PHASE 1 PALAEONTOLOGICAL IMPACT ASSESSMENT FOR CONSTRUCTION OF THE KWAKOPI WATER SUPPLY SCHEME, MSINGA LOCAL MUNICIPALITY, UMZINYATHI DISTRICT MUNICIPALITY, KWAZULU-NATAL

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Declaration of Consultants independence

I, Gary Trower, am an independent consultant and have no business, financial, personal or other interest in the proposed development project in respect of which I was appointed to do a palaeontological assessment other than fair remuneration for work performed. There are no circumstances whatsoever that compromise the objectivity of this specialist performing such work.

Gary Trower

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1. Introduction

In terms of the National Environmental Management Act 107 of 1998, Section 38 (8) of the National Heritage Resources Act 25 of 1999, and the KwaZulu-Natal Heritage Act 4 of 2008, all aspects of cultural heritage are protected and proposed developments that are likely to impact on any and all facets of heritage (i.e. historical, archaeological, palaeontological & cosmological) require a desktop study and/or field assessment in order to gauge the nature of potential heritage resources and to ensure that such resources are not damaged or destroyed through the activity which threatens them. If the observed heritage resources are ranked as highly significant and the proposed site layout cannot be rearranged or shifted to a more suitable location, mitigation measures may be necessary and scientific researchers should be given the opportunity to excavate the site and recover as much of the material as possible.

Due to increased water requirements in the region, and the fact that the old pipeline network has fallen into disrepair, the uMzinyathi District Municipality has commenced with a project to upgrade the water pipeline infrastructure in the KwaKopi Area, just south of Tugela Ferry. This water supply scheme will comprise of a borehole with pump station; water treatment works; three new reservoirs; 66km of reticulation pipes ranging from 20-200 mm; and 10km of ductile iron raisings mains ranging from 100-150 mm to supply water to the reservoirs. This development will for the most part use existing routes where the previous pipeline was buried, with a few exceptions where new extensions will be laid and new reservoirs will be built. The three new reservoirs to be constructed will have a capacity of between 300-350 kL, which along with two existing reservoirs will be fed with potable water from the water treatment works. The specification for the pipeline trench is that it is to be 0.8 m wide and 1.2 m deep, and will cross 17 watercourses. Once completed, this network will provide a reliable potable water supply to the mountainous region between the villages of KwaKopi, Embangweni and Dungamanzi, central KwaZulu-Natal (Figure 1-6).

The area of the proposed development is situated within a region which has a very high palaeo-sensitivity rating; therefore a Phase 1 Palaeontological Impact Assessment was used to ascertain the likelihood of encountering fossil material during construction activities. Fossil material can exist within bedrock or within Quaternary alluvium situated within the floodplains of streams and rivers, so these were the points along the survey that received the most attention. The study was carried out using a combination of Google Earth, geological maps, the SAHRIS PalaeoSensitivity map, a database of all known fossil sites in South Africa, published journal articles of the geology of the region, South African legislation pertaining to heritage, and a thorough field survey.

Figure 1: Satellite view from above showing the layout of the pipeline network, just a few kilometres south of the uThukela (Tugela) River. The vast majority of the water supply scheme will occur atop the mountains between KwaKopi, Dungamanzi and Embangweni. (Modified Google Earth image, AfriGIS, 2019)

Figure 2: Satellite view from the south, looking north. This image clearly depicts the layout of the pipeline in the high-lying areas. The proximity of the pipeline to the prominent uThukela (Tugela) River hints at the likelihood that this territory has been used by the ancestors of humankind since at least the Early Stone Age. (Modified Google Earth image, AfriGIS 2019)

