining activities were already undertaken by the 1890s on the farm Welgegund. This farm is located within the present study area. These mining activities continued intermittently until the 1930s, and based on information presently available, continued here after a hiatus of many decades. No mining activities currently take place on site. Significant tangible remains associated with this mine would include all tangible mining remains older than 100 years and buildings older than 60 years. In fact, one such a building was identified during the site visit in close proximity to the mine (see Site 4).

Should any development footprints within 1 000 m of the building at Site 4 be proposed, the following mitigation will have to be undertaken:

- Archaeological field surveys of these proposed development footprint areas should identify any significant tangible remains associated with the old diamond mine whereas the associated heritage impact assessment would address any perceived significant impacts on these tangible remains.

### **13.10.2 Functional Responsibilities of the Applicant**

The functional responsibilities of the Applicant are:

- In cases where any additional footprints are proposed within 1 000 m of the building at Site 4, the Applicant must appoint a heritage specialist to undertake archaeological field surveys as well as the compilation of a heritage impact assessment report; and
- Any mitigation measures outlined in the heritage impact assessment report must be implemented by the Applicant.

## **13.11 Suggested Measures to Mitigate the Impact of Development on Palaeontology**

### **13.11.1 Mitigation Measures**

Dr. Lloyd Rossouw of Palaeo Field Services was appointed to undertake a field-based palaeontological impact assessment of the proposed development. His study found that the proposed well sites are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance.

The palaeontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units.

For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites. All proposed pipeline route options are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit and the Sand River. Any excavation exceeding a depth of 1m into these overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines. Both site options for the combined helium and CNG gas conditioning plant are underlain by palaeontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance. Any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

Some of the most significant fossil-bearing rocks in the study are associated with Permian deposits of the Karoo Supergroup, in this case represented by the Ecca Group Volksrust Formation and the lower Adelaide Subgroup of the Beaufort Group. These deposits are allocated a moderate to very high palaeontological significance respectively and represent one of the richest assemblages of vertebrate, invertebrate and plant fossils in the world. Other palaeontologically significant sediments include late Quaternary floodplain deposits associated with the Sand and Doring Rivers.

The well sites are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. The palaeontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units.

For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

All the pipeline route options are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Areas associated with late Quaternary alluvial deposits (erosional gullies flanking river crossings) were investigated but no aboveground evidence of Quaternary fossil remains were found. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit (GPS coordinates S 28.184572 E 26.731733) (**Fig. 126 & 127**) and the Sand River (GPS coordinates S 28.117869 E 26.719411) (**Fig. 128-130**). Any excavation exceeding a depth of 1m into these overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

Both site options for the combined helium and CNG gas conditioning plant are underlain by palaeontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance. Any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

In summary, the following mitigation measures are required:

- For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites;
- Any excavation exceeding a depth of 1m into the two identified overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines; and
- The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

### 13.11.2 Functional Responsibilities of the Applicant

The functional responsibilities of the Applicant are:

- To ensure that the required mitigation measures as outlined above are implemented.

## 13.12 **Suggested Measures to Mitigate the Impact of Exploration on Sacred Natural Sites**

### 13.12.1 Mitigation Measures

The International Union for Conservation of Nature (IUCN) defines Sacred Natural Sites as areas of land or water having

special spiritual significance to peoples and communities (IUCN, 2008). Such Sacred Natural Sites are found across Southern Africa as well, and for various reasons are often kept secret. No Sacred Natural Sites are known to be located within the overall production right as well as the production footprint areas. As the potential impact on such Sacred Natural Sites falls within the study of groundwater, which is the author is not educated nor experienced in, the project geohydrologist has been asked to provide her observations on this aspect. The following mitigation measures are recommended:

- Once final production drilling footprints (both existing and proposed) are determined and confirmed for implementation, a public participation process must be undertaken during which the Interested & Affected Parties (I&APs) are invited to come forward and state whether they are aware of any sacred water sites (secret or not) located within a 500m radius area from each proposed drilling position. It is important to note that at this stage the I&Ps will not be requested to provide information on the exact location of such sacred sites, only whether such sites are located within a 500 m radius area from the proposed drilling position(s) or not. Care must be taken during the public participation to ensure that the cartographic and location information presented to the I&APs contains clear enough information for them to confidently recognise the positions of such proposed drilling site(s) should these be located anywhere in proximity to the properties and landscapes they have knowledge of. The presentation of such cartographic information in English, Afrikaans and Sesotho would be paramount;
- Should an I&AP state that such a sacred site is indeed located within 500 m of a proposed drilling position, an experienced team comprising a heritage specialist and geohydrologist must accompany the I&AP to the sacred site for confirmation purposes;
- The heritage specialist and geohydrologist must compile a letter to indicate the findings of their fieldwork i.e. whether such a sacred site was indeed identified within 500 m from the proposed drilling position;
- All aspects relating to the location of the sacred site must be kept strictly confidential. At no stage will any information regarding the position of the sacred site (GPS coordinates, property description etc.) be contained in the letter, or in any other report, document or verbal communication; and
- The confidential manner in which this mitigation will be approached and undertaken with regards to the locations of Sacred Natural Sites, must be clearly communicated to the I&AP from the outset.
- No development footprints (including exploration drilling) may be allowed within 500 m of a confirmed Sacred Natural Site.

#### 13.12.2 Functional Responsibilities of the Applicant

- To ensure that once development footprints are proposed, the above mentioned mitigation measures regarding Sacred Natural Sites be implemented.

## **14. ACTION PLAN FOR IMPLEMENTATION**

### **14.1 Basic Principles of the Action Plan**

The action plan to mitigate identified development impacts is based on the following overriding principle:

- The minimisation of the disturbance of the proposed development activities on the identified heritage constraints and sensitivities.

### **14.2 Management Measures and Mechanisms**

The management measures and mechanisms to minimize the impact of the proposed development activities on the identified heritage constraints and sensitivities, are outlined in the Chapter 13 as well as in the table under Required Actions below.

### **14.3 Required Actions**

The individual actions required to implement the mitigation of the impact of the proposed development on identified heritage sensitivities and constraints, are outlined in **Table 27** below.

