KOLOMELA AMENDMENT PROJECT

Amendment of Existing Mining Activities on the Farms Ploegfontein 487; Remainder of Leeuwfontein 485; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485, Welgevonden 486 and Floradale 230 located South-west of Postmasburg, Northern Cape Province.

Heritage Impact Assessment

Issue Date: **13 March 2015**

Revision No.: **4**

Client: **Synergistics Environmental Services**

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Declaration of Independence

The report has been compiled by PGS Heritage, an appointed Heritage Specialist for Synergistics Environmental Services. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes.

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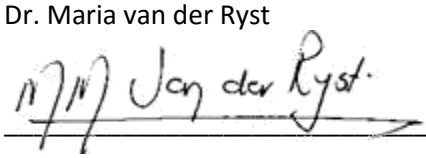

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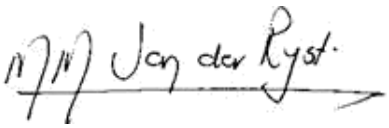
Stone Age Specialist & Second Reviewer	M. van der Ryst		Stone Age Specialist

EXECUTIVE SUMMARY

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed Kolomela Amendment Project, which represents the expansion of existing mining activities located on the Farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485, Welgevonden 486 and Floradale 230 located south-west of Postmasburg, Northern Cape Province.

The scope of work was to provide a Heritage Impact Assessment report for the proposed Kolomela Amendment Project. The study commenced with a brief archival and historical desktop study which was used to compile a historical layering of the study area within its regional context. This component indicated that both the immediate study area and the surrounding farms have a rich historical and archaeological history. The archival and historical study was followed by a detailed investigation of all previous heritage and archaeological reports made available by the mine and as identified on SAHRIS. This component of the study was crucial in that as the entire mining property had been covered during previous archaeological and heritage studies, no additional field surveys were to be done for this study.

The only fieldwork that was conducted on the mine property consisted of a brief site visit by an archaeologist from PGS Heritage, together with a Stone Age specialist, to visit some of the sites located within the present study area. The aim of this site visit was to verify the character, extent, significance and required mitigation measures relative to those sites located within the mining development footprint areas. During the site visit one new site was also identified, namely a farm worker cemetery (see Site KOL 4.4).

A detailed field survey was undertaken on the the section of proposed new pipeline and associated boreholes (forming part of the Floradale Aquifer Recharge) which is situated on the farm Floradale 230. However, limited fieldwork was undertaken on those sections of the pipeline which are proposed within the mine property on the farms Wolhaarkop and Kapstevel, since that area had been surveyed previously for the existing mining activities.

Eight heritage sites were identified within the amended mining expansion footprint. These sites will be discussed in more detail below.

Stone Age sites

Six Stone Age sites (KOL 1, KOL 2, KOL 5, KOL 6, KOL 7 and KOL 8), covering the Early and Middle Stone Age periods, will be affected. These mainly take the form of small shallow pans, most of which are located along the eastern end of the overall mining property. Interestingly, at least 165 such small pans are located along the eastern end of the mining property. However, site KOL 2 is a scatter of possibly Later Stone Age artefacts found on a colluvial fan in one of the valleys located closer to the western end of the mining property.

It is important to note that four of the sites from this section comprise clusters of small pans which are believed to contain Stone Age material. These four pan clusters form part of the belt of at least 165 small pans located along the eastern end of the mine property. Due to the high number of small pans from within the study area, it was impractical for each individual pan to be visited in the field and assessed for its exact archaeological characteristics. These four pan clusters were provided with the same archaeological status, significance and mitigation based on the archaeological characteristics of at least three pans investigated nearby (with site KOL 1 representing one of these). The four separate clusters of pans will be impacted by the Ploegfontein Pits, the LFN Waste Rock Dump (which will impact two of the pan clusters), as well as the LFS Waste Rock Dump.

Each pan cluster has been given a separate site identification number (see KOL 5, KOL 6, KOL 7 and KOL 8) and each of these sites contains different pan numbers. As such, KOL 5 contains 19 small pans (of which seven had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 6 contains six small pans (of which five had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 7 contains 44 small pans (of which 17 had been destroyed by previous mining activities conducted between 7 October 2013 and 2 December 2014) and KOL 8 contains four small pans. From this outline it is evident that due to mining impact KOL 5 now contains 12 small pans, KOL 6 contains one small pan, KOL 7 contains 27 small pans and KOL 8 contains four small pans.

One of the individual pan sites that was visited and assessed during the current site visit (KOL 1) is a site that was highlighted in the previous reports by Morris (2005) and van der Ryst (2011), due to density of lithics and the presence of ceramics.

These pan sites are all allocated a significance of low-medium. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants 2011:20).

Late Iron Age / Historic sites

One historic mining site (KOL 3) was identified. This site is situated on the farm Welgevonden 486, in the prospecting area of the existing open-cast pit. Although the site will not be directly impacted upon by the proposed Kapstevel North Dump 2, this mining development will be located on three sides of the site and peripheral impacts can be expected.

Due to the closeness of the proposed Kapstevel North Dump 2 to the mining site, a number of mitigation measures are recommended in the report, including a Phase 2 Archaeological Assessment of the site to establish the extent and characteristics of the old mining activities and, at the same time, the provisional establishment of a 400 m buffer area around the site. Once the exact extent and characteristics of the site have been established, final recommendations with regard to the required buffer zone around the site will be made. A monitoring programme has also been recommended.

Historic Structures / Farmstead Sites

One historic farmyard complex (KOL 4) was identified as likely to be impacted by the mining expansion area. The site is a historical farmstead complex located on the farm Kapstevel. It is a multi-component site which comprises various buildings, structures and landscape features of a farm retained from the late 19th century to the present day. The site was assessed to be of overall high significance and a previous Heritage Management Plan (African Heritage Consultants, 2011) recommended that the site be formally protected as a Provincial Heritage site.

As indicated above, the site comprises a number of elements, namely: historic structures associated with the original farmstead (KOL 4.1), a historic cemetery for the Bredenkamp family (KOL 4.2), various landscape features associated with the farmstead including dams (KOL 4.3), as well as a farm worker cemetery and accommodation (KOL 4.4). The KSS Waste Rock Dump cuts significantly into the high sensitivity buffer zone identified in the Heritage Management Plan and will have a direct negative impact on the farm worker cemetery, which is located within the present footprint area of the KSS Waste Rock Dump.

Due to the high negative impact represented by the KSS Waste Rock Dump on the farm worker cemetery, as well as the impact on the buffer zone that was established in the Heritage Management Plan, **it is required that the layout of the KSS Waste Rock Dump be changed to allow for the continued preservation of the site and all of its components. The layout of the KSS Waste Rock Dump will have to be changed in such a way that the presently high sensitivity zone identified in the Heritage Management Plan is maintained and to allow for a buffer area of at least 250 m around the newly discovered farm worker cemetery and a buffer area distance of 100 m between the proposed development and the area of high significance identified in the Heritage Management Plan.** Monitoring would also be required during construction.

Furthermore, due to the equally high negative impact represented by the proposed new pipeline for the Floradale Aquifer Recharge Project on Site 4.2 (the Bredenkamp cemetery) as well as on the high sensitivity buffer zone identified in the Heritage Management Plan, **it is required that the layout of the section of pipeline located on the farms Wolhaarkop 485 and Kapstevel 541 be changed to allow for the continued preservation of the buffer area around the site as well as all the site components. The layout of the pipeline will have to be changed in such a way that the presently high sensitivity zone identified in the Heritage Management Plan is maintained and to allow for a buffer area of at least 250 m around the white cemetery.** Monitoring will also be required during construction.

Impact risk calculations were undertaken on the expected impact of the proposed mining expansion on the eight sites identified. This indicated that the proposed mining expansion poses a Low to High Impact Risk to the identified sites.

Palaeontology

The Kolomela Mining Area is mainly underlain by Vaalian aged rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups, as well as Quaternary aged sediments of the Kalahari Group, surface limestone and alluvium. Cave breccias are associated with dolomite deposits of the Ghaap Group.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of this group. The potential carbonaceous breccias might also contain very important early hominin remains. A Phase 1 Palaeontological Impact Assessment (PIA) investigation by a professional palaeontologist is recommended for these areas.

The surface limestone overlies the highly sensitive dolomites and is allocated High Palaeontological sensitivity. These limestones can contain significant fossils of Quaternary-aged plants and animals. Where surface limestone will be removed for mining purposes, the limestone must be inspected for fossils and the underlying Ghaap Group sediments must be inspected for the presence of stromatolites. A Phase I PIA investigation is recommended for the areas where excavation of the limestone is planned.

Sediments of the Koegas Subgroup, Postmasburg, Olifantshoek and Kalahari Groups, as well as the alluvium are allocated Moderate Palaeontological sensitivities and any fossils observed must be reported to the ECO.

Palaeontological recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments, as well as the surface limestone, contain significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.
2. An accredited palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment (PIA) to confirm the presence of significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or

where they are planned to be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining operations.

3. The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed, the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
4. These recommendations must form part of the EMP of the project.

In general terms, only the footprint areas of the proposed mining activities (including the new pipeline and associated boreholes representing the Floradale 230 Aquifer Recharge Project) as depicted on the mine expansion footprint layout plan from within this Report, were assessed during this Heritage Impact Assessment. Should the development footprints of the proposed development change in any way, these additional areas will have to be assessed in the field and included as part of a revised heritage impact assessment study.

Impact risk calculations were undertaken on the expected impact of the proposed mining expansion on the eight identified sites. This indicated that the proposed mining expansion poses a Low to High Impact Risk to the identified sites. In general, it is recommended that Phase 2 mitigation measures would be required for six of the eight identified sites (KOL 1, KOL 3, KOL 5, KOL 6, KOL7 and KOL 8). The high significance allocated in previous heritage assessments to the farmstead at KOL 4 as well as the recommendation in these reports that site should be allocated Provincial Heritage Significance Status, means that any perceived impact on this site and its components must be avoided. As indicated above, the development of the KSS Waste Rock Dump as well as the Floradale Acquifer Recharge Pipeline cannot be allowed to proceed as planned at present and their layout will have to change to allow for the preservation of the identified buffer area around the historic farmstead, the preservation of the newly discovered farm worker cemetery which is currently located within the footprint area of the abovementioned waste rock dump as well as the Bredenkamp cemetery located at present within the footprint of the abovementioned pipeline.

On the condition that these recommendations are adhered to, there are no heritage grounds to prevent the proposed mining development from taking place.

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1 INTRODUCTION

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed Kolomela Amendment Project, which represented the expansion of existing mining activities located on the Farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485, Welgevonden 486, and Floradale 230 located south-west of Postmasburg, Northern Cape Province.

1.1 Scope of the Study

The main aim of the study was to identify all heritage sites and finds that occur in the proposed mining amendment footprint area. The Heritage Impact Assessment aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the identified heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

The aims of the study are as follows:

- To provide a Heritage Impact Assessment report in terms of the proposed mining amendment.

1.2 Specialist Qualifications

This Heritage Impact Assessment Report was compiled by PGS Heritage.

The staff at PGS Heritage has a combined experience of nearly 40 years in the heritage consulting industry. PGS Heritage and its staff have extensive experience in managing HIA processes and PGS Heritage will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Polke Birkholtz, the Project Manager, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited with the CRM

Section of ASAPA. He has 18 years of experience in the heritage assessment and management field and holds a BA (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History as well as a BA (Hons) in Archaeology (cum laude) from the same university.

Jennifer Kitto, co-author of this report, has 16 years' experience in the heritage sector, a large part of which involved working for a government department responsible for administering the National Heritage Resources Act, No 25 of 1999. She is therefore well-versed in the legislative requirements of heritage management. She holds a BA in Archaeology and Social Anthropology and a BA (Hons) in Social Anthropology.

Marko Hutten, the archaeologist from PGS Heritage who conducted the site visit, has 18 years of experience in the industry and is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Field Director.

Dr Maria van der Ryst acted in advisory capacity as specialist for the Stone Age sites. She has undertaken extensive and in-depth research at several Stone Age and rock art localities. She has also conducted a number of Phase 2 Archaeological Impact Assessments with a focus on the Iron Age and the Stone Age and specialist studies on the Stone Age.

Dr Gideon Groenewald, the appointed Palaeontologist for this project, holds a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

1.3 Assumptions and Limitations

The following assumptions and limitations exist:

- The main scope of work comprised the compilation of a Heritage Impact Assessment report for the proposed mine amendment area.
- PGS Heritage was appointed to compile a Heritage Impact Assessment (including a Palaeontological Desktop Study) based on previous heritage studies and fieldwork only. This approach was followed in that the entire mining property had been surveyed in the field during a number of previous heritage and archaeological studies, including that of Morris (2005), Küsel (2011), Miller (2011) and Van der Ryst (2011).
- For the purposes of this report, it is assumed that the fieldwork undertaken during the previous archaeological and heritage studies covered the present proposed mining amendment areas in full.
- To confirm certain aspects of previously identified heritage sites, a brief archaeological site visit was undertaken by an archaeologist from PGS Heritage (Marko Hutten) and the project Stone Age specialist (Dr Maria van der Ryst). This site visit did not represent any further field surveys.
- In addition, a further survey was undertaken separately, to assess the area affected by the proposed new pipeline and associated boreholes representing the Floradale Aquifer Recharge Project. A complete field survey was undertaken of the proposed pipeline and associated boreholes located on the farm Floradale 230. However, limited fieldwork was undertaken on the sections of the pipeline which occur within the mine property on the farms Wolhaarkop and Kapstevel, since that area had been surveyed previously for the existing mining activities.
- Should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must be contacted immediately. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
iv. Development Facilitation Act (DFA), Act 67 of 1995

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources (CRM).

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Plan (EMP) – Section (34)(b)
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    a. Section 39(3)
iv. Development Facilitation Act (DFA) Act 67 of 1995
    a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…” The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008).

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

1.5 Terminology and Abbreviations

Archaeological resources

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominin remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance

Holocene

The most recent geological time period which commenced 10 000 years ago.

Later Stone Age

The archaeology of the last 20 000 years associated with fully modern people.

Middle Stone Age

The archaeology of the Stone Age around 20 000-500 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants that lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

The table below provides a description of the abbreviations which are used in this report:

Abbreviations	*Description*
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
BIFs	Banded Iron Formations
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ESA	Earlier Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Later Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PGS	PGS Heritage and Grave Relocation Consultants
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa

ROD	Record of Decision
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

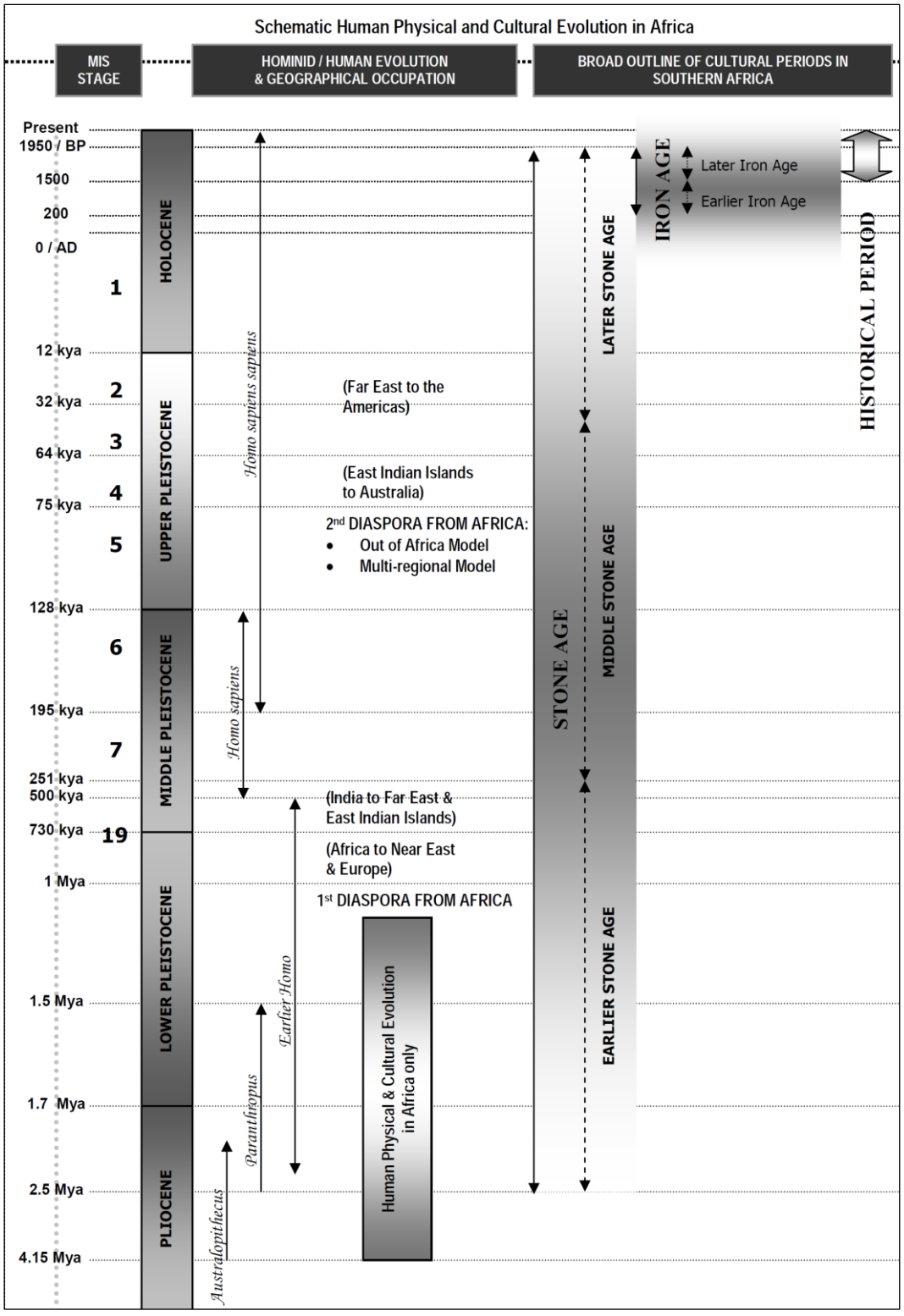

Figure 1 – Human and Cultural Time line in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

2.1.1 The Proposed Development excluding the Floradale Acquifer Recharge Project

Coordinates (WGS 84)	NW cnr: S28°20'2.91"; E22°50'50.71" SW cnr: S28°23'50.06"; E22°49'56.79"	NE cnr: S28°21'43.99"; E23° 1'53.25" SE cnr: S28°26'27.05"; E 22°56'52.08
Property	The proposed activity is located within the Kolomela Mine, on the farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485 and Welgevonden 486.	
Location	The study area is located approximately 12 km south-west of Postmasburg and is situated in the Tsantsabane Local Municipality of the ZF Mgcawu District Municipality, Northern Cape Province.	
Extent	The proposed mining amendment comprises the establishment of waste rock dumps, a mining pit, haul roads as well as a conveyor belt. The combined extent of the entire proposed development is roughly 4,500 hectares whereas the entire mine property is roughly 16,818 hectares in extent. In addition, a section of a proposed new pipeline will be located on the western side of the mining amendment development area within the mine property. See table below for details on the pipeline.	
Land Description	The current land use within the Kolomela Mine property is primarily mining. Some evidence for game farming can also be seen, which may be remnants of previous agricultural activities on newly acquired properties. The dominant land use in the area surrounding Kolomela Mine is livestock and game farming. There are also a number of human settlements and other land uses adjacent to the mine site.	

2.1.2 Floradale Aquifer Recharge Project

Coordinates (WGS 84)	N end: S28°21'50.40"; E22°49'31.6" S end: S28°25'30.0"; E22°49'17.7"	E end: S28°23'19.1"; E22°52'10.4" W end: S28°22'58.8"; E 22°48'48.9"
Property	The proposed activity is located on both the farm Floradale 230 (directly adjacent and to the west of the mine property) as well as two farms from within the mine property namely Wolhaarkop and Kapstevel.	
Location	The study area is located approximately 12 km south-west of Postmasburg and is situated in the Tsantsabane Local Municipality of the ZF Mgcawu District Municipality, Northern Cape Province.	
Extent	The Floradale Aquifer Recharge Project consists of a proposed new pipeline and associated boreholes located partly on the farm Floradale 230 and partly on the farms Wolhaarkop and Kapstevel. The combined extent of the entire proposed pipeline is 17.204 km which comprises a 6.586 km section within the mining property and a 11.318 km section located on the farm Floradale.	
Land Description	The current land use within the Kolomela Mine property (Kapstevel and Wolhaarkop farms) is primarily mining. Some evidence for game farming can also be seen, which may be remnants of previous agricultural activities on newly acquired properties. The dominant land use in the area surrounding Kolomela Mine (Floradale) is livestock and game farming. There are also a number of human settlements and other land uses adjacent to the mine site.	

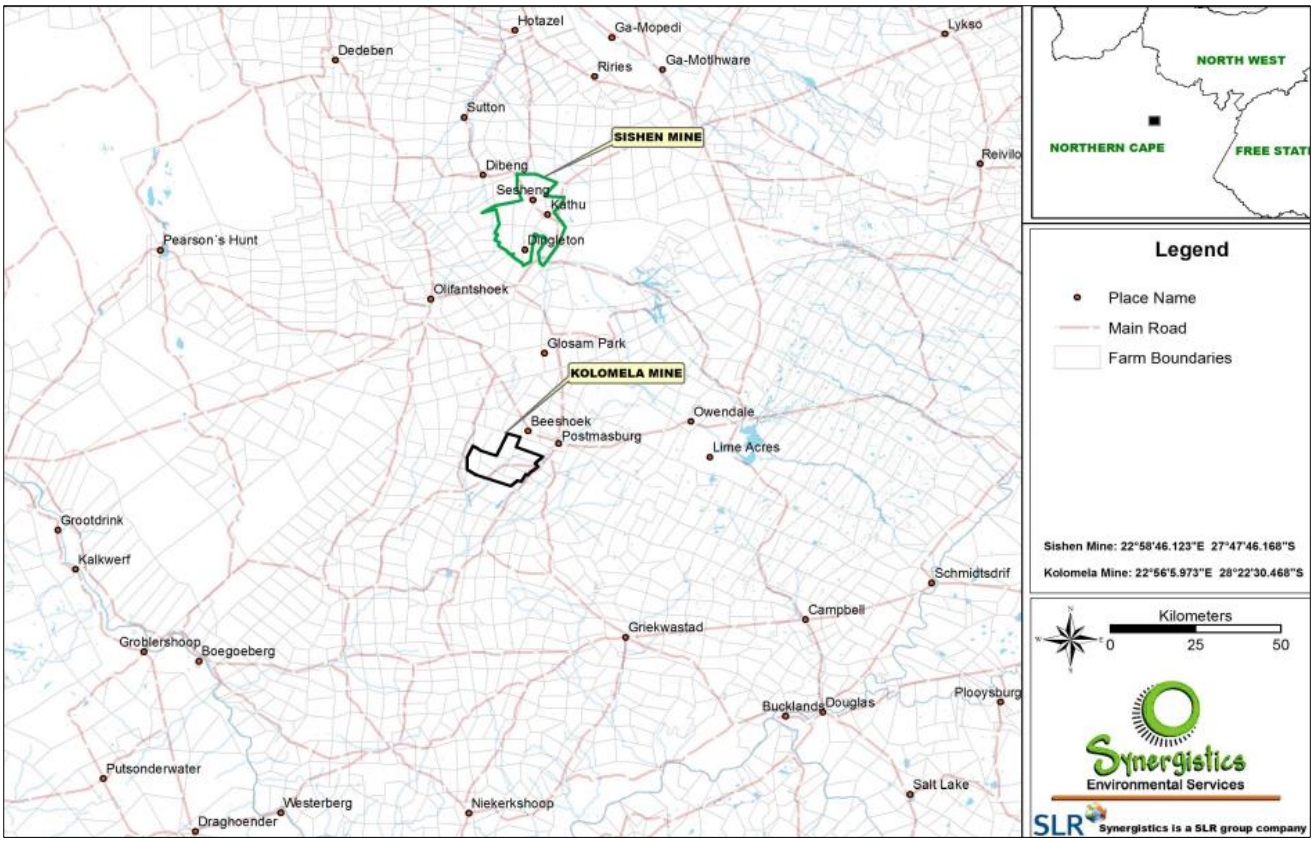

Figure 2 – Location of the overall Study Area within its Regional Context. From a map supplied by the client.

Figure 3 – Google Earth image depicting the location of the entire Kolomela Mine property.

2.2 Technical Project Description

2.2.1 Description of the Kolomela Amendment Project excluding the Acquifer Recharge

The proposed development is known as the Kolomela Amendment Project and the applicant is the Sishen Iron Ore Company (Pty) Ltd (SIOC), which forms part of Kumba Iron Ore Limited (Kumba).

The proposed development entails the expansion of existing mining activities as part of an overall amendment of mining activities at Kolomela Mine. The proposed mining development is located on the Farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485 and Welgevonden 486, located south-west of Postmasburg, Northern Cape Province.

Mining currently takes place on the farms Remainder of Leeuwfontein 488, Strydfontein 614, remainder of Klipbankfontein 489, Portions 1, 2, 3 and the remainder of Kapstevel 541.

The Minister of Mineral Resources granted a mining right for iron ore on 5 May 2008 authorising the exploitation of iron ore by Kumba on the following farms: Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485; Welgevonden 476; and Welgevonden 486. SIOC is also the holder of the surface rights of these properties. The Kolomela mining right {Ref: (NC) 069 MR}, is valid until 17 September 2038 unless cancelled or suspended.

Current mining operations involve mining from three pits on the farms Leeuwfontein 488, Strydfontein 614, Remainder of Klipbankfontein 489, and portions 1, 2, 3, and the Remainder of Kapstevel 541. Existing processing facilities involve a direct shipping ore (DSO) operation, involving crushing and screening of recovered ore material into stockpiles of ‘lump’ and ‘fines’ for transportation by rail to Saldanha Bay.

The Environmental Impact Assessment (EIA) has been commissioned for the Kolomela Mine to include various projects aimed at satisfying current business requirements ongoing business improvements (Optimization) and possible expansions to the maximum potential of the current Life of Mine (LOM) DSO resources. These resources include the Leeuwfontein, Klipbankfontein and Kapstevel pits. The EIA will also include some iron ore reserves within the Kolomela Mine’s approved mining rights area. These reserves include Tierbult, Ploegfontein and Kapstevel South.

The projects will require possible optimisation and debottlenecking of the existing processing plant and the construction of additional infrastructure requirements.

It is envisaged that the Kolomela Amendment Project will entail the development of the following:

- Five Waste Rock Dumps namely the KSS Waste Rock Dump, KSN Waste Rock Dump, KF Waste Rock Dump, LFS Waste Rock Dump as well as the LFN Waste Rock Dump. These Waste Rock Dumps are proposed across the study area. It is important to note that sections of some of these Waste Rock Dumps had already been disturbed. These previously disturbed sections are found at the KSS Waste Rock Dump, KSN Waste Rock Dump, KF Waste Rock Dump, LFS Waste Rock Dump as well as the LFN Waste Rock Dump.
- One mine dump namely the Kapstevel North Dump 2.
- One new pit namely the Kapstevel South Pit which is located directly south and adjacent to the KSS Waste Rock Dump and the KSN Waste Rock Dump. Sections of this proposed pit had also been previously disturbed by mining activities.
- Kapstevel at Pit Facility located a short distance north-east of the Kapstevel South Pit.
- Product Bed Area
- DMS Plant located adjacent to the Product Bed Area.
- Haul Truck Facility
- Parking Area near the Haul Truck Facility
- Expansion of the Explosive Magazine
- Sewage Treatment Plant
- Two Haul Roads, one of which would link the Product Bed Area on the eastern end of the study area with the KSS Waste Rock Dump on the western end of the study area. The second haul road will link the KF Waste Rock Dump with the previously mentioned haul road.
- The Ploegfontein Pits located on the north-eastern end of the study area.
- One Access Road to provide a link between the Ploegfontein Pits and the main mine core.
- A Conveyor Belt that will link the core of the mine with the Kapstevel at Pit Facility.