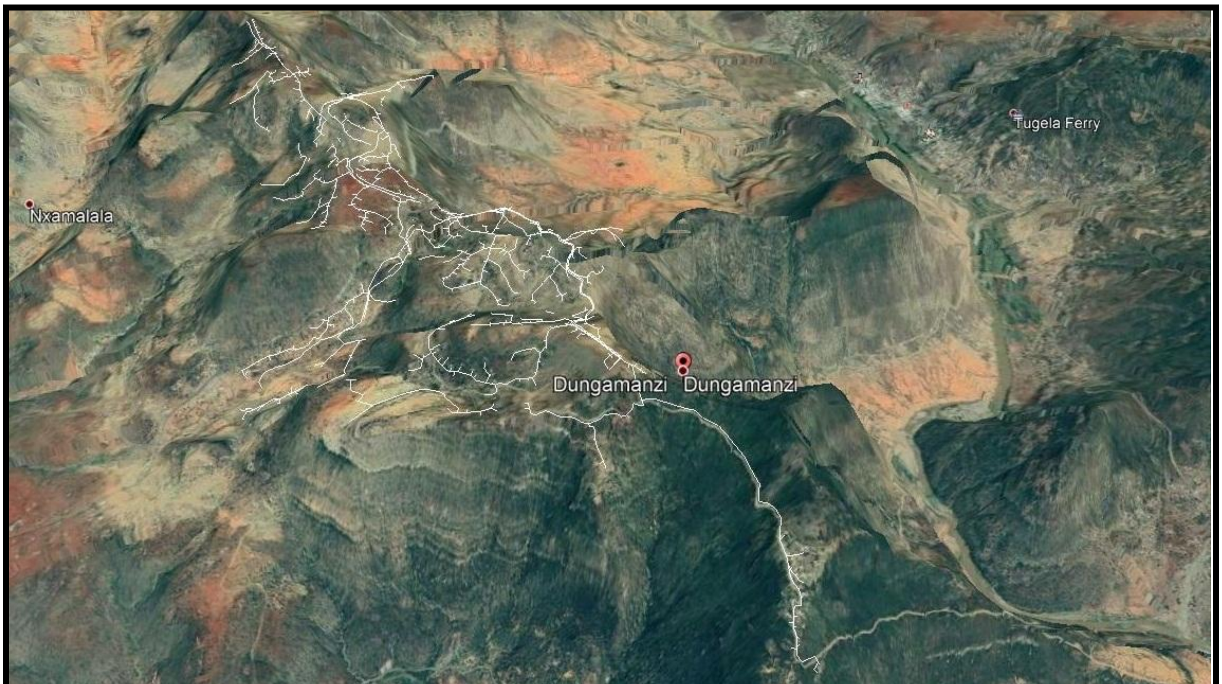

Figure 3: View from the east, looking west: satellite image showing the broader region surrounding the proposed pipeline, with Tugela Ferry visible on the right and Nxamalala on the left. The layout in white indicates the extent of the development and depicts all the branches of the pipeline. North is to the right of the page (Modified Google Earth image, AfriGIS, 2019)

Figure 4: A satellite view of the western arm of the pipeline network. The yellow square indicates the quarry in Fig. 18 where fossils were recorded, and the red arrows point to graves (Fig. 35-37) which were located fairly close to the route of the pipeline. (Modified Google Earth image, AfriGIS 2019)

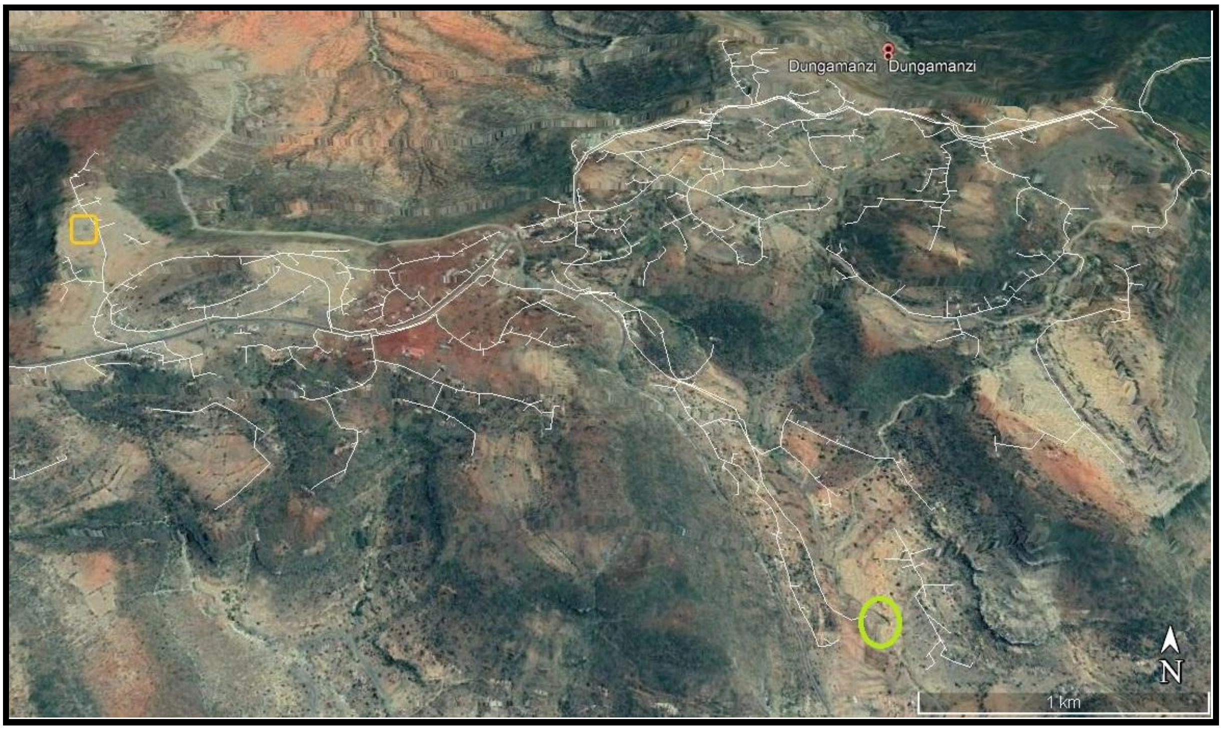

Figure 5: Satellite view of the central portion of the pipeline network. The yellow square indicates the quarry in Figure 18 where fossils were recorded, and the green circle (Fig. 16 & 17) points to the area in the riverbed where pottery and iron slag fragments were photographed, just to the east of the R33 (Modified Google Earth image, AfriGIS 2019)

Figure 6: Satellite view of the eastern section of the pipeline network. The R33 can be seen winding through the mountains in the bottom left corner of the image, with the green circle indicating the stratified riverbank deposits and adjacent archaeological site. (Modified Google Earth image, AfriGIS 2019)

2. Geology

The underlying geology in the area of the proposed pipeline is dominated by Middle Permian deposits of the Ecca Group, more specifically the Vryheid Formation (Figure 7). The existence of terrestrial, fresh water and marine palaeo-ecosystems in the Permian landscape means that plant and other fossils may be present within this geological unit, and this is also the reason why it has a palaeo-sensitivity rating of very high (red). This stratigraphic unit comprises of medium to coarse-grained sandstone, grey micaceous shale and coal. These deposits accumulated along the floor and edges of a giant inland sea which was fed by several rivers draining into the basin. These units form an important component and subdivision of the stratigraphy of the Karoo Supergroup, an extensive inland basin which preserves a rich array of tetrapod fauna which existed through the Permian and Triassic of southern Gondwana (Rubidge 2005, Smith *et al.* 1993). Rocks of the Karoo Basin are therefore rich repositories for palaeontological material, necessitating measures to minimize activities which may disturb or destroy fossils preserved in underlying beds.