Table 14- Mitigation Measures required for Impacts on TET 1 and TET 8

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 1 and TET 8</b>							
<b>A</b>	The Applicant and ECO shall identify a suitably qualified archaeologist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified archaeologist to undertake the heritage monitoring of the two sites.	(ECO Monthly Checklist/Report)
<b>2. Heritage Monitoring</b>							
<b>A</b>	The Applicant and ECO shall notify the appointed archaeologist well in advance before construction of the pipeline commences.	Planning	Action that needs to be undertaken at least four weeks in advance of construction.	Applicant ECO	ECO (Monthly)	To provide the archaeologist with enough headway to ensure that he/she is on site when construction commences.	(ECO Monthly Checklist/Report)
<b>B</b>	The appointed archaeologist must undertake heritage monitoring of the two cemeteries during all construction taking place within 200 m of the two sites.	Construction Phase	Will be undertaken during Construction Phase for as long as construction work takes place within 200 m of the two sites.	Archaeologist ECO	ECO (Monthly)	To ensure that no disturbance takes place to the two cemeteries during the construction of nearby pipelines.	(ECO Monthly Checklist/Report)

<b>C</b>	The appointed archaeologist must compile one monitoring report within which the observations and findings of the monitoring activities can be contained. Additional mitigation recommendations, should these be deemed necessary, must also be included.	Construction Phase	Within one week after completing the monitoring.	Archaeologist ECO	ECO (Monthly)	To provide written feedback on the monitoring of the two cemeteries.	(ECO Monthly Checklist/Report)
<b>3. Measures Required should Suspected Evidence for Disturbance to the Two Cemeteries as a result of Construction Activities be Identified.</b>							
<b>A</b>	Should suspected evidence for disturbance as a result of the construction work be identified during monitoring, the appointed archaeologist must inform the ECO and Applicant immediately and all construction work within 200 m of that cemetery must be halted immediately.	Construction Phase	Immediately after discovery of suspected evidence of disturbance as a result of construction activities.	Archaeologist ECO	ECO (Monthly) Heritage Specialist Applicant	To ensure that the ECO and Applicant immediately become aware of the suspected disturbance for impacts on the two cemeteries.	(ECO Monthly Checklist/Report) Monitoring Report
<b>B</b>	The archaeologist will provide the ECO and Applicant with the mitigation measures that will be required from this point onward. The exact mitigation measures to be followed would depend on the characteristics of the discovery and conditions of the site.	Construction Phase	Within 48 hours of first discovery of suspected disturbance.	Heritage Specialist	Archaeologist ECO Applicant	To outline the exact mitigation measures required.	(ECO Monthly Checklist/Report) Monitoring Report

Table 15- Mitigation Measures required for Impacts on TET 2 and TET 3

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 2 and TET 3</b>							
<b>A</b>	The Applicant and ECO shall identify a suitably qualified archaeologist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified archaeologist to undertake the mitigation of the two sites.	(ECO Monthly Checklist/Report)
<b>2. Archaeological Mitigation of TET 2 and TET 3</b>							
<b>A</b>	The appointed archaeologist must record the two sites by way of measured drawings, photographs and qualitative descriptions.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To undertake the recording of the two sites.	(ECO Monthly Checklist/Report)
<b>B</b>	The appointed archaeologist must compile a Phase 2 report for the two sites within which the data and findings of the previous phase can be included.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To compile a written document on the recording of the two sites.	(ECO Monthly Checklist/Report)
<b>C</b>	Submission of permit application to SAHRA to allow for the disturbance to the site. A Phase 2 Heritage Report must accompany the permit.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To obtain a permit from SAHRA to allow for the disturbance to the sites.	(ECO Monthly Checklist/Report)

Table 16- Mitigation Measures required for Impacts on TET 4, TET 5, TET 12, TET 13 and TET 14

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 4, TET 5, TET 12, TET 13 and TET 14</b>							
<b>A</b>	The Applicant and ECO shall identify a suitably qualified archaeologist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified archaeologist to undertake the mitigation.	(ECO Monthly Checklist/Report)
<b>2. Archaeological Mitigation of TET 4, TET 5, TET 12, TET 13 and TET 14</b>							
<b>A</b>	The appointed archaeologist must notify SAHRA in writing that reconnaissance excavations will be undertaken to test for the presence of graves.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To notify SAHRA in writing of the intended reconnaissance excavation.	(ECO Monthly Checklist/Report)
<b>B</b>	Reconnaissance excavation of the structures to assess whether any graves are indeed located there.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To undertake mitigation at the sites.	(ECO Monthly Checklist/Report)
<b>C</b>	The appointed archaeologist must compile a report on the excavations and clearly state whether any evidence for graves are located at these sites or not.	Planning	Action that needs to be undertaken two weeks after completion of reconnaissance excavations.	Archaeologist ECO	ECO (Monthly)	To compile a written document on the reconnaissance excavations.	(ECO Monthly Checklist/Report)

**3. Measures Required should Evidence for Graves be Identified during the Reconnaissance Excavations**

<b>A</b>	A full grave relocation process will have to be implemented.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To undertake the relocation of the graves identified during the reconnaissance excavations.	(ECO Monthly Checklist/Report)
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Table 17- Mitigation Measures required for Impacts on TET 6, TET 7, TET 11, TET 15 and TET 16

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 6, TET 7, TET 11, TET 15 and TET 16</b>							
<b>A</b>	The final development footprint, whether it entails the In-Field (Alt 4) pipeline, the in-Field North (HDR1) pipeline or the Trunkline (ST23 to Sibanye), must be re-aligned to allow for a buffer area of at least 50m between each of the cemeteries and the development footprint area.	Planning	Immediate action that needs to be undertaken as soon as the final development alternative is decided upon.	Applicant ECO	ECO (Monthly)	To ensure that no component of the development footprints are situated closer than 50 m from any of these cemeteries.	(ECO Monthly Checklist/Report)

Table 18- Mitigation Measures required for Impacts on TET 9, TET 10 and TET 18

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 9, TET 10 and TET 18</b>							
<b>A</b>	The Applicant and ECO must identify a suitably qualified archaeologist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified archaeologist to undertake the mitigation.	(ECO Monthly Checklist/Report)
<b>2. Archaeological Mitigation of TET 9, TET 10 and TET 18</b>							
<b>A</b>	The appointed archaeologist must record the sites by way of measured drawings, photographs and qualitative descriptions.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To undertake the recording of the sites.	(ECO Monthly Checklist/Report)
<b>B</b>	The appointed archaeologist must compile a Phase 2 report for the sites within which the data and findings of the previous phase can be included.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To compile a written document on the recording of the two sites.	(ECO Monthly Checklist/Report)
<b>C</b>	Submission of permit application to SAHRA / Free State Heritage to allow for the disturbance to the site. The Phase 2 report must accompany the permit.	Planning	Action that needs to be undertaken well in advance of construction.	Archaeologist ECO	ECO (Monthly)	To obtain a permit from SAHRA / Free State Heritage to allow for the disturbance to the sites.	(ECO Monthly Checklist/Report)

**3. Archaeological Watching Brief at TET 9**

<b>A</b>	The appointed archaeologist must implement an archaeological watching brief during construction of the pipeline on the banks of the Sand River.	Construction Phase	Will be undertaken during Construction Phase for as long as construction work takes place in proximity to TET 9 and the banks of the Sand River	Archaeologist ECO	ECO (Monthly)	To implement an archaeological watching brief at TET 9.	(ECO Monthly Checklist/Report)
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Table 19- Mitigation Measures required for Impacts on TET 11, TET 12, TET 13, TET 14, TET 19, TET 20, TET 21, TET 22, TET 23, TET 24, TET 25 and TET 26