*2.2.2 **Floradale Aquifer Recharge Project***

The proposed development is known as the Floradale Aquifer Recharge Project and the applicant is the Sishen Iron Ore Company (Pty) Ltd (SIOC), which forms part of Kumba Iron Ore Limited (Kumba).

The SIOC proposes to direct surplus groundwater generated from the de-watering process at the Kolomela Mine into aquifers located within the Soutloop River located to the west of the Kolomela Mine. Aquifer Recharging involves pumping water under pressure into injection boreholes within the tributary of the Soutloop River. The Kolomela Mine abstracts an average of 1 940 m3/h of water (in accordance with the Water Use Licence) to drop the natural groundwater level below the pit excavations. The local aquifer on the farm Floradale 230 & 484 (located on the western boundary of the Kolomela Mine) is planned to be recharged with surplus water from dewatering activities that cannot be released into the Sedibeng Vaal-Gamagara Water Supply Scheme. The total planned drilling is thus: 25 potential injection boreholes and 30 monitoring boreholes, giving a total of 55 boreholes. Boreholes are constructed to a depth of 10-20 m to penetrate a 5 m thick gravel layer. The water will be piped using a pipe with an internal diameter of 0.3 m (300 mm) from the operations at the Kapstevel and Kapstevel South Pits to a tributary of the Soutloop River.

Synergistics Environmental Services (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner (EAP) responsible for the applications required under South African environmental legislation.

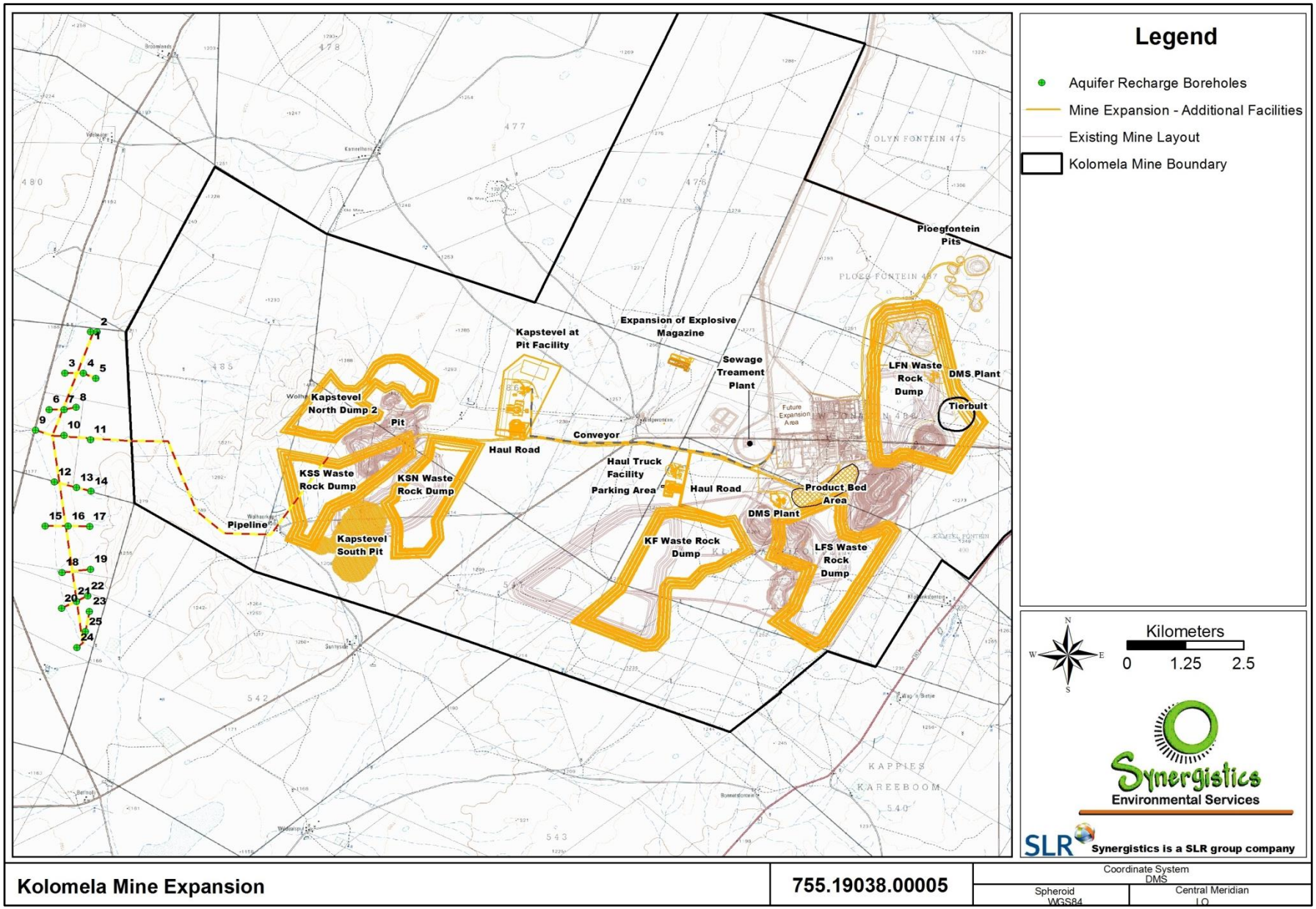

Figure 4 – Development layout plan for the proposed Kolomela Amendment Project. Please note that this study deals with the areas marked in gold only.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS Heritage for the proposed Kolomela Amendment Project and the associated Floradale Aquifer Recharge Project, which represents the expansion of existing mining activities of the Kolomela Mine. The applicable maps, tables and figures are included as stipulated in the NHRA (No. 25 of 1999) and the National Environmental Management Act (NEMA) (No. 107 of 1998). The HIA process comprised three steps:

Step I – Desktop Studies: As the mine property had been covered by previous archaeological and heritage surveys, the only new field surveys undertaken for this study were on the proposed pipeline and boreholes of the Floradale Aquifer Recharge Project. As a result, and specificially in terms of the mining development located within the mine property, this study made extensive use of the information from previous heritage and archaeological reports to identify and reassess heritage sites located within the proposed footprint areas. The desktop study was therefore aimed at obtaining all the available heritage and archaeological reports from this area. This was augmented by an archival and historical overview of the study area and surrounding landscape.

A palaeontological desktop study was also undertaken by Dr Gideon Groenewald and its findings incorporated in this report.

Step II – Fieldwork: For the reasons outlined above two separate fieldwork visits were undertaken for this study, namely:

- Kolomela Amendment Project excluding the Aquifer Project:

  The first limited site visit was conducted over the course of one day (Wednesday, 4 February 2015) by a fieldwork team comprising an archaeologist (Marko Hutten) and Stone Age specialist (Dr. Maria van der Ryst).

  This site visit was aimed at visiting some of the archaeological and heritage sites which had been identified during previous studies and which would likely be impacted by the proposed amendment of mining activities.

- Floradale Aquifer Recharge Project:

  The second fieldwork component comprised a detailed walkthrough of all the footrpitns associated with the Floradale Aquifer Project which are located on the farm Floradale and more limited fieldwork on that section of the Aquifer Project located within the mining property on the farms Wolhaarkop and Kapstevel. This second fieldwork component was conducted over the course of two days (Wednesday, 4 March and Thursday, 5 March 2015).

Step III – Report: The final step involved the assessment of heritage resources identified in the limited physical survey, as well as mapping, recommendations and the writing of a report.

The assessment of significance of heritage sites was based on five 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 - <10/50m2
  - Medium - 10-50/50m2
  - High - >50/50m2
- 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 development 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 (SAHRA) (2006) and approved by the Association for Southern African Professional Archaeologists

(ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 1**).

Table 1: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium	Recording before destruction
Generally Protected C (GP.C)	Grade 4D	Low	Destruction

3.2 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors, along with the equivalent quantitative rating scale for each of the aforementioned criteria, is given below.

Table 2: Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated site / proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

Significance Assessment

The significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, 10 structures younger than 60 years might be affected by a proposed development, and if destroyed the impact can be considered as VERY LOW in that the structures are all of Low Heritage Significance. If two of the structures are older than 60 years and of historic significance, and as a result of High Heritage Significance, the impact will be considered to be HIGH to VERY HIGH. A more detailed description of the impact significance rating scale is given in **Table 3** below.

Table 3: Description of the significance rating scale

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and

		fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 4**.

Table 4: Description of the spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / Proposed Site	The impact will affect an area no bigger than the site.

Temporal/Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal or duration scale is rated according to criteria set out in **Table 5**.

Table 5: Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium-term	The environmental impact identified will operate for the duration of life of the project.
4	Long-term	The environmental impact identified will operate beyond the life of operation of the project.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

The probability or likelihood of an impact occurring is outlined below.

Table 6: Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very likely
5	It is going to happen / has occurred

Degree of Certainty

As with all studies, it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used, as discussed in **Table 7**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making.

Table 7: Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Table 8: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Local	Medium Term	Could Happen	**Low**
Impact on heritage structures	2	3	3	3	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, which is divided by 3 to give a criterion rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The criteria rating of 2.67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 9: Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for heritage structures above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

4 CURRENT STATUS QUO

4.1 Description of Mining Expansion Study Area

Note: the information in this section is taken from the Kolomela Expansion Environmental Scoping Report Final for Review by the Northern Cape Department of Environment and Nature Conservation (Synergistics, June 2014).

The proposed activity comprises the extension of existing mining activities within the Kolomela Mine, on the farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485; Welgevonden 476 and Welgevonden 486 as well as a section of an acquifer project on the farm Floradle located directly to the west of the mining property. The study area is situated south-west of Postmasburg, Northern Cape Province.

Man-made topographical features, including open pits, waste rock dumps and mining infrastructure, dominate the topography of the mining rights area at Kolomela Mine. Three pits, up to 300m deep and covering an area of approximately 384 hectares, have been excavated at the mine. The associated waste rock dumps are up to 20m high and cover approximately 926 hectares. The natural surface topography of the mining area (unaffected by mining activities) is relatively flat with an ephemeral stream, the Groenwaterspruit, incising a dendritic drainage pattern up to 40 m deep along the eastern border of the Kolomela mining right area.

It is important to note that sections of the proposed mining development areas are disturbed by previous mining activities. This includes sections of the KSS Waste Rock Dump, KSN Waste Rock Dump, KF Waste Rock Dump, LFS Waste Rock Dump, LFN Waste Rock Dump and Kapstevel South Pit.

The majority of the area slopes gently to the south west from the Ploegfontein area to Welgevonden, with several drainage courses converging to the south of the mining area into a small spruit, which has generally been referred to as the Welgevondenspruit. The south-eastern part of the Kolomela Mine property, which comprises around 50 000 ha, consists of mainly calcrete-capped plains on red soils. Numerous small shallow pans, also known as dolines, of 100 to 200 m in diameter with a couple of larger pans, occur over most of this area. These pans collect and hold rainwater for short periods after the seasonal rains. A prominent hill, Wolhaarkop, rises above the plains on the south-western portion of the project area (Synergistics).

The dominant land use in the area surrounding Kolomela Mine is livestock farming. Due to the arid nature of the climate, intensive commercial crop production is not possible. There are also a number of human settlements and other land uses adjacent to the mine site. These are as follows:

i) Residential:

a) The Town of Postmasburg. This urban area lies approximately 12 kilometres north-east of the mine.

b) Beeshoek Mine Residential Village. This residential complex lies approximately 10 kilometres north of the mine.

c) Farmhouses and farm labourer homes. There are a number of these residences scattered around the area.

ii) Educational: There are a number of schools in Postmasburg. The closest to Kolomela Mine is the high school, which is located on the south-eastern sector of the town.

iii) Mining: The Beeshoek Mine is located 11.5 kilometres north of Kolomela Mine.

iv) Agriculture: The main farming activities are mainly restricted to sheep, cattle and goat farming due to the semi-arid climate and thin soil cover.

Figure 5 – General view of an undisturbed section from within the study area. Evidence for mining can be seen in the background.

5 DESKTOP STUDY FINDINGS

5.1 Archival and Historic Maps of the Study Area and Surrounding Landscape

5.1.1 Griqualand West and Adjacent Territories Map (undated, possibly c. 1875)

The figure below depicts a section of the map titled, "Map No 1 Shewing the Relative Positions of Griqualand West and Adjacent Territories" (National Archives, Maps, 3/1784). Since other information on the map refers to the boundaries of Griqualand West at various dates from 1830 to 1871, this map can probably be dated to between c. 1872 and c. 1875. The following observations can be made:

- The geographically recognisable names of Blinkklip and Kappies are shown (circled in yellow). Blinkklip is the site of the prehistoric and historic settlement which later became the European town of Postmasburg. Kappies is possibly the original name of the farm currently known as "Kappies Kareeboom", which is located directly south-east of the present study area. As a result it is clear that the present study is located directly north-west of the depicted place name of Kappies on this map.
- While the two places of Blinkklip and Kappies are both located within a triangular shaped area on the map, the present study area would be either just within or just outside of the western side of the triangular shape. This line represents a boundary line between the then Orange Free State and the Griqua under Waterboer that was claimed by President Jacobus Johannes Venter of the Republic of the Orange Free State in 1862. From this it is evident that the study area was located at the time on this boundary line claimed by the Free State in 1862, and quite possible was situated just within the land claimed by the Free State. Of course these boundary lines and claims to land became extremely significant after the discovery of diamonds.
- The post-1871 position of Griqualand West is depicted on the map as a shaded area and indicates that the present study area was located within Griqualand West at the time. The area falling outside and to the north of this shaded section was in 1885 proclaimed as the Crown Colony of British Bechuanaland.

Figure 6 – This map depicts the Relative Positions of Griqualand West and Adjacent Territories (National Archives, Maps, 3/1784). The blue line marks the position of the boundary between the Griqua of Adam Kok (on the left) and the Voortrekkers (on the right). The white arrow depicts the estimated position of the present study area.

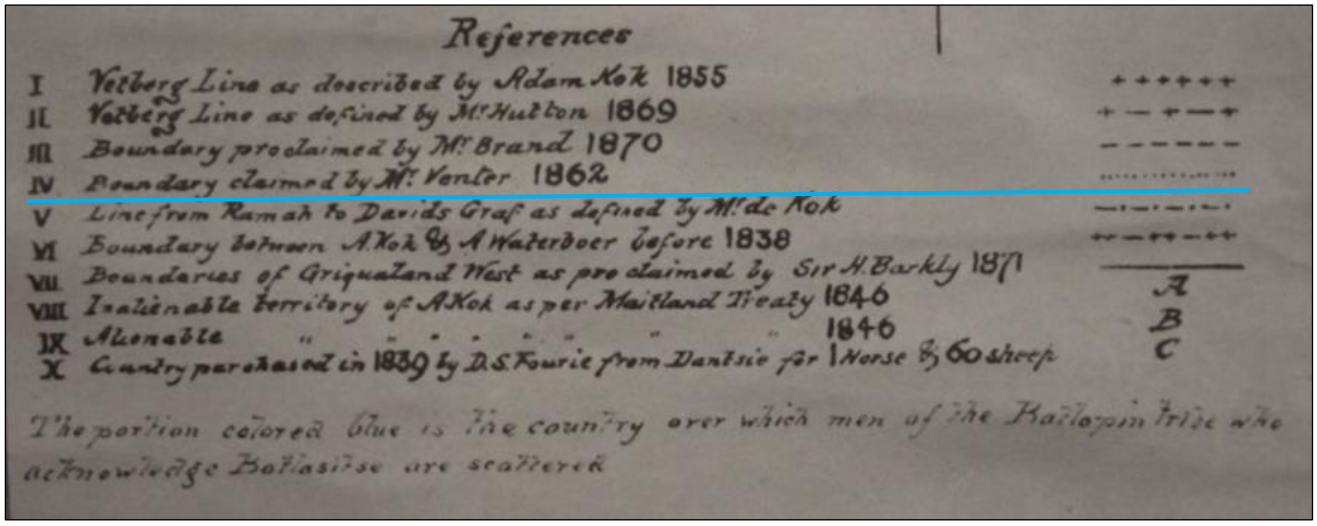

Figure 7 - View of references section or legend from the same map. The relevant item from the legend namely the boundary line claimed by President Venter is underlined in blue.

5.1.2 Griquatown Sheet of the Cape of Good Hope Reconnaissance Series, 1914

The figure below depicts a section of the Griquatown Sheet of the Cape of Good Hope Reconnaissance Series (National Archives, Maps, 3/652). The sheet was surveyed in 1911 by Captain R.B. Hopkins (Manchester Regiment) and Lieutenant J.L. Lockhart (Hampshire Regiment) under the direction of the Staff Captain in charge of Reconnaissance Surveys of the Cape of Good Hope. The sheet was drawn and printed by the War Office in 1914. The following observations can be made:

- A farmstead with the name "Wolhaarkop" is depicted on the map (marked in red). It comprises two buildings, a wind-pump, as well as a temporary dam. It is believed that this farmstead was identified during previous heritage surveys on the western boundary of the farm Kapstevel. This site is included in this report as site KOL 4.
- The "Klipbanksfontein" farmstead is shown on the map (see purple marker) as one building.
- A farmstead with the name "Kameelfontein" is depicted on the map (marked in yellow). It comprises one building as well as a temporary dam.
- Two temporary dams (see green markers) are located within the study area.
- Two small temporary pans (see blue markers) are located within the study area.

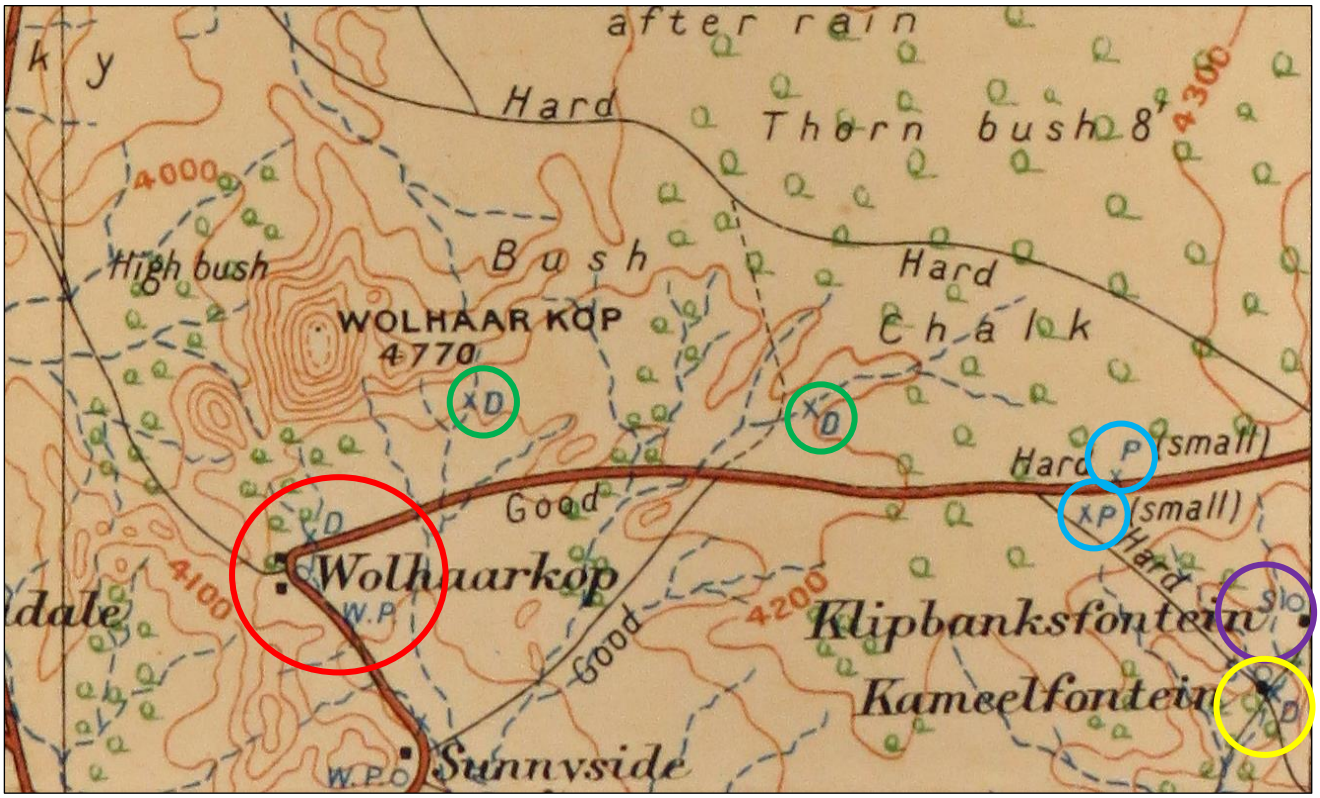

Figure 8 - Section of the Griquatown Sheet of the Cape of Good Hope Reconnaissance Series, dated to 1911 (National Archives, Maps, 3/652). Almost the entire area as depicted in this image is located within the mine.

5.2 Historic Overview of the Study Area and Surrounding Landscape

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with more robust flaked tools. It dates to approximately <2 million years ago. The second technological phase is the Acheulian and comprises more refined stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago. A number of ESA sites and occurrences are known from the general vicinity, though the most significant sites from this area are the Kathu Pan and Kathu Townlands localities and also the Bestwood sites (Chazan et al, 2012) all located in proximity to the town of Kathu 75 km to the north-east. Research at Kathu Townlands was first undertaken by P.B. Beaumont (1990, 2004). The locality has a remarkable high lithic density containing millions of ESA artefacts (Mitchell, 2002; Walker et al, 2013; Walker et al, 2014). Moreover, the interface between the ESA and MSA is also represented at Kathu Pan by the transitional lithic industry of the Fauresmith (Porat et al, 2010).
<250 000 to 40 000 years ago	The Middle Stone Age (MSA) is associated with flakes, points and blades manufactured by means of the prepared core technique. This phase is furthermore associated with modern humans and complex cognition (Wadley 2013). MSA sites and occurrences had been identified in the direct vicinity of the study area, with the very significant Kathu Pan localities (Wilkins & Chazan, 2012) located 75 km to the north-east. See also, for example, Beaumont (2009) and Kruger (2014).
40 000 years ago to the historic past	The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small stone tools known as microliths. A number of LSA sites are known from the direct vicinity of the study area. Significant examples include the specularite mines at Blinkklipkop (18.2 km to the north-east) and Doornfontein (14.9 km to the north), as well as the rock engraving sites at Beeshoek (9.9 km to the north-east) and Palingpan (23.9 km to the north-east).
800 AD – 820 AD	The archaeological excavations undertaken by Beaumont and Boshier (1974) and Thackeray et al (1983) have revealed that the mining of specularite at Doornfontein and Tsantsabane/Blinkklipkop commenced during this time. Blinkklipkop for example is located 10.5 km north-east of the study area. During this initial period the mining activities would have been undertaken by San hunter-gatherers and Kora pastoralists. Only after the 17th century were such activities likely also undertaken by the Iron Age Tswana groups.
Early 1600s	The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Daniëlskuil) (Snyman, 1986). In terms of

	the Thlaro specifically, Breutz (1963) states that after they broke away from the Hurutshe during the period between 1580 and 1610, they travelled along the Molopo River and the Southern Kalahari before arriving at the confluence of the Kudumane, Mosaweng and Molopo. From here they established themselves at Tsowe (west of Morokweng), Gatlhose (10.9km south-east of the study area), Majeng (Langeberg), Khoiise (Khuis on the Molopo River) and Tlhaka-la-Tlou (present day Daniëlskuil situated roughly 72km south-east of the study area). It is evident that the study area and surrounding landscape would be been central within the overall settlement area of the two Tswana groups at the time.
c. 1770	During this time the Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1786 – c. 1795	A German deserter by the name of Jan Bloem established himself at Tsantsabane (Blinkklip) (Legassick, 2010). This place is located 5km north-east of the present-day town of Postmasburg. The settlement of Jan Bloem at the specularite mine may have been a way in which to control the valuable site and any trading activities associated with it.
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the study area during this time. The study area and surrounding landscape would have represented a southern peripheral area of the overall landscape occupied by especially the Thlaping and Thlaro groups at the time. From a map depicted in Legassick (2010:338) it is evident that at the time the Kora started moving in north-eastern direction from the areas along the central Orange river to the banks of the Harts River.
Early 1800s	After the threat of the Kora became less intensive, the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis there during the 1820s (Snyman, 1986). The settlement of the Thlaping in the vicinity of Kuruman occurred during the reign of Molehabangwe. This period in the history of the Thlaping was seen as a period of wealth and power, and at the time they even had control of the *sibello* quarry near Blinkklip (Legassick, 2010).
1801	The first known visit to this area by European explorers (i.e. excluding European renegades and fugitives such as Jan Bloem) took place in 1801. The journey was undertaken by P.J. Truter and Dr W. Somerville. They crossed over the Orange River in the vicinity of Prieska, and passed Blinkklip on their way to present-day Kuruman (Bergh, 1999).
1802 - 1813	During this year William Anderson and Cornelius Kramer, both of the London Missionary Society, established a mission station at a place called Leeuwenkuil. The focus of their work was a group known as the Bastards (Erasmus, 2004). This group could be described as a cultural conglomeration descending not only from relationships between different cultures and races

	(i.e. European and Khoi), but also comprised remnants of Khoi and San groups as well as freed slaves. The particular group later became known as the Griqua. Due to the problems caused by the presence of lions at Leeuwenkuil, the mission station was moved in 1805 to a place higher up called Klaarwater. On 7 August 1813, the settlement which had sprung up at Klaarwater was renamed Griquatown. This came about as a result of a number of proposals made by the Reverend John Campbell, the Director of the London Missionary Society who was visiting the mission stations from this area at the time. He suggested that "...*the Bastards change their name to 'Griqua' and that Klaarwater became Griquatown. This was because 'on consulting among themselves they found a majority were descended from a person of the name Griqua'*..." (Legassick, 2010). Griquatown is located 54 km south-east of the present study area.
1805	During this year the German explorer Martin Hinrich Carl Lichtenstein travelled through the general vicinity of the study area. After crossing the Orange River in the vicinity of present-day Prieska, Lichtenstein's party visited present-day Daniëlskuil, and by June 1805 they were at Blinkklip (Postmasburg), a well-known source for obtaining specular haematite. Archaeological investigations at Blinkklipkop (also known as Nauga) established a date of AD 800 for the utilization of this particular rich source (Thackeray., et al, 1983). From here they travelled further north and reached the Kuruman River where they met Tswana-speaking people. They followed the river downstream for three days, after which they followed a tributary to reach Lattakoe. From here they turned south and reached the Orange River on 11 July 1805. While on their way to the Kuruman River (and to the south thereof), Lichtenstein and his fellow travellers visited a small settlement consisting of "*…about thirty flat spherical huts.*" Although the people who stayed here were herdsmen who looked after the cattle of richer people living on the Kuruman River, they indicated that San (Bushmen) were also present in the area (Lichtenstein, 1930). Although Lichtenstein was certainly not the first European explorer to travel through this area (the Truter & Somerville expedition had for example passed through this area in 1801), or for that matter the last (Burchell travelled through the area in 1811 followed by John Campbell in 1813) (Bergh, 1999), Lichtenstein did leave behind a written record of this journey providing a valuable glimpse into the early history of the general surroundings of the study area.
1811 – 1813	During this period the famous English explorer and artist William Burchell visited the general vicinity of the study area. Accompanied by missionary Anderson, Burchell crossed over the Orange River at Little Bend from where they travelled to Klaarwater. Using the settlement as a temporary base, Burchell undertook numerous journeys which included one which passed through Blinkklip (Bergh, 1999).
1813	During 1813 John Campbell of the London Missionary Society also visited the general vicinity of the study area. He arrived at Klaarwater on 9 June 1813, where he rested for a few days before continuing in a northern direction to present-day Kuruman, passing through Blinkklip on the way (Bergh, 1999).

Figure 9

Reverend John Campbell (Campbell, 1815). He paid a visit to Blinkklip during the second half of 1813.