When viewing the PalaeoSensitivity map on the SAHRA website (www.sahra.org.za/sahris/map/palaeo, Figure 8 & 9), this area has a very high palaeontological sensitivity rating (red), while other small pockets are given a moderate rating (green). The areas marked with grey have a zero sensitivity rating and represent outcrops of dolerite, representing Jurassic lava that intruded into older rocks approximately 150-180 million years ago (**Jd** on map). Being volcanic, these rocks represent a sterile geological unit in terms of fossil occurences. Considerably younger (< 2.5 million) Quaternary deposits (e.g. alluvium & **Qm**) occur alongside many of the drainage lines of the lower lying areas and include gravel beds; overbank deposits; clay; top soil and colluvium.

Quaternary alluvium in the form of channel and floodplain deposits may harbour archaeological and palaeontological material as water sources such as springs or streams will always attract human and animal activity. Due to its very nature water has the ability to rapidly bury material, giving it a chance to possibly fossilize and be caught between layers as a page in time. The Basic Assessment Report for this project mentions that the pipeline will cross 17 watercourses and that during its construction, one of the key impacts will be "damage to watercourse banks, wetland areas and riparian zones", as well as digging "below the level of the riverbed". Not all of these watercourses contain Quaternary alluvium as the terrain is quite steep, but it is possible that archaeological and/or palaeontological may have been disturbed during work activities within stream beds and along floodplains but was difficult to gauge due to the near completion of the project.

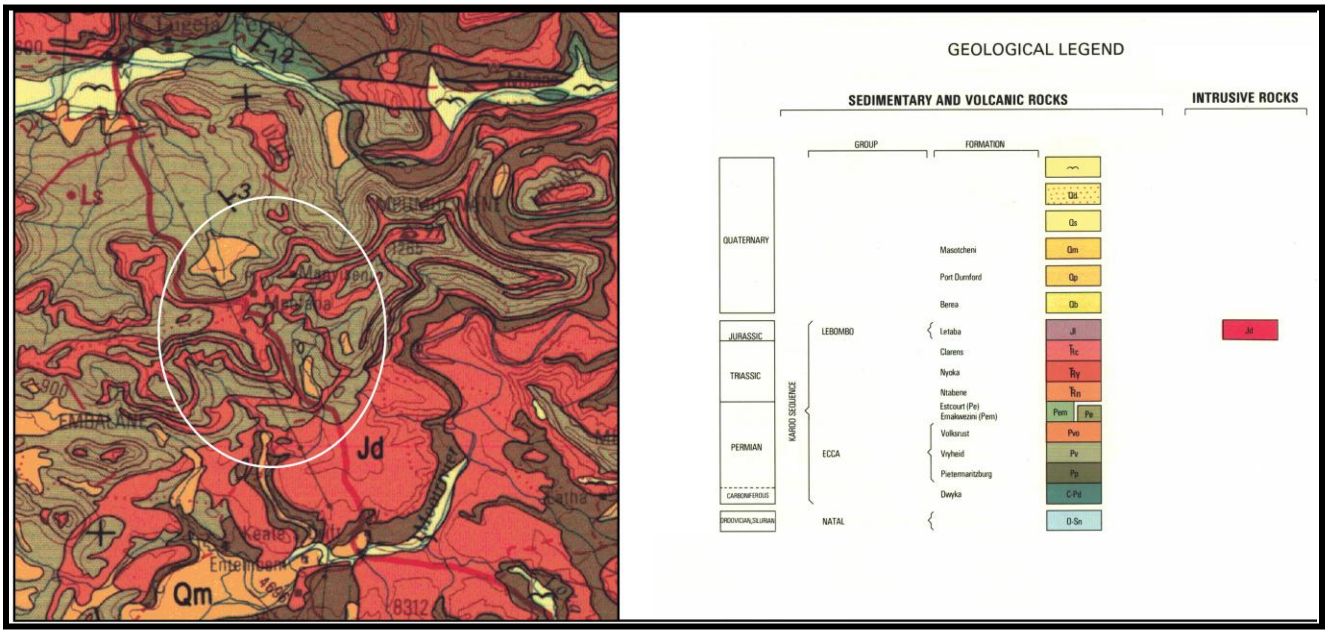

Figure 7: Geology of the region surrounding the proposed pipeline, indicated within the white circle. Large outcrops of intrusive lavas in the form of dolerites (**Jd**) are the most abundant geological unit within the site footprint. The Vryheid Formation (**Pv**) of the **Ecca Group** is also fairly abundant within the landscape. Quaternary deposits occur along several of the large drainages and include the basal boulder bed and yellow-brain sandy clay unit (**Qm**) and Quaternary alluvium. North is at the top of the page (Modified from 2830 Dundee, 1:250 000 Geological Series, Geological Survey, Pretoria, 1988)