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of TET 11, TET 12, TET 13, TET 14, TET 19, TET 20, TET 21, TET 22, TET 23, TET 24, TET 25 and TET 26</b>							
<b>A</b>	The placement of the development footprints for the six proposed well positions at F1, F2, F3, F4, F5 and F6 as well as the proposed compressor site at ST23 must be done in such a way that a buffer area of at least 50m is allowed between these development footprints and the 12 heritage sites identified within the 1km circular areas.	Planning	Immediate action that needs to be undertaken as soon as the final development alternative is decided upon.	Applicant ECO	ECO (Monthly)	To ensure that no component of the six proposed well positions as well as the proposed ST23 compressor plant is situated closer than 50 m from any of the sites identified within the 1km circular areas.	(ECO Monthly Checklist/Report)

Table 20- Mitigation Measures required for Addressing Impact of Additional Development Footprints on Heritage Sites

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation in terms of the Additional Development Footprints</b>							
<b>A</b>	The Applicant and ECO must ensure that any additional development footprint areas must take cognizance of the heritage sensitivity maps provided in this report and as far as possible, identified heritage sensitivities must be avoided in the establishment of additional development footprints.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To ensure that the identified heritage sensitivities are taken into consideration during the planning of additional footprint areas.	(ECO Monthly Checklist/Report)
<b>B</b>	The Applicant and ECO shall identify a suitably qualified heritage specialist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified heritage specialist to undertake the heritage walkthroughs and other mitigation.	(ECO Monthly Checklist/Report)
<b>C</b>	The Applicant and ECO shall provide the additional development footprints to the appointed heritage specialist.	Planning	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)	To ensure that the heritage specialist is informed as to the details (including position and extent) of the additional development footprints.	(ECO Monthly Checklist/Report)

## 2. Heritage Walkthroughs and Report

<b>A</b>	The appointed heritage specialist must undertake heritage walkthroughs of the additional development footprint areas.	Planning	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and suitably mitigated.	(ECO Monthly Checklist/Report)
<b>B</b>	The appointed heritage specialist must compile a heritage impact assessment report outlining the findings of the fieldwork and providing mitigation measures, should such mitigation measures be deemed necessary.	Planning	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and suitably mitigated.	(ECO Monthly Checklist/Report)
<b>C</b>	The ECO and Applicant must implement the mitigation measures as outlined in the heritage report.	Planning	Although this action will in all likelihood be undertaken during the	ECO Applicant	ECO (Monthly)	To ensure that the mitigation measures recommended by the heritage	(ECO Monthly Checklist/Report)

			Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.			specialist is implemented.	
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Table 21- Mitigation Measures required for Addressing Impact on the Battle of Zand River

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Mitigation Measures required should any proposed Additional Development Footprint Area be located closer than 1 000 m from the Sand River</b>							
<b>A</b>	The Applicant and ECO shall identify a suitably qualified heritage specialist to assist in conducting the mitigation. Once identified this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of development.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified heritage specialist to undertake the heritage walkthroughs and other mitigation.	(ECO Monthly Checklist/Report)
<b>B</b>	The Applicant and ECO shall provide the additional development footprints to the appointed heritage specialist.	Planning	Action that needs to be undertaken well in advance of exploration	Applicant ECO	ECO (Monthly)	To ensure that the heritage specialist is informed as to the details (including position and extent) of the additional development footprints.	(ECO Monthly Checklist/Report)
<b>2. Heritage Walkthroughs and Report</b>							
<b>A</b>	The appointed heritage specialist must undertake heritage walkthroughs of the additional development footprint areas.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and	(ECO Monthly Checklist/Report)

			well in advance of actual proposed additional development work.			suitably mitigated.	
<b>B</b>	The appointed heritage specialist must compile a heritage impact assessment report outlining the findings of the fieldwork and providing mitigation measures, should such mitigation measures be deemed necessary.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and suitably mitigated.	(ECO Monthly Checklist/Report)
<b>C</b>	The ECO and Applicant must implement the mitigation measures as outlined in the heritage report.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	ECO Applicant	ECO (Monthly)	To ensure that the mitigation measures recommended by the heritage specialist are implemented.	(ECO Monthly Checklist/Report)

Table 22- Mitigation Measures required for Addressing Impact on Tangible Remains of the Old Diamond Mine at Welgegend

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Mitigation Measures required should any proposed Additional Development Footprint Area be located closer than 1 000 m from the building at Site 4</b>							
<b>A</b>	The Applicant and ECO shall identify a suitably qualified heritage specialist to assist in conducting the mitigation. Once identified this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of development.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified heritage specialist to undertake the heritage walkthroughs and other mitigation.	(ECO Monthly Checklist/Report)
<b>B</b>	The Applicant and ECO shall provide the additional development footprints to the appointed heritage specialist.	Planning	Action that needs to be undertaken well in advance of exploration	Applicant ECO	ECO (Monthly)	To ensure that the heritage specialist is informed as to the details (including position and extent) of the additional development footprints.	(ECO Monthly Checklist/Report)
<b>2. Heritage Walkthroughs and Report</b>							
<b>A</b>	The appointed heritage specialist must undertake heritage walkthroughs of the additional development footprint areas.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and	(ECO Monthly Checklist/Report)

			well in advance of actual proposed additional development work.			suitably mitigated.	
<b>B</b>	The appointed heritage specialist must compile a heritage impact assessment report outlining the findings of the fieldwork and providing mitigation measures, should such mitigation measures be deemed necessary.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist ECO	ECO (Monthly)	To ensure that any impacts on heritage sites by additional development activities are identified at an early stage and suitably mitigated.	(ECO Monthly Checklist/Report)
<b>C</b>	The ECO and Applicant must implement the mitigation measures as outlined in the heritage report.	Construction and Operation Phases	Although this action will in all likelihood be undertaken during the Construction and Operation Phases, it must be undertaken well in advance of actual proposed additional development work.	ECO Applicant	ECO (Monthly)	To ensure that the mitigation measures recommended by the heritage specialist are implemented.	(ECO Monthly Checklist/Report)

Table 23 - Mitigation Measures required for Addressing Impact on Sacred Natural Sites

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Initial Mitigation Measures Required</b>							
<b>A</b>	The Applicant and ECO shall ensure that all development footprints (including proposed drilling positions) must be presented to the I&APs by way of a public participation process to invite the I&APs to indicate whether any Sacred Natural Sites are located within 500 m of such proposed footprint areas. It is important to note that at this stage the I&APs will not be requested to provide information on the exact location of such sacred sites, only whether such sites are located within a 500 m radius area from the proposed development footprints or not. It is the responsibility of the Applicant and ECO to ensure that the cartographic and location information presented to the I&APs contain clear enough information for them to confidently recognise the positions of such proposed development footprints should these be located anywhere in proximity to the properties and landscapes they have knowledge of. The presentation of such cartographic information in English, Afrikaans and Sesotho would be paramount. The confidential manner in which this mitigation will be approached and undertaken with regards to the locations of Sacred Natural Sites, must be	Planning	Action that needs to be undertaken well in advance of construction, and depending on when such footprints become available, may be undertaken in various stages throughout the overall project cycle. However, this mitigation must be completed well before the actual development work on the newly proposed footprints commences.	Applicant ECO	ECO (Monthly)	To ensure that a public participation takes place to invite Interested & Affected Parties to state whether they are aware of any Sacred Natural Sites within 500 m from the proposed development footprints.	(ECO Monthly Checklist/Report)