1820s	Barend Barends and his followers moved from their settlement at Danielskuil to Boetsap (roughly 154km north-east of the study area). At the same time Thlaping ruler Mothibi, the brother of Mahura, settled in the vicinity of Boetsap before moving to Griquatown (Legassick, 2010). The first settlement of Blinkklip by the Griqua also took place during this time (Legassick, 2010).
20 December 1820	On this day Andries Waterboer was elected as leader of Griquatown in the place of Berend Berends (Legassick, 2010). This period saw fission within the Griqua community, and it is not surprising that two long-term leaders moved away from Griquatown to establish autonomous settlements away from their former town. Berend Berends for example moved to Daniëlskuil (54 km south-east of the study area), whereas Adam Kok II established himself in the vicinity of Campbell (85 km south-east of the study area) (Legassick, 2010).
1821 – August 1828	During this period another group of Griqua became dissatisfied with Waterboer and moved away from Griquatown to first settle along the Modder River. This group was known as the Bergenaars and they were supported by Kora and San elements (Cope, 1977). A section of the Bergenaars known as the Klein Bergenaars (Little Bergenaars) settled along the Langberg. At its closest point this mountain range is located 6.5 km west of the present study area. The Bergenaars constantly attacked the Thlaro,

	Thlaphing as well as the Griqua. On three separate occasions (late 1824, July 1827 and December 1827) they attacked Griquatown itself (Cope, 1977).
Early 1830s	During this time Andries Waterboer stationed a number of Griqua families at a fountain north of Tsantsabane (Blinkklip) as well as at Daniëlskuil. Shortly thereafter, a missionary of the London Missionary Society by the name of John Baillie was transferred from the mission station at Kuruman to Tsantsabane. He was to work among the Sotho-Tswana living in and around Tsantsabane at the time. Baillie subsequently left the mission station and resigned from the London Missionary Society in 1836 (Legassick, 2010).
2 April 1842	A treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed upon boundary closest to the study area ran from "...*the northerly point of the Langeberg and extending a little south of Nokaneng, and further half-way between Maremane and Klipfontein*..." (Legassick, 2010:291). While the exact location of Nokaneng is not currently known, the farms Klipfontein 437 and Maremane 678 are situated 24.7 km and 40.9 km to the north-east. This suggests that the present study area was located south of the boundary line between the Griqua and the Thlaping as defined in the treaty. As such, the study area was defined within this treaty as forming part of the land of the Griqua (Legassick, 2010).
1850	A Thlaro leader by the name of Molete and his baThlaro baga Keakopa followers moved away from the Korannaberg and established themselves at Gathlose, roughly 48 km north-east of the study area (Breutz, 1963). Likely between 1850 and 1860 the area known as Maremane (located directly north of Gathlose) was an outpost grazing area of the BaThlaro chief Makgolokwe and his son Toto. The first designated leader of this area was Isaak Thupane Thupane, followed by Toto's son Robanyane who fled to present-day Namibia after the Langberg Rebellion of 1897 (Breutz, 1963).
1850 – 1855	During this period a Thlaro chief by the name of Isaak Thupane Thupane established himself at Logageng (Gatkoppies) near Postmasburg. He subsequently moved with his followers to Groenwater 453. However, during the time that Thupane was living at Logageng, Kgangeng discovered the fountain at Metsematale. Subsequently, the land was ceded by Waterboer to the Thlaro and Kgangeng and his followers settled at Groenwater as well (Breutz, 1963). The farm Groenwater 453 is located 25 km north-east of the study area.
13 December 1852	After the death of Andries Waterboer, his son Nicolaas Waterboer became the leader of Griquatown. He ruled Griquatown until the annexation of the area by the British in 1871 (see below) (Legassick, 2010). It was during the rule of Nicolaas Waterboer that diamonds were discovered in the area which led to a period of claims and counter-claims between the Griqua, the Orange Free State as well as the Zuid-Afrikaansche Republiek and which eventually led to the annexation of the area.

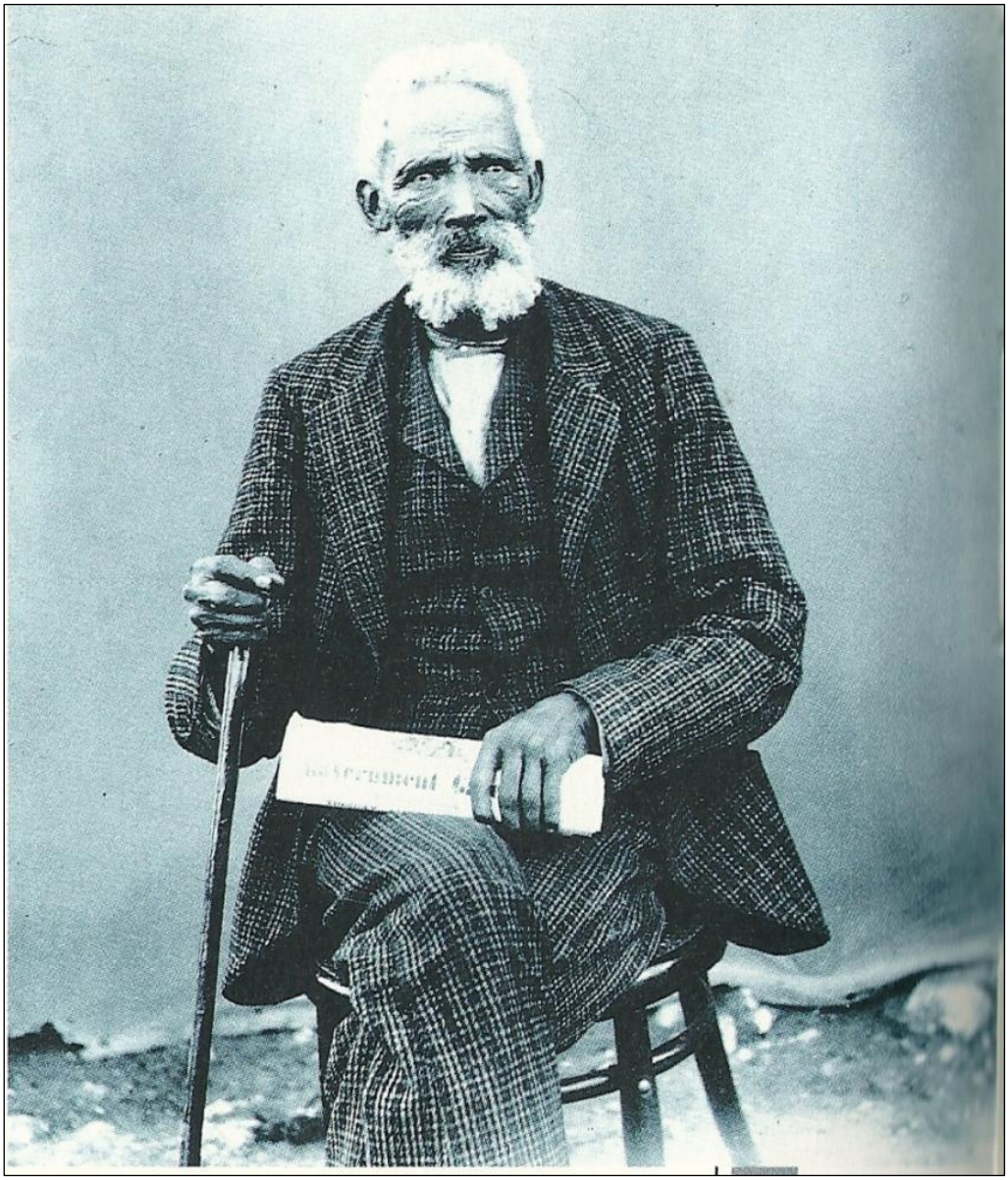

Figure 10

Nicolaas Waterboer, who succeeded as leader of Griquatown in 1852 after the death of his father Andries Waterboer (Reader's Digest, 1994:168).

Before 1856	During the period before 1856 the Thlaro leader Masibi occupied the area known as Skeyfontein (also Skeynfontein or Dikeing). The farm Skeyfontein 536 is located 19.4 km east of the present study area.
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River in the vicinity of the confluence of the Vaal and Harts Rivers (Van Staden, 1983). This resulted in large numbers of fortune seekers streaming into the wider vicinity of the study area from overseas. This factor would have had a profound impact on the social-dynamics of the landscape.

27 October 1871	The area located in general terms between the Orange and Vaal Rivers and south of Kuruman was proclaimed as British Territory and named Griqualand West. This proclamation came as a result of ownership disputes between the Griqua, the Boer Republic of the Orange Free State and the Boer Republic of the Zuid-Afrikaansche Republiek in terms of the newly discovered diamond diggings (www. wikipedia.org). The study area fell within Griqualand West at the time.

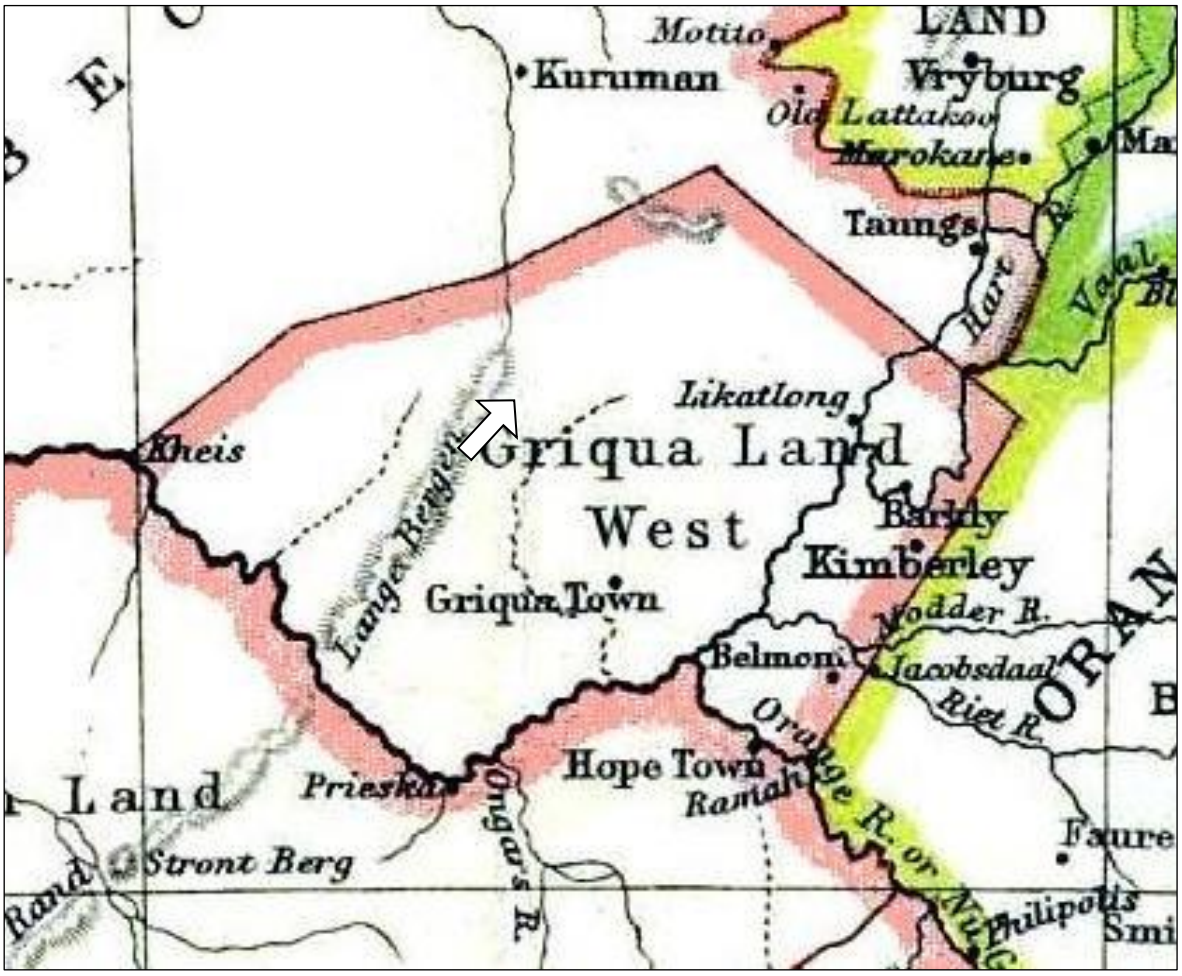

Figure 11

Section of a map titled "Sketch Map of South Africa showing British Possessions". The map is dated to July 1885. (www.wikipedia.com).The boundaries and position of Griqualand West is depicted on this figure. The approximate position of the present study area is shown.

1873 - 1876	After the province of Griqualand West came into existence in 1873, the study area now fell within the Griquatown (later Hay) District of Griqualand West. Subsequently, three government surveyors namely M.P. Auret, F.H.S. Orpen and J. Mintern were sent out to survey the whole district into individual farms (Snyman, 1983).

1876 - 1878	During this period the first farms in the vicinity of Blinkklip were bought by white farmers. These included the farms Pensfontein (bought by C. And G. Harrison), Kappies (bought by John Ryland), Soetfontein (bought by Henry Immuell) as well as the farms Vlakplaats, Abelsvlakte, Blouboskuil, Bloubosputs and Geelputs (all bought by R. Attwell). At the time farms such as Matsap, Klipfontein, Olynfontein, Kalkfontein, Gazip, Ploegfontein, Goedgedacht, Lukasdam, Vaalpan, Rooipoort and Klipbanksfontein had Griqua owners (Snyman, 1983). Interestingly, of all the farms mentioned in this paragraph, Klipbanksfontein are located within the present study area whereas farms such as Pensfontein and Olynfontein are located directly adjacent to the present study area.
1878	A rebellion broke out amongst some of the Tswana communities living in Griqualand West. This rebellion, which was a response to British expansion and colonialism, spread to the Langberg. A force under Colonel Charles Warren left Griqualand West during October 1878 and defeated the "rebels" at the Langberg (Snyman, 1986).
1880 - 1892	During this period a number of events took place which led to the establishment of the town of Postmasburg. One of these events occurred during February 1880 when a troop of the Griqualand West Border Police was stationed at Blinkklip. The reason for this decision was that Blinkklip was situated strategically close to the Bechuanaland border (Snyman, 1983). Another event was the inclusion of Griqualand West in the Cape Colony during 1880, which resulted in higher numbers of permanent white settlement in the area (Snyman, 1983). That the Blinkklip area was seen from government side as favourable for the establishment of a town, can be deduced from the fact that during 1881 a government surveyor by the name of J. Mintern had surveyed the whole Blinkklip valley between Olynfontein and Vinci into agricultural stands. During the same year as many as 38 whites were staying on farms at Blinkklip (Snyman, 1983). During 1882 a number of Reformed Church congregates arrived in the area between Griquatown and Blinkklip. In May 1884 the congregation agreed to establish a church place on the farm Ploegfontein (located directly north-east of the study area) for a period of five years. When the period of five years ended, the church council undertook an investigation to find a suitable place for a new church as well as a new town. On 30 November 1889 the congregation finally decided to establish the new town and church at Blinkklip. They submitted an application to the authorities, but it was turned down. On 2 March 1891 their religious leader Dominie Martinus Postma submitted a petition which had been signed by 51 people in favour of the establishment of a town at Blinkklip, to the authorities. This application was approved and during April 1891 a government surveyor by the name of J.A. Thwaites surveyed 82 stands around the police camp. As it took more than a year for the stands to be allocated, a second petition was organised during

	September 1891. The petition asked for the rapid allocation of stands, as well as for the renaming of the settlement from Blinkklip to Postmasburg in honour of Professor Dirk Postma, the founder of the Reformed Church of South Africa. Although the authorities were in favour of the establishment of a town, they did not agree with the proposed name change. In January 1892 Dominie Martinus Postma again asked for the name change and indicated that all the white residents of area were in favour of this. On 14 April 1892 the Assistant-Commissioner of Crown Lands reported as follows: "*...in view of the unanimous request of the inhabitants, instructions have been issued for the necessary arrangements to be made for the change of the name of the township from 'Blink Klip' to 'Postmasburg'* (Snyman, 1983:10). The town's stands were eventually only sold on 12 August 1892 (Snyman, 1983).

Figure 12

Historic portraits of the two members of the Postma family associated with early development of Postmasburg. On the left is Professor Dirk Postma in whose honour the town of Postmasburg was named, with Dominie Martinus Postma on the right. He was the person driving the establishment and naming of the town (Snyman, 1983:9).

30 September 1885	Sir Charles Warren proclaims British Bechuanaland. This area comprised the land between Griqualand West and the Molopo River (Snyman, 1986). As mentioned elsewhere, the boundary between British Bechuanaland and Griqualand West was established a short distance north of the study area.
1886	As a result of the work of a commission appointed by the British rulers of British Bechuanaland, a number of so-called "native reserves" were established in this area. These included the Gatlhose Reserve and the Maremane Reserve (Snyman, 1986).
c. 1890	The Griqua mined iron at Gatkoppies near Postmasburg (Breutz, 1963).
September 1896	A viral disease affecting cattle (and some other species of even-toed ungulates) known as Rinderpest swept through Southern Africa during this time (www.wikipedia.org). Although attempts were made to halt the spread of the disease from the north by erecting a fence between the boundaries of Griqualand West and Bechuanaland, this proved unsuccessful. Incidentally, only three gates were placed in this fence, namely at Gatlhose, Nelsonsfontein and Blikfontein (Snyman, 1988).

Figure 13 An everyday scene in Griqualand West during the Rinderpest Epidemic: large numbers of destroyed cattle (Snyman, 1983:20).

1897	The Rinderpest epidemic did not only have a massive socio-economic impact, it also resulted in the Langberg Rebellion of 1897. Conflict broke out between the authorities and a Thlaping leader from Taung, Galeshiwe. The conflict arose after some of his cattle that were infected by Rinderpest were destroyed by the government to kerb the spread of the disease. After killing an officer, Galeshiwe fled to the Thlaro leader Toto of the Langberg. A full-scale rebellion broke out that was eventually suppressed (Breutz, 1963).

	Although most of the activities associated with the rebellion took place some distance to the north-west of the study area, the impact of the rebellion was felt throughout the surrounding landscape. For example, farms located not too far from study area such as Lukasdam (7.4 km north of the study area), Mount Temple (21.8 km north-west of the study area) and Vlakfontein (13.3 km north-east of the study area) came under attack from stock thieves during this time. After the farms Mount Temple and Groenkloof were physically attacked, a police post which had been established on the farm Vlakfontein was reinforced (Snyman, 1983).

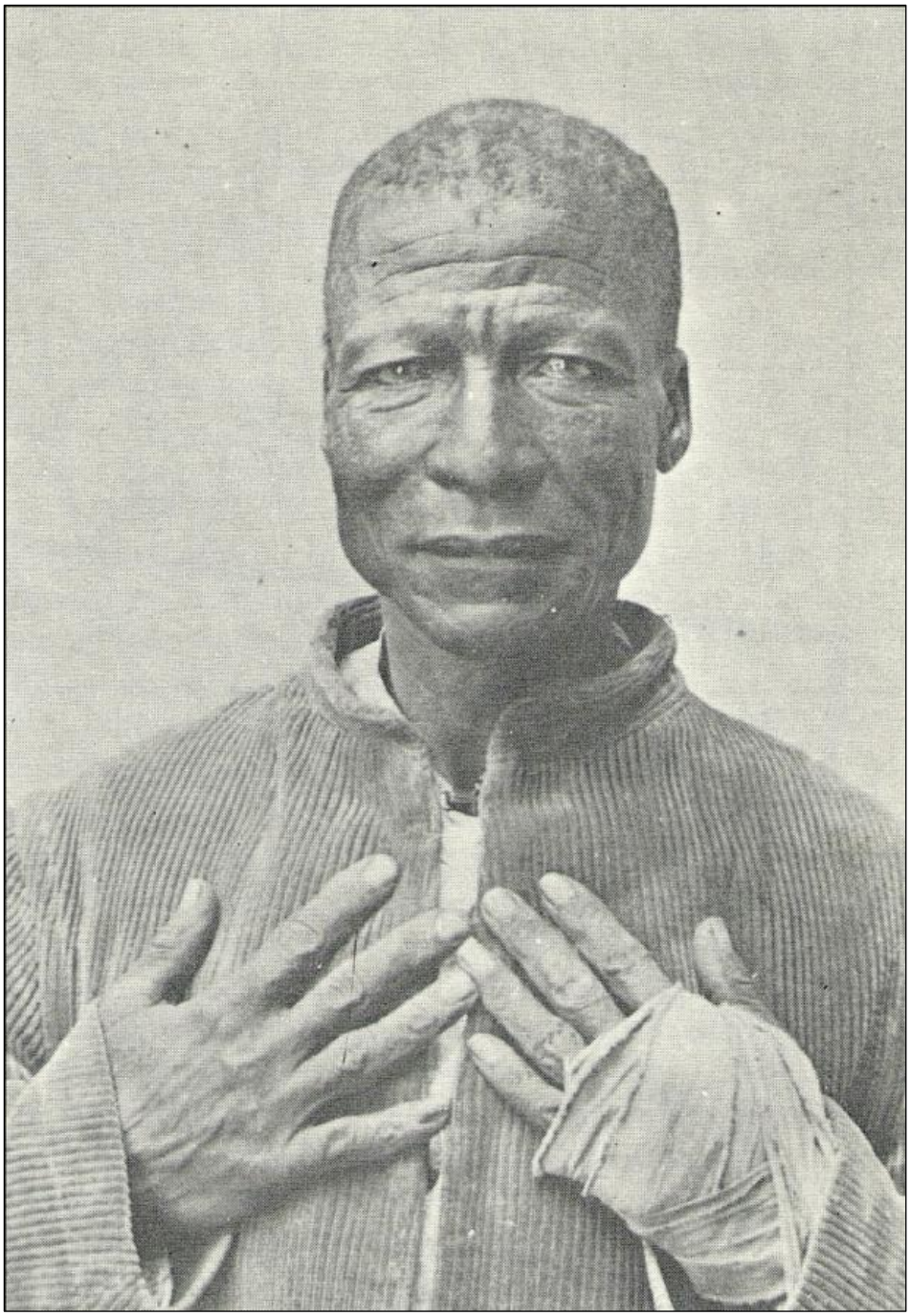

Figure 14 Toto, leader of the Thlaro along the Langeberg (Snyman, 1986:17).

1899 - 1902	The South African War (also known as the Anglo Boer War) was fought between Great Britain and the Boer republics of the Zuid-Afrikaansche Republiek and Orange Free State. After the outbreak of hostilities on 11 October 1899, the military commander of Griqualand West and British Bechuanaland Lieutenant-Colonel R.P. Kekewich issued a proclamation whereby all residents of these areas were considered British subjects and as such had to refrain from assisting the Boer forces. However, when a Free State Commando under Kommandant Jan Jordaan and Judge J.B.M. Hertzog occupied Postmasburg on 18 November 1899, a large number of Postmasburg residents took up arms and joined the commando. These rebels formed part of the force under the command of P.J. de Villiers which by March 1900 was in command of the entire Griqualand West. The rebels were under the direct command of Kommandant Jan Vorster and Veldkornet Piet Venter (Snyman, 1983). In April 1900 Sir Charles Warren received the order to retake Griqualand West and British Bechuanaland. Apart from a short delay caused by a skirmish at Fabersput (near Campbell), Warren occupied the towns from within the area (including Postmasburg) within a short period of time. This had a devastating effect on the morale of the rebel forces, who for the most part surrendered. However, fifty rebels under the command of General De Villiers joined the Transvaal forces under the command of General J.H. de la Rey in the western part of the Zuid-Afrikaansche Republiek (Snyman, 1983). In June 1901 General De Villiers attacked the region again to act as a link between General J.H. de la Rey in the Western Transvaal and General J.C. Smuts in the North-Western Cape. On 10 August 1901 the town of Postmasburg was occupied by Boer forces under the command of Kommandant E. Conroy. A number of victories for the Boer forces in this area followed, including the attack on 10 August 1901 of Veldkornet Van Aswegen at Kareepan which resulted in the taking of 110 horses. The farm Kareepan 450 is located 9.4 km north-east of the study area. Other successes took place at Griquatown and Rooikoppies. These Boer victories resulted in almost the entire white population of Postmasburg taking up arms on the Boer side during August and September 1901. After a battle at Kalkfontein (south of Postmasburg) on 15 September 1901, the town was retaken by the British. However, during January and February 1902 General De Villiers was again in control of Postmasburg and used it as his headquarters during this period (Snyman, 1983). During the last few months of the war, the Boer forces focussed their attention on attacking the convoys operating between Griquatown and Daniëlskuil. This resulted in skirmishes and battles at places such as Dirkspan and Doornfontein, both located north-east of the study area (Snyman, 1983). The war ended on 31 May 1902 with the British as victors. The effects of the war were felt for years after the hostilities had actually ended.

Figure 15 A group of Boer rebels from Postmasburg (Snyman, 1983:16).

Figure 16

Captain T.L.H. Shone, who not only discovered a Kimberlite pipe near Postmasburg, but who is also regarded as the first person to mine manganese in the vicinity of the study area (S.A. Manganese, 1977:24)

1913	In this year the so-called “Native Locations” of Skeyfontein and Groenwater were established by Proclamation 131 of 1913 (Breutz, 1963).
1918	During this period the Influenza Pandemic arrived in South Africa. Although the Postmasburg area was seemingly not seriously affected by the disease (Snyman, 1983), the situation on the diamond diggings toward Lichtenburg and Bloemhof were much worse and hundreds of people died there during this period (Van Onselen, 1996).
1918 - 1920	During 1918 a prospector by the name of Casper Venter and his assistant Plaatjie discovered a Kimberlite pipe on the townlands of Postmasburg. The following year T.L.H. Shone discovered a second Kimberlite pipe which became the Postma’s Diamond Mine. Venter sold his discovery rights to Oliver Daniel, and during May 1920 the West End Diamond Mine was established. In the same year Daniel and his partners sold the mine to Sir Abe Bailey for an amount of £80,000.00 (Snyman, 1983). Although the discovery of the Kimberlite pipe brought large numbers of fortune seekers to Postmasburg in the hope that the town would become the new Kimberley, it was only the West End Mine as well as the Postma’s Mine which proceeded with the mining of diamonds (S.A. Manganese, 1977). The West End Diamond Mine was located 13.9 km north-east of the present study area.
1919 - 1930	Mine activities at the West End Diamond Mine continued during this period, until work was ceased due to the financial crisis associated with the Great Depression. During this time the mine retrieved 182, 955 carats of diamonds (Snyman, 1983).
1920 - 1921	The Kimberlite pipe which had been discovered by Shone was mined during this time by Postma’s Diamond Prospect Limited (Snyman, 1983).
1922	In this year T.L.H. Shone (who had discovered the Kimberlite pipe at Postma’s Mine three years earlier) discovered manganese on the farm Doornfontein. Although the presence of manganese in the surrounding landscape had been known before this discovery Shone was the first person to actually mine manganese in this area and was also responsible for focussing the attention of those interested in manganese on the surroundings of Postmasburg (Snyman, 1983). The farm Doornfontein 446 is located 13.3 km to the north of the present study area.
1922 - 1923	After the cessation of activities by the Postma’s Diamond Prospect Limited, mining activities were undertaken during this time by the Diamond Fields of Africa Exploration Company Limited (Snyman, 1983).
1925	With partners Reg Saner and John Dale-Lace, T.L.H. Shone established the first manganese mining company in South Africa, namely Union Manganese Mines and Minerals Limited. The company obtained options on a number of farms in the Postmasburg district (Snyman, 1983).