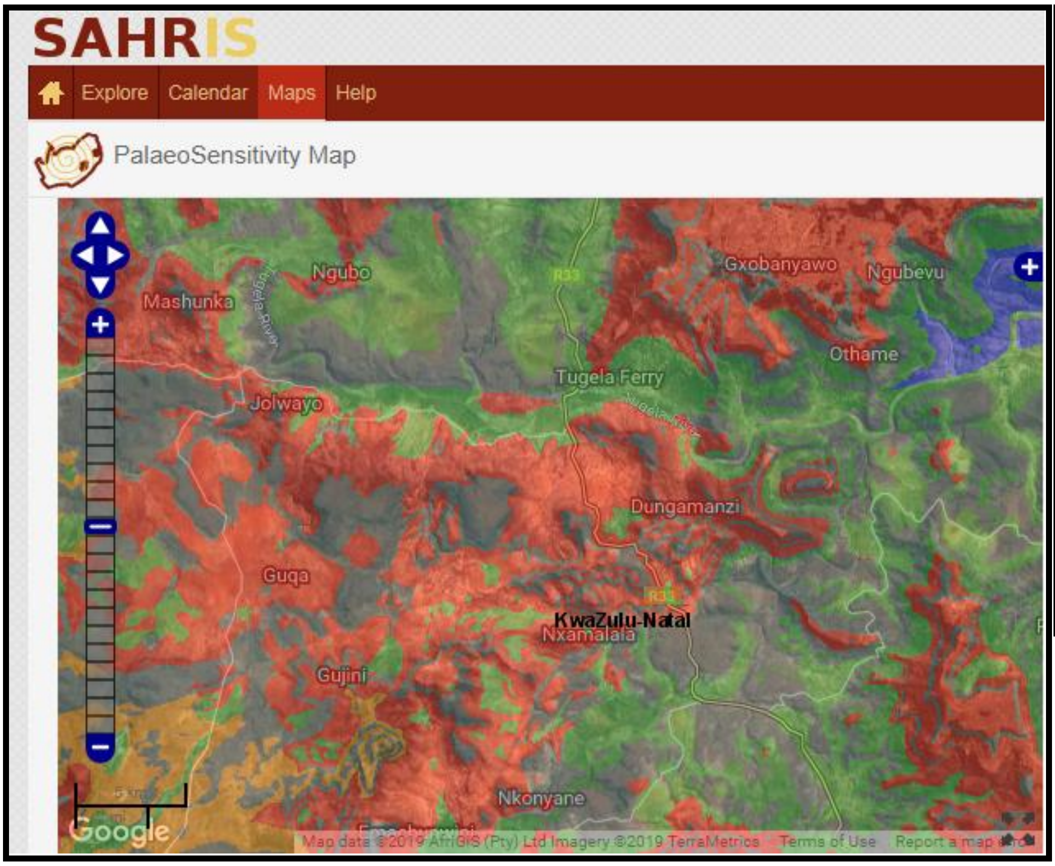

Figure 8: The SAHRA PalaeoSensitivity map, depicting a satellite image of the broader region surrounding the proposed development. Large parts of the pathway of the pipeline occur in a highly sensitive area (red), with small patches of green (moderate sensitivity) and patches of grey (dolerite, non-fossiliferous), which has a sensitivity rating of zero. (Modified from www.sahra.org.za/sahris/map/palaeo)

