

APPENDIX 2

ARCHAEOLOGICAL IMPACT ASSESSMENT: PROPOSED GAS-FIRED INDEPENDENT POWER PLANT TO SUPPORT SALDANHA STEEL AND OTHER INDUSTRIES IN SALDANHA BAY, WESTERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act No 25 of 1999)

Case Number: 16041107AS0425E

Prepared for:
ERM South Africa (Pty) Ltd
On behalf of:
ArcelorMittal South Africa



July 2016
Revised September 2016

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EXECUTIVE SUMMARY

Site Name

ACO Associates cc has been appointed by Environmental Resources Management Southern Africa (ERM) on behalf of the client, AcerlorMittal South Africa, to undertake a Heritage Impact Assessment for the proposed gas-fired power plant to be constructed adjacent the AcerlorMittal Steel Works in Saldanha Bay, Western Cape.

A NID application was submitted to Heritage Western Cape, and their response, dated 6 May 2016 requires an integrated Heritage Impact Assessment comprising the following studies:

- Impacts to Archaeological heritage resources
- Impacts to Palaeontological heritage resources

This report constitutes the Archaeological Specialist Report.

Description of Proposed Development

Survey

Field surveys were conducted by Webley, Halkett and Robinson on the 13th June 2016 and by Webley, Halkett, Robinson and Avery on the 22 June 2016.

Archaeological Resources Identified

- Two silcrete flakes and a fragment of ostrich eggshell were found along the proposed pipeline route, and one chunk of quartzite was found on the Site B location for the power plant.

Anticipated Impacts on Archaeological Resources

- No impacts are anticipated on archaeological resources.
- In a background assessment of the archaeology of the Saldanha Bay area, Hart (2015b) concludes: *"The study area is one of the best studied yet least significant tracts of landscape in the Western Cape in archaeological terms"*.

Cumulative Impacts

A number of developments have taken place and/or are planned in the immediate vicinity of the proposed gas-fired power plant and pipeline. Archaeological Impact assessments conducted over the last decade have confirmed that the probability of recovering archaeological remains is low, the significance of the archaeological remains is very low and that no further mitigation is required (see Figure 5 in Appendix 2). The cumulative impact of the proposed development on archaeological resources is negligible.

Recommendations

This archaeological specialist report has not identified any impacts to archaeology and the development may proceed.

- If any human remains are uncovered, particularly along that stretch of the coastline close to Saldanha Bay, then work must stop in that area, and Heritage Western Cape must be notified immediately (Tel: 021 483 9685);
- Should any significant archaeological or palaeontological material be uncovered during construction work, then further mitigation may be required. Additional work would need to be conducted under a Workplan (rather than a permit) in terms of Section 38(10) of the NHRA.

Authors and Date

Halkett, David
Robinson, Jess
Webley, Lita

SPECIALIST DECLARATION

I, Lita Webley, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offense in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Signature of specialist

A handwritten signature in black ink that reads "L. E. Webley". The signature is written in a cursive style with a long, sweeping tail on the letter 'y'.

Specialist Field: Archaeology and Heritage

Name of Company: ACO Associates

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

| Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6 | Cross-reference in this report |
|--|---|
| (a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae; | Lita Webley CV attached |
| (b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Specialist declaration Page 3 |
| (c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 3 |
| (d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment; | 14 & 22 June 2016. Season has no impacts on heritage |
| (e) a description of the methodology adopted in preparing the report or carrying out the specialised process; | Section 5 |
| (f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure; | Section 8 |
| (g) an identification of any areas to be avoided, including buffers; | Section 8 |
| (h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Figure 6 |
| (i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 5 |
| (j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment; | Section 7 |
| (o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | None |
| (p) any other information requested by the competent authority. | Letters from registered conservation bodies and municipality - attached |

| Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 3 - Environmental Impact Assessment Process | Cross-reference in this report |
|---|--|
| Describe any policies or legislation relevant to your field that the applicant will need to comply with. | National Heritage Resources Act, No 25 of 1999 |
| Comment on need/desirability of the proposal in terms your field and in terms of the proposal's location. | Section 2 |
| Determine the-- (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and (ii) degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated; | Section 8 & 9 |
| Determine what the most ideal location within the site for the activity is in terms of your field. | Section 11 & 12 |
| Identify suitable measures to avoid, manage or mitigate identified impacts. | Section 9 |
| Identify residual risks that need to be managed and monitored. | Section 8 & 9 |
| Include a concluding statement indicating a preferred alternative in terms of your field. | Section 11 & 12 |

GLOSSARY

Archaeology: Remains resulting from human activity which is in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Early Stone Age: The archaeology of the Stone Age between 700 000 and 2500 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 Western Cape: The compliance authority which protects national heritage in the Western Cape.

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

Late Stone Age: The archaeology of the last 20 000 years associated with fully modern people.

Middle Stone Age: The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.

National Estate: The collective heritage assets of the Nation

Palaeontology: Any fossilised remains or fossil trace of animals or plants which 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.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Structure (historic:) Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Acronyms

| | |
|-------|---|
| DEA | Department of Environmental Affairs |
| ESA | Early Stone Age |
| GPS | Global Positioning System |
| HIA | Heritage Impact Assessment |
| LSA | Late Stone Age |
| MSA | Middle Stone Age |
| NHRA | National Heritage Resources Act |
| SAHRA | South African Heritage Resources Agency |

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1. INTRODUCTION

ACO Associates cc was appointed by Environmental Resources Management Southern Africa (ERM) on behalf of the client, AcerlorMittal South Africa, to undertake a Heritage Impact Assessment for the proposed gas-fired power plant to be constructed adjacent the AcerlorMittal Steel Works in Saldanha Bay, Western Cape (Figure 1).



Figure 1: The location of Site A (yellow polygon) and Site B (turquoise polygon) for the proposed power plant and the pipeline (in black) to Saldanha Bay. The proposed power plant will be directly adjacent the Blouwater Substation and less than 1km from the ArcelorMittal Steel Works. Note the dark blue line indicates the access roads and the green lines are the existing powerlines from the Blouwater substation to the Aurora substation, close to Hopefield.

2. DEVELOPMENT PROPOSALS

In order to ensure the requirement for stable, economical electricity over the long term, it is proposed to construct a 1507 MW Combined Cycle Gas Turbine (CCGT) power plant adjacent to the AcerlorMittal Saldanha Steel site.

2.1 Pipeline

CNG and LNG will be supplied by ship to the Port of Saldanha where it will be offloaded by a submersible pipeline either from a mooring area located offshore or a berthing location in the Port of Saldanha. The LNG pipeline (re-gasified gas) and servitude will run from the pipeline entry point connecting to the power plant boundary. There is proposed to be a gas and sea-water forwarding station at the start of the land-based pipeline system. There will also be a gas and sea-water receiving station at the Power plant.

The gas pipeline will be buried to a depth of 3 to 4m, cover a servitude width of approximately 15-20m and be approximately 3 900m and/or 4 600m in length. Exact dimensions will be determined by the contractor after geotechnical and walk-down inspection and the contractor's own

calculations and risk assessment. The pipeline will be installed underground and this implies the opening of a working strip along the right of way of the pipeline.

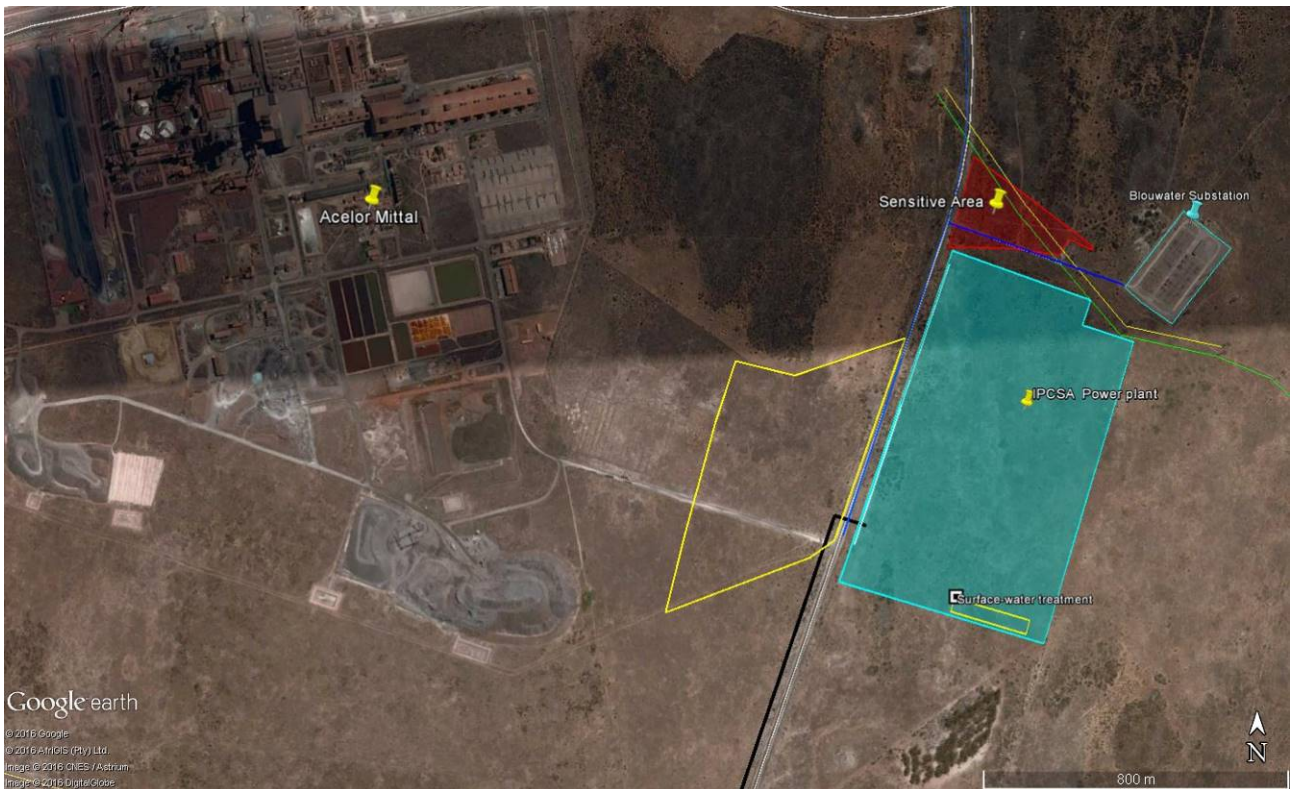


Figure 2: The proposed position of the power plant (Site A in yellow and Site B in turquoise) in relation to the Blouwater substation and the AcerlorMittal steel works.



Figure 3: The route of the proposed pipeline.

2.2 Power Lines

A feeder line of 132kV (sized for a capacity of 400MW), will take the power from the power plant to the AcelorMittal Steel Works. Any additional power generated at the plant will be evacuated through the construction of a new 22km High Voltage (440kV) line from the power plants own switch yard to the existing Aurora substation, following the existing Blouwater to Aurora 132kV feeder servitude.