1924 - 1927	Mining activities were taken over by the Postma's Diamond Syndicate in 1934 after the cessation of activities by Diamond Field (Snyman, 1983).
22 December 1926 – May 1927	On 22 December 1926 a second manganese mining company was established by Niels Langkilde and A.J. Bester. The company was named South African Manganese Limited (Snyman, 1983). During 1927 the company appointed two experienced prospectors to investigate the properties of the company. These two prospectors were S. Griffiths and W.J. Marais. Their work focussed on the four most important farms owned by the company, namely Kapstewel (located 20.1 km north of the study area), Thaakwanene (located 30.7 km north-east of the study area), Knoffelfontein (unknown location) and Doornput (seemingly located north of Postmasburg). Although the results of the prospecting activities were deemed to be very positive, the lack of a railway link between the market and these properties was a serious hurdle (S.A. Manganese, 1977).
1929	A company by the name of the Postma's Diamond Mine undertook mining activities at the Postma's Mine (Snyman, 1983).
4 November 1930	On this day the extension of the railway line from Koopmansfontein to Postmasburg was officially opened by the Minister of Railways, C.W. Malan. This meant that Postmasburg was now one of the few towns in the Northern Cape which boasted a direct rail link. The extension of the railway line to Beeshoek was built by the Manganese Corporation, whereas the further extensions of the line to Lohatla and Manganore (1936), Sishen (1953) and Hotazel (1961) were undertaken by the South African Railways (Snyman, 1983).
1930 - 1932	During 1930 an Englishman by the name of Pringle-Smith was appointed by S.A. Manganese to devise and execute a "...*thorough prospecting programme of S.A. Manganese's properties*..." (S.A. Manganese, 1977:46). This meant that the prospecting work undertaken in 1927 and which had been halted due to the poor financial climate and the lack of a railway link could now be proceeded with. Within a relatively short spate of time Pringle-Smith started opening up the beds on the farms Kapstewel and Doornput. However, the company did not have the market which for example the Manganese Corporation possessed at the time, and as a result the ore was stockpiled at these two farms. Pringle-Smith left the Postmasburg area in 1932 after the financial implications of the Great Depression worsened the situation for S.A. Manganese to such an extent that he was asked to agree to a much lower salary (S.A. Manganese, 1977).
1930 - 1931	The activities at the Postma's Mine were continued during this time by the company Postma's Mine (Snyman, 1983).
1931 -1939	During this time the dumps at the West End Diamond Mine were mined by F. Bernhardi, R.A. Dunsford and T. Begbie. However, this proved unsustainable and this work was ceased in 1939 (Snyman, 1983).

Early 1930s	Due to the financial impacts of the Great Depression, a number of smaller manganese mining companies were closed down. A period of amalgamation followed which resulted in the South African Manganese Limited as well as the Associated Manganese Miners of South Africa Limited becoming the leaders in the manganese mining industry (Snyman, 1983).
1935	The Postmasburg Diamond Mine was the last company to undertake mining activities at the Postma's Mine. All activities at the mine were halted when the mine became flooded during this year. The different mining companies operating at the Postma's Mine during the period from 1919 to 1935 retrieved a total of 5,155 carats of diamonds (Snyman, 1983). The Mancorp Mine village was established during this year (Snyman, 1983).
c. 1936	After the willingness of the South African Railways Administration to extend the railway line from Postmasburg to Kapstewel and Lohatla became known, the entire manganese industry north of Postmasburg changed for the better. An example of this was that S.A. Manganese stepped up operations on the farm Kapstewel. The work here was overseen by none other than Captain T.L.H. Shone (S.A. Manganese, 1977). The promise of railway extensions to this area also resulted in other mining activities such as the establishment of a mining company by the name of Gloucester Manganese. This company was established to mine the manganese deposits on the farm Gloucester. Shortly thereafter an amalgamation took place between Gloucester Manganese and the Manganese Corporation which resulted in the formation of the Associated Manganese Mines of South Africa Limited (Ammosal). Ammosal re-erected the old ore handling plant from Beeshoek on the farm Gloucester and the operations here represented a large portion of the total manganese production of 250,000 tons (S.A. Manganese, 1977).

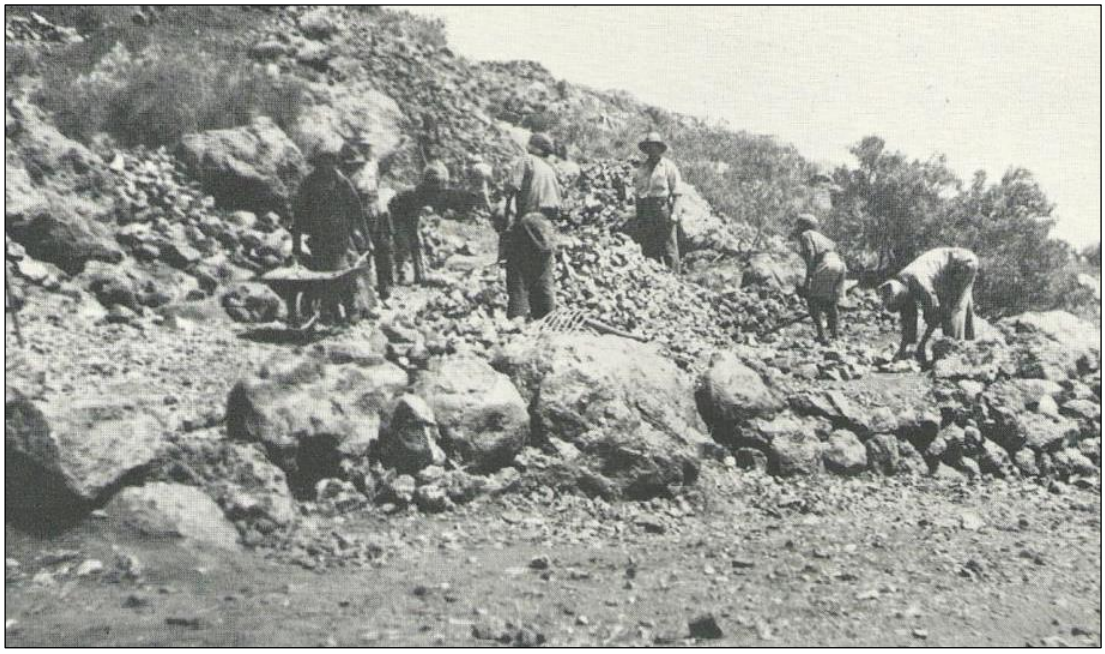

Figure 17 Prospecting activities on the farm Kapstewel during 1937 (S.A. Manganese, 1977:59).

1937	The farm to the east of Gloucester, named Lohatla, was now being viewed more favourably by S.A. Manganese. During this year they reached an agreement with the owner, which eventually resulted in the acquisition of the farm (S.A. Manganese, 1977). During the same year the company bought the freehold of the farm Klipfontein and also bought 600 morgen of the farm Kapstewel in order to build a staff village. This village was named Manganore (S.A. Manganese, 1977). The Lohatla mine village was also established during this time (Snyman, 1983).
1948	The production of iron ore came to the foreground during this time with the mining of iron ore by S.A. Manganese at Manganore and by the Associated Manganese Miners of South Africa at Beeshoek (Snyman, 1983).
1953	In this year Iscor commenced iron production at Sishen (Snyman, 1983).
1958 - 1978	Iron ore (and manganese) mining activities were undertaken by Consolidated African Mines on the farms Pensfontein (11.6 km north-east of study area), Kapstewel and Rooinekke. These activities were halted when the market for iron disappeared in 1978 (Snyman, 1983).
1959 - 1966	Iron ore mining activities were started at the so-called Springbok Mine during 1959. These activities took place around a low hill situated south-west of Postmasburg. The work on the town end of the property was undertaken by the Springbok Industrial and Mineral Ventures Limited and the work undertaken on the other end (toward the farm Koeispeen 475) were undertaken by Griqualand Iron Ore (Pty) Ltd. The mining activities of the companies at Springbok Mine ceased in 1966 (Snyman, 1983). The Springbok Mine is situated 7.7 km north-east of the study area.
Early 1960s	The residents of Skeyfontein and Groenwater were forcibly removed from their land as part of the system of Apartheid (BAO, 2390, D188/1235/1).
1963	F.M. Mangan discovered iron ore deposits on the farm Kareepan (Snyman, 1983). This farm is situated 9.4 km north-east of the present study area.
1963 - 1977	During this time mining activities were renewed on the original prospecting land of West End Diamond Mine. Mining activities included the sinking of two shafts as well as the working of the old mine dumps. Due to financial losses, all activities here were ceased in 1977 (Snyman, 1983).
c. 1966 - 1978	During this time Springbok Industrial started mining the iron ore deposits which had been discovered on Kareepan in 1963. By 1978 all activities were halted as there was no more market for iron ore (Snyman, 1973).
1976 - 1977	During this time the Gatlhose and Maremane Communities were removed from their land and taken to the Shipton Farms in the then homeland of Bophutatswana. After their removal, the South African Government decided to establish a Battle School here. As the Khosis Community was still staying on the land, they were moved to a section of the original land roughly 14 000 hectares in extent. The Lohatla Battle School was subsequently established (www.lrc.org.za/Docs/Judgments/khosis.doc).

5.3 A Review of the Archaeological Context of the Northern Cape

5.3.1 Introduction

The Northern Cape is an arid region with limited surface water so that archaeological remains are often found in the vicinity of water (Mitchell, 2002) and also sources of lithics that have been used to produce stone tools. Palaeo- and current river systems, springs and pans and dominant geographical landscape features such as hills or shelters are important locales within any landscape. The region has very numerous small shallow pans. Areas around and in pans tend to display higher densities of lithics (van der Ryst, 2011; Habitat, 2013).

The region abounds with the remains of prehistoric hunting and gathering groups. Numerous archaeological sites have been recorded, researched and published through archaeological impact and heritage assessments. In addition to the well-known Taung localities some important fossiliferous and lithic-bearing breccias have recently been found on the Ghaap Plateau (Curnoe, 2005; Herries et al, 2007; Johnson et al, 1997). Stone tools mostly mark areas of prehistoric occupations and these suggest a widespread presence for tool-producing Plio-Pleistocene hominins in southern Africa (Barham and Mitchell 2008). This important part of the prehistory of southern Africa, known as the Stone Age, is chronologically divided into the Earlier, Middle and Later Stone Ages (ESA, MSA and LSA).

The ESA is characterized by the use of large stone cutting tools (LCT's) (McNabb et al, 2004), in particular handaxes, but also cleavers and tool types such as scrapers. Following on the ESA the MSA typologies represent greater specialization in the production of stone tools, in particular flake, blade and scraper tools and also in a more extended range of specialized, formal tools. Regional lithic style, evidence for symbolic signalling, polished bone tools, portable art and decorative items are apparent during the MSA. ESA and MSA lithics occur widespread around water sources and previously favourable land settings that are now buried. During the LSA small (microlithic) tools, bone tools and weapon armatures and a range of decorative items as well as rock art were produced. Ceramics were used and/or manufactured by hunters and Khoekhoe herders towards the terminal phases of the LSA over a period of around 2000 year. The more recent occupations of LSA groups are abundant as surface finds and in sealed deposits in shelters (Beaumont et al,.. 1995).

Differences in stone artefact assemblages have been used in attempts to discern between late-Holocene hunter-gatherer and herder sites (Parsons, 2003, 2004, 2007, 2008; Lombard and Parsons, 2008) but this distinction is not generally accepted. Hunter-gatherer assemblages termed Swartkop may contain grass-tempered ceramics (Beaumont and Vogel, 1989). Sites with engravings, for example Jagt Pan, are often situated close to water sources. The Doornfontein herder sites contain ceramics that occasionally have lugs and/or spouts. Differences in the geographical spread indicate a preference for pastoral Doornfontein sites along rivers while Swartkop sites are usually found further from the river (Fauvelle-Aymar, 2004). Substantial herder encampments were located along the Orange River floodplain. Hendrik Jacob Wikar during his travels in 1778 recorded the names of the various herder groups who had settlements on both sides of the river (Mossop, 1935). Stone circles have also been documented in the Northern Cape. These features may represent residential structures being the bases of huts or windbreaks, storage structures, stock enclosures or hunting blinds (Kinahan, 1996; Parsons, 2004; Jacobson, 2005).

5.3.2 Pan Sites

A pan site investigated near Kathu on the farm Nooitgedacht 469 (Woon 469) demonstrated a similar pattern to the pan sites at Kolomela. The Phase 2 investigations confirmed an ephemeral utilization during the ESA, low incidences of MSA tool types and a later LSA occupation (Habitat, 2013).

5.3.3 Shelter Sites

Cave sites, apart from the well-known Wonderwerk, are uncommon. The lithic succession at Wonderwerk serves as a benchmark for the Stone Age sequence of the Northern Cape (Chazan et al. 2008). Rock shelters along the escarpment contain deposits of LSA and herder occupations (Humphreys and Thackeray, 1983; Herries et al, 2007). The Ghaap Escarpment contains small rock shelters with occupations dating to the Holocene (Humphreys and Thackeray, 1983; Herries et al, 2007). Excavations at Burchell's Shelter (Humphreys, 1975) and Dikbosch I and II and at two shelters at Limerock (Humphreys and Thackeray, 1983) confirm occupations up to the historical period. Travellers such as Burchell (1967) described some of the Bushmen present within this region. He noted that they wore sandals and that their skin karosses were reddened with ochre (Humphreys, 1975:10, 16).

A recent HIA undertaken at Heuningkrans 364 in the Postmasburg District (African Heritage Consultants, 2013) not only recorded extensive MSA deposits with lithics made on Banded Ironstone Formations (BIFs) but also several LSA shelter sites. Lithics, ostrich eggshell fragments and rubbing stones and also undiagnostic ceramics have been noted in a line of shelters situated mid-slope on a range of low cliffs within a small valley. This is a contained cultural landscape that exhibits all the elements and subsistence resources required by a hunter-gatherer lifestyle. The valley is accordingly a significant heritage feature.

5.3.4 Rock Art

The rock art of the Northern Cape comprises paintings and, importantly, diverse categories of engravings (Morris, 2012). There are several engraving sites close to the study area near Daniëlskuil: Daniëlskuil Townlands, Lime Acres at Beestehoek, Ouplaas, Boplaas, Klipvlei and Carter Block (Wilman, 1933; Collins, 1973; Morris, 1988, 2001, 2002, 2007, 2008, 2009, 2012; Morris and Beaumont, 1994; Beaumont, 1998; Webley, 2010). Some depict historical subject matter from the 19th of farmers (or perhaps Griqua) wearing broad-brimmed hats (Morris and Beaumont, 1994). Similar imagery has been recorded north of Daniëlskuil (Morris, 2009).

5.3.5 The Use and Mining of Pigments

Earth pigments, and in particular ochre and specular haematite, is universally used for secular and religious purposes (Watts, 2002). Pigments and the unique engraved and incised ochre tablets from MSA contexts at sites such as Wonderwerk demonstrate the time-depth of such practices (Mitchell, 2002). Manuports of soft red haematite were found in association with an ESA Acheulean assemblage at Kathu Pan I in deposits dated to ~540 ka ago (Porat et al, 2010). At Wonderwerk, Kathu Pan and Canteen Koppie similar unmodified specularite and ochre lumps have been found in association with transitional ESA/MSA Fauresmith lithics (Beaumont and Bednarik, 2013). The specularite mines in the Northern Cape, including Tsantsabane/Blinkklipkop and Doornfontein 1 near Postmasburg, were rich and well-known ore sources that were quarried extensively over a long period of time (Arbousset and Daumas, 1968; Beaumont and Boshier, 1974; Beaumont and Morris, 1990; Thackeray et al, 1983). A pigment quarry represents a compressed record of long-term extraction and field processing where ongoing quarrying of ore bodies often destroys earlier evidence.

5.4 Previous Archaeological and Heritage Studies from the General Region around the Study Area

A search of the SAHRIS database for previous reports submitted to SAHRA produced eight archaeological or heritage impact assessment reports. See the summarised details of these reports below.

- ***Report On A Phase 1 Archaeological Impact Assessment of Proposed Mining Areas on the Farms Bruce, King, Mokaning and Parson; Between Postmasburg and Kathu, Northern Cape. David Morris. February 2005. Ivuzi Water, Environmental and Earth Science Consultants.***

  This report identified four grave/cemetery sites: three on the farm Parson and one on the farm King. Several Stone Age sites were also identified, mainly in the form of sparse scatters of artefacts situated on the plains area and parts of some hills, as well as along the banks of the Gamokara River. These sites were all Middle Stone Age.

- ***Phase 1 Heritage Impact Assessment Report on the farm portions potentially affected by a proposed direct rail link between the Sishen South Mine near Postmasburg and the Sishen - Saldanha Line, Siyanda District Municipality, Northern Cape Province. Peter Beaumont. September 2007. Synergistics Environmental Services.***

  The survey identified two Later Stone Age occurrences, of which one may postdate AD 1900, three burial sites, and a historic house with a nearby rubbish dump that probably dates to between 1900 and 1950.

- ***Heritage Impact Assessment Scoping Report: Proposed Skeifontein Photovoltaic Power Plant and Power Lines, Near Postmasburg, Northern Cape. Elize Becker. November 2011. CCA Environmental.***

  Roughly 28 heritage sites were identified in this report. Approximately 12 were historical structures or the remains of such structures (i.e. stone walls, collapsed ruins, etc.). A number of settlements, with at least one grave/cemetery site, were also identified. Scattered stone tools were also identified at a few localities.

- ***Heritage Impact Assessment on Portion 2 and the Remainder of the farm Gloucester 674, near Postmasburg (Tsantsabane Local Municipality) in the Northern Cape Province. For: Kai Batla Holdings (Pty) Ltd. By A.J. Pelser and A.C. van Vollenhoven. Archaetnos. May 2011***

  Only three sites were identified by this survey: two of the sites comprised ruins of historical structures, while the third site contained the remains of a number of more recent prefabricated structures dating to the period c. 1970s.

- ***Phase 1 Heritage Impact Assessment Report on Five Borrow Pits adjacent to the R383 and R386 Roads south of Postmasburg, Siyanda District Municipality, Northern Cape Province. Peter Beaumont. September 2007. Synergistics Environmental Services.***

  The only heritage sites identified in this report, were modest lithic samples in the vicinity of the existing borrow pits. Two borrow pits are located on the farm Klip Bankfontein 489, which is one of the farms affected by the expansion of mining activities in the current study area. One borrow pit is located on the farm Ploeg Fontein 487.

- ***Cultural Heritage Site Inspection Report for the purpose of a prospecting right EMP – (Portion Of) Skeyfontein 536, Postmasburg District, Northern Cape, South Africa. Karin van Ryneveld. Diamond Core Resources. 29 June 2005***

  No culturally significant heritage sites were identified, except for a few random Middle Stone Age lithics.

- ***A Second Report on a Heritage Impact Assessment for the Upgrade of Transnet's Glosam Siding for PMG's Bishop Mine (Loading Bay) on Portion 2 and the Remainder of Gloucester 674 near Postmasburg, Tsantsabane Local Municipality, Northern Cape. For: Kai Batla Holdings (Pty) Ltd. A.J. Pelser. Archaetnos. June 2012***

  A number of heritage sites were identified in this report and in previous one (2011) by Archaetnos. Most of the identified sites were either historical structures/ruins or scatters of Stone Age artefacts.

- ***A Report on a Heritage Impact Assessment Study for proposed mining development on the remaining extent and Portions 2, 3, 4 And 5 Of Kapstewel 436, Kuruman Registration District, Siyanda District Municipality, Northern Cape Province. For Autumn Skies Trading 128 Cc. A.J. Pelser & Dr A.C. Van Vollenhoven. Archaetnos. July 2009.***

  Stone tools were found scattered over the area during the survey. One possible, small, Iron Age site was found in the area during the survey. Seven sites were identified overall. Three of these were recent structures associated with the existing mine. One is an archaeological site with stone-wall structures that may date to either the Late Stone Age or the Iron Age. There is also a possible grave.

5.5 Previous Archaeological and Heritage Studies from within the Kolomela Mine Property

A number of previous archaeological and heritage surveys were undertaken within the property of the Kolomela Mine. Various sites were identified by these archaeological and heritage impact assessment studies (Morris 2005, van der Ryst 2011, Miller 2011, Küsel 2011). These reports identified 17 heritage sites in total, 15 of which fall within the actual mine boundary.

Of the 15 heritage sites within the mine boundary, six sites are archaeological (five Stone Age and one Iron Age/historic). Three of the identified Stone Age sites were highlighted as having significance but these will not be affected by the current proposed expansion of mining activities. One of these sites is a haematite outcrop with LSA and MSA artefacts, as well as some examples of animal "rubbing stones". This site is located on the farm Wolhaarkop and was identified in the reports by Morris (2005) and van der Ryst (2011). One is a surface scatter of Middle Stone Age (MSA) stone artefacts located on the farm Leeuwfontein, at the site where the footprint of the mining plant is marked to be extended in the future for a beneficiation process (van der Ryst, 2011). The third is a large pan, one of several located on the farm Leeuwfontein, which was highlighted as significant as the surface collection was dominated by Earlier Stone Age (ESA) tool types (van der Ryst, 2011). The remaining three archaeological sites were assessed to be of low significance.

Eleven historical structures and farmstead complexes located within the mine boundary were identified in a report undertaken by Miller in 2011. All of these identified historical sites were also documented photographically and by drawings (Miller, 2011). Nine of these structures and

farmstead complexes are located within the boundary of the mining area and two are located on farms situated outside the mining area boundary.

Of the nine sites located within the mining boundary, five are historical farmstead complexes, some of which contain relatively well-preserved buildings and structures and others of which comprise only the remains of structures. These farmstead complexes were assessed to be of varying significance, from low to medium, depending on the preservation (Miller, 2011).

The other two sites included a herder's dwelling, located on the farm Kapstevel; and a farming outpost site, containing various secondary structures (windmill, reservoir, several wire-fenced animal enclosures, remains of a labourer's house, vegetable garden, prefabricated steel-framed shed dwelling). These sites were assessed to be of no to low significance by Miller (2011).

The two historical sites located outside the mine boundary include a site on the farm Gruispan where various pieces of historical mining equipment were identified and a historical farmstead located on the farm Kappies Karreeboom, which is situated south of the mine boundary.

5.6 Previous Archaeological and Heritage Reports from the Farm Floradale 230

No reports were found on the SAHRIS database for the farm Floradale 230.

5.7 Palaeontological Desktop Summary

Dr Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed expansion of the Kolomela Mine, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province (see **Appendix B** for the complete Desktop PIA report). The Kolomela Mining Area is mainly underlain by Vaalian aged rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups, as well as Quaternary aged sediments of the Kalahari Group, surface limestone and alluvium. Cave breccias are associated with dolomite deposits of the Ghaap Group.

The study area is underlain by rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups of the Transvaal Supergroup, as well as sediments of the Kalahari Group and surface limestone and alluvium (Figure 18). The Geological Legend (Figure 19) refers to old terms of

mapping and for the sake of this desktop, the latest geological terms, as presently used on the latest version of the geological map for South Africa (Council for Geoscience, Pretoria) will be used.

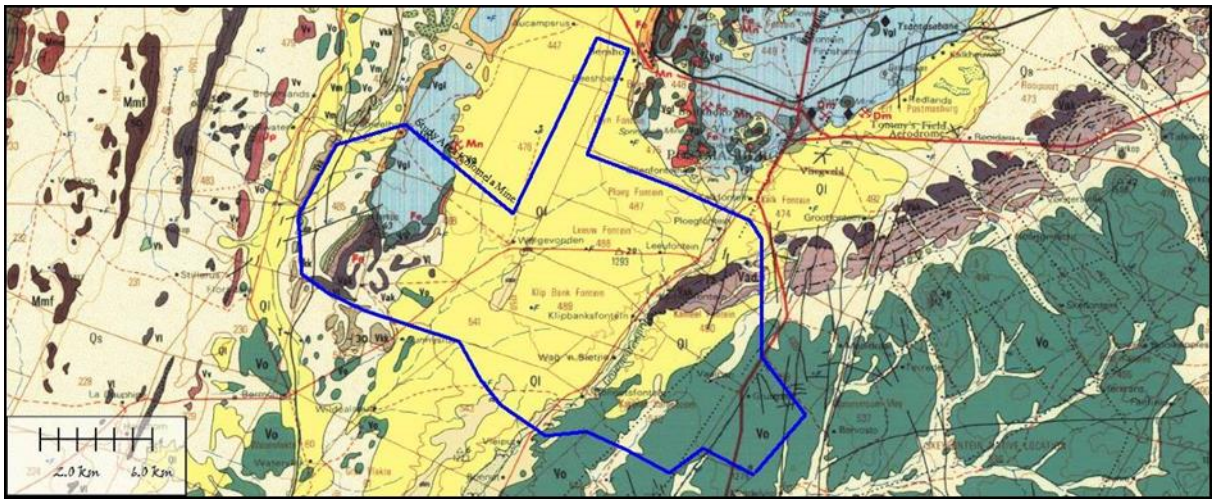

Figure 18 - Geology of the area underlying the Kolomela Mine

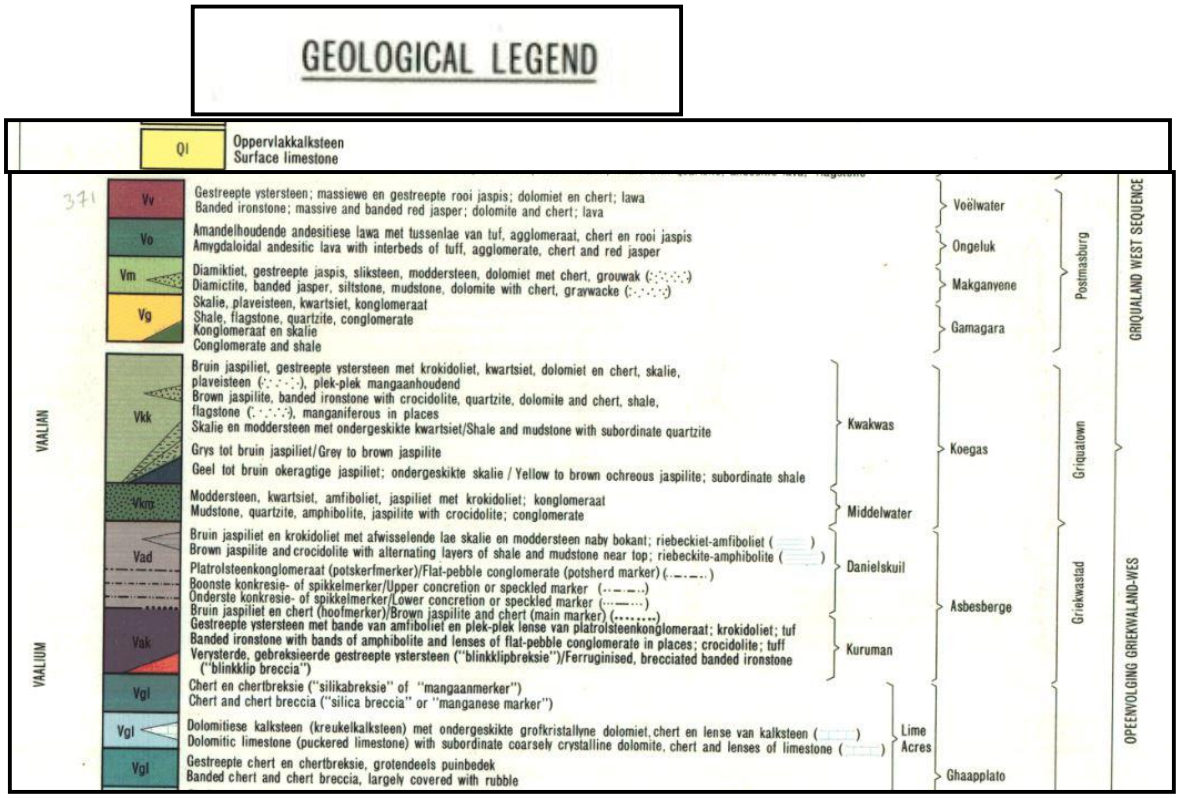

Figure 19 - Geological Legend

The entire development area falls on relatively sensitive dolomitic terrain as well as areas underlain by relatively sensitive surface deposits that need to be removed for mining purposes. The area is

sensitive for both dolomitic stromatolites and micro-fossils as well as possible fossiliferous breccias (**Figure 20**). The different sensitivity classes used are explained in the Table below.

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond *et al* 2008.	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gardenia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Developer and HIA consultant must take note of possible fossils and make professional recommendations on the impact of development on significant palaeontological finds recorded in the literature. SAHRA must be notified if new fossils are recorded and collection of a representative sample of potential fossiliferous material recommended.
GREY	Very Low Palaeontological sensitivity/vulnerability. Very low to no possibility that fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Developer and HIA consultant must note archaeological reports for possible descriptions of palaeontological finds in Cenozoic aged surface deposits.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of Very High palaeontological sensitivity to the areas underlain by the rocks of this group. The potential carbonaceous breccias might also contain very important early Hominin remains. A Phase 1 PIA investigation by a professional palaeontologist is recommended for these areas

The surface limestones overlie the highly sensitive dolomites and are allocated High Palaeontological sensitivity. These limestones can contain significant fossils of Quaternary aged plants and animals. Where surface limestone will be removed for mining purposes, the limestone must be inspected for fossils and the underlying Ghaap Group sediments must be inspected for the presence of stromatolites. A Phase I PIA investigation is recommended for the areas where excavation of the limestone is planned.