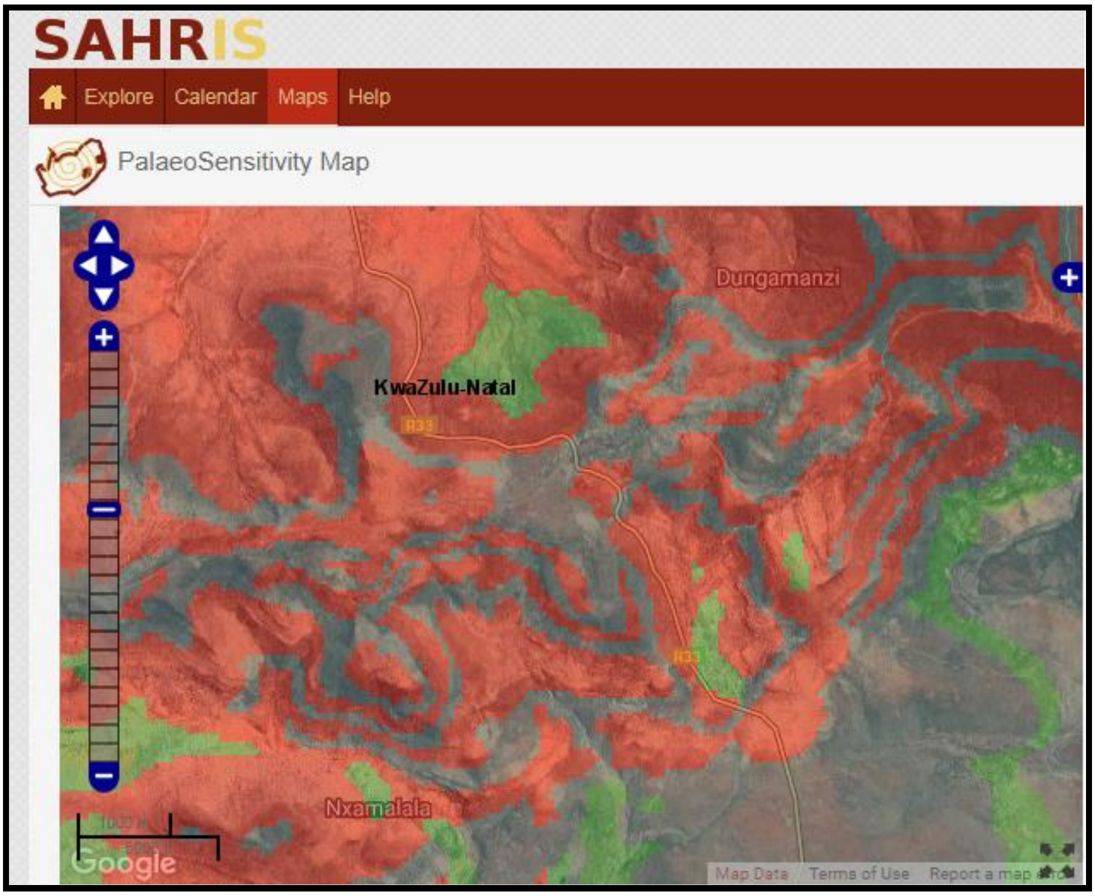

Figure 9: The SAHRIS map depicting a zoomed in view of the area of the proposed development, with the R33 visible running through the middle of it. Large parts of the pathway of the pipeline occur in a highly sensitive area (red), with small patches of green (moderate sensitivity). (Modified from the SAHRA PalaeoSensitivity map, www.sahra.org.za/sahris/map/palaeo)

3. Field observations

The fossiliferous Ecca is partially shielded by overlying younger sediments comprised of a mixture of top soil, decomposed bedrock and colluvium, and some alluvium. If this layer is several metres thick it can function as a kind of buffer protecting underlying palaeo-sensitive rocks from human activity at the surface. During the survey it was noted that this layer of top soil varied in depth but was mostly very shallow or absent due to the mountainous nature of the terrain. These soil surfaces can be very old, but if they include Quaternary deposits they may contain archaeological material such as lithics from the Early to Late Stone Age, as well as evidence of agro-pastoralists due to the fact that humans have been using this landscape for tens of thousands of years.

During the survey it was noted that construction activities were already in an advanced stage of completion and that work had commenced before the PIA was conducted. Several sections of the pipeline had already been laid and earth moving equipment was on site digging new trenches (Figure 10-17). The fact that several of the pipeline extensions had already been laid and covered up made it difficult to gauge the nature of the underlying bedrock that had been exposed during digging activities. In other areas there were still sections of freshly exposed shale piled next to the pipeline route, which were investigated to ascertain the possibility of fossil occurrences. The slabs of shale were dusty and heaped up, making it difficult to get a clear view of exposed rock surfaces which need to be relatively clean to reveal fossil material within them (Figure 10-12).

Figure 10 & 11: Pipeline trenches dug adjacent to the road leading up to iNhlabamkhosi, with piles of shale waiting to be pushed back over the trench once the pipeline has been laid and connected. These piles were examined for traces of fossils, but were dusty and unstable, making them challenging to survey.

Figure 12 & 13: Sections of the pipeline network had already been laid (left), and new trenches were actively being dug and prepared (right). In Fig.12 the bedrock is fossiliferous shale and immediately to the right of this photo is the quarry where the fossils were recorded. In Fig.13 the bedrock is dolerite

Figure 14 & 15: On top of a dolerite hill a construction crew were busy digging the trench leading up to one of the existing reservoirs, which will be replaced with a new 350kL concrete/steel reservoir. Another team of workers was inside the completed section of the trench and were preparing the base of it for the laying of the pipe. The specifications given for the trench is that it is to be 0.8 m wide, but this ditch considerably exceeded that. The reason for this could be because of the fact that this bedrock was non-fossiliferous and caution wasn't needed to be exercised, or because it was maybe a more difficult rock-type to excavate

Figure 16 & 17: To the east of the R33 and adjacent to the Fabeni River, a pocket of Quaternary alluvium was exposed very close to the position of the borehole (left). A stratified sediment package is visible behind the power line pole, which contained archaeological material but no visible fossils. A construction crew were busy with heavy earth moving equipment and were busy digging into the uppermost part of the floodplain deposit, a unit which is likely to contain abundant lithic material

3.1 Palaeontology

Immediately adjacent to the pipeline at GPS coordinates 28° 48' 13.22" S, 30° 27' 10.37" E a quarry-like area was observed (yellow squares in Figure 4 & 5). These rocks have been exposed to the elements for years and have been washed clean of dirt and sand, thereby presenting clear flat surfaces of embedded imprints representing trace fossils in the form of invertebrate burrows, as well as material which appeared to represent fossilized leaves. Throughout the entire survey this was the only patch of rocks which presented a good opportunity to gauge the fossiliferous potential of shales disturbed during pipe-laying operations, and this quarry showed that fossils are abundantly present as correctly predicted by the SAHRIS map. None of the material recorded was rare or exceptional and although invertebrate trails were common, no animal fossils (invertebrate or vertebrate) were observed.

Instances where the path of the pipeline crosses over rivers and/or streams (including riverbed, riverbanks, riparian zones and wetlands), or runs parallel to them within their floodplain zone could potentially pose a risk to buried fossils and/or archaeological material within such areas. The pipeline will cross 17 watercourses where several cubic metres of material will be moved or deposited, with listed and specific activities to be triggered including GNR 327, Listing Notice 1, Activity 12 (a) and Activity 19 (Basic Assessment Report). The mountainous nature of the terrain reduces the chances of alluvium along many of the streams, which generally accumulates in the valleys where it is more open and flat, and the rivers meander.

The artefacts recorded in the floodplain of the Fabeni River close to the R33 proves that archaeological material is present where pockets of Quaternary alluvium survives in this region. Dongas were present on the eastern side of the river, and the river bank was stratified with sediments vastly differing in colour, indicating that the deposits accumulated over a period of time during different climatic regimes. Although archaeologically sensitive, no Quaternary fossils were observed within the younger alluvial deposits, where a section of the pipeline was laid down within the floodplain of the river. The potential exists that fossils are preserved somewhere within these deposits and may have been exposed during this extension of the network, but fortunately most of the pipeline trenches were shallow and only dug into the uppermost younger part of the valley fill sediment package.