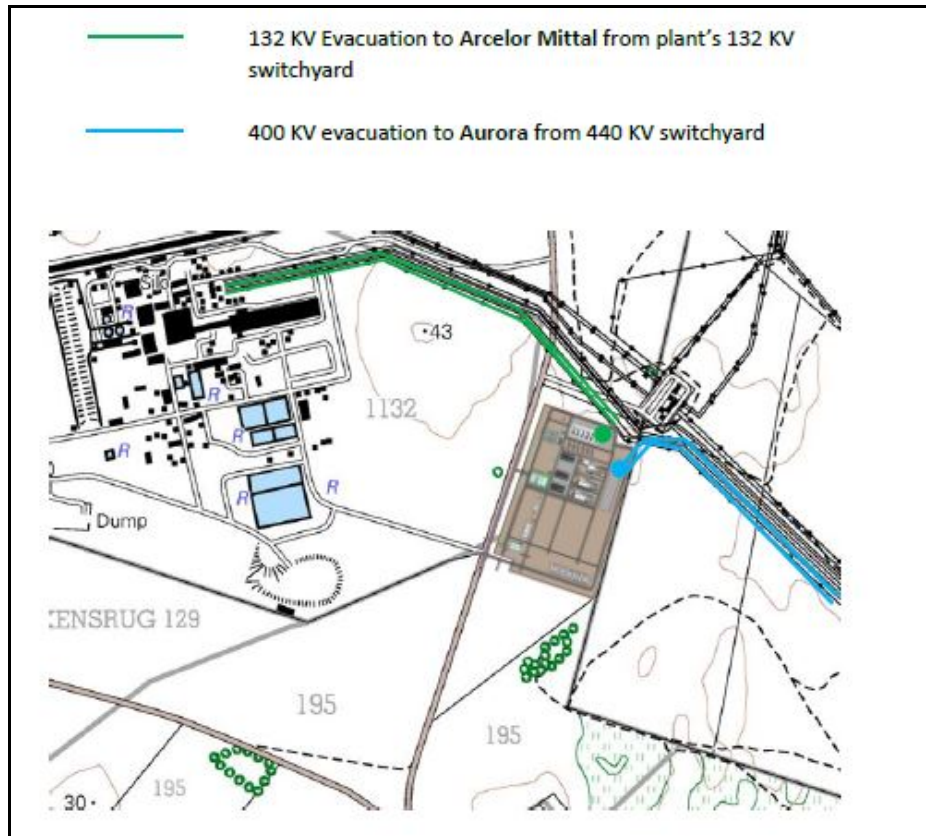


Figure 4: The new 132kV powerline from the power plant to the AcelorMittal Steel Works is indicated in green. The blue line from the Blouwater substation to the Aurora substation follows an existing servitude.

2.3 Ancillary Facilities

In addition, the project will include the following facilities:

- Access road to site;
- 132kV and 400kV switchyard;
- Control and electrical building;
- Central control room, warehouse and administrative buildings;
- Firefighting systems;
- Fuel/gas/diesel storage facilities;
- Emergency backup generators;
- Chemical storage facilities.

The proposed project will be implemented in two phases. Phase 1 will include the installation of five open cycle Siemens Industrial Trent 60 gas turbines, with a further two turbines installed in Phase 2.

2.4 Location Alternatives

ArcelorMittal considered two alternative sites for the development of the gas-fired power plant based on proximity to the existing ArcelorMittal Steel Works site. Other considerations included land availability and zoning status, distance from the existing power transmission infrastructure, vegetation sensitivity, access to the site and proximity to residential areas. Site A is adjacent the steel works, while Site B is across the road from the steel works. The Site A property is smaller than Site B and does not allow for future expansion. There is easier access to Site A than Site B.

The No-Go Alternative would mean that the project does not go ahead. In this case there would be no impact associated with the project. However, the No-Go Alternative would almost certainly mean that Saldanha Steel would no longer be financially viable and would have to shut down, leading to major negative socio-economic consequences to both the Saldanha and the wider Western Cape and South Africa.

3. TERMS OF REFERENCE

- Collect secondary data on the occurrence and distribution of heritage, archaeological and palaeontological sites in the project area;
- Legal review, including local regulatory requirements, IFC Performance Standards and other relevant local and international regulations, including permit requirements;
- Survey the project affected area (including pipeline routes), identify and describe sites of interest;
- Explain how the different elements of the project may affect any heritage sites within the project area;
- Evaluate the potential impacts on sites of interest;
- Assess cumulative impact of development with current and planned developments in the area;
- Describe mitigation/management measures that may be implemented to avoid or reduce any negative impacts on these sites and enhance benefits of the development;
- Provide recommendations for any ongoing monitoring that may be necessary, limitations of the study and indicate any additional studies that may be required, if any;
- Liaise, submit and follow-up on all relevant permits, project applications and associated documents to Heritage Western Cape, as required. Provide a description of the permit application process.

4. HERITAGE LEGISLATION

This report is conducted in terms of Section 38 (8) of the National Heritage Resources Act, No 25 of 1999 (NHRA).

The NHRA provides protection for the following categories of heritage resources:

- Landscapes, cultural or natural (Section 3 (3));
- Buildings or structures older than 60 years (Section 34);
- Archaeological Sites, palaeontological material and meteorites (Section 35);
- Burial grounds and graves (Section 36);
- Public monuments and memorials (Section 37); and
- Living heritage (defined in the Act as including cultural tradition, oral history, performance, ritual, popular memory, skills and techniques, indigenous knowledge systems and the holistic approach to nature, society and social relationships) (Section 2 (d) (xxi)).

Since the project is subject to an Environmental Impact Assessment, Heritage Western Cape (HWC) is required to provide comment on the proposed project in order to facilitate final decision making by the Department of Environmental Affairs and Development Planning (DEA&DP).

4.1 Archaeology & Palaeontology (Section 35(4))

No person may, without a permit issued by HWC, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite.

Archaeological is defined as: “material remains resulting from human activity which is in a state of disuse and is in or on land and which is older than 100 years, including artefacts, human and hominid remains and artificial features and structures”.

Palaeontological is defined as: “any fossilised remains or fossil trace of animals or plants which 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”.

4.2 Burial grounds and graves (Section 36(3))

No person may, without a permit issued by the South African Heritage Resources Authority (SAHRA), destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority.

4.3 Grading

The South African heritage resources management system is based on grading, which provides for assigning the appropriate level of management responsibility to a heritage resource.

Table 1: Grading of Heritage Resources

| Grade | Level of significance | Description |
|-------|-----------------------|---|
| I | National | Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources. |
| II | Provincial | Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources. |
| IIIA | Local | Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3a heritage resources. |
| IIIB | Local | Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3b heritage resources. |
| IIIC | Local | Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3c heritage resources. |

The grading of heritage sites, as prescribed in the NHRA, is only concerned with categories I, II and III. The subdivision of Grade III sites was introduced in the Western Cape and is used in this report.

A Notice of Intent to Develop (NID) was submitted to HWC and their comment is attached to the Heritage Impact Assessment as Annex A.

5. METHODOLOGY

5.1 Background Literature study

The construction of the Port of Saldanha Iron Ore Terminal in the 1970's has seen increased industrialisation of the area culminating in formal designation of this area as an Industrial Development Zone (IDZ) supported at both Provincial and National level. The fact that Saldanha has become an important development node has resulted in numerous EIAs commissioned for both industrial and residential development. In many instances these studies were carried out on speculative future uses for the land which never reached fruition. The heritage of this area has become quite well understood. Hart (2015a & 2015b) has undertaken at least two recent desktop literature reviews of the area, and the background information on the area is therefore easily accessible.

In addition, a background search of published material, online material and other commercial (CRM) projects in the area was made via the South African Heritage Resources Information Systems (SAHRIS) database.

5.2 Field Survey

The polygon of the proposed development was provided to ACO Associates. The sites were surveyed by Halkett, Webley and Robinson on the 14th June 2016 and Avery accompanied the archaeologists on the 22nd June 2016. Transects were walked across the study area looking for heritage remains. All sites and features were photographed and recorded and their positions taken with a hand-held Garmin GPS receiver set to the WGSS84 datum.

5.3 Assumptions and Limitations

It is important to emphasise that our survey was only able to identify above ground heritage resources. There may be archaeological sites (as well as human remains) buried beneath the topsoil. We are of the opinion that this is not a significant limitation as it can be managed through the inclusion of a chance find procedure in the ESMP.

6. RECEIVING ENVIRONMENT/BASELINE

The study area is flat and without any rocky foci or outcrops that may have attracted pre-colonial settlement. It is covered with low, knee-high vegetation. The area is undeveloped and generally undisturbed with a number of informal roads criss-crossing the dunes. Calcrete is visible on the surface in areas. The local built environment is mostly modern, with the majority of buildings close to the study area being industrial in nature.



Plate 1: The pipeline comes ashore in an area which has already been extensively transformed.



Plate 2: The vegetation along the first 900m of the pipeline, from the entry point at Saldanha Bay, is extremely dense and visibility is difficult.



Plate 3: Visibility is good in the area of the proposed power plant (Site B) as it is used for livestock grazing. Note that the calcrete is close to the surface, and is exposed in places.



Plate 4: View towards Site A in the foreground, at the AcelorMittal Steel Works in the background.

6.1 Archaeological Background

There have been numerous field assessments of the Saldanha Bay area during the course of the last 20 years (Figure 5). Kaplan (1996) recorded a scatter of MSA and LSA stone artefacts during his survey for the proposed Saldanha Steel facility. Orton (2011) noted, during his survey for the Isivunguvungu Wind Farm to the south of the ArcelorMittal steel plant, that no significant archaeological remains were recovered. In 2011, Orton conducted a detailed survey of the farms Uyekraal 189/1 and Langeberg 187/4 which lie to the north of the study area and which share similar physical characteristics. Despite an extensive survey, no archaeological material of any kind was located on the surface. Orton (2013) undertook a further survey for a possible pipe line for the Mass Oil and Gas Services (MOGS) and reported finding a single calcrete flake of unknown origin. Both Kaplan (1996) and Orton (2011 & 2012) considered the archaeological significance of the area to be very low.

Hart (2015a) concludes: “All studies to date that have taken place on the flatlands/coastal plain to the north of Saldanha Bay have reported a lack of archaeological sites but high palaeontological sensitivity”. In another report for the Saldanha Bay area, Hart (2015b) concludes: “*The study area is one of the best studied yet least significant tracts of landscape in the Western Cape in archaeological terms. It must however, be pointed out that the area of low sensitivity is a very specific area of the West Coast adjacent to a low energy beach where marine resources were few – namely the northern shore of Saldanha Bay*”.

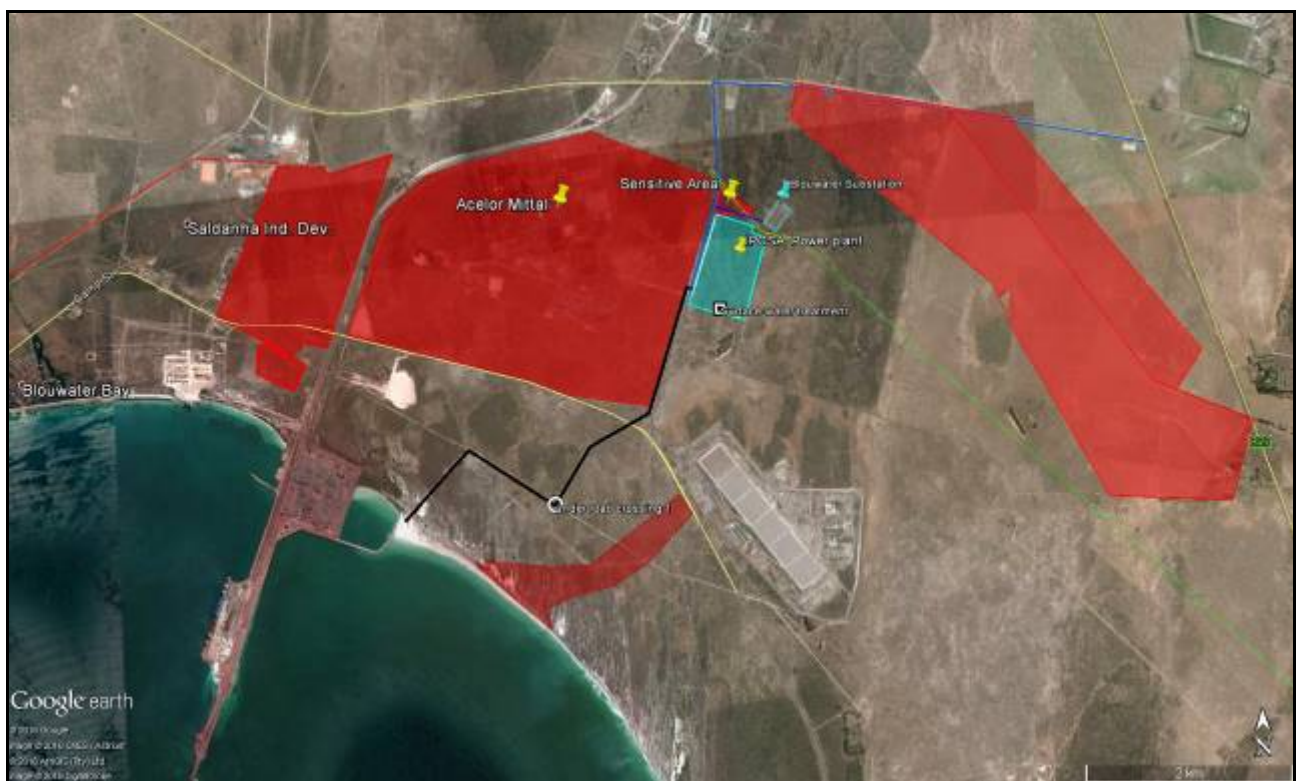


Figure 5: The red polygons on this map indicate the areas where archaeological surveys have previously been conducted for contract projects. Our knowledge of the archaeology of this general area is therefore reasonably comprehensive.