Sediments of the Koegas Subgroup, Postmasburg, Olifantshoek and Kalahari Groups, as well as the alluvium are allocated Moderate Palaeontological sensitivities and any fossils observed must be reported to the ECO.

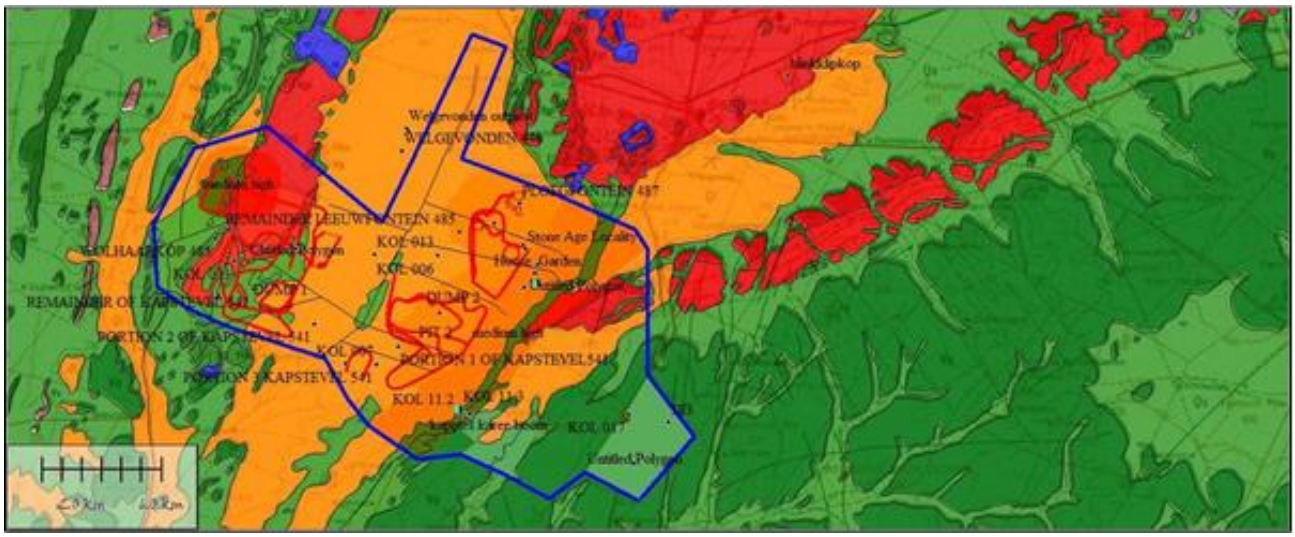

Figure 20 - Palaeontological sensitivity of areas underlain by specific infrastructure planning (red lines) at the mine. Colour coding is explained in the Table above.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments, as well as the surface limestone, contain significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.

2. An accredited palaeontologist must be appointed to undertake a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or where they will be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining operations.
3. The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
4. These recommendations must form part of the EMP of the project.

6 SITES LOCATED WITHIN PROPOSED DEVELOPMENT AREAS

As noted above, the main Scope of Work for which PGS Heritage was appointed was to provide a Heritage Impact Assessment report for the proposed Kolomela Amendment Project using the information from previous archaeological and heritage surveys of the mining property. As a result no field surveys were undertaken by PGS Heritage staff within the mine property itself, with only one limited site visit to the study area carried out to assess the significance of some of the known sites from within the study area.

A complete field survey was undertaken on the footprint of the section of proposed new pipeline and associated boreholes, which is situated on the farm Floradale 230 (Floradale Aquifer Recharge Project). However, limited fieldwork was undertaken on the sections of the pipeline which occur within the mine property on the farms Wolhaarkop and Kapstevel, since this area had been surveyed previously for the existing mining activities.

With the exception of the farm worker cemetery at KOL 4.4, the heritage resources included in this report are based on information obtained from several previous heritage and archaeological impact assessment reports (Morris, 2005; African Heritage Consultants, 2011; Miller, 2011; van der Ryst, 2011). The cemetery at KOL 4.4 was shown to staff of PGS Heritage by representatives from the mine on the day of the site visit.

6.1 Heritage Sites Identified within the Mining Property

Eight heritage sites were identified within the footprint areas of the Kolomela Amendment Project inside the mining property. All eight of these had been identified in previous impact assessment reports, however, due to the revised mining expansion footprint, it was necessary that the positions, significance and impact on these sites should be confirmed, therefore the need for the site visit.

Furthermore, previous heritage reports pointed to the fact that although the south-eastern part of the Kolomela Mine property consists of mainly calcrete-capped plains, numerous small shallow pans (of 100 to 200 m in diameter) as well as a couple of larger pans were all identified in this area. During the reassessment of heritage resources (van der Ryst, 2011) the patterning observance by Morris (2005) of a generally dispersed scatter of stone tools across the landscape, but with a major focus on the utilization of raw materials used in the manufacture of stone tools and also the available plant and water resources provided by the numerous small pans settings, was substantiated.

The investigation of the pan localities suggest relatively short visits over time by small groups of people. Hunter-gatherers view land as an integral part of their identity. Each group has a defined territory with a collection of natural resources on which they depends for survival (Marshall, 1976; Barnard, 2011). Ownership implies access to the resources of this area, an inalienable right which is acquired by non-exclusive inheritance and utilization. A main subsistence strategy applied in the planning of hunting and gathering trips is to limit the duration and the distances to be covered (van der Ryst, 2011). Primary territories also included a permanent or semi-permanent waterhole (Smith, 1999), such as the pans, springs and the annual watercourses at Kolomela, along with other resources, in particularly plant foods.

It is important to note that four of the sites from this section comprise clusters of small pans which are believed to contain Stone Age material. These four pan clusters form part of the belt of at least 165 small pans located along the eastern end of the mine property. Due to the high number of small pans from within the study area, it was impractical for each individual pan to be visited in the field and assessed for its exact archaeological characteristics. These four pan clusters were provided with the same archaeological status, significance and mitigation based on the archaeological characteristics of at least three pans investigated nearby (with site KOL 1 representing one of these). The four separate clusters of pans will be impacted by the Ploegfontein Pits, the LFN Waste Rock Dump (which will impact two of the pan clusters) as well as well as the LFS Waste Rock Dump.

Each cluster has been given a separate site identification number (see KOL 5, KOL 6, KOL 7 and KOL 8) and each of these sites contains different pan numbers. As such, KOL 5 contains 19 small pans (of which seven had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 6 contains six small pans (of which five had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 7 contains 44 small pans (of which 17 had been destroyed by previous mining activities conducted between 7 October 2013 and 2 December 2014) and KOL 8 contains four small pans. From this outline it is evident that due to mining impact KOL 5 now contains 12 small pans, KOL 6 a single small pan, KOL 7 contains 27 small pans and KOL 8 four small pans.

We already pointed out that several pans from this area had been visited during previous archaeological and heritage projects. During the 2011 visit the main pan (KOL 1) recommended by Morris (2015) for investigation was sampled to establish relative densities and at four the presence of MSA and LSA lithics was confirmed. Two of these pans were again assessed during the 2015 site visit. However, on comparing the locations of these pans with the expansion footprint plan, it was evident that only one of these previously visited pans will be directly impacted by the expansion footprint. This pan has therefore been described separately (see KOL 1, below).

In the section that follows the eight heritage sites from within the development footprint areas located within the mine property will be discussed individually. It is important to note that the sites discussed here comprise those sites located within the development footprint areas, as well as the ones situated within a distance of 200m from the proposed development areas.

6.1.1 Site KOL 1

Site Coordinates:

S28° 22' 01.1"
E22° 58' 53.2"

Site Description:

This site is one of a number of shallow pans located on the farms Leeuwfontein and Ploegfontein. As indicated elsewhere, these pans are all roughly 100 to 200 m in diameter.

The pan at KOL 1 is on the farm Ploegfontein. The site was first documented in Morris' impact assessment report of 2005 and was later confirmed by Van der Ryst's report of 2011.

During previous field surveys a surface density of stone artefacts of up to 15 artefacts/m^2 could be identified. The stone artefacts are mainly of Middle Stone Age typology.

During the heritage impact assessment undertaken by Van der Ryst in 2011, this pan yielded a representative collection of MSA and LSA stone tool types, and also a few ceramic sherds. The recent site visit by PGS Heritage on 4 February 2015 confirmed the previous findings of MSA and LSA lithics as well as some ceramics at the site.

Site significance:

Both Morris (2005) and van der Ryst (2011) previously assigned low-medium heritage significance to this site in view of the relative densities of the lithics. In view of the presence of ceramics, it is recommended that Phase 2 mitigation in the form of archaeological sampling takes place here. This mitigation must be completed before the proposed amendment to the Kolomela Mine destroys the site.

Figure 21 - Small pan site identified by Morris (2005)

Figure 22 – Establishing the surface densities of stone artefacts during the heritage impact assessment by Van der Ryst (2011).

Figure 23 – Cores identified at KOL 1 by Van der Ryst (2011)

Figure 24 - Some of the flakes identified at KOL 1 by Van der Ryst (2011)

6.1.2 Site KOL 2

Site Coordinates:

S 28° 23’ 0.45”
E 22° 52’ 0.74”

Site Description:

KOL 2 is a Stone Age site that was identified by Morris (2005) on the Remainder of the farm Kapstevel. The site comprises a scatter of possibly Late Stone Age artefacts observed on a colluvial fan in one of the valleys. The surface density of the site was assessed to be perhaps 3 or 4 artefacts per m². Van der Ryst’s later survey (2011) confirmed that on the plains section of the study area mainly isolated specimens or dispersed clusters of stone tools were observed to be present. However, her study does not identify any specific sites. This site was not visited during the recent site visit, due to its low significance and time constraints. The site coordinates were verified though.

Site significance

Morris did not provide an assessment of significance of this site. Van der Ryst (2011) provided a general significance assessment for the low-density or isolated occurrences of stone tools on the plains. The areas were assessed to be of Low Significance.

Figure 25 - MSA tools observed at on archaeological occurrence on the plains (van der Ryst 2011)

6.1.3 Site KOL 3

Site Coordinates:

S 28° 22’ 37.43”
E 22° 52’ 46.12”

Site Description:

This site was identified previously by Van der Ryst (2011). It is located on the farm Welgevonden 486.

The site is situated within the prospecting area of an open-cast pit. The area surrounding the workings has been heavily prospected during the current mining activities. The open-mine workings of haematite consist of a narrow trench with two stopes on the highest section. It is similar to ancient open mining technologies that resulted in a narrow deep trench (Küsel, 1979) and was suited to rocks that dip steeply or are vertical (Hammer et al, 2000:51). The mine workings drain towards the east. It has been estimated that 3000 to 4000 tons of haematite ore could have been removed. The backfilling of the excavation obscure details such as possible tunnels (van der Ryst, 2011).

Information provided by the last owner indicated that two small outcrops of specularite have been worked by some groups during the twentieth century (Van der Ryst, 2011).

Site significance

The recent assessment concurs with previous recommendations (African Heritage Consultants, 2011; van der Ryst, 2011). It is the only known historic mine on the Kolomela Mine and significantly larger than some of the other historic mines recorded in areas such as Daniëlskuil.

The site is of High heritage significance. The open-air mine is an important feature that documents the history of mining and ore extraction within the study area as well as within the broader region.

Figure 26 - View along the open excavation representing the historic mine.

Figure 27 - Detail of excavation in the historic mine. (Photograph by S Küsel, in Miller 2011)

6.1.4 Site KOL 4

Site coordinates:

S 28° 24’ 02.85”

E 22° 51’ 32.52”

Site description:

A historical farmstead is situated on the farm Kapstevel. It comprises a farmyard containing several structures; together with associated landscape features; and two cemeteries. The site has been divided into four sub-categories to facilitate significance and mitigation requirements.

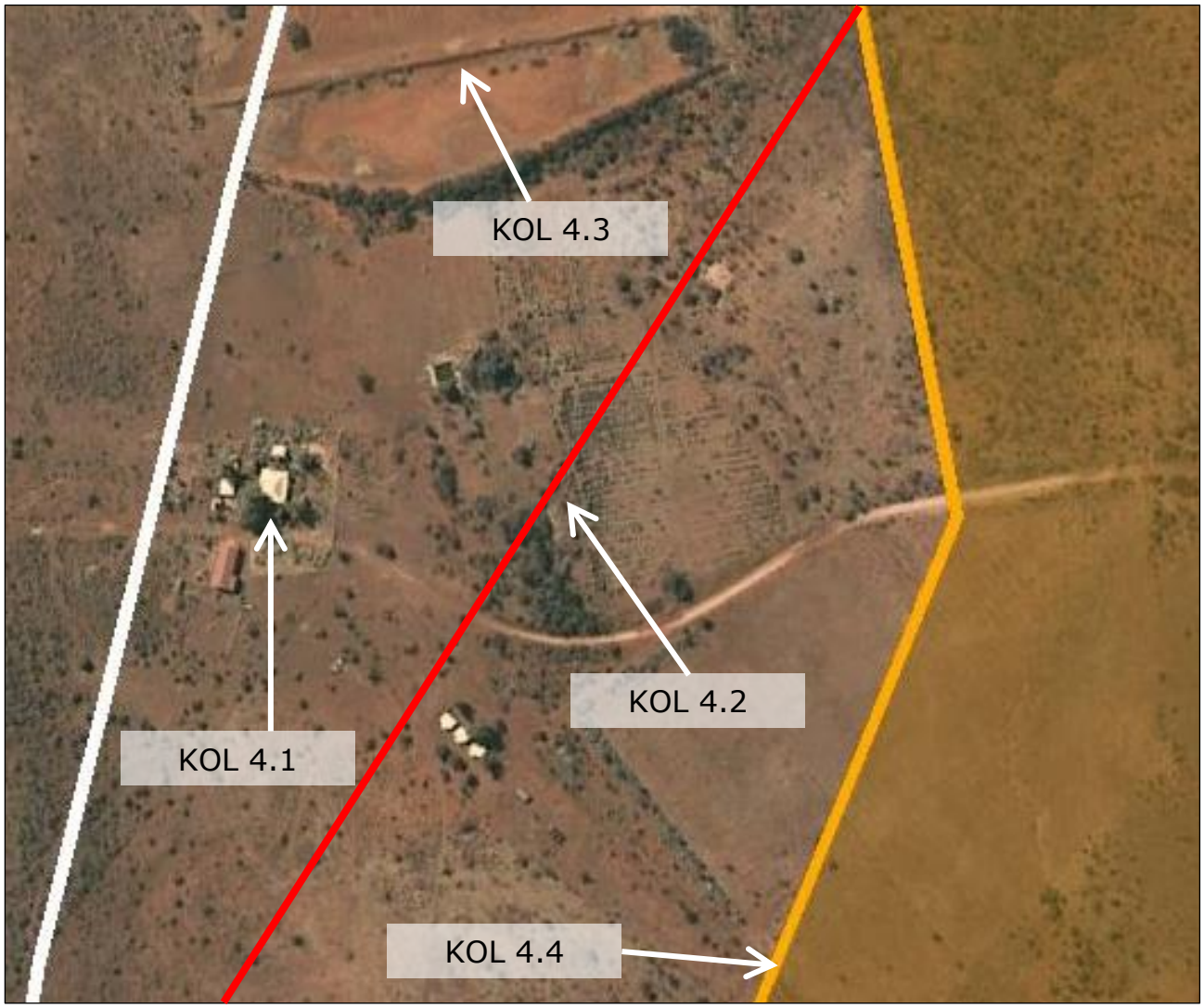

Figure 28 – Google Earth image depicting the farmstead at KOL 4 and all of its components. The area shaded in gold represents the footprint area of the KSS Waste Rock Dump whereas the red line represents the proposed pipeline route for the Floradale Acquifer Project. The white line shows the boundary between the farms Kapstevel (right) and Wolhaarkop (left).

Site KOL 4.1

Site coordinates:

S 28° 24’ 02.85”
E 22° 51’ 32.52”

Site Description:

The farmyard comprises a main dwelling, a wagon shed, kitchen with bakery extension, a school, a power generation shed, a cold room and various early 20th century farming tools.

Significance:

The original dwelling, barn and outer kitchen were built at the beginning of the 20th century. During the 1920s the main house was extended and it would appear that the school was added at this time. It is likely that the final alterations were made during the 1960s. Finally the whole site was refurbished for the occupation of the farm manager of the Kolomela mining operations, possibly during the late 1990s or early twenty-first century.

As it comprises structures older than 60 years, the farmyard enjoys general protection under the provision of Section 34 (1) of the National Heritage Resources Act, Act 25 of 1999. Furthermore, sections of the farmyard are also believed to be older than 100 years and as a result these buildings are defined as archaeological sites and as such are protected by Section 35 (4) of the same Act.

Besides, the site is not only older than 60 years but represents a complete time capsule of a century of farming lifestyle in the Northern Cape. All elements of the site are well preserved, and collectively it qualifies to be declared as a provincial heritage site (African Heritage Consultants, 2011).

Figure 29 – Three views of the farmstead structures at KOL4.1. The image on top depicts the historic farmhouse, with the image on the bottom left showing the old barn and the one on the bottom right an outside kitchen. All three these photographs appeared in the report of Sidney Miller (2011).

Site KOL 4.2

Site coordinates:

S 28° 24’ 02.61”
E 22° 51’ 38.33”

Site Description:

A cemetery of the Bredenkamp family is located roughly 160 m east of the farmyard. The graves are divided into parallel rows and are all covered by formal dressings and all have inscribed headstones. The cemetery comprises the graves of 12 members of the Bredenkamp family.

One of the oldest graves in the cemetery dates to 1893 and contains the following inscription:

IN LOVING MEMORY
OF
ALETTA ELIZABETH
BREDENKAMP
BORN 11 DECEMBER
1889
DIED 13 JULY 1893
PARENTS
JM & AE BREDENKAMP
MAT 19 VERS 14

The most recent grave appears to date from 1997 and contains the following inscription:

PETRUS
JOHANNES
BREDENKAMP
☆ *28-10-1940*
† *30-05-1997*

It is therefore evident that the cemetery can in all likelihood be dated to between 1893 and 1997. As a result many of the graves from the cemetery are older than 60 years and some older than 100 years. As a result these graves are protected by Section 36 of the National Heritage Resources Act. The cemetery is associated with the Bredenkamp family who have lived on the Kapstevel farm for over 100 years and four generations (Miller, 2011).

Significance:

All graves are automatically assigned a High significance as they are protected by general legislation regarding human remains, as well as the National Heritage Resources Act. This High significance is emphasised by the fact that the cemetery is associated with the historical owners of the farm as well as the fact that graves inherently have high levels of emotional, historic, religious and scientific value.

Figure 30 – General view of the cemetery of the Bredenkamp family at KOL 4.2.

Figure 31 – The grave of Aletta Elizabeth Bredenkamp that dates to 1893.

Figure 32 – The grave of Petrus Johannes Bredenkamp that dates to 1997.

KOL 4.3

Site coordinates:

S 28° 23’ 56.01”
E 22° 51’ 35.97”

Site Description:

The main landscape features associated with the farmyard are situated to the north-east of the dwelling and comprise two generations of valley dams that are typical of water storage in this region, together with associated irrigation fields. The farm road that used to be the communication link from Postmasburg over Leeuwfontein and Welgevonden also runs through the farmyard.

Significance:

The significance of these features is related to the fact that they form part of a larger overall farmstead complex, the individual components of which have been retained from the nineteenth century to the present day. The significance is assessed as being medium-high.

Figure 33

Google Earth image depicting the context between the Kapstevel farmstead as well as the dams and irrigation structures.

KOL 4.4

Site Coordinates (cemetery):

S 28° 24’ 12.4”
E 22° 51’ 43.7”

Site Description:

A cemetery which can be associated with nearby farm worker accommodation was identified south-east of the farmyard. The farm worker cemetery was only identified recently by the Mine’s Environmental team and was investigated during the 2015 site visit. It is not fenced and consists of approximately 30 graves. The graves are placed in three unequal rows and all the graves are orientated from west to east. Most of the graves have elongated mounds of soil and packed rocks as grave dressings, with some of the graves only containing a single rock at the western end to indicate the grave position. The cemetery covers an area of approximately 10m x 25m in extent.

Significance:

All graves are automatically assigned a High significance as they are protected by general legislation regarding human remains, as well as the NHRA. This High significance is emphasised by the fact that the cemetery is associated with the historical farm workers on the farm and also because all graves inherently have high levels of emotional, historic, religious and scientific value.

Figure 34 – General view of the cemetery at KOL 4.4.

6.1.5 Site KOL 5

Site Coordinates (approximate centre):

S 28° 22’ 40.82”
E 22° 59’ 18.80”

Site Description:

In the Heritage Management Plan compiled for the Kolomela Mine (African Heritage Consultants, 2011), a total of 165 small pans were identified along the eastern end of the mine property. A cluster of 19 of these pans identified in 2011 will be impacted upon by the development of the LFN Waste Rock Dump. A comparison of the Google Earth images for the period between 2011 and the present day has indicated that seven of these 19 small pans had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014. This means that 12 small pans remain here. These 12 pans represent the site known for the purposes of this report as KOL 5.

The reports by both Morris (2005) and van der Ryst (2011) identified such pan sites as likely to have concentrations of Stone Age lithic material, with some also having ceramic material. Due to the extensive number of small pans from within the mining property, these 165 small pans were not individually assessed. Furthermore, no photographs for KOL 5 are available as PGS Heritage was not commissioned to undertake a field survey, but to assess the impact of the revised mining expansion area footprint on sites that had been identified by previous impact assessment surveys and reports.

Significance:

These pans can be assumed to have similar significance to that noted by both Morris (2005) and van der Ryst (2011) for the pans that were investigated during the fieldwork for their respective reports. All of these pan localities are assigned a low to medium significance. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants, 2011:20). This said, it is worth noting that the imagery of the Heritage Management Plan allocates Medium to High Significance to all 165 pans located on the eastern end of the mine property.

6.1.6 Site KOL 6

Site Coordinates (approximate centre):

S 28° 23’ 23.24”
E 22° 59’ 11.04”

Site Description:

In the Heritage Management Plan compiled for the Kolomela Mine (African Heritage Consultants, 2011), a total of 165 small pans were identified along the eastern end of the mine property. A cluster of six of these pans identified in 2011 will also be impacted upon by the development of the LFN Waste Rock Dump. A comparison of the Google Earth images for the period between 2011 and the present day has indicated that five of these six small pans had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014. This means that a single small pan remains here. For the purposes of the report this pan is labelled KOL 6.

Both Morris (2005) and van der Ryst (2011) identified such pan sites as likely to have concentrations of Stone Age lithic material and sometimes with ceramics as well. Due to the extensive number of small pans from within the mining property, these 165 small pans were not individually assessed. Furthermore, photographs for KOL 6 are not available as PGS Heritage was not commissioned to undertake a field survey, but only to assess the impact of the revised mining expansion area footprint on sites that had been identified by previous impact assessment surveys and reports.

Significance:

The pan can be assumed to have similar significance to that noted by Morris (2005) and van der Ryst (2011) who investigated the locality during the fieldwork for their respective reports. The pan is believed to be of low to medium significance. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants 2011:20). This said, it should be noted that the imagery of the 2011 Heritage Management Plan allocates a Medium to High Significance to all 165 pans located on the eastern end of the mine property.

Figure 35 – Google Earth image depicting the position of KOL 5 in relation to the proposed mining development footprints. The 19 pans comprising KOL 5 are highlighted in red. The pan positions were obtained from the Heritage Management Plan for the Kolomela Mine (African Heritage Consultants, 2011).

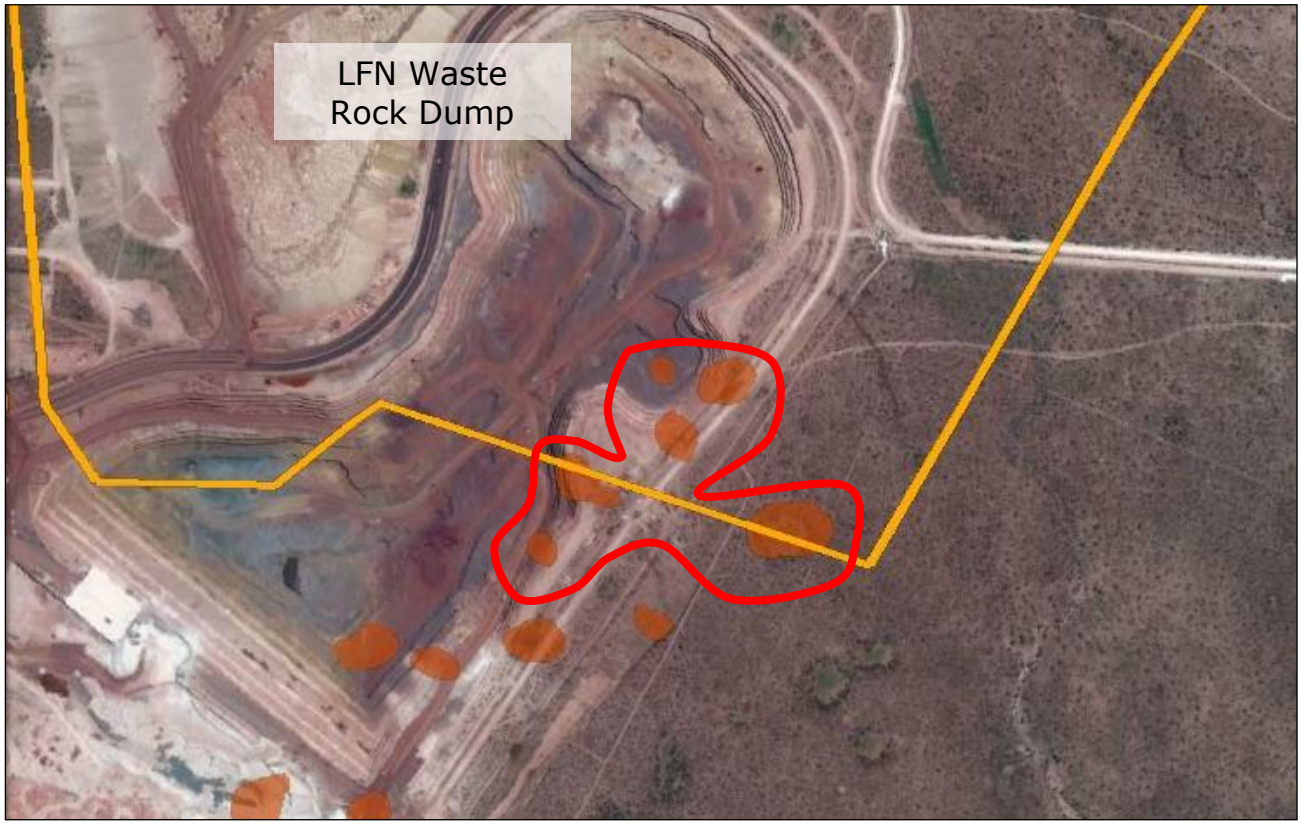

Figure 36 – Google Earth image depicting the position of KOL 6 in relation to the proposed mining development footprints. The six pans comprising KOL 6 are highlighted in red. The pan positions were obtained from the Heritage Management Plan for the Kolomela Mine (African Heritage Consultants, 2011).

6.1.7 Site KOL 7

Site Coordinates (approximate centre):

S 28° 24’ 40.55”
E 22° 58’ 0.68”

Site Description:

In the Heritage Management Plan compiled for the Kolomela Mine (African Heritage Consultants, 2011), a total of 165 small pans were identified along the eastern end of the mine property. A cluster of 44 of these pans identified in 2011 will also be impacted upon by the development of the LFS Waste Rock Dump. A comparison of the Google Earth images for the period between 2011 and the present day has indicated that 17 of these 44 small pans had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014. This means that 27 small pan remains here. These 27 pans represent the site known for the purposes of this report as KOL 7.

Both Morris (2005) and van der Ryst (2011) identified such pan sites as likely to have concentrations of Stone Age lithics with ceramic fragments noted at several of these pan localities. Due to the extensive number of small pans from within the mining property, these 165 small pans were not individually assessed. Furthermore, photographs for KOL 6 are not available as PGS Heritage was not commissioned to undertake a field survey, but to assess the impact of the revised mining expansion area footprint on sites that had been identified by previous impact assessment surveys and reports.