Figure 18: The quarry highlighted with the yellow square in Figure 4 & 5, GPS coordinates: 28° 48' 13.22" S, 30° 27' 10.37" E. This area has been exposed to the elements for many years so the surfaces on the rock slabs are clear with lots of detail visible. Several trace fossils were observed, with worm trails being especially common.

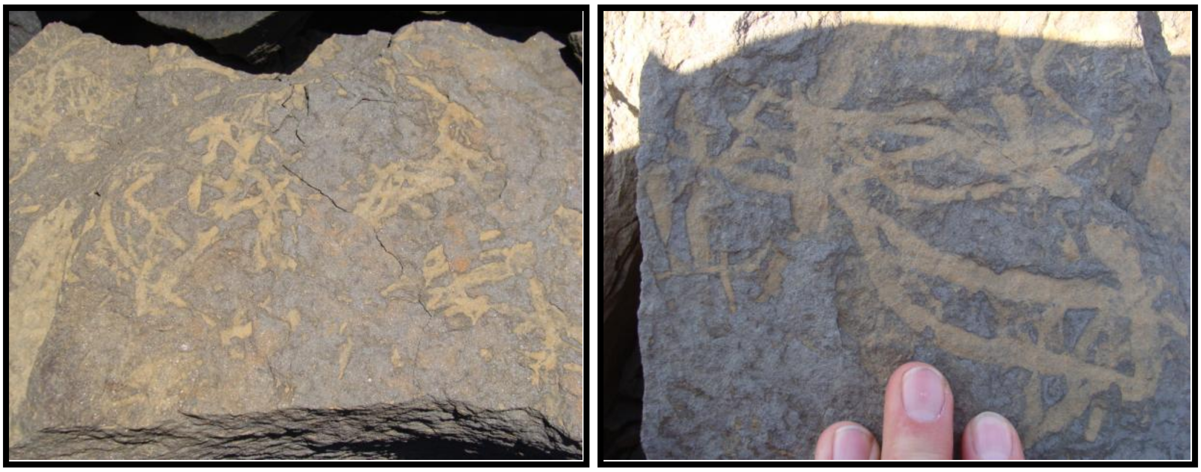

Figure 19 & 20: The tunnels and burrows of invertebrates were visible on several of the rock surfaces in the quarry and appear to represent worm trails, GPS coordinates: 28° 48' 13.22" S, 30° 27' 10.37" E

Figure 21 & 22: Visible on one of the exposed rock surfaces within the quarry area were fossils which appeared to represent the imprints of fossil leaves. GPS coordinates: 28° 48' 13.22" S, 30° 27' 10.37" E

3.2 Archaeology

During the survey, three locations were recorded where stone tools were present. The first site was located at GPS coordinates 28° 48' 03.31" S, 30° 27' 04.44" E and comprised of a partial lower grindstone. It was in its current position due to the creation of the pipeline trench and was resting amongst other rocks (Figure 23). It was broken and had low-medium use wear damage on its grinding surface. The second archaeological occurrence was along the river, where an abundance of artefacts was visible. On the very edge of the floodplain a single large flake with a facetted platform was recorded, indicating that it likely originates from the MSA as this method of flaking was not used in the LSA (Figure 24, GPS coordinates 28° 49' 12.00" S, 30° 29' 05.76" E. Whilst walking across the floodplain to where the back-actors were digging the trench, a single thumbnail scraper was observed (Figure 25, GPS coordinates 28° 49' 11.70" S, 30° 29' 07.26" E).

On the eastern side of the stream several dongas were exposed which contained stratified floodplain deposits (Figure 16). These were surveyed in order to ascertain whether any

Quaternary fauna had preserved within this pocket of valley alluvium, but no fossils were recorded. Pottery fragments were observed which could be a few hundred years old or could date back to the Iron Age (Figure 26, 27 & 29, GPS coordinates 28° 49′ 08.98″ S, 30° 29′ 11.42″ E). Several of the larger pieces appeared to refit, representing a large section of a pot that had survived and was confined to a small area (Figure 27). A few pieces of iron slag were also noted within the dongas (Figure 28). The third archaeological site comprised of several LSA flakes and tools, including numerous adzes and scrapers (GPS coordinates 28° 48′ 52.20″ S, 30° 26′ 57.31″ E, Figure 30-34). These tools appear to represent wood-working activities, although some of them could have been used for working animal hides. The current vegetation growing on the mountain slopes and within the valleys includes numerous trees and bushes, and early man may have sought out such a resource for producing tools such as spears, bows, or digging sticks, thereby leaving behind the stone implements which were most suited to shaping them.

In terms of graves, there are several points where the path of the pipeline comes within metres of graves, and it is always important to maintain a sufficient buffer zone around these culturally sensitive features (GPS coordinates 28° 48′ 48.52″ S, 30° 26′ 58.33″ E, Figure 35-37). Although graves are mostly easily recognizable due to the dolerite boulders packed on them, the engineers will need to be cautious in the case where graves are many decades old and have become overgrown with aloes and small trees, making them less recognizable amongst established vegetation.