	clearly communicated to the I&APs from the outset.						
<b>B</b>	Should any of the I&APs indicate that such Sacred Natural Sites are indeed located within 500 m from the proposed development footprints, the Applicant and ECO must identify a suitably qualified heritage specialist and geohydrologist to assist in conducting the mitigation. Once identified this individual or company must be appointed.	Planning	Action that needs to be undertaken well in advance of construction, and depending on when such footprints become available, may be undertaken in various stages throughout the overall project cycle. However, this mitigation must be completed well before the actual development work on the newly proposed footprints commences.	Applicant ECO	ECO (Monthly)	To appoint a suitably qualified heritage specialist and geohydrologist to undertake the mitigation.	(ECO Monthly Checklist/Report)
<b>2. Field-Based Confirmation of Sacred Natural Site</b>							
<b>A</b>	The appointed heritage specialist and geohydrologist must accompany the I&AP who indicated the presence of a Sacred Natural Site within 500 m from the proposed development footprints, to this Sacred Natural Site.	Planning	Action that needs to be undertaken well in advance of construction, and depending on when such footprints	Heritage Specialist Geohydrologist ECO	ECO (Monthly)	To ensure that the required mitigation is undertaken.	(ECO Monthly Checklist/Report)

			become available, may be undertaken in various stages throughout the overall project cycle. However, this mitigation must be completed well before the actual development work on the newly proposed footprints commences.				
<b>B</b>	The appointed heritage specialist and geohydrologist must compile a letter containing their findings and observations in terms of the field-based confirmation of the presence of a Sacred Natural Site. All aspects relating to the location of the sacred site must be kept strictly confidential. At no stage will any information regarding the position of the sacred site (GPS coordinates, property description etc.) be contained in the letter, or in any other report, document or verbal communication.	Planning	Action that needs to be undertaken well in advance of construction, and depending on when such footprints become available, may be undertaken in various stages throughout the overall project cycle. However, this mitigation must be completed well before the actual	Heritage Specialist Geohydrologist ECO	ECO (Monthly)	To ensure that the required mitigation is undertaken.	(ECO Monthly Checklist/Report)

			development work on the newly proposed footprints commences.				
<b>3. Mitigation Measures in terms of Confirmed Sacred Natural Site</b>							
<b>A</b>	The Applicant and ECO shall ensure that no development footprints are placed within a radius of 500m from a Sacred Natural Site which had been confirmed during the previous mitigation measures.	Planning	Action that needs to be undertaken well in advance of construction, and depending on when such footprints become available, may be undertaken in various stages throughout the overall project cycle. However, this mitigation must be completed well before the actual development work on the newly proposed footprints commences.	Applicant ECO	ECO (Monthly)	To ensure that the required mitigation is undertaken.	(ECO Monthly Checklist/Report)

Table 24 -Mitigation Measures required for Palaeontology

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>1. Immediate Mitigation in terms of Palaeontology</b>							
<b>A</b>	The Applicant together with the ECO shall identify a suitably qualified palaeontologist to undertake the palaeontological mitigation. Once identified this individual or company must be appointed.	Planning	Immediate action	Applicant ECO	ECO (Monthly)	The appointed palaeontologist would undertake the required mitigation measures.	(ECO Monthly Checklist/Report)
<b>2. Palaeontological Monitoring</b>							
<b>A</b>	The Applicant and ECO shall notify the appointed palaeontologist well in advance before construction of the pipeline (in the two identified sensitive areas) and infrastructure commence.	Planning	Action that needs to be undertaken at least four weeks in advance of construction.	Applicant ECO	ECO (Monthly)	To provide the palaeontologist with enough headway to ensure that he/she is on site when construction commences.	(ECO Monthly Checklist/Report)
<b>B</b>	The appointed palaeontologist must undertake monitoring of the construction of infrastructure deeper than 1m into unweathered sedimentary bedrock and pipeline construction of 1m and deeper into the two identified sensitive areas.	Construction Phase	Will be undertaken during Construction Phase for as long as construction work takes at these areas.	Palaeontologist ECO	ECO (Monthly)	To monitor the impact of construction work on palaeontology.	(ECO Monthly Checklist/Report)
<b>C</b>	The appointed palaeontologist must compile one monitoring report within which the observations and findings of the monitoring activities can be	Construction Phase	Within one week after completing	Palaeontologist ECO	ECO (Monthly)	To provide written feedback on the	(ECO Monthly Checklist/Report)

	contained. Additional mitigation recommendations, should these be deemed necessary, must also be included.		the monitoring.			monitoring of the two cemeteries.	
<b>3. Permit Application to SAHRA</b>							
<b>A</b>	The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if deemed necessary.	Construction Phase	Action to be undertaken on the discretion of the palaeontologist.	Palaeontologist ECO	ECO (Monthly)	To undertake the necessary mitigation measures in terms of palaeontology.	(ECO Monthly Checklist/Report)

Table 25- Action Plan for Implementation

ACTION PLAN				
Phase	Management Action	Timeframe for Implementation	Responsible Party for Implementation (Frequency)	Responsible Party for Monitoring/Audit/Review (Frequency)
<b>Activities required during the Planning Phase</b>				
Planning	Identify and appoint suitably qualified palaeontologist to undertake the required palaeontological monitoring.	Immediate action	Applicant ECO	ECO (Monthly)
Planning	The Applicant and ECO shall notify the appointed palaeontologist well in advance before construction of the pipeline (in the two identified sensitive areas) and infrastructure commence.	Action that needs to be undertaken at least four weeks in advance of construction.	Applicant ECO	ECO (Monthly)
Planning	All development footprints (including proposed drilling positions) must be presented to the I&APs by way of a public participation process to invite the I&APs to indicate whether any Sacred Natural Sites are located within 500 m of such proposed footprint areas.	Immediate action	Applicant ECO	ECO (Monthly)
Planning	Should any of the I&APs indicate that such Sacred Natural Sites are indeed located within 500 m from the proposed development footprints, the Applicant and ECO must identify a suitably qualified heritage specialist and geohydrologist to assist in conducting the mitigation. Once identified this individual or company must be appointed.	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)

Planning	The appointed heritage specialist and geohydrologist must accompany the I&AP who indicated the presence of a Sacred Natural Site within 500 m from the proposed development footprints, to this Sacred Natural Site.	Action that needs to be undertaken well in advance of construction.	Heritage Specialist Geohydrologist	Letter
Planning	The appointed heritage specialist and geohydrologist must compile a letter containing their findings and observations in terms of the field-based confirmation of the presence of a Sacred Natural Site. All aspects relating to the location of the sacred site must be kept strictly confidential. At no stage will any information regarding the position of the sacred site (GPS coordinates, property description etc.) be contained in the letter, or in any other report, document or verbal communication.	Action that needs to be undertaken well in advance of construction.	Heritage Specialist Geohydrologist	Letter
Planning	The Applicant and ECO shall ensure that no development footprints are placed within a radius of 500m from a Sacred Natural Site which had been confirmed during the previous mitigation measures.	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)
Planning	Identify and appoint a suitably qualified archaeologist to assist in undertaking the mitigation of TET 1, TET 2, TET 3, TET 4, TET 5, TET 8, TET 9, TET 10, TET 12, TET 13, TET 14 and TET 18. Once identified, this individual or company must be appointed.	Immediate action	Applicant ECO	ECO (Monthly)
Planning	The appointed archaeologist must record the sites (TET 2, TET 3, TET 9, TET 10 and TET 18) by way of measured drawings, photographs and qualitative descriptions.	Action that needs to be undertaken well in advance of construction.	Archaeologist	ECO (Monthly)