Early and Middle Stone Age

MSA shell midden remains have been identified along this stretch of the West Coast, most notably the late Middle Pleistocene site of Hoedjiespunt 1 (Berger & Parkinson 1995; Stynder *et al.* 2001) further to the north and west of the study area, while Dietl *et al.* (2005) have reported finding MSA

artefacts between the Geelbek Dunes, further to the south and east of the study area. In general, ESA and MSA material is sparsely distributed in the Saldanha Bay area.

Later Stone Age

LSA archaeological sites are more common than ESA or MSA sites in the vicinity of the study area and are generally located in association with specific landscape features such as deflation hollows between the sand dunes or rocky (granite) outcrops which provided shelter to hunter-gatherer or pastoralist groups. The latter is particularly evident at Kasteelberg 10 km northwest of Vredenburg and other smaller granite hills on the Vredenburg Peninsula (Sadr *et al.* 2003; Smith 2006; Smith *et al.* 1991). Other surveys just west (Hart & Pether 2008) and east (Orton 2011) of the study area yielded no surface archaeological material, while a survey at the northern end of Saldanha Bay located just two ephemeral LSA sites (Hart 2003). These areas mostly abut sandy shores, but further south in the vicinity of Club Mykonos there are many shell middens associated with the rocky shores. A number of these sites have been excavated revealing the typical cultural finds, such as stone tools, ostrich eggshell beads and shell scrapers associated with coastal shell middens (Hart 2001; Hart and Gribble 1998; Hart & Jerardino 1998).

Another landscape feature that attracted prehistoric settlement is sand dunes. Some 20 km south of the study area, Conard and Kandel (2006; Conard *et al.* 1999; Kandel & Conard 2005) have described numerous occurrences LSA material located in deflating areas between the dunes at Geelbek in the West Coast National Park.

Occasionally, the pattern of archaeological sites associated with landscape features does not hold true. A significant open shell midden was recently uncovered, accidentally, in the town of Saldanha Bay, some 600m from the coast and in a flat, open area (Orton 2009). While the site was destroyed during construction activities, the tiny amount of material recovered showed that occupation spanning the last 6000 years had occurred. Multiple burials were also present (Dewar 2010) but these were all clustered within a few centuries of 2000 years ago.

6.2 Colonial Period

Since its discovery, Saldanha Bay (named by the Dutch after Antonio de Saldanha who visited the Cape in the early 1500's), was used as a safe anchorage by virtually every sea going nation who had trading interests in the east. The bay shores were not permanently settled in any meaningful way until quite late in the history of the Cape. The Dutch East India Company (*Vereenigde Oostindische Compagnie* or VOC) chose Table Bay as a preferred location to establish a permanent re-victualing station rather than Saldanha Bay, because Table Bay had permanent water, arable land, and supplies of wood and was generally well suited to land based settlement. Being anxious to maintain a presence at Saldanha Bay, the VOC established a small garrison on the Postberg Peninsula in 1666. The bay remained in Dutch hands until the first British occupation of 1795. Archaeological sites relating to the colonial period are generally rare with the most significant one from this region being Oudepost, the Dutch East India Company outpost on the Churchaven Peninsula (Schrire *et al.* 1990). The lack of water at Saldanha impeded its development until a permanent water supply was constructed by the military engineers at the beginning of World War 2.

Development of the area was restricted to sparse farms and fishing which was centered at the small hamlet of Hoedjiesbaai. In the early 20th century whale fisheries were established at Donkergat and Salamander Bay which saw increased growth of the hamlet with the installation of jetties and coaling facilities. By the late 1930's the whaling industry had collapsed. In 1942 Saldanha Bay became a defended anchorage with boom defenses, a mine field and batteries on each side of the entrance to the bay. The bay itself was extensively used by convoys and warships alike. A permanent naval base was established and the area's water problems were at last resolved when military engineers established a water supply which was piped from the Berg

River. The strategic importance of Saldanha Bay continues to grow with its status as the Cape's only deep sea Port.

6.3 Cemeteries and Graves

Later Stone Age burials can occur almost anywhere, but particularly in sandy substrate. People would likely have been buried at or very close to where they died and numerous burials have been reported from the Saldanha coast and adjacent hinterland (Morris 1992). The table below is derived from data supplied in Morris (1992) and shows the general location of human remains and approximate radiocarbon dates. It highlights the very real possibility of uncovering human remains during construction along the Saldanha Bay coastline. It is important to emphasise that burials recovered after 1992, such as those at Diaz Street, Saldanha (Dewar 2010) are not included in this table.

Table 3: Later Stone Age burials recovered from Saldanha Bay (after Morris 1992)

| Catalogue Number | Description | Radiocarbon Dating (BP is Before Present) |
|------------------|---|---|
| SAM6063 | Military area, Saldanha Bay - found on a kopje during excavations for water pipes | 1170+30BP |
| SAM4791 | Noordbaai, Saldanha – in shallow grave in eroded midden | None |
| SAM4792 | Noordbaai, Saldanha – on surface midden | None |
| SAM4793 | Noordbaai, Saldanha – in shallow grave in eroded midden | 4110+60BP |
| SAM4794 | Noordbaai, Saldanha – on midden | None |
| SAM4899 | Saldanha | 2440+60BP |
| SAM4900 | Saldanha – from dune on shore from foundations of a house, Camp St | 140+50BP |
| SAM5095 | Saldanha – from midden on dune, 100ft from sea, 0.4miles from Hoedjies Bay Hotel | 2660+70BP |
| SAM6074 | Saldanha – found in sand dunes above high water mark | 1360+40BP |
| SAM6075 | Saldanha – found in sand dunes above high water mark | 1330+40BP |
| SAM6078 | Saldanha | None |
| SAM6147 | Saldanha | None |
| NMB1347 | Saldanha | None |
| NMB1348 | Saldanha | None |
| SAM4666 | Saldanha | None |
| UCT60 | Saldanha – grave 2.5 feet deep in soft sand of hill | 950+50BP |
| UCT264 | Saldanha – found during construction of railway jetty | None |
| UCT138 | Saldanha – from midden deposit about 50 feet from sea | None |
| SAM6020 | Saldanha - Tikosklip | 620+30BP |

7. FINDINGS

Based on observations, most of the area surveyed has been extensively disturbed by agricultural practices which include ploughing and old agricultural lands. This is supported by the many large heaps of calcrete blocks. Despite a fairly comprehensive field survey (Figure 6) along the pipeline, and in the area identified for the power plant (Sites A and B), no pre-colonial or colonial period archaeological sites were found. The archaeological findings discussed below constitute isolated finds and their co-ordinates are provided in Table 2.

7.1 Pre-Colonial Archaeological Sites

Scatters of shell, overwhelmingly dominated by white mussels (various species) and land snails (*Trigonephrus globulus*), were recorded along the coastal dune at the commencement of the pipeline. This dominance suggests that the scatters were mostly made through natural processes: (1) natural mortality of the snails and their subsequent exposure through deflation and (2) collection of the mussels by gulls. Gulls are well known to collect mussels and drop them on to hard surfaces to break them open, after which they eat the shellfish. These finds are thus technically palaeontological and they will be discussed at greater length in the Palaeontological

report. However, among these shells were a few items that hint at a human addition to the assemblages. These include a few limpets (*C. granatina* and *S. argenvillei*), some *Turbo sarmaticus* operculae, some ostrich eggshell fragments and some animal bones (including bird bone). The anthropogenic component at these sites is very ephemeral, as Orton (2012) observed a few kilometres to the south-east, during his survey for the West Coast Desalination plant.



Figure 6: Map of the archaeological survey tracks (in red).



Plate 5: Scatter of shell in the sand dunes along the commencement of the pipeline.



Plate 6: Two fragments of flaked silcrete and a single fragment of ostrich eggshell was found along the route of the pipeline. They are of vary low significance.

The only other archaeological remains recovered, was one chunk of quartz, and a single chunk of quartzite.

7.2 Graves

No evidence of graves or stone cairns was found.

8. IMPACT ASSESSMENT

Specialists are requested to assess the impacts at all phases of the project life: construction, operation and decommissioning. In practice, the vast majority of impacts to heritage resources occur during the construction phase.

8.1 Impacts to Pre-colonial & Colonial Archaeology

Since archaeological sites are non-renewable, it is important that they are identified and their significance assessed prior to development. The main cause of impacts to archaeological sites is direct, physical disturbance of the material itself and its context. The significance of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose buried archaeological sites and artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. The impacts are likely to be most severe during the construction period although indirect impacts may occur during the operational phase of the project.

The biggest threat to pre-colonial archaeological remains is potential impacts to sub-surface remains and these are difficult to predict and to mitigate.

Table 4: Potential impact to buried Archaeology (pre-colonial and colonial)

| Nature: Disturbance and destruction of pre-colonial and colonial period archaeological material by construction of the pipeline and power plant | | |
|--|---------------------------|------------------------|
| | Without Mitigation | With Mitigation |
| Type | Direct | Direct |
| Extent | Local | Local |
| Duration | Permanent (Irreversible) | Permanent |
| Scale | Small | Small |

| | | |
|--|----------------------|----------------------|
| Frequency | | |
| Likelihood | Unlikely | Unlikely |
| Impact Magnitude | Low Impact Magnitude | Low Impact Magnitude |
| Receptor Sensitivity | Low | Low |
| Impact Significance | Low | Low |
| Status (positive or negative) | Minor | Negligible |
| Irreplaceable loss of resources? | No | No |
| Can impacts be mitigated? | Yes | |
| Mitigation: Impacts are expected to be low. It is recommended that: <ul style="list-style-type: none"> If any archaeological material is uncovered during construction, that work must stop in that area and Heritage Western Cape must be notified (Telephone: 021 483 9685). | | |
| Cumulative impacts: The cumulative impact will remain low, with the probability of finding archaeological remains low, the significance of the remains remaining very low, and the impacts negligible. | | |
| Residual impacts: N/A | | |

Archaeological material was not observed on the study site and impacts are thus expected of very low significance. A small chance exists of finding buried archaeological material but this is expected to be very low, and monitoring is not required.

8.2 Impacts to Graves and Cairns

Graves enjoy high heritage significance. Human remains are protected by a plethora of legislation including the Human Tissues Act (Act No 65 of 1983), the Exhumation Ordinance of 1980 and the National Heritage Resources Act (Act No 25 of 1999). In the event of human bones being found on site, Heritage Western Cape must be informed immediately and the remains removed by an archaeologist under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.

Table 5: Potential impact to Graves and Cairns

| | | |
|--|---------------------------|------------------------|
| Nature: Disturbance and destruction of pre-colonial and colonial human remains by construction of the pipeline and power plant | | |
| | Without Mitigation | With Mitigation |
| Type | Direct | Direct |
| Extent | Local | Local |
| Duration | Permanent (Irreversible) | Permanent |
| Scale | Medium | Low |
| Frequency | | |
| Likelihood | Unlikely | Unlikely |
| Impact Magnitude | Low Impact Magnitude | Low Impact Magnitude |
| Receptor Sensitivity | High | Low |
| Impact Significance | Low | Low |
| Status (positive or negative) | Minor | Negligible |
| Irreplaceable loss of resources? | No | No |
| Can impacts be mitigated? | Yes | |
| Mitigation: Impacts are expected to be low. It is recommended that: <ul style="list-style-type: none"> If any human remains area uncovered during construction, that work must stop immediately in that area and Heritage Western Cape must be notified (Telephone: 021 483 9685). | | |
| Cumulative impacts: Although human remains enjoy a high degree of significance, the probability of uncovering them along the route of the pipeline and the proposed gas fired power plant is low and the cumulative impact is therefore also very low. | | |
| Residual impacts: N/A | | |

Graves are best avoided by development. An extensive consultation process is required if exhumation is considered.