Significance:

The pan can be assumed to have similar significance to that noted by both Morris (2005) and van der Ryst (2011) for the purposes of this report for the pans that were investigated during the fieldwork for their respective reports. The pans are believed to be of low to medium significance. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants, 2011:20). This said, it is worth noting that the imagery of the Heritage Management Plan allocates Medium to High Significance to all 165 pans located on the eastern end of the mine property.

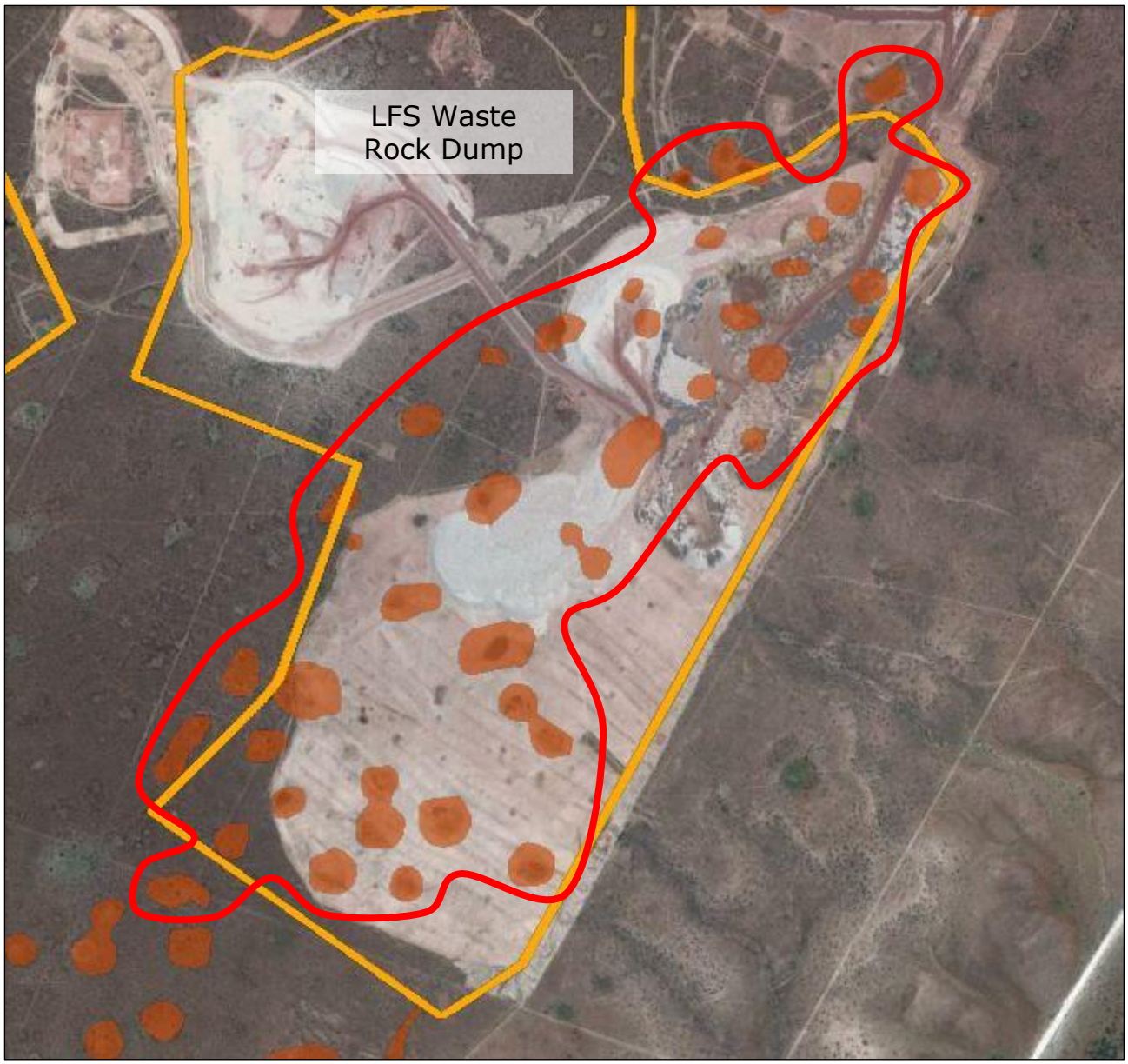

Figure 37 – Google Earth image depicting the position of KOL 7 in relation to the proposed mining development footprints. The 44 pans comprising KOL 7 are highlighted in red. The pan positions were obtained from the Heritage Management Plan for the Kolomela Mine (African Heritage Consultants, 2011).

6.1.8 Site KOL 8

Site Coordinates (approximate centre):

S 28° 21’ 20.34”
E 22° 59’ 45.28”

Site Description:

In the Heritage Management Plan compiled for the Kolomela Mine (African Heritage Consultants, 2011), a total of 165 small pans were identified along the eastern end of the mine property. A cluster of four of these pans identified in 2011 will also be impacted upon by the development of the Ploegfontein Pits. These four pans represent the site known for the purposes of this report as KOL 8.

Both Morris (2005) and van der Ryst (2011) identified such pan sites as likely to have concentrations of Stone Age lithic material, and sometimes with ceramics as well. Due to the extensive number of small pans from within the mining property, these 165 small pans were not individually assessed. Furthermore, no photographs for KOL 6 are available as PGS Heritage was not commissioned to undertake a field survey, but to assess the impact of the revised mining expansion area footprint on sites that had been identified by previous impact assessment surveys and reports.

Significance:

The pan can be assumed to have similar significance to that noted by both Morris (2005) and van der Ryst (2011, for the pans that were investigated during the fieldwork for their respective reports. The pans are believed to be of low to medium significance. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants 2011:20).

This said, it should be noted that the imagery of the Heritage Management Plan allocates a Medium to High Significance to all 165 pans located on the eastern end of the mine property.

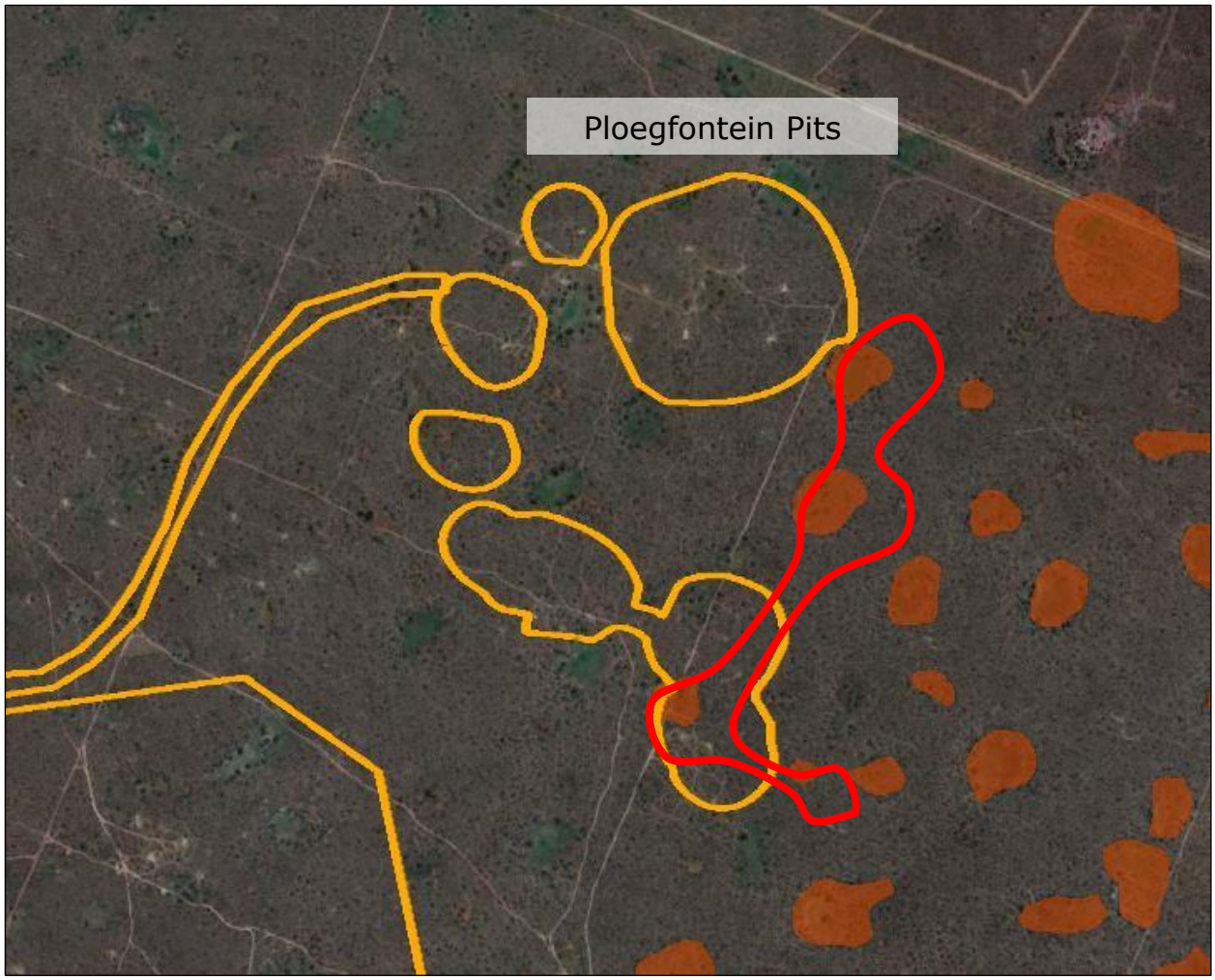

Figure 38 – Google Earth image depicting the position of KOL 8 in relation to the proposed mining development footprints. The four pans comprising KOL 8 are highlighted in red. The pan positions were obtained from the Heritage Management Plan for the Kolomela Mine (African Heritage Consultants, 2011).

6.2 Heritage Sites Identified within the Farm Floradale 230

The field survey of the proposed pipeline and boreholes located on the farm Floradale did not identify any new heritage sites. The proposed pipeline and boreholes are largely situated within an elongated, wide valley along which the Soutloop (a non-perennial stream) flows. The central parts of the valley is mainly characterised by grass and small shrubs (**Figure 40**). The valley slopes have some larger and denser vegetation (**Figure 41**). Both the valley floor and the valley slopes consist of red sandy soils, which is at least one metre deep in some areas (**Figure 42**). **Figures 44 to 47** show views of some of the existing boreholes on Floradale farm and views of some of the proposed new borehole sites. The pipeline route crosses over from Floradale to Wolhaarkop/Kapstevel farm and will cross the game fence and the fire break on the boundary of the two properties (**Figure 43**).

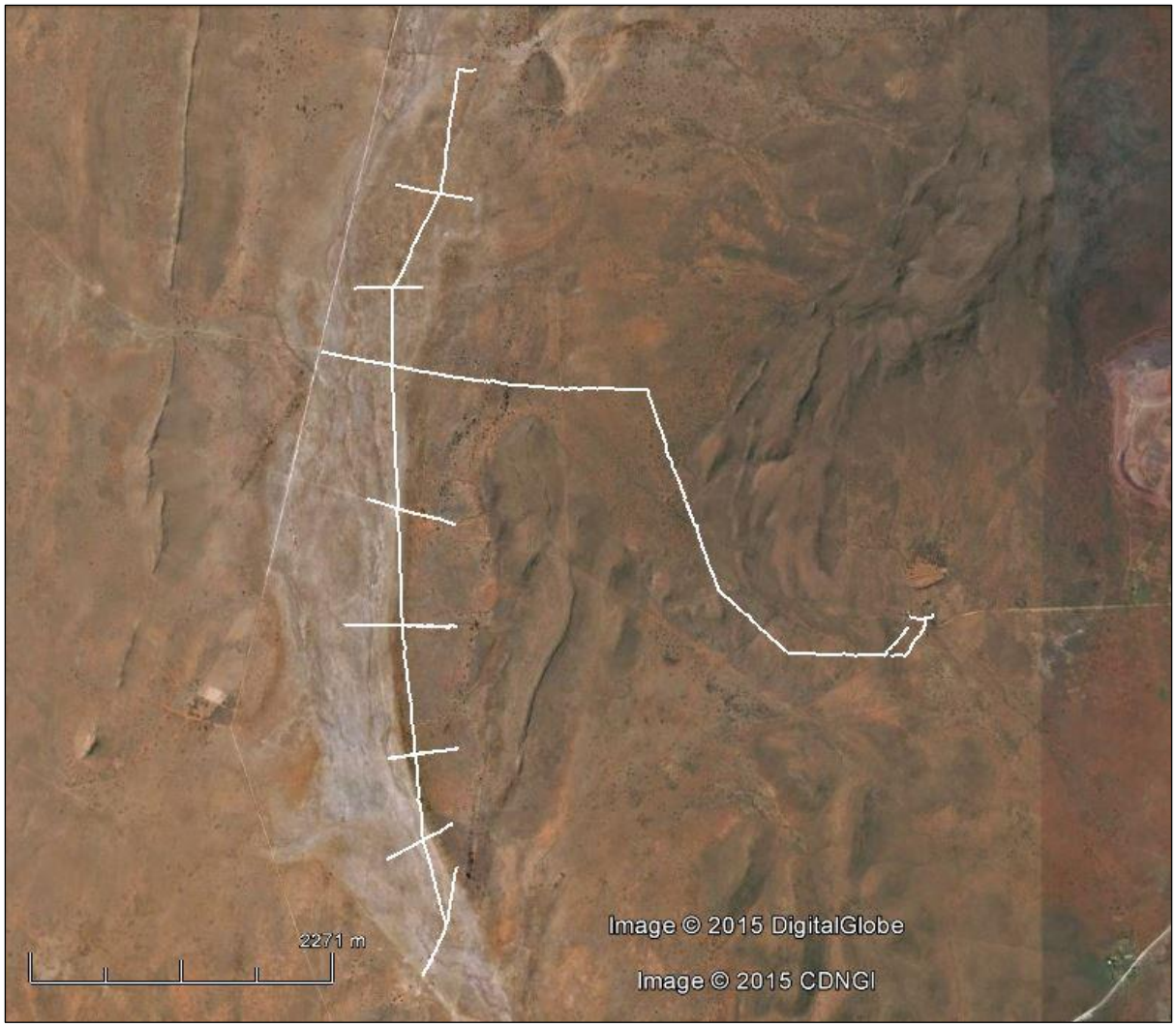

Figure 39 – Tracklog of the survey of the Aquifer Recharge Pipeline route located on the Floradale, Wolhaarkop and Kapstevel farms.

Figure 40 – General View of Floradale farm pipeline route study area, showing the sparse grass and scrub vegetation

Figure 41 – View of the valley slopes showing the denser vegetation

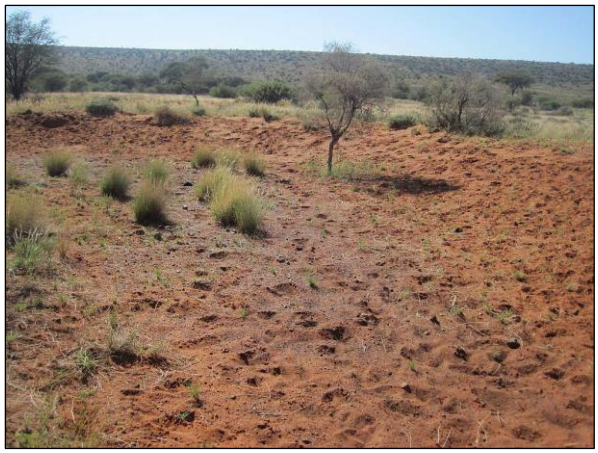

Figure 42 – View showing the deep, red sandy soils

Figure 43 – View of the boundary between Floradale and Wolhaarkop farms

Figure 44 – Floradale farm, Borehole No. 1

Figure 45 – Floradale farm, Borehole No. 13

Figure 46 - Floradale farm, Borehole No. 17

Figure 47 - Floradale farm, Borehole No. 21

7 IMPACT OF PROPOSED DEVELOPMENT

Please note that this impact assessment is based on the recent limited site visit to the mining expansion footprint study area within the Kolomela Mine property as well as the separate field survey of the proposed new pipeline footprint on the farm Floradale as well as the information from the previous heritage impact assessment reports and the 2011 Heritage Management Plan report.

7.1 Impact of the Mining Development on the Identified Heritage Sites

7.1.1 Risk Calculation for the Impact of the Proposed Development on Site KOL 1

In this section the impact of the proposed development on Site KOL 1 will be established. This site is located within the northern end of the LFN Waste Rock Dump so the impact will be direct and permanent in that the site will be destroyed during the development of this waste rock dump.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \text{ X } \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 1 + 5)}{3} \text{ X } \frac{4}{5}$$

IMPACT RISK = 2.4

Table 10: Risk Calculation for Development Impact on Site KOL 1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 1	3	1	5	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 1 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the LFN Waste Rock Dump on site KOL 1.

In this case, Phase 2 mitigation would comprise archaeological sampling of the lithics and ceramics present in the pan under a permit issued by the South African Heritage Resources Agency (SAHRA). This recommendation was also provided in the report of African Heritage Consultants (2011:20).

7.1.2 Risk Calculation for the Impact of the Proposed Development on Site KOL 2

In this section the impact of the proposed development on Site KOL 2 will be established. This site is located within the south-by-southwestern end of Kapstevel North Dump 2. The development of this dump will have a direct and permanent impact on the site in that it will be destroyed.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(2 + 1 + 5)}{3} \times \frac{4}{5}$$

Impact Risk = 2.13

Table 11: Risk Calculation for Development Impact on Site KOL 2

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 2	2	1	5	4	**2.13**

This calculation has revealed that the impact risk of the proposed development on Site KOL 2 falls within Impact Class 3, which represents a **Moderate Impact Risk**. Due to the low significance of the site the only mitigation that would be required is an undertaking by the mine to appoint an archaeologist should any archaeological material be exposed here during construction.

7.1.3 Risk Calculation for the Impact of the Proposed Development on Site KOL 3

In this section the impact of the proposed development on Site KOL 3 will be established. While the site has a high significance, the proposed Kapstevel North Dump 2 development will not extend to KOL 3 but will be placed on its northern (210 m away), western and (170 m away) and southern (150 m away) ends. As a result the impact on the site will be peripheral and not direct.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \times \frac{3}{5}$$

Impact Risk = 2.4

Table 12: Risk Calculation for Development Impact on Site KOL 3

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional	Long Term	Could Happen	**Moderate**
Impact on Site KOL 3	4	4	4	3	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 2 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the Kapstevel North Dump 2 on site KOL 3.

In this case, Phase 2 mitigation would be required under a permit issued by the South African Heritage Resources Agency (SAHRA). After the Phase 2 report has been approved, an application will have to be made to SAHRA for a destruction permit.

7.1.4 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.1

In this section the impact of the proposed development on Site KOL 4.1 will be established. The farmyard buildings are located, at their closest, roughly 378 m from the proposed KSS Waste Rock Dump. As a result no direct impact on the farmstead buildings is expected.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \times \frac{2}{5}$$

Impact Risk = 1.6

Table 13: Risk Calculation for Development Impact on Site KOL 4.1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Provincial	Long Term	Unlikely	**Low**
Impact on KOL 4.1	4	4	4	2	**1.6**

This calculation has revealed that the impact risk of the proposed development on Site KOL 4.1 falls within Impact Class 2, which represents a **Low Impact Risk**. As a result, and viewed in isolation, no mitigation is required for this element of the site. However, please note the general recommendations below.

7.1.5 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.2

In this section the impact of the proposed development on Site KOL 4.2 will be established. The Bredenkamp family cemetery is located, at its closest, roughly 248 m from the proposed KSS Waste Rock Dump. As a result no direct impact on the cemetery is expected.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(5 + 4 + 4)}{3} \times \frac{2}{5}$$

Impact Risk = 1.73

Table 14: Risk Calculation for Development Impact on Site KOL 4.2

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Very High	Provincial	Long Term	Unlikely	**Low**
Impact on KOL 4.2	5	4	4	2	**1.73**

This calculation has revealed that the impact risk of the proposed development on Site KOL 4.1 falls within Impact Class 2, which represents a **Low Impact Risk**. As a result, and viewed in isolation, no mitigation is required for this component of the site. However, please note the general recommendations below.

7.1.6 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.3

In this section the impact of the proposed development on Site KOL 4.3 will be established. The nearest landscape features comprising the dams are located roughly 84 m from the proposed KSS Waste Rock Dump. As a result no direct impact on the dams is expected, although peripheral impacts may exist.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 4)}{3} \times \frac{3}{5}$$

Impact Risk = 2.2

Table 15: Risk Calculation for Development Impact on Site KOL 4.3

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional	Long Term	Could Happen	**Moderate**
Impact on KOL 4.3	4	3	4	3	**2.2**

This calculation has revealed that the impact risk of the proposed development on Site KOL 4.3 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the KSS Waste Rock Dump on site KOL 4.3. In this case, Phase 2 mitigation would comprise monitoring of the site and immediate corrective measures should any actual impacts become evident.

7.1.7 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.4

In this section the impact of the proposed development on Site KOL 4.4 will be established. The farm worker cemetery and accommodation are located just within the western boundary of the KSS Waste Rock Dump. As a result a direct negative impact on the cemetery is expected. This means that the cemetery will be destroyed if the development of the KSS Waste Rock Dump continues unmitigated.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(5 + 4 + 5)}{3} \times \frac{5}{5}$$

Impact Risk = 4.66

Table 16: Risk Calculation for Development Impact on Site KOL 4.4

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Very High	Provincial	Permanent	Will Happen	**Very High**
Impact on KOL 4.4	5	4	5	5	**4.66**

This calculation has revealed that the impact risk of the proposed development on Site KOL 4.4 falls within Impact Class 5, which represents a **Very High Impact Risk**. This means that drastic changes to the development layout plan will be required to mitigate the impact.

7.1.8 Risk Calculation for the Impact of the Development on Site KOL 4 within its Historic Landscape

In this section the impact of the proposed development on Site KOL 4 as a whole (i.e. inclusive of all four site components), within its historic landscape will be established. In the Heritage Management Plan Report compiled by African Heritage Consultants in 2011, a high sensitivity buffer area was defined around the farmstead. The proposed development of the KSS Waste Rock Dump will infringe on the eastern end of this previously defined high sensitivity buffer area.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 5)}{3} \times \frac{5}{5}$$

Impact Risk = 4.33

Table 18: Risk Calculation for Development Impact on Site KOL 4 within its Historic Landscape

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Provincial	Permanent	Will Happen	**Very High**
Impact on KOL 4	4	4	5	5	**4.33**

This calculation has revealed that the impact risk of the proposed development on Site KOL 4 falls within Impact Class 5, which represents a **Very High Impact Risk**. This means that drastic changes to the development layout plan will be required to mitigate the impact.

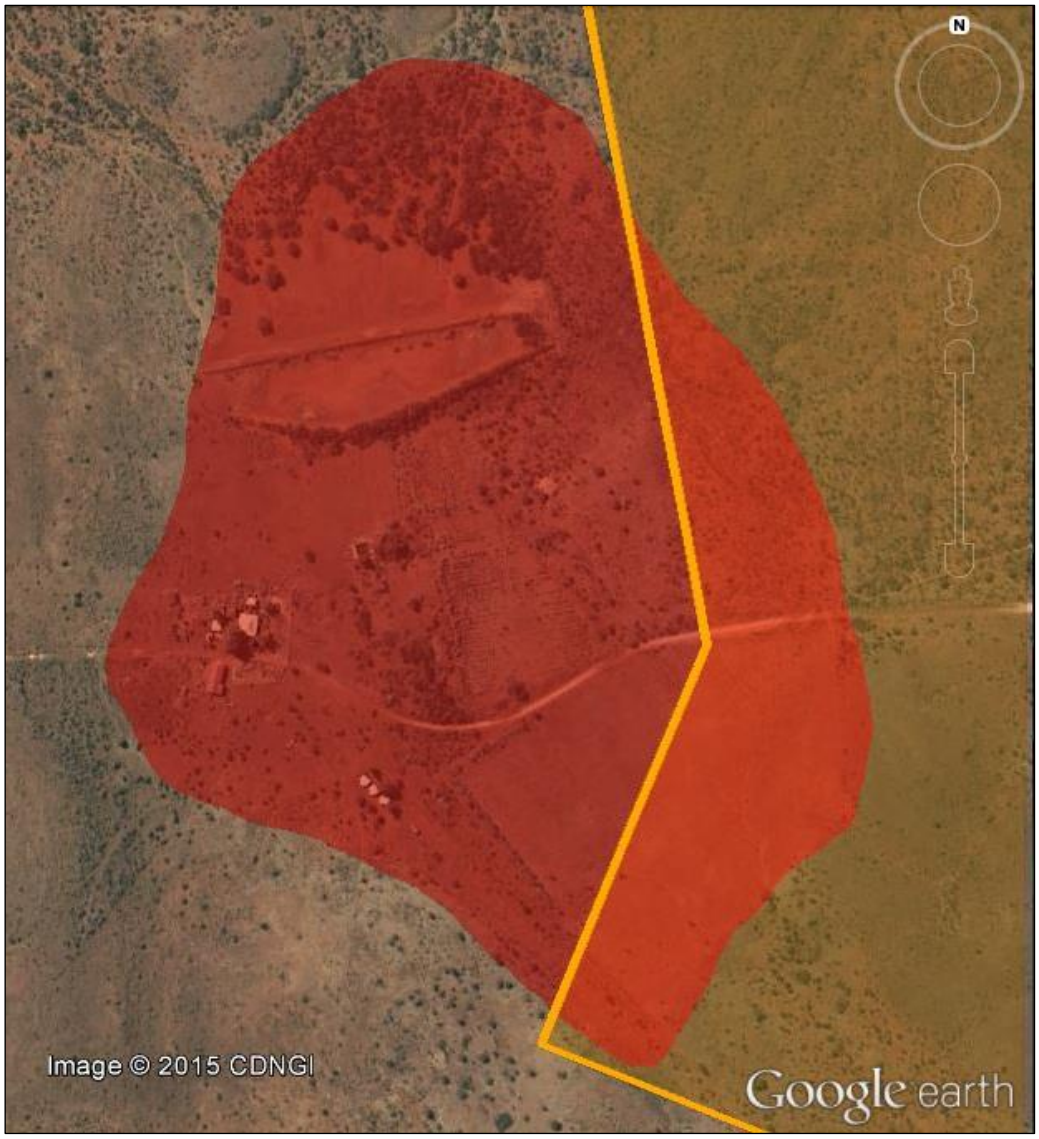

Figure 48 – Google Earth image with an overlay showing the proposed KSS Waste Rock Dump in gold over the high sensitivity buffer area that was demarcated in the Heritage Management Plan (African Heritage Consultants, 2011) in red. It is clear from this overlay that the proposed development of the KSS Waste Rock Dump will have a direct impact on the eastern end of the high sensitivity area.

7.1.9 Risk Calculation for the Impact of the Proposed Development on Site KOL 5

In this section the impact of the proposed development on Site KOL 5 will be established. This site comprises 12 small pans located within the footprint area of the LFN Waste Rock Dump. As a result a direct and permanent impact is expected. It must be noted that this impact risk calculation will take note of the fact that the exact archaeological characteristics of the 12 pans are not known.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 1 + 5)}{3} \times \frac{4}{5}$$

IMPACT RISK = 2.4

Table 19: Risk Calculation for Development Impact on Site KOL 5

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 5	3	1	5	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 5 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the LFN Waste Rock Dump on site KOL 5.

In this case, Phase 2 mitigation would comprise archaeological sampling of the lithics present in the 12 pans under a permit issued by the South African Heritage Resources Agency (SAHRA).

7.1.10 Risk Calculation for the Impact of the Proposed Development on Site KOL 6

In this section the impact of the proposed development on Site KOL 6 will be established. This site comprises one remaining small pan located within the footprint area of the LFN Waste Rock Dump. As a result a direct and permanent impact is expected. It must be noted that this impact risk

calculation will take note of the fact that the exact archaeological characteristics of the pan are not known.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 1 + 5)}{3} \times \frac{4}{5}$$

IMPACT RISK = 2.4

Table 20: Risk Calculation for Development Impact on Site KOL 6

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 6	3	1	5	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 6 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the LFN Waste Rock Dump on site KOL 6.