Planning	The appointed archaeologist must compile a Phase 2 report for TET 2, TET 3, TET 9, TET 10 and TET 18 within which the data and findings of the previous phase can be included.	Action that needs to be undertaken well in advance of construction.	Archaeologist	ECO (Monthly)
Planning	Submission of permit application to SAHRA / Free State Heritage to allow for the disturbance to TET 2, TET 3, TET 9, TET 10 and TET 18. The Phase 2 report must accompany the permit.	Action that needs to be undertaken well in advance of construction.	Archaeologist	ECO (Monthly)
Planning	The Applicant and ECO shall ensure that no development footprints are placed within a radius of 500m from a Sacred Natural Site which had been confirmed during the previous mitigation measures.	Action that needs to be undertaken well in advance of construction.	Applicant ECO	ECO (Monthly)
Planning	The appointed archaeologist must notify SAHRA in writing that reconnaissance excavations will be undertaken to test for the presence of graves at TET 4, TET 5, TET 12, TET 13 and TET 14.	Action that needs to be undertaken well in advance of construction.	Archaeologist	Written Report by Archaeologist ECO (Monthly)
Planning	Reconnaissance excavation of the structures to assess whether any graves are indeed located at TET 4, TET 5, TET 12, TET 13 and TET 14.	Action that needs to be undertaken well in advance of construction.	Archaeologist	Written Report by Archaeologist ECO (Monthly)
Planning	The appointed archaeologist must compile a report on the excavations and clearly state whether or not any evidence for graves are located at TET 4, TET 5, TET 12, TET 13 and TET 14.	Action that needs to be undertaken two weeks after completion of reconnaissance excavations.	Archaeologist	Written Report by Archaeologist ECO (Monthly)
Planning	The final development footprint, whether it entails the In-Field (Alt 4) pipeline, the in-Field North (HDR1) pipeline or the Trunkline (ST23 to Sibanye), must be re-	Immediate action that needs to be undertaken as soon as the final development alternative is decided upon.	Applicant ECO	ECO (Monthly)

	aligned to allow for a buffer area of at least 50m between this development footprint and each of the cemeteries at TET 6, TET 7, TET 11, TET 15 & TET 16.			
Planning	The placement of the development footprints for the six proposed well positions at F1, F2, F3, F4, F5 and F6 as well as the proposed compressor site at ST23 must be done in such a way that a buffer area of at least 50m is allowed between these development footprints and the 12 heritage sites identified within the 1km circular areas.	Immediate action that needs to be undertaken as soon as the final development alternative is decided upon.	Applicant ECO	ECO (Monthly)
Planning	Whenever additional development footprints are considered, the Applicant and ECO must ensure that the placement and design of such additional development footprint areas must take cognizance of the heritage sensitivity maps provided in this report and as far as possible, identified heritage sensitivities must be avoided in the establishment of additional development footprints.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Applicant ECO	ECO (Monthly)
Planning	Once additional development footprints had been finalised, or when such additional development footprints are located within 1 000 m of either the Sand River or Site 4 from this report, the Applicant and ECO shall identify a suitably qualified heritage specialist to assist in conducting the mitigation. Once identified, this individual or company must be appointed.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Applicant ECO	ECO (Monthly)

Planning	The Applicant and ECO shall provide the additional development footprints to the appointed heritage specialist.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Applicant ECO	ECO (Monthly)
Planning	The appointed heritage specialist must undertake heritage walkthroughs of the additional development footprint areas.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist	Heritage Report
Planning	The appointed heritage specialist must compile a heritage impact assessment report outlining the findings of the fieldwork and providing mitigation measures, should such mitigation measures be deemed necessary.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Heritage Specialist	Heritage Report
Planning	The ECO and Applicant must implement the mitigation measures as outlined in the heritage report.	Although this action can potentially be undertaken during either the Planning, Construction or Operation Phases of the project, it must be undertaken well in advance of actual proposed additional development work.	Applicant ECO	ECO (Monthly)
<b>Activities required during the Construction Phase</b>				
Construction	The appointed palaeontologist must undertake monitoring of the construction of infrastructure deeper than 1m into unweathered sedimentary bedrock and pipeline construction of 1m and deeper into the two identified sensitive areas.	Will be undertaken during Construction Phase for as long as construction work takes at these areas.	Palaeontologist ECO	ECO (Monthly)

Construction	The appointed palaeontologist must compile one monitoring report within which the observations and findings of the monitoring activities can be contained. Additional mitigation recommendations, should these be deemed necessary, must also be included.	Within one week after completing the monitoring.	Palaeontologist ECO	ECO (Monthly)
Construction	The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if deemed necessary.	Action to be undertaken on the discretion of the palaeontologist.	Palaeontologist ECO	ECO (Monthly)
Construction	The appointed archaeologist must be notified in writing of the planned commencement of construction work within 200 m from TET 1 and TET 8.	At least four weeks in advance of planned commencement of construction work within 200 m of the two cemeteries.	ECO	ECO (Monthly)
Construction	The appointed archaeologist must undertake heritage monitoring of the two cemeteries during all construction taking place within 200 m of the two sites.	For the duration of the time that construction activities take place within 200 m of TET 1 and TET 8.	Archaeologist	ECO (Monthly)
Construction	The appointed archaeologist must compile one monitoring report within which the observations and findings of the monitoring activities can be contained. Additional mitigation recommendations, should these be deemed necessary, must also be included.	Within one week after completing the monitoring.	Archaeologist	Written Report by Archaeologist ECO (Monthly)
Construction	The appointed archaeologist must implement an archaeological watching brief during construction of the pipeline on the banks of the Sand River.	Will be undertaken during the Construction Phase for as long as construction work takes place in proximity to TET 9 and the banks of the Sand River	Archaeologist	ECO (Monthly)

## 15. CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage was appointed by Environmental Impact Management Services (EIMS) to undertake a Heritage Impact Assessment for the proposed Tetra4 Cluster 1 project which proposes to extend natural gas production operations within an existing Production Right (PASA Reference: 12/4/1/07/2/2), in the Matjhabeng and Masilonyana Local Municipalities, near the town of Virginia. The study area is approximately 14 300 ha in extent in the Free State Province.