9. MITIGATION

The study has not identified any likelihood of impacts to archaeology, and further monitoring of the construction activities is not required.

However, if any archaeological or human remains are uncovered during development, work should stop in that area and Heritage Western Cape must be notified. They will either send out a staff member to investigate, or else contact an archaeologist to undertake a field assessment. If significant finds are uncovered, then mitigation may be required under a Workplan issued by Heritage Western Cape. Mitigation may include the excavation of the material. Alternatively, if a highly significant site (Grade 1) is uncovered, HWC may recommend the conservation of the site.

10. CUMULATIVE IMPACTS

The study area is one of the best studied yet least significant tracts of landscape in the Western Cape in archaeological terms.

Previous archaeological impact assessments undertaken in the surrounding area were consulted and the following conclusions were made:

- Hart & Pether (2008) rate impacts of the Salkor Yard Expansion, the railway line and powerlines as the scale is low, confidence is high, that the significance (with or without mitigation) is “Not Significant”;
- Halkett (2011) with respect the AFRISAM cement project do not provide any impact ratings but did not expect any significant impacts;
- Orton (2011) with respect the proposed Isivunguvungu Wind Farm described the probability of finding archaeological sites as “improbable”, the significance as “very low” and commented that “No assessments in the immediate vicinity has yielded significant archaeology and none is present on this site. Cumulative Impacts are thus insignificant”;
- Orton (2011) with respect the proposed pipe yard in the Iron Ore terminal noted that no significant archaeological resources were expected on the development site (improbable), and the significance was expected to be very low.
- Kruger (2013) with respect the Saldanha Separation Plant rated the archaeological remains as having low significance, that impacts would be negligible.

All archaeologists who have conducted research in this specific area of the Saldanha IDZ, have expressed a high degree of confidence that the likelihood of finding significant remains was extremely low, and the cumulative impacts have therefore been assessed as “insignificant”.

From a cumulative impact perspective, no mitigation is required, with the exception of the standard protocol to consider the possibility of buried archaeology and/or human remains.

The proposed development may therefore proceed.

11. EMP

The following recommendations should be included in the EMP:

- If any archaeological material is uncovered during construction, that work must stop in that area and Heritage Western Cape must be notified (Telephone: 021 483 9685);
- If any human remains area uncovered during construction, that work must stop immediately in that area and Heritage Western Cape must be notified (Telephone: 021 483 9685).

12. RECOMMENDATIONS

Indications are that in terms of archaeological heritage the proposed activity is viable; impacts are expected to be very limited and controllable.

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Table 2: Archaeological sites

*NCW - a resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate (Guide to Grading for Local Authorities: Version 9 – March 2016).

OES = Ostrich eggshell fragments.

| SITE | LAT S DEG DEG | LON E DEG DEG | DESCRIPTION | SIGNIFI-CANCE |
|------|---------------|---------------|---|--------------------|
| -001 | 33 0.315 | 18 0.652 | Very large spread white mussel shell and snail shell next to a high sand dune, along the start of the pipeline. There is some fresh bone (including bird bone). Gull drops along the dune or related to the mid-Holocene? | Palaeontological |
| -002 | 33° 0.175 | 18° 0.805 | Calcrete outcrop on jeep track | Not archaeological |
| -003 | 33° 0.135 | 18° 0.865' | White mussel in the jeep track – <i>Lutraria</i> sp? | Palaeontological |
| L001 | 33° 0.143 | 18° 0.864 | On a little ridge near the road, two silcrete flakes and a fragment of OES | NCW |
| L002 | 33° 0.135 | 18° 0.864 | Single quartz chunk | NCW |
| L003 | 33° 0.117 | 18° 0.906 | Pipeline cover, along the pipeline route | Not archaeological |
| L004 | 33° 0.176 | 18° 1.611 | Heap of stone from old fields | Not archaeological |
| L005 | 32° 59.835 | 18° 2.089 | Road rubble dumped on the pipeline route | Not archaeological |
| L006 | 32° 59.595 | 18° 2.173 | Several small pans lined with calcrete | Not archaeological |
| L007 | 32° 59.314 | 18° 2.662 | Large, dark grey quartzite chunk | NCW |

ANNEXURE A

Our Ref: HM/WEST COAST/SALDANHA BAY/FARM YZERVARKENSRUG 129 & PORTION 2 OF FARM JACKELSKLOOF 195
Case No.: 16041107AS0425E
Enquiries: Andrew September
E-mail: andrew.september@westerncape.gov.za
Tel: 021 483 9543
Date: 06 May 2016



Stuart Heather-Clark
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RESPONSE TO NOTIFICATION OF INTENT TO DEVELOP: HIA REQUIRED
In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999) and the Western Cape Provincial Gazette 6061, Notice 298 of 2003

NOTIFICATION OF INTENT TO DEVELOP: PROPOSED ARCELORMITTAL GAS TURBINES AND ASSOCIATED ELECTRICAL INFRASTRUCTURE ON REMAINDER EXTENT ON FARM YZERVARKENSRUG 129 AND PORTION 2 OF FARM JACKELSKLOOF 195, SALDANHA BAY, WEST COAST, SUBMITTED IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

CASE NUMBER: 16041107AS0425E

DEADP Reference: N/A

The matter above has reference.

Heritage Western Cape is in receipt of your application for the above matter received on 25 April 2016. This matter was discussed at the Heritage Officers meeting held on 29 April 2016.

You are hereby notified that, since there is reason to believe that the proposed gas turbines and associated electrical infrastructure will impact on heritage resources, HWC requires that a Heritage Impact Assessment (HIA) that satisfies the provisions of section 38(3) of the NHRA be submitted. This HIA must have specific reference to the following:

- Impacts to archaeological heritage resources
- Impacts to palaeontological heritage resources

The required HIA must have an integrated set of recommendations.

The comments of relevant registered conservation bodies and the relevant Municipality must be requested and included in the HIA where provided. Proof of these requests must be supplied.

HWC reserves the right to request additional information as required.

Should you have any further queries, please contact the official above and quote the case number.

Yours faithfully

Mr Mxolisi Dlamuka
Chief Executive Officer, Heritage Western Cape

www.westerncape.gov.za/cas

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• **Tel:** +27 (0)21 483 3559 • **E-mail:** info@heritagewesterncape.gov.za

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SALDANHA BAAI BAY
MUNISIPALITEIT | MUNICIPALITY | uMASIPALA

REF NO:

PI 129 rem; PI195/2

ENQUIRIES:

N Duarte; E Mmbadi

Ms Mr

Tougheeda Aspeling

REGISTERED MAIL

ERM Southern Africa (Pty) Ltd
Postnet Suite 90
Private Bag X12
Tokai
7966

RE: DRAFT SCOPING REPORT FOR PROPOSED GAS-FIRED INDEPENDENT POWER PLANT TO SUPPORT SALDANHA STEEL AND OTHER INDUSTRIES IN SALDANHA BAY, WESTERN CAPE PROVINCE.

1. The Proposed Gas-Fired Independent Power Plant to support Saldanha Steel and other Industries in Saldanha Bay: Draft Scoping Report dated 04 March 2016 refers.
2. The negative cumulative impact on the Critical Biodiversity Area within the Saldanha Bay area due to development of industries and associated infrastructures is Saldanha Bay Municipality's priority concern. A detailed botanical study is required for further comments.
3. Storm water management and waste water discharge are of serious concern and should be discussed in detail.
4. Please inform the Environment & Heritage Section of the Saldanha Bay Municipality on any Paleontological and Archaeological findings for our records.

pp: MUNICIPAL MANAGER

Date: 05-04-16

/em

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Serve, Grow and Succeed Together

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WEST COAST DISTRICT MUNICIPALITY**

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Address all correspondence
to:

**MUNISIPALE BESTUURDER/
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1 April 2016

ATTENTION: TOUGHEEDA ASPELING

Environmental Resources Management
Postnet Suite 90
Private Bag X12
TOKAI
7966

Madam

**DRAFT SCOPING REPORT: PROPOSED GAS-FIRED POWER PLANT FOR
SALDANHA STEEL AND OTHER INDUSTRIES, SALDANHA BAY**

1. Your letter of 4 March 2016 and the Draft Scoping Report for the project have reference.
2. The West Coast District Municipality takes note of the information contained in the Draft Scoping Report for the proposal. However, it is recommended that more information be provided on the following:
 - 2.1 Cumulative impact on water resources taking into account all existing and proposed industrial developments at the Saldanha Port.
 - 2.2 Disaster Risk Management.

Yours faithfully


MUNICIPAL MANAGER
/dk

LITA WEBLEY – ABBREVIATED CURRICULUM VITAE (2016)

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ACADEMIC QUALIFICATIONS:

- Matriculated: 1974, Kloof High School, Kwa-Zulu Natal, South Africa
- BA (Hons) Archaeology, 1978, University of Stellenbosch
- MA (cum laude) Archaeology, 1984, University of Stellenbosch
- PhD Archaeology, 1992, University of Cape Town

PROFESSIONAL CAREER:

- 1979-1980: Junior lecturer, Semitic Languages, University of South Africa
- 1981: Junior Lecturer, Archaeology, University of Stellenbosch
- 1982-1983: Research Assistant, Anthropology, University of Stellenbosch
- 1984: Temporary Lecturer, Archaeology, University of Fort Hare
- 1985-1986: Teaching Assistant, Archaeology, University of Cape Town
- 1988-1990: Archaeologist, Natal Museum Services, Pietermaritzberg
- 1990-1997: Archaeologist, Albany Museum, Grahamstown
- 1997-1998: Assistant Director, Albany Museum, Grahamstown
- 1999-2005: Acting Head (Acting Deputy Director), Albany Museum, Grahamstown.
- 2005-2008: Director: Albany Museum
- 2008-to present: Principle Investigator, ACO Associates cc

FIELDS OF SPECIALITY AND COMPETENCE:

- Heritage and Archaeological Impact Assessments in Western Cape, Eastern Cape and Northern Cape;
- Accredited as Principal Investigator for Stone Age Archaeology, Shell Midden Archaeology, Colonial Period Archaeology, and as Field Director for Grave Relocations
- Ethno-archaeology (anthropology) and oral history in Northern and Eastern Cape
- Specialised in Archaeology of Northern Cape
- Presentation of Heritage Workshops to communities and government officials
- Excavations at over 50 archaeological sites
- Design and implementation of museum displays

CONSULTANCY WORK

- Completion of over 250 Heritage/Archaeological Impact Assessments since 1996;
- Heritage surveys/cultural mapping in: Richtersveld National Park, Addo National Park and Namaqua National Park;
- Heritage Surveys in Great Fish Nature Reserve, Fort Fordyce Nature Reserve, Karoo Nature and Mkambati Nature Reserve in the Eastern Cape Province.

PUBLICATIONS:

- Five chapters in books
- Total of 20 articles in refereed journals
- At least 20 popular articles
- Numerous conference presentations in South Africa and abroad (United States and Europe)

COURSES COMPLETED:

- GIS Course at Rhodes University in 2004
- Architectural and Urban Conservation Course (Skills Development) presented by Dr S Townsend in the Faculty of Engineering and the Built Environment, University of Cape Town, 2008.