Figure 23: A badly damaged lower grindstone. It was lying amongst a pile of dolerite boulders that had been piled up adjacent to the pipeline trench. The grinding surface revealed a low-medium use wear

Figure 24 & 25: A MSA flake with facetted platform (left) & a thumbnail scraper (right), found within the floodplain of the Fabeni River

Figure 26 & 27: A survey of the dongas found east of the borehole revealed abundant pottery fragments, several of which appeared to refit and were confined to a small area. Although these may be a few hundred years old, iron slag fragments found close to the ceramics seem to suggest it could be Iron Age material


Figure 28 & 29: A fragment of iron slag (left) & two pottery fragments (right), also part of the archaeological material preserved within the Quaternary alluvium of the Fabeni River


Figure 30 & 31: Multiple flakes and stone tools were spread across several metres of a mountain slope, right in the direct pathway of the pipeline. These were out of context and due to the fact that the soil is so shallow on the slopes, it was difficult to pinpoint exactly where they originated from. A blade or knife is visible on the left and an adze is displayed on the right

Figure 32, 33 & 34: Along a section of the mountain slope, several LSA tools were encountered which seemed to suggest some form of wood-working activity. An adze has a typical steep-sided, chisel-like edge, which is ideal for stripping bark off stems and shaping wood with a chiselling-rasping action. The circular shape of the tool depicted in Fig 33 is ideal for shaping a branch into a bow or spear. The mountains in this region are covered with bushes and trees and early humans occupying the landscape may have sought out species of tree growing on the slopes, leaving their wood processing tools behind. Scraping tools such as these can also be used for shaving layers of tissue off animal skins in order to prepare them for tanning

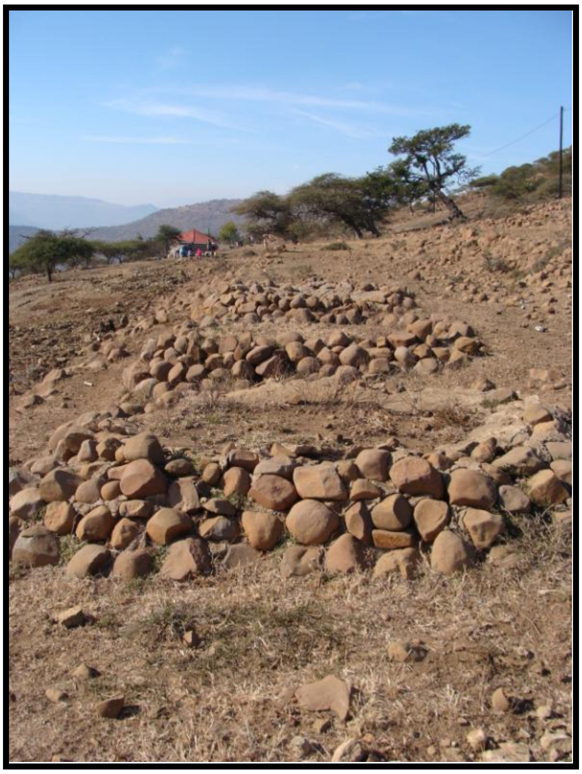

Figure 35, 36 & 37: Several graves were recorded that were fairly close to the route of the pipeline. Fortunately these were easily recognisable by the technique of covering them with dolerite boulders, but older graves that are overgrown with vegetation may be more difficult to recognise.

4. Contingency plan for possible fossil discoveries: chance-find protocol

Based on the work of Almond *et al.* (2009) and Groenewald *et al.* (2014) and summarised on the SAHRIS website (www.sahra.org.za/sahris/map/palaeo), if a development occurs within a red zone a desktop study is required, as well as a phase 1 Palaeontological Impact Assessment (PIA) comprising a field survey and recording of fossils. A phase 2 PIA is also required, which entails the rescue of fossil material during construction activities, as well as the compulsory application for a collection and destruction permit. If the development occurs in an orange zone, a desktop survey as well as a phase 1 PIA comprising of a field survey and collection of fossils is compulsory. A prior application for a collection permit is therefore recommended and a phase 2 PIA may be necessary during the construction phase of the project. If the development occurs in a green zone, a desktop survey as well as phase 1 PIA comprising a field survey is recommended. Lastly developments which occur in a blue or grey zone may require a desktop survey, based on the known heritage sites in the area as well as the nature of surrounding geological units.

As explained above, the likelihood that fossils were exposed during the laying of the pipeline is very likely. The normal procedure for recovering palaeontological material would be to identify areas which are dense in fossils and whose recovery and preparation could address certain scientific questions. The process would then entail obtaining permission from the landowner/s and applying to SAHRA (South African Heritage Resources Agency) or another provincial heritage agency for a collection permit to excavate or remove blocks of bedrock for preparation in the lab. This is a slow and time-consuming process which requires the skills of a field palaeontologist to spot worthy material within geological exposures, and skilled fossil preparators who can successfully recover fossils from sediment or slabs of bedrock. But in the case of developments fossils may be exposed which were not being targeted as a part of a formal scientific investigation, which then requires intervention to ensure they are evaluated and possibly recovered. In this way, construction activities can provide an opportunity for scientists in that sediments or bedrock will be exposed which otherwise would be hidden from view and would have been costly to excavate.

Heritage consultants such as archaeologists and palaeontologists are required to evaluate proposed development sites in the hope of recording and/or recovering important objects and artefacts before they are damaged or destroyed, but during the entire timeline of a construction project a palaeontologist conducting a Phase 1 or Phase 2 PIA is generally only on site for a few hours. Having an archaeologist and/or palaeontologist on site to examine every scoop of a back actor/JCB would be very costly and impractical, so additional site visits may be required for certain large-scale projects, or developments in highly sensitive areas.

If fossils are unearthed during the rest of the project timeline when no heritage consultants are on site to give a positive confirmation of the material in question, they may be difficult for the on-site layman to identify as many geological formations superficially resemble palaeontological material. Pseudo-fossils and certain mineral deposits often form into a variety of shapes which may closely resemble plant and animal fossils, making it more difficult for laypersons to positively identify chance finds in the field. Furthermore, it is not the responsibility of site workers to keep an eye out for heritage objects, neither are they likely to have had the appropriate training on what to look for.