The purpose of the Heritage Impact Assessment report is to assess the impacts of a proposed development on the identified heritage resources. This is important because heritage resources are protected in terms of the National Heritage Resources Act, No 25 of 1999, (NHRA) from *inter alia*, destruction or damage, excavation or removal, or other disturbance, without a permit from the responsible heritage resources authority. The National Heritage Resources Act, No 25 of 1999, (NHRA) states that heritage resources are unique and non-renewable and, as such, any impact on such resources must be seen as significant (NHRA, section 5(1)(a)). The NHRA specifically protects certain categories of heritage resources, i.e.: structures, archaeological and paleontological (including meteorological) sites and material and graves and burial grounds (NHRA, sections 34, 35 and 36). Furthermore, Section 38 of the NHRA provides for and regulates the compilation of impact assessment reports of heritage resources that may be affected by construction or development activities.

The desktop research undertaken during the Heritage Scoping Report that preceded this Heritage Impact Assessment, revealed that the study area and surrounding landscape have a long and diverse historical and archaeological history and that significant potential exists for archaeological and historical sites and material to be located within the study area. The research has also identified specific possible heritage sensitive areas within the study area.

Apart from the overall study area covered by the desktop study work, a development footprint was provided by EIMS to assess as part of this Heritage Impact Assessment.

This Heritage Impact Assessment Report (HIA), which follows on the Heritage Scoping Report, includes the findings of the desktop study undertaken during the Heritage Scoping as well as the findings and recommendations of the archaeological and heritage field surveys undertaken of the proposed development footprint areas. A palaeontological desktop study was undertaken during Scoping Phase and a field-based palaeontological impact assessment was undertaken during this EIA Phase. Both studies are included in this report.

### Desktop Study Findings

The Heritage Scoping Report has highlighted a number of heritage sensitivities and features including the Battle of Zand River (7 – 10 May 1900), an historic diamond mine on the farm Welgegund, archaeological sites, historic buildings

and structures, cemeteries, palaeontology as well as unmarked graves from within the study area. Additional desktop study observations made during this Heritage Impact Assessment include Sacred Natural Sites.

The desktop evaluation of the study area and surrounds has shown that the possibility exists of finding various heritage resources in the proposed study area, including historical structures as well as graves and cemeteries. A site visit was undertaken during which the findings of the desktop study was confirmed in that a total of 45 heritage sites comprising 21 cemeteries, 22 historic structures and buildings, one Stone Age site, one historic midden of archaeological age and one site comprising historic road markers.

It must be noted that the fieldwork mentioned above was only a heritage scoping visit aimed at accessing as many properties as possible. No detailed walkthrough of any particular areas were undertaken during the heritage scoping phase.

#### Battle of Zand River (7 – 10 May 1900)

The archival and historical desktop study has revealed that during the Battle of Zand River (7 May -10 May 1902), units of the British cavalry under command of General John French crossed over the Du Preez Leger Drift to outflank the Boer position on the northern bank of the river. This drift is located within the study area, where the bridge on the road between Welkom and Theunissen is located. This said, and based on available literature, no shots were fired here as the drift was not held by the Boer forces.

#### Historic Diamond Mining Activities on the Farm Welgegund (Currently Driekoppies)

The archival and historical desktop study has revealed that historic diamond prospecting and mining activities occurred on the farm Welgegund. These activities were already in progress by the early 1890s, and appears to have continued almost unabated until the early 1930s. Mining activities appear to have continued more recently at Welgegund, but by the time of the site visit in 2016 these activities had evidently long been abandoned as well. One of the first companies involved here appears to have been the Van Rensburg Diamond Syndicate. The syndicate sold its interest in the farm to the Driekopjes Diamond Mining Company in 1892. Of interest is that the Driekopjes Company had Sir Thomas Major Cullinan as a founding director. Subsequent diamond mining companies involved at Welgegund include the New Driekopjes, Magnus, Triumph and Welgegund.

#### Archaeological Sites

Evaluation of archival and historic maps and satellite imagery, coupled with the fieldwork, have revealed that archaeological sites such as Middle Stone Age and Later Stone Age surface scatters, Historic Farmsteads and Historic

Middens of Archaeological Age may very likely be located within the general study area. These sites are protected by the National Heritage Resources Act. While some of these sites were identified during the site visit, others may still be located within the study area. As a result, should any further development footprints be defined, such additional footprint areas will have to be assessed in the field by way of archaeological field surveys to identify any such features which may be located there. These studies will be required to determine the significance of each site and to assess the possible development impacts on each of them during the Heritage Impact Assessment phase. At the same time appropriate mitigation measures will also be outlined.

#### Historic Buildings and Structures

Evaluation of archival and historic maps and satellite imagery, coupled with the fieldwork, have revealed that a number of historic buildings and structures are located within the study area. However, more sites may still be located within the overall study area. As a result, should any development footprints be defined, such footprint areas will have to be assessed in the field by way of archaeological field surveys to identify these features within the development footprint areas. Additionally, an assessment by an architectural historian of each historic building and structure located within or near such footprint areas will also have to be undertaken. These studies will be required to determine significance of each building or structure and will assess the possible development impacts on each of them during the Heritage Impact Assessment phase. At the same time appropriate mitigation measures will also be outlined.

#### Graves and Cemeteries

The site visit identified 21 cemeteries, with one additional cemetery not visited in the field confirmed by a previous heritage study. It is likely that even more cemeteries and grave sites are located within the study area. Any marked graves and cemeteries located within future development footprint areas will be identified during the archaeological walkthroughs of those footprint areas. Cemeteries and grave sites are protected by various legislations and the best option would be the in situ preservation of the sites. Should this not be possible, a standard grave relocation process (including a detailed social consultation process) must be undertaken.

#### Unmarked Stillborn Graves

An evaluation of the available historic maps has revealed a significant number of historic homesteads of black African communities within the study area. The presence of these features raises another heritage concern, that of unmarked stillborn babies. In terms of black African tradition, stillborn babies were often buried in unmarked graves underneath or adjacent to the homesteads of their parents. Cemeteries and grave sites are protected by various legislations and the best option would be social consultation with the former (or present) residents of this area to assess whether any such unmarked graves are located within the final study area for the HIA coupled by archaeological monitoring of the

development activities.

### Palaeontology

Dr. Gideon Groenewald was appointed by PGS Heritage to undertake a palaeontological desktop study of the overall application area. His study revealed that the application area is mainly underlain by Permian aged rocks of the Adelaide Subgroup and Jurassic aged dolerite of the Karoo Supergroup as well as Quaternary aged Aeolian sand of the Gordonia Formation and Tertiary aged sediments associated with terrestrial deposits mainly referred to as the Matjhabeng type sediments close to Virginia in the Free State.

The very high fossiliferous potential of the Adelaide Subgroup, Beaufort Group strata, warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of this Subgroup. A similarly Very High Palaeontological sensitivity is allocated to Tertiary aged sediments in this region. The Gordonia Formation is allocated a High Sensitivity and Dolerite areas are allocated Very Low Palaeontological sensitivity. If extensive excavation of topsoil and removal of more than 3m of soil cover is planned in this region, all the areas of activity will be allocated a Very High Palaeontological Sensitivity as these rocks can contain very significant remains of plants and animals that will contribute significantly to our understanding of the palaeo-environments in this part of the Karoo Basin.