PROFESSIONAL STATUS:

- Association of Southern African Professional Archaeologists
- Accredited Principle Investigator for CRM (Stone Age, Coastal Shell Middens and Colonial Archaeology) and Field Director (Burials and Exhumations)

HERITAGE COMMITTEES:

- 1994: Heritage sub-committee responsible for drafting new heritage legislation for the Eastern Cape
- 1997-2001: Member of the transitional Eastern Cape Regional Committee of the National Monuments Council.
- 2003-2008: Executive member of Makana Heritage Forum (Makana Municipality) Grahamstown
- 2013 – to present: Member of permits committee (APM) of Heritage Western Cape
- 2013 – to present: Member of the Council of Heritage Western Cape
- 2013-2014: Member of the Eastern Cape Provincial Heritage Resources Agency (ECPHRA) permit committee
- 2015 – to present: Member of the IACom committee of Heritage Western Cape

SKILLS BASE AND CORE COMPETENCIES

Managerial skills

Excavation skills (excavated over 50 archaeological sites)

Publication/report writing skills (published 25 peer-reviewed articles and chapters in books)

Editorial skills (served on 3 editorial boards)

Museum Display skills (involved in 8 Museum exhibitions)

Heritage management skills (served on various heritage bodies in Eastern & Western Cape)

Heritage training skills (presented 8 heritage training workshops to local communities and government officials in the Eastern Cape)

APPENDIX 1

Palaeontological Assessment: Proposed Gas-Fired Independent Power Plant to Support Saldanha Steel and Other Industries in Saldanha Bay, Western Cape (1:50000 3218CA & CC Velddrif; 3317BB &3318AA Saldanha)

Prepared by

Graham Avery
(Sole Proprietor)

Archaeozoology, Stone Age Archaeology and Quaternary Palaeontology

July 2016

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Executive Summary

Graham Avery was commissioned by ACO Associates cc on behalf of their client to provide an assessment report on the palaeontological implications of the Proposed Gas-Fired Independent Power Plant to Support Saldanha Steel and Other Industries in Saldanha Bay, Western Cape. The palaeontological assessment relates to the proposed servitude for the pipelines from Saldanha Bay shore to the proposed location of the power plant further inland.

Proposed activity: Provision of independent gas-fired power in the Saldanha Bay area.

Location: It is located in a palaeontologically-sensitive region of potentially fossiliferous sediments underlain by bedrock of Cape granite Suite rock, which outcrops in places but is not palaeontologically relevant here. The route traverses remnants of Plio-Pleistocene Langebaan Formation calcretes, and Velddrif Formation, each of which has palaeontological potential; agricultural activity has modified most of the proposed servitude. During excavations for the pipeline, fossil finds may be encountered in these Formations. Any finds would be significant and would require careful recording and possible systematic excavation. Given the proposed depth at which the pipe line will be laid, it is unlikely to affect much earlier Varswater Formation deposits.

Dependent on the depth of foundations, excavations for the Power Plant and ancillary facilities may encounter older sediments like the Varswater Formation.

Palaeontological remains are rare, protected by the South African National Heritage Resources Act of 1999, and if encountered, must be recorded by an appropriately qualified person.

Given proposed excavation depths, impacts of the pipeline are likely to be low and in the Langebaan Formation due to predicted sparsity of fossils, but manageable. Should Velddrif Formation shell deposits be encountered at the coast, impact would be moderate, but manageable. Appropriate management would reduce impacts to very low.

Given the sparseness of fossil occurrence in the Langebaan Formation and our lack of knowledge, palaeontological finds would have significant importance and impact at the power plant site would be high in the Langebaan Formation and, possibly in earlier formations if encountered, , but appropriate management would reduce impact to very low.

With respect cumulative impacts, provided that palaeontologists can use the opportunity arising from major construction works to adequately sample and record profiles and exposed material as part of the environmental management process, a potential negative impact can be transformed into a positive opportunity to increase the levels of knowledge about a locality and its past environments.

In summary, provided palaeontologists are given the opportunity to recover potentially-important 'fossil' material in sediments that are not normally accessible, potentially negative impacts can be seen as positive.

**Proposed Gas-Fired Independent Power Plant to Support Saldanha Steel and Other Industries
in Saldanha Bay, Western Cape**

Declaration

by the independent person who compiled a specialist report or undertook a specialist process I
Graham Avery, as an appointed independent specialist hereby declare that I:

1. acted as an independent specialist in this application;
2. regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
3. do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
4. have and will not have no vested interest in the proposed activity proceeding;
5. have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
6. am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
7. have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
8. am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.



Signature of the specialist:

Graham Avery (Sole Proprietor) Archaeozoology, Stone Age Archaeology and Quaternary Palaeontology

Name of company:

18th July 2016

Date:

Introduction

A gas-Fired Power Plant to Support ArcelorMittal Saldanha Steelworks and other Industries in Saldanha Bay is planned to ensure stable, economical electricity over the long term. The power plant will be adjacent to the ArcelorMittal Saldanha Steelworks. The project will supply the power needs of ArcelorMittal Saldanha Steel and excess electricity will be made available to industries in the Saldanha Industrial Development Zone (IDZ) and/or Municipalities within the Western Cape.

Pipeline

CNG and LNG will be supplied by ship to the Port of Saldanha where it will be offloaded by a submersible pipeline either from a mooring area located offshore or a berthing location in the Port of Saldanha.

The gas pipeline and servitude will run from the pipeline entry point connecting to the power plant boundary. There is proposed to be a gas and sea-water forwarding station at the start of the land-based pipeline system. There will also be a gas and sea-water receiving station at the Power plant.

Both Natural Gas and sea water/fresh water will be transferred down the pipeline. There will be a dual, parallel gas pipeline for security of gas supply. A seawater pipeline will provide the power plant with sea water for desalination. Fresh water hydrants will be placed above ground near to the pipeline marker beacons as a rapid response measure in the event of a gas-leakage fire.

The pipeline will be installed underground and this implies the opening of a working strip along the right of way of the pipeline. The pipeline(s) will be buried to a depth of 3 to 4m and cover a servitude width of approximately 6m to 20m, possibly 30 m to 36m elsewhere during construction (depending on safety and construction concerns), and approximately 3900m to 4600m in length.

Power Lines

A feeder line of 132kV (sized for a capacity of 400MW) will take the power from the power plant to the ArcelorMittal Steel Works.

Ancillary infrastructure will include:

- Access road to site;
- 132kV and 400kV switchyard;
- Control and electrical building;
- Central control room, warehouse and administrative buildings;
- Firefighting systems;
- Fuel/gas/diesel storage facilities;
- Emergency backup generators;

- Chemical storage facilities.

Excavations for foundations will be required.

Power Plant Location Alternatives

ArcelorMittal considered two alternative sites for the development of the gas-fired power plant based on proximity to the existing ArcelorMittal Steel Works site. Site A is adjacent to the steel works, while Site B, the preferred alternative, is across the road from the steel works adjacent to the existing Blue Water Sub-station (Figure 1).

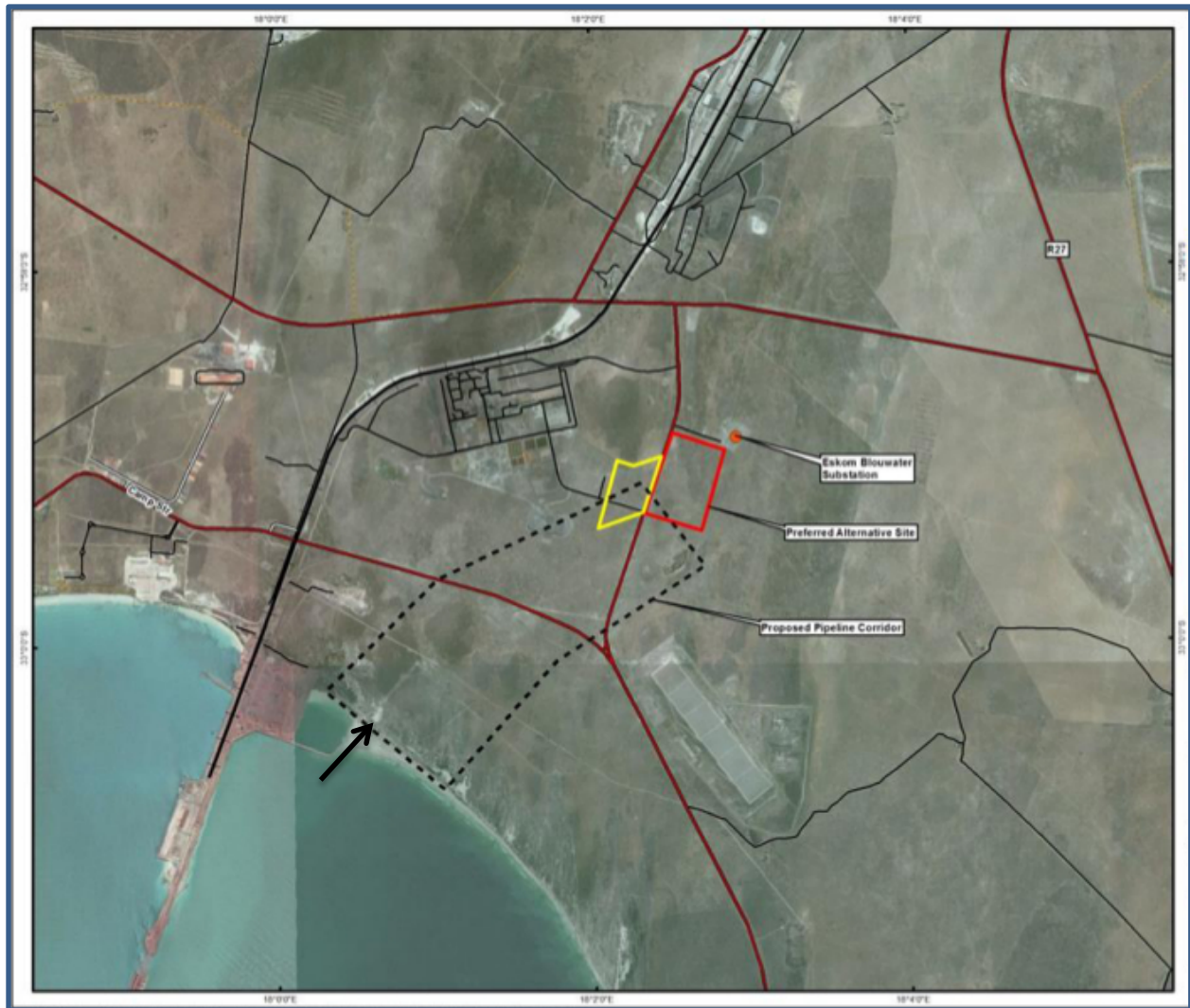


Figure 1. Location of Alternatives A (yellow) and B (red). Black arrow indicates start of onshore pipeline servitude.

Method

Graham Avery was commissioned by Lita Webley (ACO Associates) on behalf of their client to assess the palaeontological and Pleistocene archaeological potential of the proposed pipeline and Power Plant. A background study of the palaeontological potential of the study area was conducted by Dr G. Avery Archaeozoologist. The 1:125000 Map Sheet 255: 3217D &

3218C (St Helenabaai), 3317B & 3318A (Saldanhaabaai) and other geological sources were consulted. Existing Palaeontological Impact Assessments have been drawn on for useful descriptions of the stratigraphic and lithological framework of sediments in the Saldanha area (Roberts and Smith 2008, Pether 2013b, Pether 2014, Pether 2010a).

In addition, to GA's own experience, literature describing known palaeontological and Pleistocene archaeological sites was consulted to illustrate the potential of superficial and sub-surface sediments through their geological contexts and observations. The servitude for the proposed pipe line and alternative Power Plant locations A and B were traversed on foot on 22nd June 2016 (with ACO staff members, D. Halkett, L. Webley and J. Robinson). Visibility was good, since while the area is vegetated, it is mostly sparse and did not overly obscure the sandy surface.

Checklist

| | |
|---|--|
| Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6 | Cross-reference in this report |
| (a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae; | Page Appendix A |
| (b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Page 4 Declaration |
| (c) an indication of the scope of, and the purpose for which, the report was prepared; | Pages 5-6 Introduction |
| (d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Page 6 Method |
| (e) a description of the methodology adopted in preparing the report or carrying out the specialized process; | Page 6 Method |
| (f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure; | Pages 9 Baseline |
| (g) an identification of any areas to be avoided, including buffers; | None |
| (h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Figure 7 |
| (i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Page 20 Known Sites and Potential |
| (j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment; | Page 24 |
| (o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | N/A |
| (p) any other information requested by the competent authority. | This document and declaration completed |
| Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 3 - Environmental Impact Assessment Process | Cross-reference in this report |
| Describe any policies or legislation relevant to your field that the applicant will need to comply with. | Page 25 Heritage Permits Required |
| Comment on need/desirability of the proposal in terms of your field and in terms of the proposal's location. | Page 20 Known Sites and Potential |
| Determine the-- (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and (ii) degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources, and | Page 24 Impact Assessment; Page 26 Recommendations |

| | |
|--|---------------------------|
| (cc) can be avoided, managed or mitigated; | |
| Determine what the most ideal location within the site for the activity is in terms of your field. | Page 24 Impact Assessment |
| Identify suitable measures to avoid, manage or mitigate identified impacts. | Page 26 Recommendations |
| Identify residual risks that need to be managed and monitored. | |
| Include a concluding statement indicating a preferred alternative in terms of your field. | Page 26 Recommendations |

Baseline

Geology and Stratigraphy

The Saldanha area is known to be palaeontologically sensitive. The geology of the area provides a fundamental control of the sedimentation and therefore potential occurrences of palaeontological and Pleistocene archaeological remains (Rogers 1980). Surface geology and lithology is described in Figure 2.