In this case, Phase 2 mitigation would comprise archaeological sampling of the lithics present in the pan under a permit issued by the South African Heritage Resources Agency (SAHRA).

7.1.11 Risk Calculation for the Impact of the Proposed Development on Site KOL 7

In this section the impact of the proposed development on Site KOL 7 will be established. This site comprises the 27 remaining small pans located within the footprint area of the LFS Waste Rock Dump. As a result a direct and permanent impact is expected. It must be noted that this impact risk calculation will take note of the fact that the exact archaeological characteristics of the 27 pans are not known.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 1 + 5)}{3} \times \frac{4}{5}$$

IMPACT RISK = 2.4

Table 21: Risk Calculation for Development Impact on Site KOL 7

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 7	3	1	5	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 7 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the LFS Waste Rock Dump on site KOL 7. In this case, Phase 2 mitigation would comprise archaeological sampling of the lithics present in the 27 pans under a permit issued by the South African Heritage Resources Agency (SAHRA).

7.1.12 Risk Calculation for the Impact of the Proposed Development on Site KOL 8

In this section the impact of the proposed development on Site KOL 8 will be established. This site comprises four small pans located within or adjacent to the proposed Ploegfontein Pits. As a result a direct and permanent impact is expected. It must be noted that this impact risk calculation will take note of the fact that the exact archaeological characteristics of the four pans are not known.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(3 + 1 + 5)}{3} \times \frac{4}{5}$$

IMPACT RISK = 2.4

Table 22: Risk Calculation for Development Impact on Site KOL 8

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Medium	Isolated	Permanent	Very Likely	**Moderate**
Impact on Site KOL 8	3	1	5	4	**2.4**

This calculation has revealed that the impact risk of the proposed development on Site KOL 8 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the Ploegfontein Pits on site KOL 8.

In this case, Phase 2 mitigation would comprise archaeological sampling of the lithics present in the four pans under a permit issued by the South African Heritage Resources Agency (SAHRA).

7.2 Impact of the Floradale Aquifer Recharge Project on the Identified Heritage Sites

7.2.1 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.1

In this section the impact of the proposed development of the Floradale Aquifer Recharge Pipeline and Boreholes on Site KOL 4.1 will be established. Most of the farmyard buildings are located, at their closest, roughly 120-180 m from the proposed route of the pipeline. However, the proposed pipeline route will impact directly on the remains of a foundation structure which according to oral history may have been the original farmhouse. Therefore, the impact of the pipeline is expected to be mostly indirect on the majority of the farmstead buildings, but a direct impact will certainly occur on the remains of the foundation of the original farmhouse.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 4)}{3} \times \frac{4}{5}$$

Impact Risk = 2.4

Table 23: Risk Calculation for Development Impact of the Acquifer Recharge Project on Site KOL 4.1

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Provincial	Long Term	Very Likely	**High**
Impact on KOL 4.1	4	4	4	4	**3.2**

This calculation has revealed that the impact risk of the proposed development of the pipeline of the Acquifer Recharge Project on Site KOL 4.1 falls within Impact Class 4, which represents a High Impact Risk. This means that mitigation would be required.

7.2.2 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.2

In this section the impact of the proposed development of the Acquifer Recharge Project on Site KOL 4.2 will be established. The section of the proposed new Aquifer Recharge pipeline located on Kapstevel farm will pass right next to the northern end of the Bredenkamp family cemetery. As a result, a direct negative impact on the cemetery is expected. This means that the cemetery will be damaged or destroyed if the development of the Aquifer Recharge pipeline continues unmitigated.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(5 + 4 + 4)}{3} \times \frac{5}{5}$$

Impact Risk = 4.33

Table 24: Risk Calculation for Development Impact of the Acquifer Recharge Project on Site KOL 4.2

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Very High	Provincial	Long Term	Will Happen	**Very High**
Impact on KOL 4.2	5	4	4	5	**4.33**

This calculation has revealed that the impact risk of the proposed development of the pipeline of the Floradale Acquifer Project on Site KOL 4.2 falls within Impact Class 5, which represents a **Very High Impact Risk**. This means that drastic changes to the development layout plan will be required to mitigate the impact.

7.2.3 Risk Calculation for the Impact of the Proposed Development on Site KOL 4.3

In this section the impact of the proposed development of the Acquifer Recharge Project on Site KOL 4.3 will be established. The nearest landscape features comprising the dams are located roughly 56 m from the proposed new Aquifer Recharge pipeline route. As a result no direct impact on the dams is expected, although peripheral impacts may exist.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 3 + 4)}{3} \times \frac{3}{5}$$

Impact Risk = 2.2

Table 25: Risk Calculation for Development Impact on Site KOL 4.3

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Regional	Long Term	Could Happen	**Moderate**
Impact on KOL 4.3	4	3	4	3	**2.2**

This calculation has revealed that the impact risk of the proposed development of the pipeline of the Acquifer Recharge Project on Site KOL 4.3 falls within Impact Class 3, which represents a **Moderate Impact Risk**. As a result Phase 2 mitigation would be required to reduce the impact of the proposed development of the proposed new aquifer Recharge pipeline on site KOL 4.3. In this case, Phase 2 mitigation would comprise monitoring of the site and immediate corrective measures should any actual impacts become evident.

7.2.4 Risk Calculation for the Impact of the Development on Site KOL 4 within its Historic Landscape

In this section the impact of the proposed development of the Floradale Aquifer Recharge Project on Site KOL 4 as a whole (i.e. inclusive of all four site components), within its historic landscape will be established.

In the Heritage Management Plan Report compiled by African Heritage Consultants in 2011, a high sensitivity buffer area was defined around the farmstead. The proposed development of the new

Aquifer Recharge pipeline will cut straight through this previously defined high sensitivity buffer area and will almost certainly impact directly on the Bredenkamp cemetery as well as on a historic foundation structure forming part of the built heritage of the farmstead.

$$\text{Impact Risk} = \frac{(\text{Significance} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

$$\text{Impact Risk} = \frac{(4 + 4 + 5)}{3} \times \frac{5}{5}$$

Impact Risk = 4.33

Table 26: Development Impact of the Acquifer Recharge on Site KOL 4 within its Historic Landscape

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	High	Provincial	Permanent	Will Happen	**Very High**
Impact on KOL 4	4	4	5	5	**4.33**

This calculation has revealed that the impact risk of the proposed development of the Floradale Acquifer Recharge Project on Site KOL 4 falls within Impact Class 5, which represents a **Very High Impact Risk**. This means that drastic changes to the development layout plan will be required to mitigate the impact.

8 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

Please note that some of the following mitigation measures were taken from previous archaeological and heritage impact assessment reports (Morris, 2005; Küsel, 2011; Miller, 2011; Van der Ryst, 2011).

8.1 Mitigation of Impact of All Mining Development excluding the Acquifer Recharge Project

8.1.1 Mitigation Measures Required for Site KOL 1

The site has been assessed as having a Moderate Impact Risk. As a result Phase 2 mitigation would be required. In the Kolomela Heritage Management Plan (African Heritage Consultants, 2011:20) the following mitigation was recommended:

- Should future mining or infrastructural development impact on the localities where pans occur, Phase 2 mitigation is proposed under a permit issued by the South African Heritage Resources Agency (SAHRA). This Phase 2 mitigation should include representative sampling of the assemblages on certain individual pans. It was noted that this applies to all pans located on the farms Leeuwfontein, Ploegfontein and Klipbankfontein.

8.1.2 Mitigation Measures Required for Site KOL 2

The site has been assessed as having a Moderate Impact Risk. In the Kolomela Heritage Management Plan (African Heritage Consultants 2011:20) the following mitigation was recommended:

- Should future mining activities exposed archaeological material at this site, an archaeologist must be contracted to comment on the significance of the finds.

8.1.3 Mitigation Measures Required for Site KOL 3

The site has been assessed as having a Medium Impact Risk. As a result, Phase 2 mitigation should be implemented. The 2011 Kolomela Heritage Management Plan (African Heritage Consultants, 2011: 21) recommended that the Phase 2 assessment needs to confirm the nature and extent of the mining activities and at least partially re-open the mine to investigate mining practices. It was also

recommended that a 400m buffer be established around the site. As a result, the following mitigation measures are required:

- A Phase 2 Archaeological Assessment of the site should be undertaken *to* confirm the nature and extent of the mining activities and at least partially re-open the mine to investigate mining practices (African Heritage Consultants, 2011). This Phase 2 Archaeological Assessment must be conducted under a permit issued by the South African Heritage Resources Agency.
- Until such time that the Phase 2 Archaeological Assessment has established the exact boundaries of the site as well as its characteristics, a buffer area of 400 m must be maintained between the site and any proposed development. This is significant in that the existing proposed footprint area of the Kapstevel North Dump 2 is located roughly 210 m north of the site, roughly 170 m west of the site and roughly 150 m south of the site.
- Once the exact boundaries of the site as well as its characteristics had been established, this information will be used to recommend a final buffer area between the site and the proposed Kapstevel North Dump 2.
- The site must be monitored by a heritage professional on a regular basis. The frequency of monitoring site visits should start off at once every three months during the Planning Phase, and can be changed depending on the findings of the first few monitoring visits. Of course, monitoring frequency may increase during the Construction and Operational Phases of the project.

8.1.4 Mitigation Measures Required for Site KOL 4

Although the different components of Site KOL 4 have revealed different impact risk values, the calculation on the impact of the proposed development of the KSS Waste Rock Dump on the farm worker cemetery at KOL 4.4 as well as the historic landscape surrounding the farmstead (inclusive of the high sensitivity area that was defined in the Heritage Management Plan (African Heritage Consultants, 2011)) have revealed a Very High Impact Risk on both calculations. This means that immediate and direct mitigation measures would be required, including the modification of the proposed development footprint.

The following mitigation measures are required for this site:

- The layout and position of the development footprint area of the KSS Waste Rock Dump must be changed to allow for at least a 250 m buffer area between this footprint area and the farm worker cemetery at KOL 4.4 as well as at least a 100 m buffer area between this footprint area and the high sensitivity area defined in the Heritage Management Plan.
- The site must be monitored by a heritage professional on a regular basis. The frequency of monitoring site visits should start off at once every three months during the Planning Phase, and can be changed depending on the findings of the first few monitoring visits. Of course, monitoring frequency may increase during the Construction and Operational Phases of the project.

8.1.5 Mitigation Measures Required for Site KOL 5

This site has been assessed as having a Moderate Impact Risk. As a result, Phase 2 mitigation will be required. This Phase 2 mitigation should include representative sampling of the assemblages on certain individual pans. It was noted that this applies to all pans located on the farms Leeuwfontein Ploegfontein, and Klipbankfontein.

8.1.6 Mitigation Measures Required for Site KOL 6

This site has been assessed as having a Moderate Impact Risk. As a result, Phase 2 mitigation will be required. This Phase 2 mitigation should include representative sampling of the assemblages on certain individual pans. It was noted that this applies to all pans located on the farms Leeuwfontein Ploegfontein and Klipbankfontein.

8.1.7 Mitigation Measures Required for Site KOL 7

This site has been assessed as having a Moderate Impact Risk. As a result, Phase 2 mitigation will be required. This Phase 2 mitigation should include representative sampling of the assemblages on certain individual pans. It was noted that this applies to all pans located on the farms Leeuwfontein Ploegfontein and Klipbankfontein.

8.2 Mitigation of Impact of Floradale Acquifer Recharge Project

8.2.1 Mitigation Measures Required for Site KOL 4

Although the different components of Site KOL 4 have revealed different impact risk values, the calculation on the impact of the proposed development of the pipeline of the Floradale Acquifer Recharge Project on the Bredenkamp cemetery at KOL 4.2 as well as the historic landscape surrounding the farmstead (inclusive of the high sensitivity area that was defined in the Heritage Management Plan (African Heritage Consultants, 2011)) have revealed a Very High Impact Risk on both calculations. This means that immediate and direct mitigation measures would be required, including the modification of the proposed development footprint.

The following mitigation measures are required for this site:

- The layout and position of the development footprint area of the pipeline froming part of the Floradale Acquifer Recharge Project must be changed to allow for at least a 100 m buffer area between this footprint area and the Bredenkamp cemetery at KOL 4.2 as well as at least a 100 m buffer area between this footprint area and the high sensitivity area defined in the Heritage Management Plan.
- The site must be monitored by a heritage professional on a regular basis. The frequency of monitoring site visits should start off at once every three months during the Planning Phase, and can be changed depending on the findings of the first few monitoring visits. Of course, monitoring frequency may increase during the Construction and Operational Phases of the project.

8.3 Recommendations in terms of Palaeontology

The following recommendations must be adhered to in terms of palaeontology:

- The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments as well as the surface limestone contain significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.

- An accredited palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or where they are planned to be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining.
- The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
- These recommendations must form part of the EMP of the project.

8.4 General Recommendations and Mitigation Measures

The following general mitigation measures were obtained from the Kolomela Heritage Management Plan (Küsel, 2011).

8.4.1 Stone Age deposits:

The following Heritage Management Actions are required:

- To protect the integrity of the heritage resources it is recommended that access and disturbance of these localities be limited.
- Where mining or any other activity will impact on one of these sites, a Phase 2 Assessment must be commissioned and a destruction permit obtained from the relevant heritage agency.
- Once authorization for the proposed interventions has been obtained, the project can enter into the detailed design and construction phase.
- Based on the Master Plan and end use, detailed management and maintenance guidelines can be developed as a refinement of this Heritage Management Plan.

8.4.2 Farmsteads and other reusable buildings (Kapstevel farmstead)

The following Heritage Management Actions are required:

- The Mining Company, in consultation with the heritage professional, must take a decision on the future use of each of the sites.
- A detailed restoration plan for the building and surrounding landscape must be developed by a suitably qualified team of professionals (at minimum a professional archaeologist specializing in restoration of historic buildings and a registered professional architect specializing in restoration).
- The guidelines and principles of the Burra Charter shall inform the restoration plan.
- The proposed restoration plan, together with supporting documentation and permit applications, must be submitted to the relevant heritage authority for authorization.
- Once authorization for the proposed interventions has been obtained the project can enter into a detailed design and construction phase.

8.4.3 Graves and cemeteries.

The following Heritage Management Actions are required:

- Cemeteries or graveyards that are not directly impacted on by the proposed developments should be retained and conserved as is.
- All cemeteries must be demarcated, cleaned and fenced.
- If cemeteries will be directly impacted on, it is preferable for the development to be amended to avoid the cemeteries. However, if this cannot be done, then Phase 2 mitigation should be undertaken, under a permit from SAHRA and the other relevant authorities, which will involve the relocation of the cemeteries.

9 CONCLUSIONS

PGS Heritage was appointed by Synergistics Environmental Services to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed Kolomela Amendment Project, which represents the expansion of existing mining activities located on the Farms Ploegfontein 487; Remainder of Leeuwfontein 488; Strydfontein 614; Remainder of Klipbankfontein 489; Portions 1, 2, 3, and the Remainder of Kapstevel 541; Wolhaarkop 485, Welgevonden 486 and Floradale 230 located south-west of Postmasburg, Northern Cape Province.

The scope of work was to provide a Heritage Impact Assessment report for the proposed Kolomela Amendment Project. The study commenced with a brief archival and historical desktop study which was used to compile a historical layering of the study area within its regional context. This component indicated that both the immediate study area and the surrounding farms have a rich historical and archaeological history. The archival and historical study was followed by a detailed investigation of all previous heritage and archaeological reports made available by the mine and as identified on SAHRIS. This component of the study was crucial in that as the entire mining property had been covered during previous archaeological and heritage studies, no additional field surveys were to be done for this study.

The only fieldwork that was conducted on the mine property consisted of a brief site visit by an archaeologist from PGS Heritage, together with a Stone Age specialist, to visit some of the sites located within the present study area. The aim of this site visit was to verify the character, extent, significance and required mitigation measures relative to those sites located within the mining development footprint areas. During the site visit one new site was also identified, namely a farm worker cemetery (see Site KOL 4.4).

A detailed field survey was undertaken on the the section of proposed new pipeline and associated boreholes (forming part of the Floradale Aquifer Recharge) which is situated on the farm Floradale 230. However, limited fieldwork was undertaken on those sections of the pipeline which are proposed within the mine property on the farms Wolhaarkop and Kapstevel, since that area had been surveyed previously for the existing mining activities.

Eight heritage sites were identified within the amended mining expansion footprint. These sites will be discussed in more detail below.

Stone Age sites

Six Stone Age sites (KOL 1, KOL 2, KOL 5, KOL 6, KOL 7 and KOL 8), covering the Early and Middle Stone Age periods, will be affected. These mainly take the form of small shallow pans, most of which are located along the eastern end of the overall mining property. Interestingly, at least 165 such small pans are located along the eastern end of the mining property. However, site KOL 2 is a scatter of possibly Later Stone Age artefacts found on a colluvial fan in one of the valleys located closer to the western end of the mining property.

It is important to note that four of the sites from this section comprise clusters of small pans which are believed to contain Stone Age material. These four pan clusters form part of the belt of at least 165 small pans located along the eastern end of the mine property. Due to the high number of small pans from within the study area, it was impractical for each individual pan to be visited in the field and assessed for its exact archaeological characteristics. These four pan clusters were provided with the same archaeological status, significance and mitigation based on the archaeological characteristics of at least three pans investigated nearby (with site KOL 1 representing one of these). The four separate clusters of pans will be impacted by the Ploegfontein Pits, the LFN Waste Rock Dump (which will impact two of the pan clusters), as well as the LFS Waste Rock Dump.

Each pan cluster has been given a separate site identification number (see KOL 5, KOL 6, KOL 7 and KOL 8) and each of these sites contains different pan numbers. As such, KOL 5 contains 19 small pans (of which seven had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 6 contains six small pans (of which five had been destroyed by mining activities undertaken between 7 October 2013 and 2 December 2014), KOL 7 contains 44 small pans (of which 17 had been destroyed by previous mining activities conducted between 7 October 2013 and 2 December 2014) and KOL 8 contains four small pans. From this outline it is evident that due to mining impact KOL 5 now contains 12 small pans, KOL 6 contains one small pan, KOL 7 contains 27 small pans and KOL 8 contains four small pans.

One of the individual pan sites that was visited and assessed during the current site visit (KOL 1) is a site that was highlighted in the previous reports by Morris (2005) and van der Ryst (2011), due to density of lithics and the presence of ceramics.

These pan sites are all allocated a significance of low-medium. Therefore, Phase 2 mitigation (sampling) of a significant number of these pans is proposed before they are destroyed by mining activities. This will require a permit issued by the South African Heritage Resources Agency (SAHRA) (African Heritage Consultants 2011:20).

Late Iron Age / Historic sites

One historic mining site (KOL 3) was identified. This site is situated on the farm Welgevonden 486, in the prospecting area of the existing open-cast pit. Although the site will not be directly impacted

upon by the proposed Kapstevel North Dump 2, this mining development will be located on three sides of the site and peripheral impacts can be expected.

Due to the closeness of the proposed Kapstevel North Dump 2 to the mining site, a number of mitigation measures are recommended in the report, including a Phase 2 Archaeological Assessment of the site to establish the extent and characteristics of the old mining activities and, at the same time, the provisional establishment of a 400 m buffer area around the site. Once the exact extent and characteristics of the site have been established, final recommendations with regard to the required buffer zone around the site will be made. A monitoring programme has also been recommended.

Historic Structures / Farmstead Sites

One historic farmyard complex (KOL 4) was identified as likely to be impacted by the mining expansion area. The site is a historical farmstead complex located on the farm Kapstevel. It is a multi-component site which comprises various buildings, structures and landscape features of a farm retained from the late 19th century to the present day. The site was assessed to be of overall high significance and a previous Heritage Management Plan (African Heritage Consultants, 2011) recommended that the site be formally protected as a Provincial Heritage site.

As indicated above, the site comprises a number of elements, namely: historic structures associated with the original farmstead (KOL 4.1), a historic cemetery for the Bredenkamp family (KOL 4.2), various landscape features associated with the farmstead including dams (KOL 4.3), as well as a farm worker cemetery and accommodation (KOL 4.4). The KSS Waste Rock Dump cuts significantly into the high sensitivity buffer zone identified in the Heritage Management Plan and will have a direct negative impact on the farm worker cemetery, which is located within the present footprint area of the KSS Waste Rock Dump.

Due to the high negative impact represented by the KSS Waste Rock Dump on the farm worker cemetery, as well as the impact on the buffer zone that was established in the Heritage Management Plan, **it is required that the layout of the KSS Waste Rock Dump be changed to allow for the continued preservation of the site and all of its components. The layout of the KSS Waste Rock Dump will have to be changed in such a way that the presently high sensitivity zone identified in the Heritage Management Plan is maintained and to allow for a buffer area of at least**

250 m around the newly discovered farm worker cemetery and a buffer area distance of 100 m between the proposed development and the area of high significance identified in the Heritage Management Plan. Monitoring would also be required during construction.

Furthermore, due to the equally high negative impact represented by the proposed new pipeline for the Floradale Aquifer Recharge Project on Site 4.2 (the Bredenkamp cemetery) as well as on the high sensitivity buffer zone identified in the Heritage Management Plan, **it is required that the layout of the section of pipeline located on the farms Wolhaarkop 485 and Kapstevel 541 be changed to allow for the continued preservation of the buffer area around the site as well as all the site components. The layout of the pipeline will have to be changed in such a way that the presently high sensitivity zone identified in the Heritage Management Plan is maintained and to allow for a buffer area of at least 250 m around the white cemetery.** Monitoring will also be required during construction.

Impact risk calculations were undertaken on the expected impact of the proposed mining expansion on the eight sites identified. This indicated that the proposed mining expansion poses a Low to High Impact Risk to the identified sites.

Palaeontology

The Kolomela Mining Area is mainly underlain by Vaalian aged rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups, as well as Quaternary aged sediments of the Kalahari Group, surface limestone and alluvium. Cave breccias are associated with dolomite deposits of the Ghaap Group.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of this group. The potential carbonaceous breccias might also contain very important early hominin remains. A Phase 1 Palaeontological Impact Assessment (PIA) investigation by a professional palaeontologist is recommended for these areas.

The surface limestone overlies the highly sensitive dolomites and is allocated High Palaeontological sensitivity. These limestones can contain significant fossils of Quaternary-aged plants and animals.

Where surface limestone will be removed for mining purposes, the limestone must be inspected for fossils and the underlying Ghaap Group sediments must be inspected for the presence of stromatolites. A Phase I PIA investigation is recommended for the areas where excavation of the limestone is planned.

Sediments of the Koegas Subgroup, Postmasburg, Olifantshoek and Kalahari Groups, as well as the alluvium are allocated Moderate Palaeontological sensitivities and any fossils observed must be reported to the ECO.

Palaeontological recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments, as well as the surface limestone, contain significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.
2. An accredited palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment (PIA) to confirm the presence of significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or where they are planned to be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining operations.
3. The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed, the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
4. These recommendations must form part of the EMP of the project.

In general terms, only the footprint areas of the proposed mining activities (including the new pipeline and associated boreholes representing the Floradale 230 Aquifer Recharge Project) as depicted on the mine expansion footprint layout plan from within this Report, were assessed during this Heritage Impact Assessment. Should the development footprints of the proposed development

change in any way, these additional areas will have to be assessed in the field and included as part of a revised heritage impact assessment study.

Impact risk calculations were undertaken on the expected impact of the proposed mining expansion on the eight identified sites. This indicated that the proposed mining expansion poses a Low to High Impact Risk to the identified sites. In general, it is recommended that Phase 2 mitigation measures would be required for six of the eight identified sites (KOL 1, KOL 3, KOL 5, KOL 6, KOL7 and KOL 8). The high significance allocated in previous heritage assessments to the farmstead at KOL 4 as well as the recommendation in these reports that site should be allocated Provincial Heritage Significance Status, means that any perceived impact on this site and its components must be avoided. As indicated above, the development of the KSS Waste Rock Dump as well as the Floradale Acquifer Recharge Pipeline cannot be allowed to proceed as planned at present and their layout will have to change to allow for the preservation of the identified buffer area around the historic farmstead, the preservation of the newly discovered farm worker cemetery which is currently located within the footprint area of the abovementioned waste rock dump as well as the Bredenkamp cemetery located at present within the footprint of the abovementioned pipeline.

On the condition that these recommendations are adhered to, there are no heritage grounds to prevent the proposed mining development from taking place.

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10.5 Historic Topographic Maps

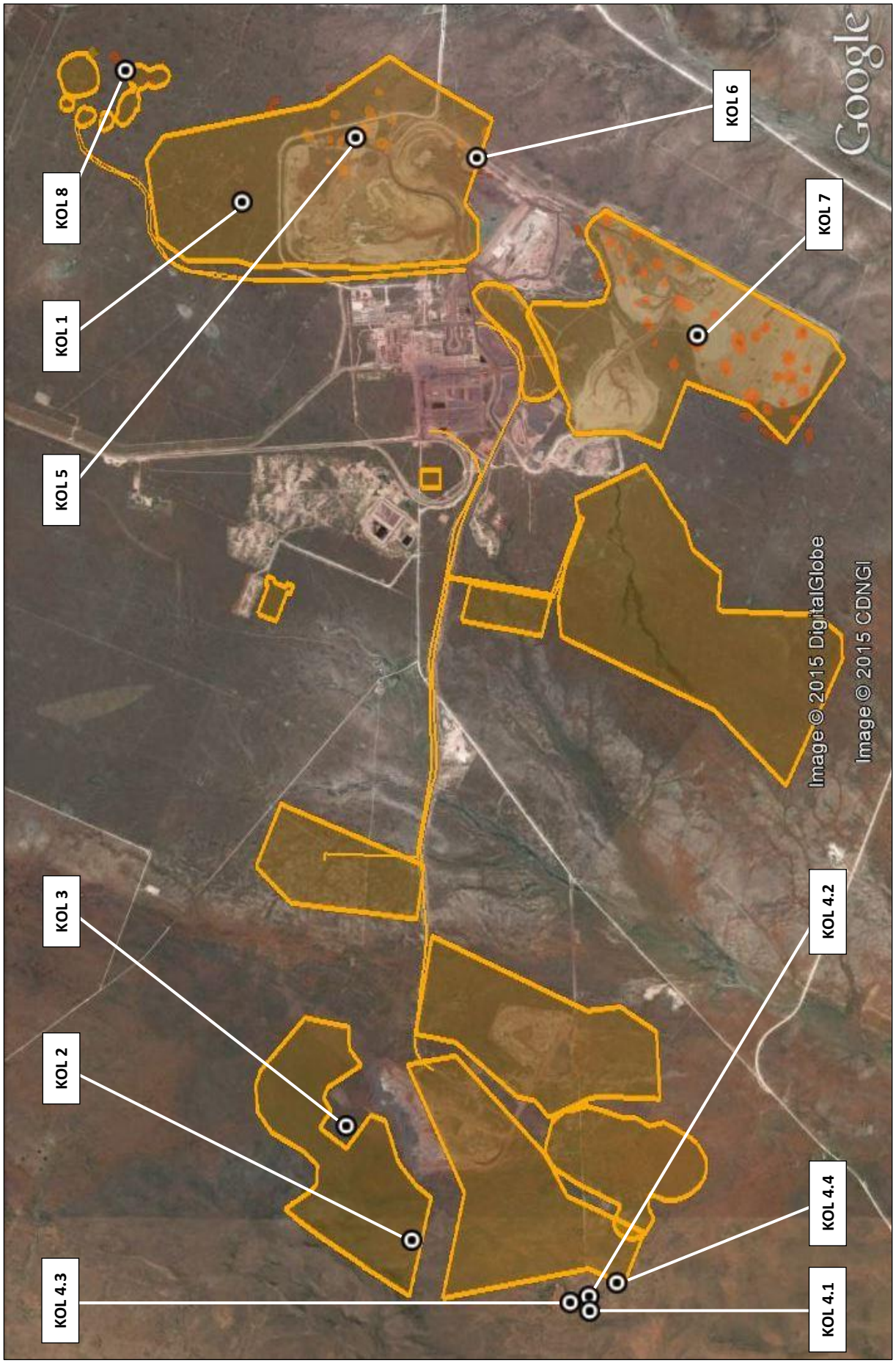
All the historic topographic maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

10.6 Contemporary Cartographic Data

MapSource and Google Earth were used to depict contemporary cartographic data.