The following recommendations were made based on this desktop study:

- The EAP as well as the ECO for this project must be made aware of the fact that the Beaufort Group sediments contains very highly significant fossil remains, albeit mostly exposed during infrastructure development. Several types of fossils have been recorded from this Group in the Karoo Basin of South Africa, with special mention of the Adelaide Subgroup. Similar fossil richness is observed in Tertiary aged sediments at Matjhabeng;
- In areas that are allocated a Very High and High Palaeontological sensitivity and specifically where deep excavation into bedrock is envisaged (following the geotechnical investigation), or where fossils are recorded during the geotechnical investigations, a qualified palaeontologist must be appointed to assess and record fossils at specific footprints of infrastructure developments (Phase 1 PIA) before development as well as during excavations for the development;
- The Aeolian sand of the Gordonia Formation covers the rocks of the highly significant Adelaide Subgroup and all the areas underlain by this formation is allocated a High Palaeontological sensitivity and a qualified Palaeontologist must visit all the sites of outcrop before excavation and during the activities of the Project if excavation will be deeper than 1.5m; and
- These recommendations must form part of the EMPr for Cluster 1.

These recommendations were made based on a palaeontological desktop study of the overall Cluster 1 application area at a time when the proposed infrastructure locations were not available. As a result, a field-based palaeontological impact assessment was commissioned and its findings presented in this HIA report.

### Sacred Natural Sites

The International Union for Conservation of Nature (IUCN) defines Sacred Natural Sites as areas of land or water having special spiritual significance to peoples and communities (IUCN, 2008). Such Sacred Natural Sites are found across Southern Africa as well, and for various reasons are often kept secret. No Sacred Natural Sites are known to be located within the overall production right as well as the production footprint areas. As the potential impact on such Sacred Natural Sites falls within the study of groundwater, which is the author is not educated nor experienced in, the project geohydrologist has been asked to provide her observations on this aspect.

### **Findings of the Fieldwork undertaken during the Heritage Impact Assessment**

As indicated above, apart from the overall study area covered by the desktop study work, a development footprint was provided by EIMS to assess as part of this Heritage Impact Assessment. An archaeological and heritage field survey of this development footprint area was undertaken during this heritage impact assessment process.

### Archaeological and Heritage Survey

An intensive archaeological and heritage field survey was conducted of the development footprint area over a period of four days and 18 heritage sites were identified. These identified sites comprise seven cemeteries (TET 1, TET 6, TET 7, TET 8, TET 11, TET 15 and TET 16), two historic structures believed to be older than 100 years (TET 2 and TET 3), three historic structures believed to be older than 60 years (TET 9, TET 10 and TET 18), five sites where graves may be located (TET 4, TET 5, TET 12, TET 13 and TET 14) as well as one site comprising a single lower grinder (TET 17).

Furthermore, a second archaeological and heritage field survey was undertaken over the course of two days which was aimed at assessing eight 1km wide circular sites within each of which Cluster 1 gas production surface infrastructure will be placed. The said infrastructure includes the six new proposed well positions known as F1, F2, F3, F4, F5 and F6 as well as two compressor stations at a location named ST23 and at Sibanye Mine Shaft 1. The survey of these eight circular areas resulted in the identification of an additional nine heritage sites comprising four cemeteries (TET 19, TET 20, TET 21 and TET 22), two Stone Age sites (TET 23 and TET 24), two historic to recent sites where the risk was identified for stillborn baby graves to be located (TET 25 and TET 26) as well as one historical building (TET 27). This latter site was deemed to be of low significance, and as a result was not taken further through the process of impact assessment etc. Apart from the nine heritage sites mentioned here, four of the sites identified during the first

fieldwork component are also located within these 1 km circular areas. These four sites are TET 11, TET 12, TET 13 and TET 14.

#### Field-Based Palaeontological Impact Assessment

Dr. Lloyd Rossouw of Palaeo Field Services was appointed to carry out a field-based Palaeontological Impact Assessment of the proposed exploration footprint area. The sections that follow below were obtained from this report. Refer **Annexure D** for report.

Dr. Rossouw's report found that proposed well sites are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. The palaeontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units. For associated infrastructure, any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase of the well sites. All proposed pipeline route options are underlain by palaeontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit and the Sand River. Any excavation exceeding a depth of 1m into these overbank deposits will require monitoring by a palaeontologist during the construction phase of the pipelines. Both site options for the combined helium and CNG gas conditioning plant are underlain by palaeontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance. Any excavation exceeding a depth of 1m into unweathered sedimentary bedrock will require monitoring by a palaeontologist during the construction phase. The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils at each of the sites relevant to the project.

#### **Site Sensitivities, Site Constraints, Impact Assessment Calculations, Required Mitigation Measures and Action Plan**

In Chapter 10 of this report, the Site Sensitivities as revealed as a result of desktop study work and heritage fieldwork, are outlined. These site sensitivities are as follows:

- Disturbance / destruction of sections of the Battle of Zand River
- Disturbance / destruction of tangible remains of the old diamond mine at Welgegund
- Destruction / damage of archaeological sites
- Disturbance / destruction of historic buildings and structures

- Disturbance / destruction of cemeteries and graves
- Disturbance / destruction of unmarked stillborn graves
- Disturbance / destruction of palaeontological resources
- Disturbance / destruction of Sacred Natural Sites
- Disturbance / destruction of the cemetery at TET 1
- Disturbance / destruction of the historic wall at TET 2
- Disturbance / destruction of the stone-walled structure at TET 3
- Disturbance / destruction of possible stillborn graves at TET 4
- Disturbance / destruction of possible stillborn graves at TET 5
- Disturbance / destruction of possible graves at TET 6
- Disturbance / destruction of the cemetery at TET 7
- Disturbance / destruction of the cemetery at TET 8
- Disturbance / destruction of the historic drift and bridge at TET 9
- Disturbance / destruction of the historic silage pit at TET 10
- Disturbance / destruction of the cemetery at TET 11
- Disturbance / destruction of possible stillborn graves at TET 12
- Disturbance / destruction of possible stillborn graves at TET 13
- Disturbance / destruction of possible stillborn graves at TET 14
- Disturbance / destruction of the cemetery at TET 15
- Disturbance / destruction of the cemetery at TET 16
- Disturbance / destruction of the historic mine building at TET 18
- Disturbance / destruction of the cemetery at TET 19
- Disturbance / destruction of the cemetery at TET 20
- Disturbance / destruction of the cemetery at TET 21
- Disturbance / destruction of the cemetery at TET 22
- Disturbance / destruction of the Stone Age site at TET 23
- Disturbance / destruction of the Stone Age site at TET 24
- Disturbance / destruction of possible stillborn graves at TET 25
- Disturbance / destruction of possible stillborn graves at TET 26

In Chapter 11 of this report, the Site Constraints are outlined. In Chapter 12 these Site Sensitivities and Site Constraints are assessed by way of impact assessment calculations. The assessments considered the envisaged pre-mitigation and post-mitigation impacts in terms of three development alternatives over the various project phases. These development alternatives are as follows:

- **Alternative 1**

Within this alternative Pipeline 2 (P2) will be utilised. This pipeline will be built to the combined Helium and Compressed Natural Gas (CNG) plant proposed to be located near the existing HDR1 facility, referred to as HP1, with two centralised compressors located at HDR1 and ST23. A trunk line that links Pipeline 2 (in proximity to HDR1) with the centralised compressor at ST23 and leading to Sibanye mine shaft 1. For this development alternative a total of 13 existing wells will be used, namely BE1, BEI02, HDR1, HZOn1, EX1, Retreat, SPG3, ST23, 1307, 1400, 1629, 2033 and 2057. Six new wells are also proposed as part of this alternative, namely F1, F2, F3, F4, F5, and F6.