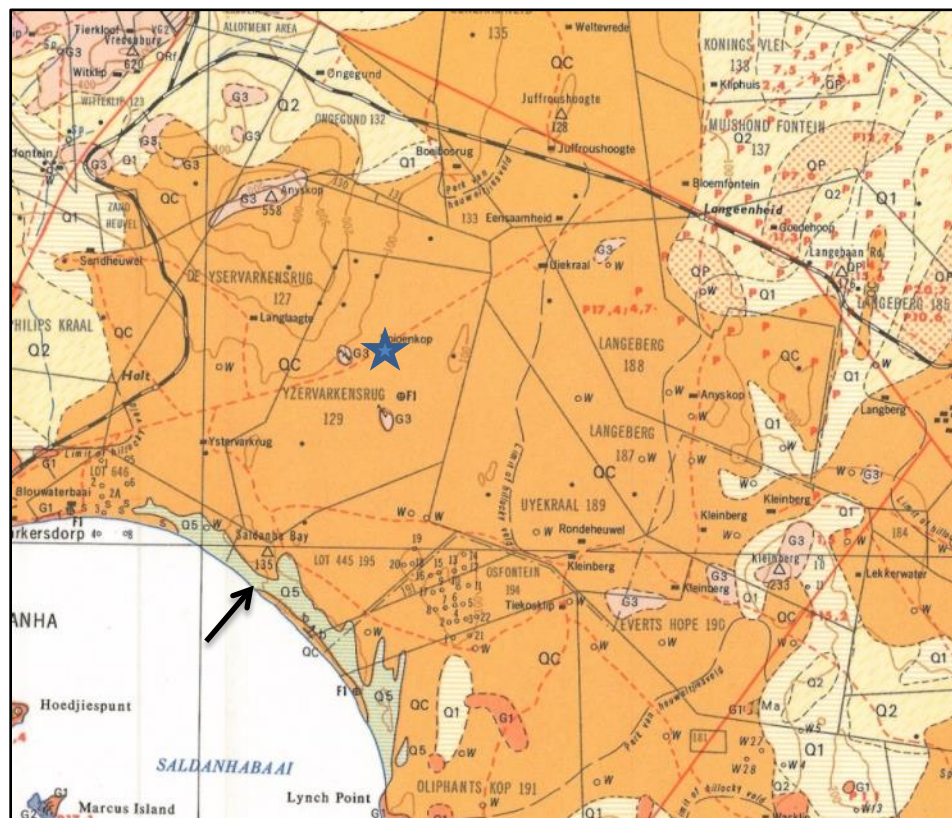


Figure 2. Surface geology of the study area (Visser and Schoch 1972). ArcelorMittal SA Saldanha Steelworks is starred and the start of the onshore pipeline is arrowed.

In the Saldanha region the Cenozoic sediments overlie basement rocks of the Cape Granite Suite (G1, G3), which outcrops in places. The Cenozoic sediments of the region, previously included in the Bredasdorp Group, are in what is now called the Sandveld Group (Table 1, Figures 2, 3 and 4) and include shallow marine, back barrier, estuarine, fluvial and terrestrial aeolian contexts dating from the Miocene, Pliocene, Pleistocene and Holocene, i.e. the past 20 Ma (Rogers 1980, Rogers 1982, Rogers 1983, Roberts et al. 2006, Roberts and Brink

2002, Roberts et al. 2011, Pether 2007, Pether, Roberts and Ward 2000, Pether 1995, Pether 2013a, Pether 2013b, Hendey 1981, Theron et al. 1992, Visser and Schoch 1973, Felix-Henningsen, Kandel and Conard 2003, Dale and McMillan 1999, Franceschini 2003, Flemming 1977).

Sediments of the Sandveld Group likely to be encountered are (Figure 2, Table 1) Witzand Formation (Qw = Recent (Holocene) and Langebaan Formation (QC, QI = Quaternary Langebaan Formation – limestone and calcrete, partially cross-bedded; calcified parabolic dune sand, including the seabed). Deposition of the Langebaan Formation, which overlies much of the region and can reach depths of >30 m, took place over a significant period, broken by significant sea level changes that affected aeolian transport and input (Table 1, Figure 3, 4, 5 and 6). Exposures of Springfontyn Formation (Qs, Q1, Q2 = Middle Pleistocene – light-grey to pale-red sandy soil) exist outside the affected area.

Table 1. Summary of the stratigraphy and lithology of the Sandveld Group. Modified from Pether (2013b), table 2, Pether (2014) Pether et al. (2000) and Roberts et al. (2006). The Langebaan and Velddrif Formations are the most likely sediments to yield palaeontological material in the context of this project, although considerably-deeper fossil-bearing formations also exist. In this context, preserved Pleistocene archaeological material is known from the Middle and Late Pleistocene, but is unlikely to be older than the Springfontyn Formation (Braun et al. 2013, Klein et al. 2007, Avery 2016 In Prep, Fuchs et al. 2008, Felix-Henningsen et al. 2003, Kandel and Conard 2012, Woodborne 2000) where it overlies the Langebaan Formation, as at Anyskop.

| Formation | Age and Lithologies | Fossil Potential |
|---|---|---|
| Witzand | Holocene and recently active calcareous dune fields and cordons (~12 ka) | Rare sub-fossils of importance for historical faunal distribution. Mainly Later Stone Age archaeological sites. |
| Springfontyn | Pleistocene to Recent (Holocene) quartzose sand dunes, silts and peats (<~2 Ma) | Mineralized bones generally sparse, but can be prolific in some areas, e.g. Elandsfontein and part of Baard’s Quarry. High significance |
| Langebaan | Late Quaternary aeolianites <~3 Ma | Mineralized bones moderately common. Local to high significance. Extends under sea. Local to high significance |
| Velddrif | Quaternary raised beaches and estuarine deposits <~1.2 Ma. Sea levels below ~15 m asl | Marine molluscs common and rare bones at or near the coast. High significance |
| Marine erosion surfaces below ~15 m asl. | | |
| Old indet. sands | | |
| Langebaan | Late Pliocene to mid- Quaternary aeolianites. <~3 Ma | Molluscs and sparse (can be patchy concentrations, e.g. Langebaanweg, bones of terrestrial and marine forms. Extends under sea. Local to high |

| | | |
|--|---|---|
| | | significance |
| Uyekraal -- Previously subsumed in the upper Varswater Fm | Mid-Pliocene marine deposits ~3 Ma. Sea-level max. ~35 m asl | Shell fossils common, local significance. Fossil bones very sparse, high significance |
| <i>Marine erosion surface to ~35 m asl</i> | | |
| Old indet. sands | | |
| Langebaan | Earlier Pliocene aeolianites <~3 Ma. | Fossil bones moderately common, local to high significance |
| Varswater – upper | Later early Pliocene regressive deposits of wider area. 5-4 Ma. Sea-level max. ~50-60 m asl | Fossil bone rare, high significance. Poorly known, fossil shells of high significance |
| Varswater – lower | Early Pliocene transgressive marine deposits in embayments (upper KGM?, LQSM and MPPM members) | Fossil bone common locally, high significance. Shells very sparse, high significance |
| <i>Marine erosion surface to ~60 m asl</i> | | |
| Very old indet sands | | |
| Prospect Hill | Miocene aeolianite 12 to 9 Ma | Fossils very sparse – high significance |
| Saldanha | Mid-Miocene marine deposits (predicted presence), 17-14 Ma. Sea-level max. ~90 m asl. May include the lower KGM? | Very few fossils recovered, high significance if found. |
| <i>Marine erosion surface to ~100 m asl</i> | | |
| Langeenheid Clayey Sand -- Previously a member of the Lower Varswater Fm | Mid Miocene early-transgression estuarine deposits (prev. LCSM Member in lower Varswater Fm.). 18-17 Ma. | Plant microfossils – high significance |
| Elandsfontyn | Middle to late Miocene fluvial coarse, angular sands, muds and carbonaceous sediments. ~15 Ma to ~12 Ma | Microfossils, including pollens, and macro remains of plants, high significance |

Ma = Million years ago; ka = Thousand years ago

Note: chronology for the base of the Lower Pleistocene Boundary has been formally re-defined to an earlier date of 2.58 Ma; the base of the Holocene has also been formalized at 11.8 ka (Gibbard et al. 2010).

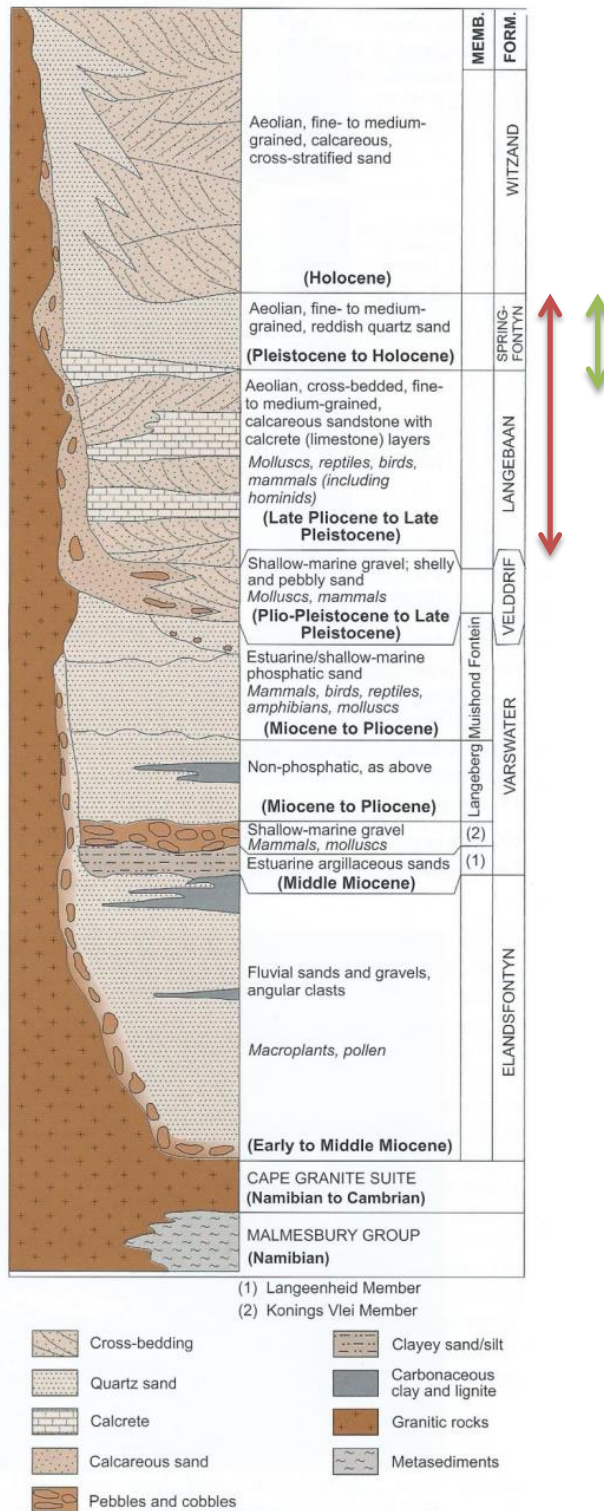


Figure 3. composite summary of Sandveld Group Lithostratigraphy in the Saldanha region (Roberts et al. 2006). Formations most likely to yield palaeontological (red) and/or Pleistocene archaeological (green) remains are arrowed.