Appendix A

HERITAGE SITE DISTRIBUTION MAP


KOL 8
KOL 1
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KOL 6
KOL 7
KOL 3
KOL 2
KOL 4.3
KOL 4.2
KOL 4.4
KOL 4.1
Google
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Appendix B

PALAEONTOLOGICAL DESKTOP STUDY

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE EXPANSION OF THE KOLOMELA MINE, TSANTSABANE LOCAL MUNICIPALITY, SIYANDA DISTRICT MUNICIPALITTY, NORTHERN CAPE PROVINCE.

For:

HIA CONSULTANTS

DATE: 11 February 2015

By

Gideon Groenewald
082 339 9202

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed expansion of mining activities at the Kolomela Mine, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province.

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

The Kolomela Mining Area is mainly underlain by Vaalian aged rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups, as well as Quaternary aged sediments of the Kalahari Group, surface limestone and alluvium. Cave breccias are associated with dolomite deposits of the Ghaap Group.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of this group. The potential carbonaceous breccias might also contain very important early Hominin remains. A Phase 1 PIA investigation by a professional palaeontologist is recommended for these areas

The surface limestones overlies the highly sensitive dolomites and is allocated a High Palaeontological sensitivity. These limestones can contain significant fossils of Quaternary aged plants and animals. Where surface limestone will be removed for mining purposes, the limestone must be inspected for fossils and the underlying Ghaap Group sediments must be inspected for the presence of stromatolites. A Phase I PIA investigation is recommended for the areas where excavation of the limestone is planned.

Sediments of the Koegas Subgroup, Postmasburg, Olifantshoek and Kalahari Groups, as well as the alluvium are allocated Moderate Palaeontological sensitivities and any fossils observed must be reported to the ECO.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments as well as the surface limestone contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.
2. An accredited palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or where they are planned to be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining operations.
3. The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
4. These recommendations must form part of the EMP of the project.

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1 INTRODUCTION

10.1 Background

Gideon Groenewald was appointed by PGS Heritage to undertake a desktop survey, assessing the potential palaeontological impact of the proposed expansion of the Kolomela Mine, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province.

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

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

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

10.2 Aims and Methodology

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

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

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

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 0.1 Palaeontological sensitivity classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al 2008.	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Developer and HIA consultant must take note of possible fossils and make professional recommendations on the impact of development on significant palaeontological finds recorded in the literature. SAHRA must be notified if new fossils are recorded and collection of a representative sample of potential fossiliferous material recommended.

GREY	Very Low Palaeontological sensitivity/vulnerability. Very low to no possibility that fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Developer and HIA consultant must note archaeological reports for possible descriptions of palaeontological finds in Cenozoic aged surface deposits.

1.3. **Scope and Limitations of the Desktop Study**

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

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

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

2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The study area is located south west of Postmasburg in the Northern Province (Figure 2.1).

The aim of the project is to expand the Kolomela Mining activities as shown in Figure 2.2.

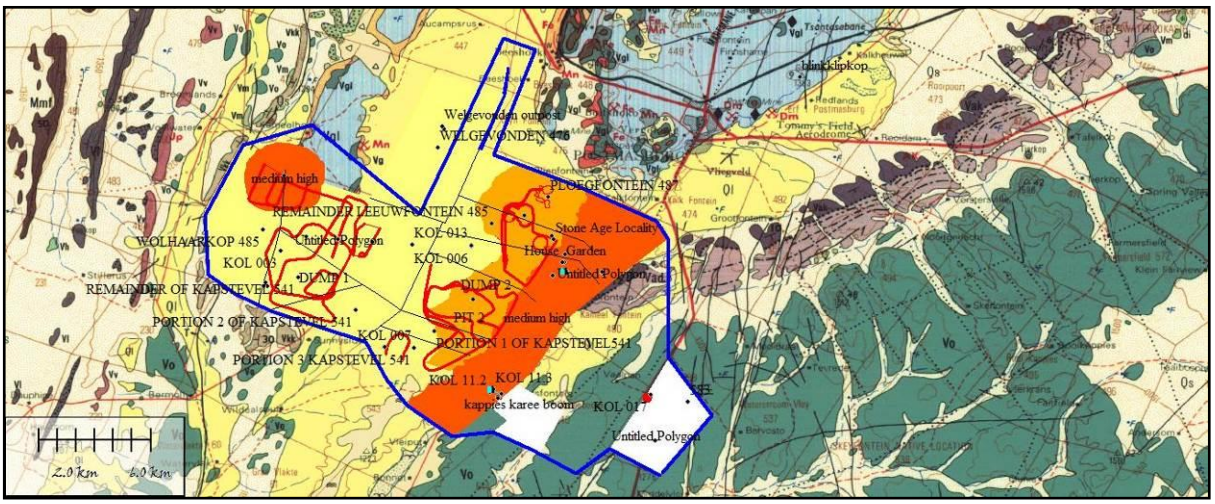

Figure 1.2 Locality of the study area for Kolomela Mine southwest of Postmasburg

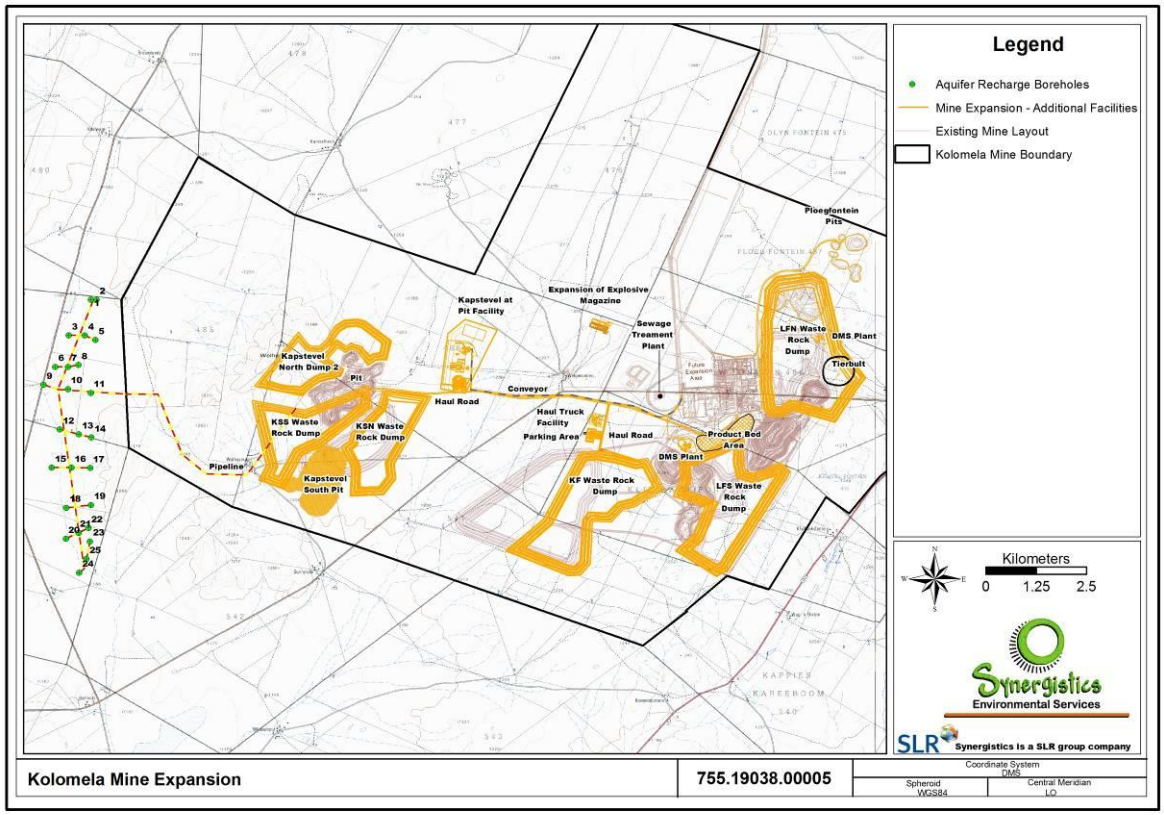

Figure 1.1 Layout and planned expansion at Kolomela Mine.

3 GEOLOGY

The study area is underlain by rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups of the Transvaal Supergroup, as well as sediments of the Kalahari Group and surface limestone and alluvium (Figure 3.1). The Geological Legend (Figure 3.2) refers to old terms of mapping and for the sake of

this desktop, the latest geological terms, as presently used on the latest version of the geological map for South Africa (Council for Geoscience, Pretoria) will be used.

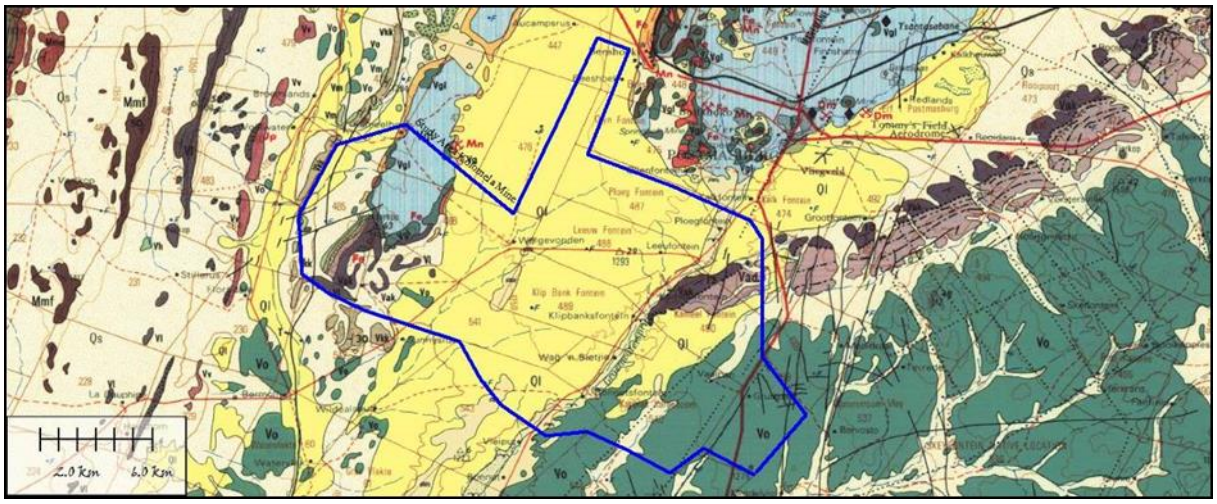

Figure 1.3 Geology of the area underlying the Kolomela Mine

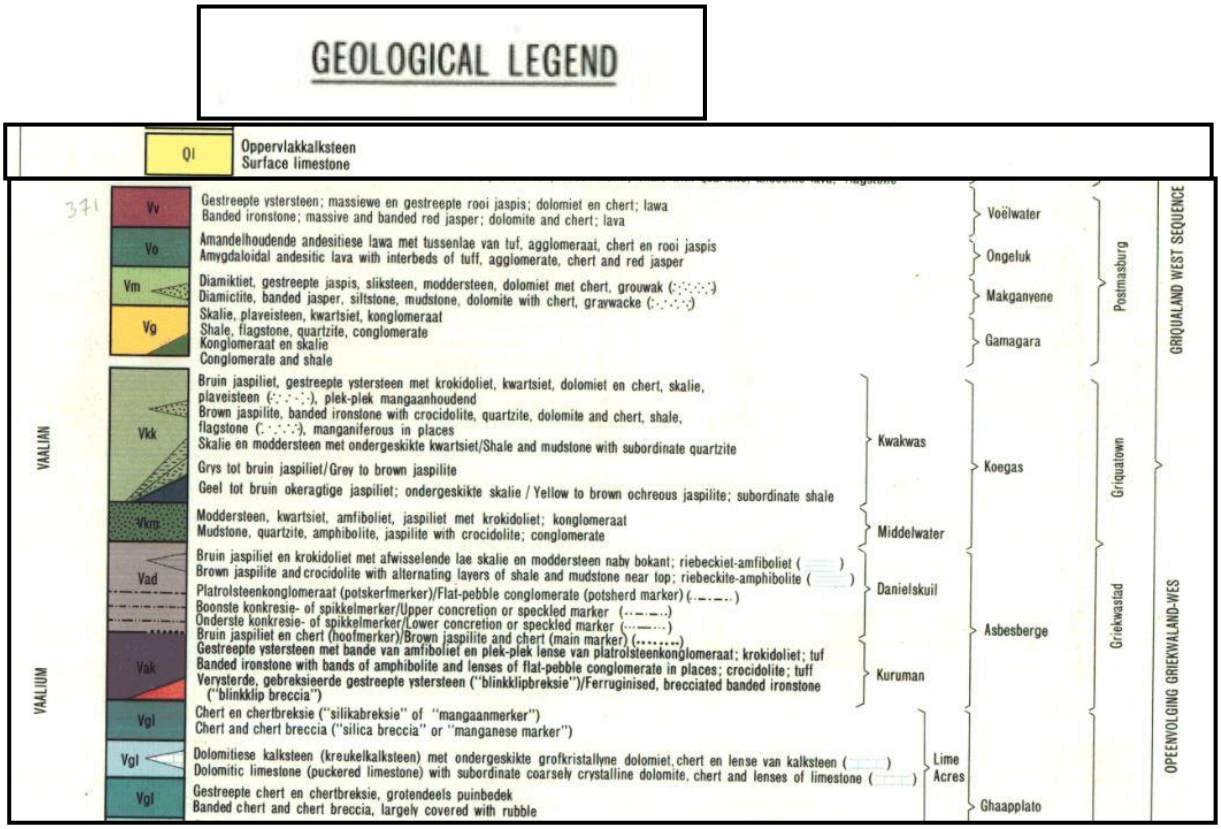

Figure 1.4. Geological Legend

3.1 Ghaap Group

The Ghaap Group consists predominantly of Vaalian aged carbonate and siliclastic rocks and is subdivided into the Schmidtsdrift, Campbell Rand and Asbestos Hills Subgroups. In the study area the larger part of the outcrop area for the lower Ghaap Group is undifferentiated, with mainly the Kuruman and Danielskuil Formations mapped out.

3.1.1. Kuruman Formation

The Kuruman Formation is mainly a banded ironstone with bands of amphibolite and lenses of flat pebble conglomerates and crocidolite. A prominent brown jaspilite and chert forms an upper marker for the formation.

3.1.2. Danielskuil Formation

The Danielskuil Formation consists predominantly of brown jaspilite and crocidolite with several prominent concretion markers. The upper part of the formation is characterised by shale and mudstone layers.

3.2 Koegas Subgroup

A small area in the western part of the study area is underlain by Vaalian aged grey to brown jaspilite, mudrock, quartzite, iron formation and dolomite of the Koegas Subgroup.

3.3. Postmasburg Group

3.3.1. Gamagara Formation

The Vaalian aged Gamagara Formation consists of shale, minor quartzites and conglomerate.

3.3.2. Makganyene Formation

Vaalian aged diamictite, carbonate and mudrock with subordinate jaspilite.

3.3.3. Ongeluk Formation

Vaalian aged andestic and basaltic lava with abundant pillows and some jaspilite.

3.4. Olifantshoek Group

3.4.1. Lucknow Formation

Predominantly Vaalian aged quartzite with subordinate flagstone and dolomitic limestone and conglomerate

3.4. Kalahari Group

3.6.1. Gordonia Formation

Quaternary aged aeolian sand, cover sand and sand dunes.

3.6. Surface Limestone

Quaternary to recent aeolian sand, alluvium, colluvium, spring tufa (calcareous) and sinter (siliceous) lake deposits, peats, pedocretes or duricrusts (clacrete and ferricrete), soils and gravel (diamondiferous in places).

3.7. Cenozoic Cave Breccias

The areas underlain by dolomites are also prone to have a very high possibility of Cenozoic aged carbonaceous cave breccias. The bone bearing breccias, calcareous tufa (flowstones, spelothems), colluvial and alluvial gravels, collapse debris, “cave earth” and other cave deposits of Late Pliocene to Late Pleistocene and Holocene (<3 Ma) can be associated with the dolomite karst topography.

3.8 Alluvium

Recent sandy and clayey deposits along the water courses in the study area.

4 PALAEONTOLOGY OF THE STUDY AREA

4.1. Ghaap Group

Range of shallow marine and lacustrine stromatolites (some very large), oolites, pisolites in carbonates, filamentous and coccoid organic walled microfossils (e.g. cyanobacteria) in siliciclastics / carbonates as well as cherts of banded iron formations (BIF) have been described from the Schmidtsdrift, Campbell Rand & Asbestos Hills Subgroups of the Ghaap Group.

4.1.1. Kuruman Formation
Small stromatolite structures are associated with dolomitic layers in the formation.

4.1.2 Danielskuil Formation
Small stromatolite structures are associated with dolomitic layers in the formation.

4.2 Koegas Subgroup

Dolomites of the Koegas Subgroup contains fossils of stromatolites. The stromatolites are not as well defined as in the Ghaap Group.

4.3 Postmasburg Group

The Postmasburg Group consists of formations that represent glacial diamictites (tillites), volcanic lavas, dolomites and ironstones of Early Proterozoic age.

4.3.1. Gamagara Formation
The Gamagara Formation is mainly a sequence of quartzites, shales and conglomerate and stromatolites will only be associated with thin interbedded carbonates.

4.3.2. Makganyene Formation
The Makhanyene Formation contains subordinate carbonate layers and mudrock. The Formation will contain small-scale stromatolites, mainly associated with carbonate layers.

4.3.3. Ongeluk Formation
The Ongeluk Formation consists mainly of volcanic rocks and jaspilite. It is unlikely that it will contain significant fossil remains.

4.4. Olifantshoek Group

4.4.1. Lucknow Formation
Stromatolites are associated with the dolomitic limestone that occurs in these predominantly quartzite and conglomeratic rock sequences.

4.5. Kalahari Group

4.5.1. Gordonia Formation

The Gordonia Formation is mainly a wind-blown sand deposit and it can contain fossil remains and palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (e.g. termitaria). Rare vertebrate remains (mammals, fish, ostrich egg shell etc.), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods and charophytes have been reported from these sediments.

Fossils mainly associated with ancient pans, lakes and river systems. Palaeontology is poorly studied but basal, Late Cretaceous gravels and lacustrine clays that might be exposed during clearing for mining operations are likely to be fossiliferous (bones, teeth, petrified wood and palynomorphs). These units are rarely exposed in areas that are not mined.

4.6 Surface Limestone

Very wide range of possible fossil remains, though these are often sparse. The fossil remains include mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms and other microfossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows and vertebrate tracks), freshwater stromatolites, plant material, including peat, foliage and wood pollens.

See archaeological literature for fossil and subfossil remains from archaeological sites (e.g. Wonderwerk Cave near Kuruman and Katu Pan near Sishen). Fossil leaves and palynomorphs can occur in calcareous tufa. A good example is the highly fossiliferous tufa found at Taung, with abundant Makapanian Mammal Age vertebrate remains, including Australopithecines.

4.7. Cenozoic Cave Breccias

The Cenozoic aged cave breccias that can be associated with the dolomites of the Ghaap Group can contain important fossil remains, including the remains of Hominins.

Diverse Late Pliocene to Pleistocene (Makapanian, Cornelian and Florisian) mammalian biotas, including several extinct hominins (spp of *Australopithecus, Paranthropus* and *Homo*), micromammals, reptiles (lizards), frogs, birds, land snails, coprolites, stone and bone artifacts and plant remains (e.g. petrified wood and palynomorphs) have been recorded from these deposits. A number of very important cave sites are for example present in similar dolomitic regions the Cradle of Humankind near Krugersdorp.

4.8 Alluvium

A wide range of fossils can be present, including mammalian bones and teeth, tortoise remains, ostrich egg shells and casts of roots. Alluvial deposits are associated with recent water courses of main rivers and streams. These sediments are presently not well studied and records of fossil occurrences are mainly associated with archaeological reports. Fossils recorded from these beds for example fossils from Rouxville and Wepener in the Free State are highly significant.

5 PALAEONTOLOGICAL SENSITIVITY

The entire development area falls on relatively sensitive dolomitic terrain as well as areas underlain by relatively sensitive surface deposits that need to be removed for mining purposes. The area is sensitive for both dolomitic stromatolites and micro-fossils as well as possible fossiliferous breccias (Figures 5.1&5.2). The different sensitivity classes used are explained in Table 1.1 above.

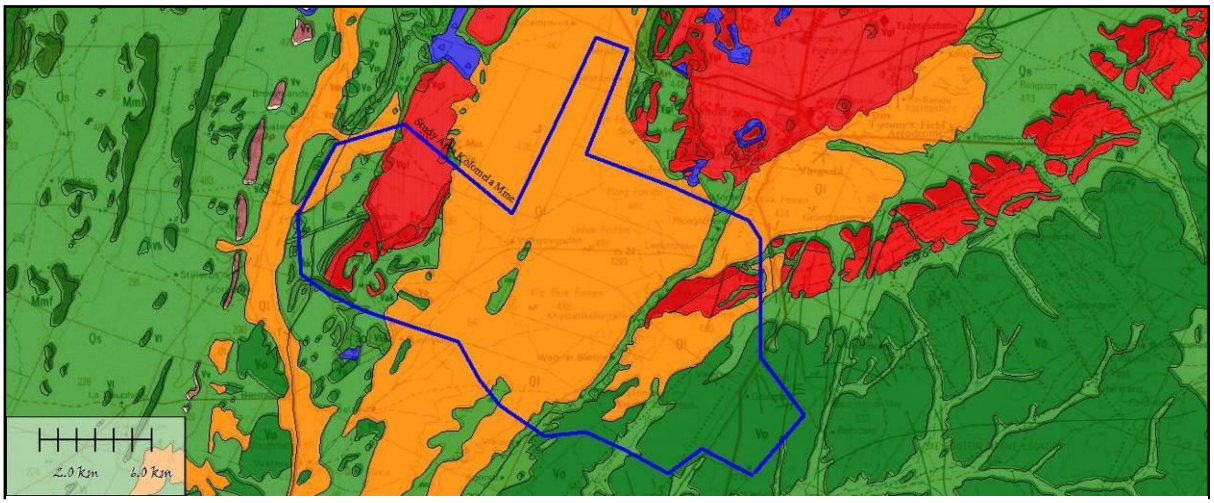

Figure 1.5 Palaeontological sensitivity of the entire footprint of the proposed development of the mine. Colour coding is explained in Table 1.1 of this document.

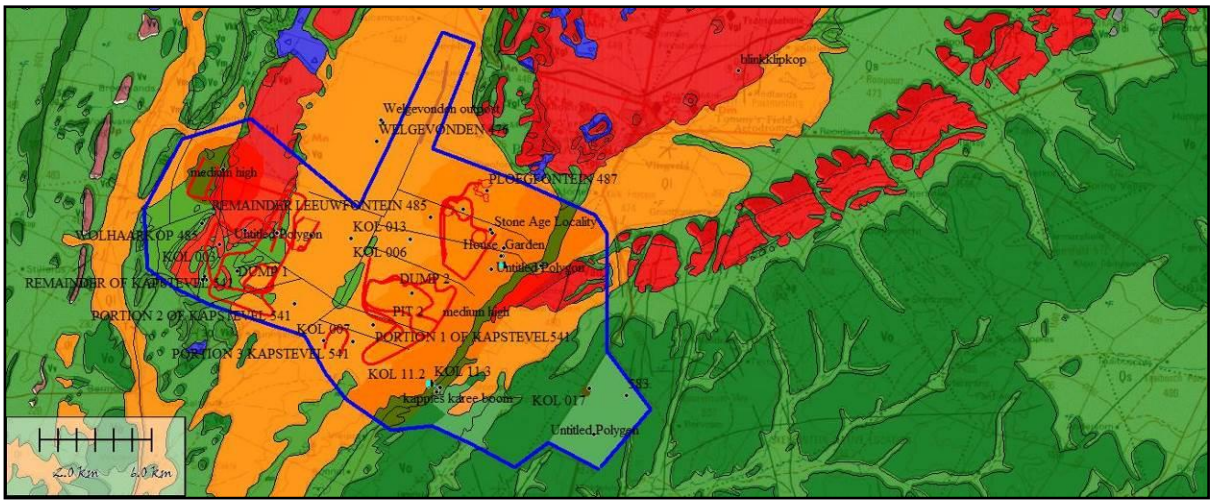

Figure 1.6 Palaeontological sensitivity of areas underlain by specific infrastructure planning at the mine. Colour coding is explained in Table 1.1 of this document.

The palaeontological sensitivity of the study area varies from Moderate Sensitivity to High and Very High Sensitive for palaeontological heritage (Figures 5.1 and 5.2).

Mining areas underlain by Ghaap Group sediments and specifically the Kuruman and Danielskuil Formations that will be mined, are allocated Very High Palaeontological sensitivity areas due to the presence of large stromatolite structures that need to be recorded if present in the dolomite.

Large areas underlain by calcareous surface deposits are allocated a High Palaeontological sensitivity and, due to the fact that the highly sensitive Ghaap Group sediments will probably be exposed during mining, the palaeontological sensitivity of the area must be regarded as highly sensitive.

Areas underlain by sediments of the Koegas Subgroup, Postmasburg Group and Olifantshoek Group, as well as the Gordonia Formation and alluvial deposits, are allocated a Moderate Palaeontological sensitivity.

6 CONCLUSION AND RECOMMENDATIONS

The Kolomela Mining Area is mainly underlain by Vaalian aged rocks of the Ghaap Group, Koegas Subgroup, Postmasburg and Olifantshoek Groups, as well as Quaternary aged sediments of the Kalahari Group, surface limestone and alluvium. Cave breccias are associated with dolomite deposits of the Ghaap Group.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of this group. The potential carbonaceous breccias might also contain very important early Hominin remains. A Phase 1 PIA investigation by a professional palaeontologist is recommended for these areas

The surface limestones overlies the highly sensitive dolomites and is allocated a High Palaeontological sensitivity. These limestones can contain significant fossils of Quaternary aged plants and animals. Where surface limestone will be removed for mining purposes, the limestone must be inspected for fossils and the underlying Ghaap Group sediments must be inspected for the presence of stromatolites. A Phase I PIA investigation is recommended for the areas where excavation of the limestone is planned.

Sediments of the Koegas Subgroup, Postmasburg, Olifantshoek and Kalahari Groups, as well as the alluvium are allocated Moderate Palaeontological sensitivities and any fossils observed must be reported to the ECO.

Recommendations:

1 The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments as well as the surface limestone contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages in the dolomite of the Ghaap Group and possibly vertebrate remains in the surface limestone.
2 An accredited palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits in areas underlain by dolomite of the Ghaap Group, as well as areas underlain by surface limestone, where these limestones are exposed or where they are planned to be exposed during mining operations. The palaeontologist must make the necessary recommendations regarding a possible Phase 2 PIA during the initial mining operations.
3 The EAP and ECO must be informed of the possible presence of fossils in rocks of the Postmasburg, Olifantshoek and Kalahari Groups, as well as in the Koegas Subgroup and alluvial deposits. If fossils are observed the ECO must be notified and the fossils recorded by the palaeontologist according to SAHRA specifications.
4 These recommendations must form part of the EMP of the project.

7 REFERENCES

Johnson MR, Anhausser CR and Thomas RJ. 2006. The Geology of South Africa. Geological Society of South Africa.

8 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

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

9 DECLARATION OF INDEPENDENCE

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

Dr Gideon Groenewald
Geologist

Appendix C

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

1. GENERAL PRINCIPLES

In areas where there has not yet been a systematic survey to identify conservation-worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been completed and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In terms of the heritage legislation, permits are required to damage, destroy, alter, or disturb such sites. People who already possess such material are required to register it. The management of heritage resources is integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued or mitigated.

In addition to the formal protection of culturally significant graves, all graves which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas) are protected. The legislation protects the interests of communities who have an interest in the graves: they must be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle should be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the applicant's (i.e. mining company or development company) cost. Thus, the applicant will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and prehistoric cultural remains, including graves and human remains.

2. GRAVES AND CEMETERIES

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.