- **Alternative 2**

Within this alternative Pipeline 4 (P4) will be utilised. This pipeline will be built to the combined Helium and CNG plant proposed to be located at Sibanye mine shaft 1 (Sibanye), referred to as HP2, with three centralised compressors located at HDR1, ST23 and Sibanye. Two trunk lines form part of this development alternative. First of these is a trunk line that links Pipeline 2 (in proximity to HDR1) with the centralised compressor at ST23, whereas the second trunk line is one that links two sections of Pipeline 4 with each other. For this development alternative a total of 13 existing wells will be used, namely BE1, BEI02, HDR1, HZOn1, EX1, Retreat, SPG3, ST23, 1307, 1400, 1629, 2033 and 2057 will be used. Six new wells are also proposed as part of this alternative, namely F1, F2, F3, F4, F5, and F6.

- **Alternative 3**

Within this alternative both Pipelines 2 and 4 (P2 & P4) will be utilised. As this alternative would represent the same impacts on heritage as identified for Alternative 2, Alternative 3 was not assessed during the impact assessment.

Chapter 13 outlines the mitigation measures required whereas Chapter 14 provides the Action Plan by way of which mitigation measures must be implemented.

### **General Observations and Recommendations**

In the Field-Based Palaeontological Impact Assessment undertaken by Dr. Rossouw, the author acknowledged that SAHRA does not have an official position with regard to groundwater and is of the personal opinion that groundwater and deep-seated aquifers in particular, are by definition a fossil resource in addition to being an important heritage resource shared by all South Africans. Dr. Rossouw added that the quality and quantity of groundwater aquifers

(including unmapped aquifers) may be adversely affected by proposed drilling activities, e.g. penetration of hydrocarbons and associated gas into fractured aquifers and migration of deep-seated groundwater to shallow aquifers which could trigger a No-Go Alternative for the study area. The obligation therefore rested with the applicant to appoint suitably qualified groundwater specialists and drilling experts to provide detailed mitigation measures for potential impact on groundwater resources that may result from the proposed development.

Following on from this, Dr. Rossouw offered the following recommendations for consideration:

- The applicant should appoint a suitably qualified groundwater specialist to establish beforehand that groundwater aquifers will not be negatively affected before the construction phase of the project commences; and
- It is necessary to provide a clear explanation of the drilling procedures and the methods that will be used to prevent hydrocarbons and associated gas from the Ecca and Beaufort Groups from entering these linear aquifers and polluting them or to avoid the creation of conduits through which deep-seated groundwater could migrate to shallow aquifers. The information must be disseminated to the South African heritage community as well as to all affected communities going forward in reviewing the EIA process.

The author of this heritage impact assessment report requires that the following recommendations to be implemented as a matter of urgency:

- SAHRA must provide written instruction to the heritage industry as to whether groundwater aspects need to be included in Heritage Impact Assessments; and
- SAHRA must recommend in writing whether the recommendations made by Dr. Rossouw regarding groundwater on an adjoining property must be viewed as mitigation measures of this Heritage Impact Assessment and as a result must be implemented.

## **Conclusions**

It is the opinion of the author of this report that subject to the Assumptions and Limitations listed in this report and on the condition that the mitigation measures as general recommendations outlined in this report are implemented as indicated, no heritage objection to the proposed development can be raised.

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### **Historic Topographic Maps**

All the historic topographic maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

### **Google Earth**

All the aerial depictions used in this report are from Google Earth.

### **Internet References**

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## HERITAGE ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies to be utilised in the HIA.

The Heritage Impact Assessment (HIA) report to be compiled by PGS Heritage and Grave Relocation Consultants (PGS) for the proposed project will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the National Heritage Resources Act (NHRA) (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consisted of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.
- Step II – Physical Survey: A physical survey will be conducted on foot through the proposed project area by qualified archaeologists', aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.
- Step III – The final step involves the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites is based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
  - Density of scatter (dispersed scatter)
    - Low - <10/50m<sup>2</sup>
    - Medium - 10-50/50m<sup>2</sup>
    - High - >50/50m<sup>2</sup>
- **uniqueness** and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

- A - No further action necessary;
- B - Mapping of the site and controlled sampling required;
- C - No-go or relocate pylon position
- D - Preserve site, or extensive data collection and mapping of the site; and
- E - Preserve site

#### Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, will be used for the purpose of this report.

Table 26: Site significance classification standards as prescribed by SAHRA

<b>FIELD RATING</b>	<b>GRADE</b>	<b>SIGNIFICANCE</b>	<b>RECOMMENDED MITIGATION</b>
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	-	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium Significance	Recording before destruction
Generally Protected C (GP.C)	-	Low Significance	Destruction

**ANNEXURE B**  
**THE SIGNIFICANCE RATING SCALES FOR THE EIA**

### Method of Assessing Impacts

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

### Determination of Environmental Risk

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R)}{4} \times N$$

4

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 17.

*Table 27: Criteria for determination of impact consequence.*

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),

	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 19 below.

*Table 28: Probability scoring.*

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:  
ER= C x P.

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
Probability						

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 19 below.

Table 29: Significance classes.

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/ mitigated.

Impact Prioritisation

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented in Section 0 it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority / significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 30: Criteria for the determination of prioritisation.

Public response (PR)	Low (1)	Not raised as a concern by the I&AP's
	Medium (2)	Issue/ impact raised by the I&AP's
	High (3)	Significant and meaningful response from the I&AP's
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 20. The impact priority is therefore determined as follows:

$$\text{Priority} = \text{PR} + \text{CI} + \text{LR}$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (refer to Table 21).

Table 31: Determination of prioritisation factor.

Priority	Ranking	Prioritisation Factor
= 3	Low	1
3 > 9	Medium	1.5
= 9	High	2

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Environmental Significance Rating	
Value	Description
< 9	Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥9; <17	Medium (i.e. where the impact could influence the decision to develop in the area),
≥ 17	High (i.e. where the impact must have an influence on the decision process to develop in the area).

For ease of use a template impact assessment form has been drafted which will need to be completed by each specialist for each relevant impact, and where necessary for each alternative. The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

**ANNEXURE C**  
**PALAEONTOLOGICAL DESKTOP STUDY**

**ANNEXURE D**

**FIELD-BASED PALAEOLOGICAL IMPACT ASSESSMENT**