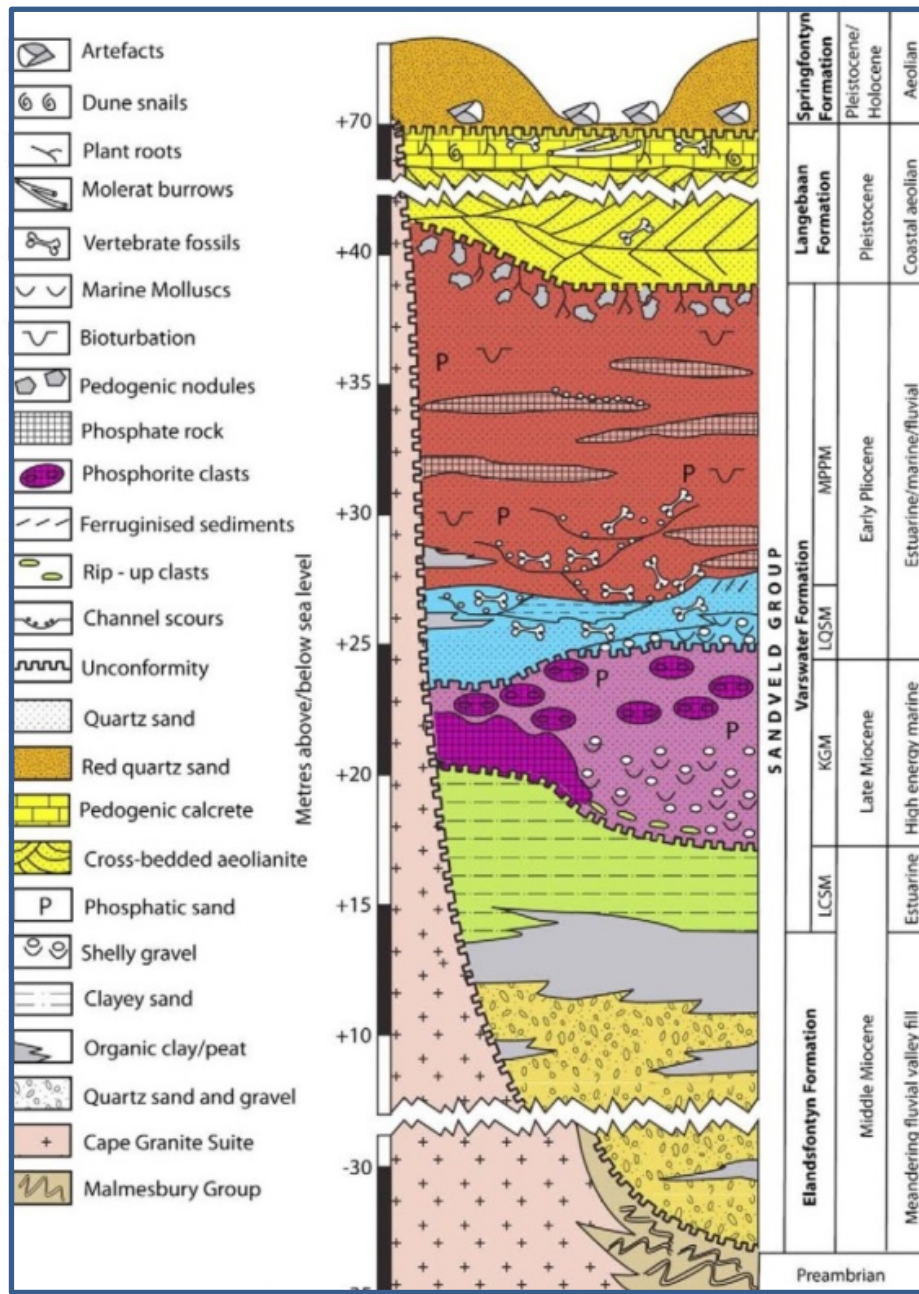


Figure 4. Lithostratigraphy and fossil-bearing formations at Langebaanweg are representative of that area (Roberts et al. 2011). Here the Langebaan Formation is ~35 m in depth.

Characteristically sandy sediment has been transported inland from the coast in a number of different-aged pulsing dune plumes (Figure 5).



Figure 5. Significant dune plumes, extending inland from the Saldanha coast (Witzand in dark purple, Langebaan Formation in light purple and Springfontyn Formation in light brown) provide the various covering sediments (Fig. 1, Roberts and Smith (2008)).

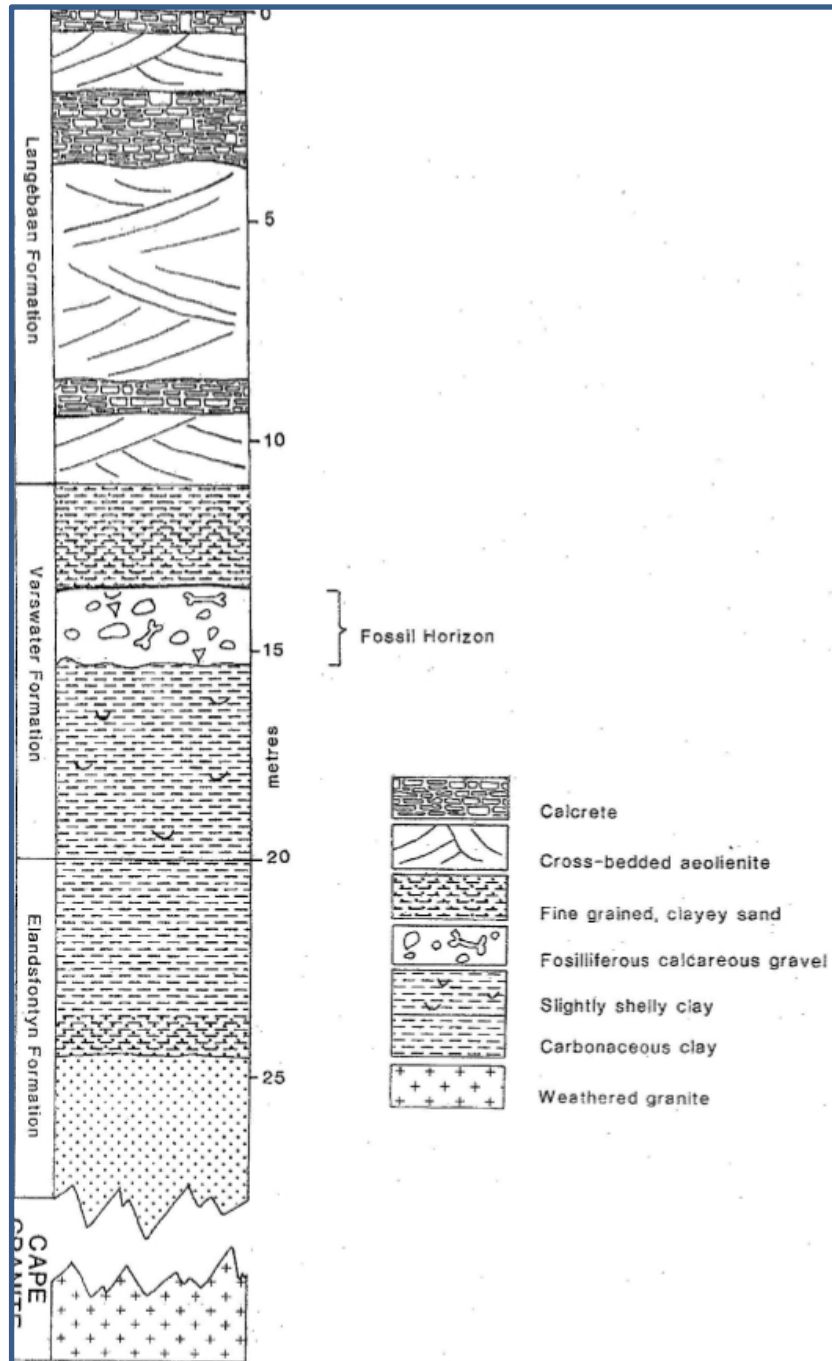


Figure 6. Stratigraphic profile recorded by Roberts (1997b) during construction of Saldanha Steel facility. Depth of Langebaan Formation here is ~12 m.

Results of Foot Survey and Desktop Study

Tracks of the foot survey coverage are shown in Figure 7.

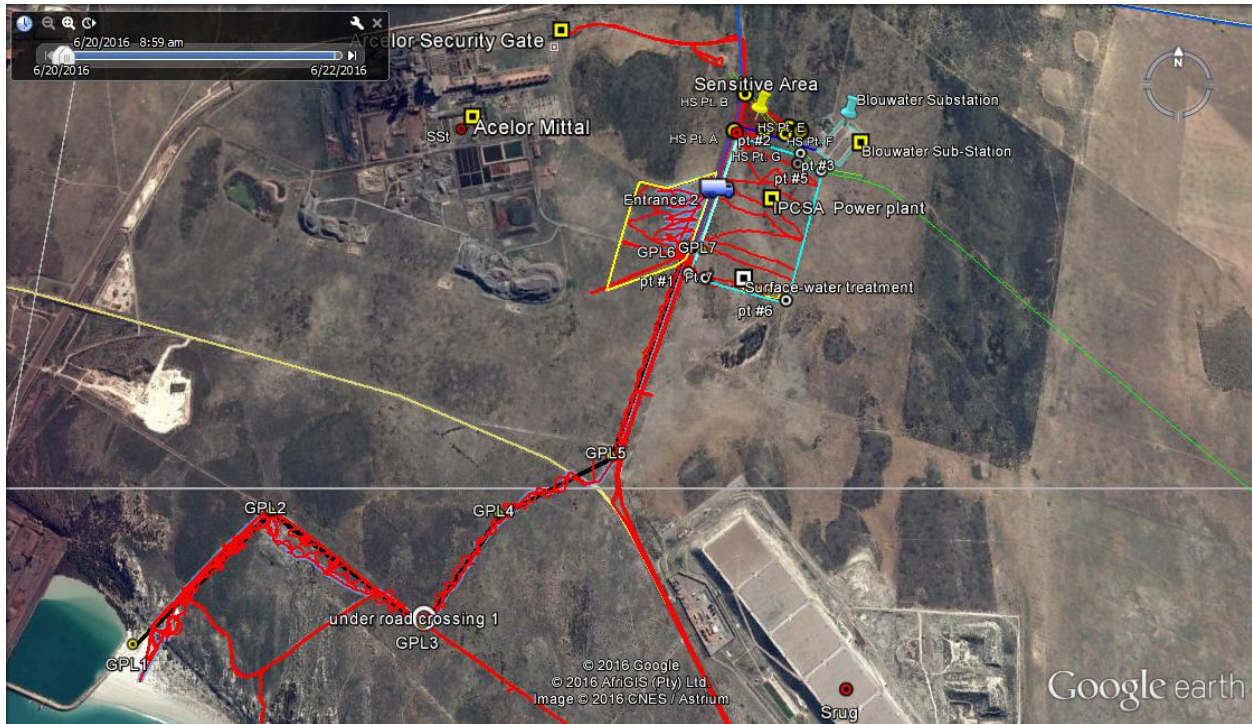


Figure 7. Combined tracks showing extent of coverage over the pipe line servitude and Alternative areas A and B. SSt=Saldanha Steel site; Srug=Skurwerug.

With the exception of sparse *Trigonephrus globulus* shells in the calcrete and rare trace fossils (root casts and insect burrows in calcrete lumps), no palaeontological or Pleistocene archaeological remains were observed on the surface.



Figure 8. Insect burrow (Top L); Disused field (bottom L); Root Casts (Top & Bottom R).

At the initiation point of the pipeline servitude, on the adjacent Witzand Formation dunes, is a deflated swale with a scatter of marine molluscs, primarily of *Donax serra*, *Maetra glabrata* and terrestrial *Trigonephrus globulus* (Figures 9 and 10); the shells are relatively recent and probably the result of gull-dropping.



Figure 9. Scatter of marine molluscs on deflated Witzand dune surface.



Figure 10. Scatter of recent terrestrial *Trigonephrus* on deflated Witzand dune surface.

The Witzand dunes gave way to a surface where calcrete of the Langebaan Formation outcropped (Figure 11).



Figure 11. Road cut through outcropping Langebaan Formation calcrete near start of pipeline servitude.