The probability of on-site foremen or construction workers operating heavy earth moving equipment and working to a strict time schedule spotting heritage objects amongst tons of bedrock or sediment is unlikely but nonetheless possible. The Faddan More Psalter of Ireland, an illuminated vellum manuscript dating back to the 8th century, was spotted in exactly this manner by an observant JCB operator digging through tons of peat in 2006. He immediately halted digging operations and contacted the relevant heritage experts, who were able to recover and eventually curate the very rare manuscript. Even within South Africa, many important archaeological and palaeontological discoveries have been made during construction projects and companies can play their part by following the law and making the effort to report heritage resources which have been unearthed during digging operations. In so doing, developers can improve their public image and potentially contribute to a rare fossil or object reaching a museum or tertiary institution where it can studied and eventually displayed to the public as heritage belongs to the entire nation and should be preserved as best as possible.

If by chance fossils were discovered which were not anticipated based on the opinion of a PIA report, construction activities would have to immediately cease and a protocol should be followed whereby the relevant provincial or national heritage custodians in the relevant province would need to be informed. Developers would also need to acquire the services of a suitably qualified palaeontologist to conduct a further field assessment in order to rank the significance of the discoveries. If anything relevant is observed, mitigation measures may be necessary and an application for a collection permit may be required. A Phase 2 PIA will be necessary so that scientists can be given the opportunity to record and/or recover fossil specimens if they are ranked as significant and likely to make a positive contribution to the field of palaeontology.

5. Assumptions and limitations

According to the amended 2017 EIA regulations, various assumptions and limitations need to be stated when reporting on proposed developments. The professional opinion given in this PIA report is based on the results of a field survey, which was used to gauge the fossiliferous potential of the bedrock exposed during digging operations. Field observations are based on recording palaeontological and/or archaeological material which is eroding out or visible on the surface. As many developments require a degree of digging down into the soil and/or underlying stratigraphy, heritage objects will only be exposed once they have been disturbed from their original positions. In this case, if fossils were exposed during digging operations they were again covered up, rendering them hidden from the assessor during the ground survey.

The results reported herein are based upon a thorough field survey and careful scrutiny of the best available maps and data sets, and all attempts were made to take a holistic, informed decision. Certain predictions about the likelihood of encountering fossils were based on all available evidence, and may prove to be less or more likely than anticipated. An examination of all fossil databases for South Africa housed at the Evolutionary Studies Institute at Wits University revealed that there are no fossil records from this region, although this does not mean that they are not present but rather that insufficient scientific research has been carried out. It is therefore probable that more fossils were present somewhere along the route of the proposed pipeline but were hidden from view due to their buried nature.

A key assumption is that the geological maps used for such reports are accurate and up to date, which may not be the case as most of them were compiled several decades ago. Since then there has been a refinement and revision of the geological model through new scientific research, yet the original maps are still widely used by PIA practitioners. A further limitation with these large scale maps (1:250 000) is that smaller outcrops of fossiliferous bedrock may not be indicated within the presented geological model. In addition, several potentially fossiliferous outcrops may have been weathered and eroded over millennia, buried under younger deposits in the form of alluvial and colluvial sediments, or capped by topsoil.

Palaeontologically-sensitive bedrock may have also been metamorphosed through its contact with intrusive lavas, damaging or destroying fossil specimens along the contact zone.

Furthermore, it is assumed that the developers will respect the guidelines set out in the laws of South Africa with regards to good environmental management practices and policies, and will immediately cease all construction if any fossiliferous material is discovered. It is also assumed that developers will practice integrity and embrace an unwavering mind-set with regards to respecting and protecting all aspects of heritage, including due consideration for the fact that such objects cannot simply be sacrificed to meet project deadlines.

6. Conclusion

Fossils do occur within the sedimentary rocks of the site footprint but were not easy to locate due to their buried nature. Some fossils are very likely to have been disturbed or damaged along the route of the pipeline, and those that were recorded during the survey were not rare or highly significant. Although the basal sediments of the Karoo Basin do contain important fossil material, as a general rule these are less significant than fossils from much later deposits in the geological sequence. Fortunately the underlying bedrock along large sections of the route of the pipeline is dolerite, a non-fossiliferous volcanic rock. Furthermore, the pipeline network is (to a large degree) following the layout of a previously installed pipeline, meaning that the ground and bedrock has already been dug up during the construction of this older network.

Based on the observations of the field survey, the pipeline network is well on the way to completion and the amount of meaningful fossil material that was exposed during the construction process is hard to gauge but was probably minimal. The purpose of a PIA is not to halt development activities, but instead to examine the site footprint and to assist by recording and potentially rescuing something important or meaningful that will be likely damaged or destroyed during construction activities. There is a method to this process, which is best conducted before the projects commences, not once it is almost complete.

The ground survey confirmed the existence of fossils, Later Stone Age lithics, Iron Age ceramics and iron slag, and modern graves within the site footprint. All of the archaeological and palaeontological material recorded during the survey was disturbed and out of context, and nothing observed was particularly rare or scientifically significant. There is therefore no reason (from a palaeontological perspective) as to why this project should not continue to completion. Many households in the region will benefit from the improved water supply scheme, providing visible service delivery and uplifting the standard of living in the area.

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3) Evolutionary Studies Institute fossil collection database

4) KwaZulu-Natal Heritage Act 4 of 2008

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