Past agricultural activity evidenced by piles of calcrete lumps typical of field clearance (Figure 12) was evident over much of the area traversed. Where Cape dune mole-rat *Bathyergus suillus* heaps were observed in old fields, pushed-up sand was clean of bone and stone.



Figure 12. Edge of disused field with pile of calcrete typical of removal during preparation of surfaces for agriculture.

Known Sites and Potential

Several important sites with fossils and/or Pleistocene archaeological material have been recorded in the Saldanha area (Table 2, Figure 13, 14). *Trigonephrus globulus*, root casts and insect burrows may occur anywhere in the Langebaan Formation. Their presence should be recorded, but since they tend to be ubiquitous, are not considered further in the assessment. Marine mollusc deposits of the Velddrif Formation occur near the coastline and reflect past sea level changes. They are important.

Table 2. Summary of palaeontological and Pleistocene archaeological sites noted. See Table 1 for lithological and chronological details regarding the formations within which fossils and/or stone artefacts occur.

| Site | Formation | Selected References | Type of Occurrence | Acronym |
|---|---|--|--|---------|
| Besaansklip | Langebaan | (Brink 2005); National Museum, Bloemfontein | Palaeontology. Hyaena den accumulation in Langebaan Formation. | Bklip |
| Danger Bay | Velddrif | (Pether 2014, Pether 2010a) | Palaeontological. Molluscs in raised beach deposits <15 m asl. | DangerB |
| Eensaamheid – Wind Farm proposal | Springfontyn Langebaan ?Varswater | (Avery and Avery 2009) | Palaeontology. Langebaan Formation included fossil gastropod <i>Trigonephrus globulus</i> . Potential, given depth of proposed foundations reportedly to >60 m. | Ens |
| Hoedjiespunt – hyaena | Langebaan | (Klein 1983, Berger and Parkington 1995, Churchill, Berger and Parkington 2000, Hare and Sealy 2013, Stynder et al. 2001, Stynder 1997, Woodborne 2000, Grine and Klein 1993); Iziko South African Museum Cenozoic Collections | Palaeontological. Brown hyaena den in eroded ridge of Langebaan Formation with terrestrial and marine taxa and modern <i>Homo sapiens</i> remains. | HDP1 |
| Hoedjiespunt – Middle Stone Age DAMA site | Langebaan | (Woodborne 2000, Kyriacou et al. 2015, Stynder et al. 2001, Stynder 1997, Will et al. 2013); Iziko South African Museum Cenozoic Collections, UCT | Middle Stone Age artefacts associated with shell midden, which includes terrestrial and marine vertebrate taxa. | HDP1 |
| Hoedjiespunt – Lime Quarry | Langebaan | (Cooke 1955, Hendey 1974) | Palaeontological. Marine fossils. First fossil otariid seal recorded in South Africa, (Cooke 1955), p166. | LQ |
| Hoedjiespunt – Sea Harvest – hyaena | Langebaan | (Grine and Klein 1993, Butzer 2004, Klein 1983); Iziko South African Museum Cenozoic Collections | Palaeontological. Brown hyaena den with terrestrial and marine taxa and modern <i>Homo sapiens</i> remains. In crevices eroded into the Langebaan Formation. Rhizoliths (root castes) and <i>Trigonephrus globulus</i> in aeolianites. | SH |

| | | | | |
|--|---|---|--|---------|
| Hoedjiespunt – Sea Harvest – Middle Stone Age midden | Langebaan | (Grine and Klein 1993, Volman 1978, Butzer 2004); Iziko South African Museum Cenozoic Collections | Archaeological. Middle Stone Age shell midden contiguous with adjacent hyaena dens. In eroded Langebaan Formation crevice/overhang. | SH |
| Kraalbaai | Langebaan (lower?) | (Rogers 1980, Compton and Franceschini 2005, Pether 2013b, Theron et al. 1992, Almond 2012) | Marine Molluscs underlying aeolianite. | Kraalb |
| Kreeftebaai – Tierbank, Postberg | Velddrif | (Flemming 1977, Pether 2013b); G Avery pers. observation | Palaeontological. Molluscs, including extinct <i>Crepidula capensis praerugulosa</i> in calcrete. (Pether 2013), Fig. 5. | Kreef2 |
| Kreeftebaai – Tierbank, Postberg | Velddrif | (Flemming 1977, Pether 2013b) G Avery pers. observation | Palaeontological. Molluscs in loose raised beach deposits above HWS. Palaeontological. (Pether 2013), Fig. 5. | Kreef1 |
| Langebaan – Kraalbaai | Langebaan (Kraalbaai Member) | (Roberts and Berger 1997, Roberts and Brink 2002) | Trackway of modern human <i>Homo sapiens</i> footprints; spoor of probable hyaena. Exposed between fractured cross-bedded structures of aeolianite. Rare vertebrate bones. | Fprint |
| Langebaan – Oosterwal | Langebaan | (R. Govender, pers. comm.); Iziko South African Museum Cenozoic Collections | Palaeontological. Marine fish and mollusc remains on intertidal platform. | Owal |
| Langebaan – Skrywershoek | Langebaan | (Grindley 1969, Rogers 1980, Haughton 1932, Franceschini 2003); Iziko South African Museum Cenozoic Collections | Palaeontological. Marine molluscs. Terrestrial vertebrates, including <i>Elephas</i> , exposed intertidally in Langebaan Lagoon and above. Not in Saldanha Municipal area. | Shoek |
| Langebaanweg – E Quarry | Langebaan; Varswater (including Saldanha) | (Hendey 1974, Grine and Hendey 1981, Hendey 1981, Roberts et al. 2011); Iziko South African Museum Cenozoic Collections | Palaeontological. National Heritage Site of global importance. Sub-surface, reached during mining. Highly diverse terrestrial, aquatic, marine vertebrate taxa; marine molluscs. Most taxa extinct. Plant taxa (pollens). Primates very rare, no hominins. Sea level > 40 m. | LBW |
| Langebaanweg – Baard’s Quarry | Langebaan; Varswater | (Hendey 1978); Iziko South African Museum Cenozoic Collections | Palaeontological. Sub-surface, reached during mining. Probably mixed Pliocene and Lower Pleistocene in river channels. Terrestrial and marine/estuarine vertebrate taxa. | Baard’s |
| Langebaanweg – Anyskop | Springfontyn | (Dietl, Kandel and Conard 2005, Conard 2001); Iziko South African Museum Cenozoic Collections | Middle and Late Pleistocene archaeological. Early Stone Age (ESA) artefacts – Late Acheulean – and Middle Stone Age – Howiesons Poort. | Akop |

Avery: PIA Gas-Fired Independent Power Plant, Saldanha Bay

| | | | | |
|---|------------------------|---|--|-------|
| Namaqua Sands Smelter | Langebaan ?Uyekraal | (Pether 2006) | Palaeontology. Bones noted in nearby borrow pit. Likelihood of intersecting fossiliferous formations if excavation is deep enough. | Nsand |
| Saldanha Bay – Small Bay | Velddrif Langebaan | (Pether 2010a) | Palaeontological. Marine molluscs exposed in raised beach deposits <15 m asl. | Sbay |
| Saldanha Bay – Spreeuwalle | Langebaan Velddrif? | (Flemming 1977, Avery et al. In Prep); Iziko South African Museum Cenozoic Collections | Palaeontological and Pleistocene archaeological. Diverse terrestrial taxa; aquatic and terrestrial molluscs around wetland. Date on overlying calcrete duricrust of 59 ka (W. Sharp, pers. comm.). Intertidal – formed during period of lower sea level. | SPW |
| Saldanha Bay – Yacht Club – Barn Owl | Langebaan | (Manthi 2002) | Palaeontological. Barn Owl roost with micromammal taxa. | YC |
| Saldanha Bay – Leentjiesklip | Langebaan | | Palaeontological. Marine molluscs exposed in development area. | Lklip |
| Saldanha Bay – Old Quarry | Langebaan | (Pether 2010a) | Palaeontology. Bones of tortoises and mollusc shells in old quarry near Iron Ore Port. | Oqua |
| Saldanha Bay Skurwerug | Langebaan | (Hendey and Cooke 1985, Tankard 1976, Rogers 1982); Iziko South African Museum Cenozoic Collections | Palaeontological. Excavations for crude oil storage encountered a small patch of important terrestrial fossils, including an extinct pig. | Srug |
| Saldanha Bay – Yacht Club – hyaena | Langebaan | (Avery 2014, Avery 2013); Iziko South African Museum Cenozoic Collections | Palaeontological. Brown hyaena den with terrestrial taxa. | YC |
| Saldanha Port – Portion 16 Pienaars Poort 197 | Velddrif Langebaan | G Avery pers. observation | Palaeontological. Marine molluscs exposed in raised beach deposits in borrow pit. | SP |
| Saldanha Steel | Langebaan | (Pether 1995, Roberts 1997a, Avery and Klein 2011, Avery 1994); Iziko South African Museum Cenozoic Collections | Palaeontological. Sub-surface, reached during deep foundation excavation. Some terrestrial <i>Trigonephrus globulus</i> in Langebaan Fm. | SS |
| SALKOR | Langebaan | (Pether 2011, Almond 2012) | Palaeontological. Sparse bones of ungulate. | SAL |

| | | | | |
|-----------|-----------|---------------------------|--|-------|
| Swartriet | Langebaan | G Avery pers. observation | Palaeontological. Intertidal. Patch of sparse vertebrate bones in eroding intertidal platform. | Sriet |
|-----------|-----------|---------------------------|--|-------|

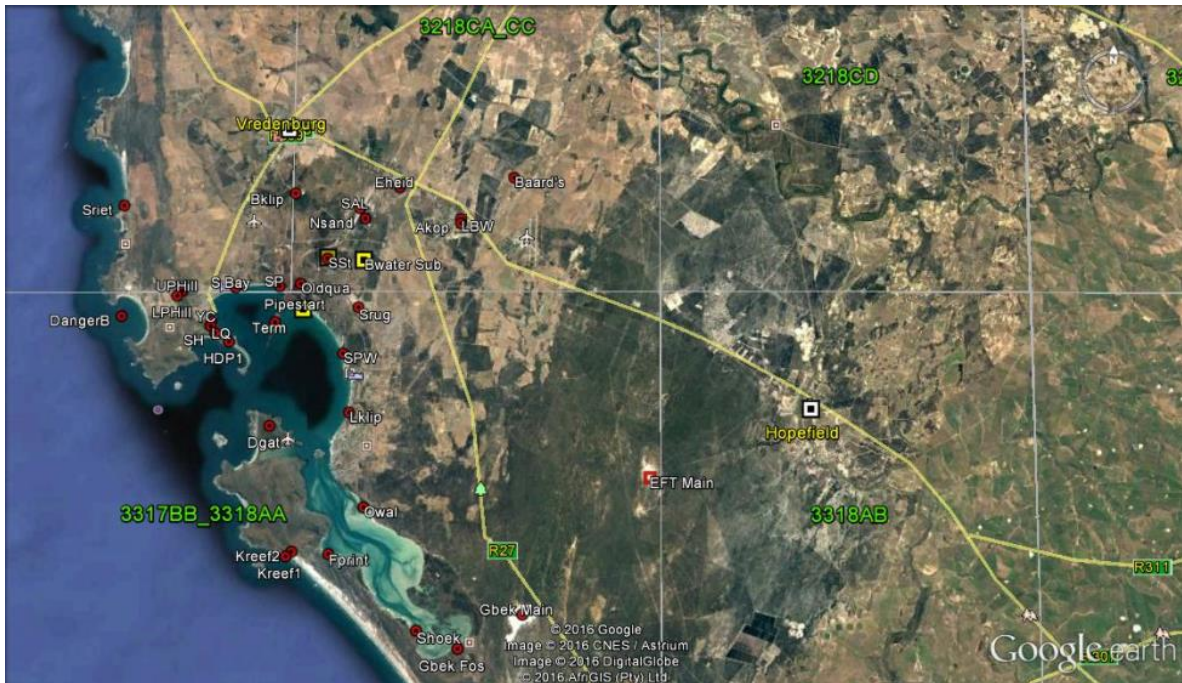


Figure 13. Google Earth view with locations of palaeontological occurrences.

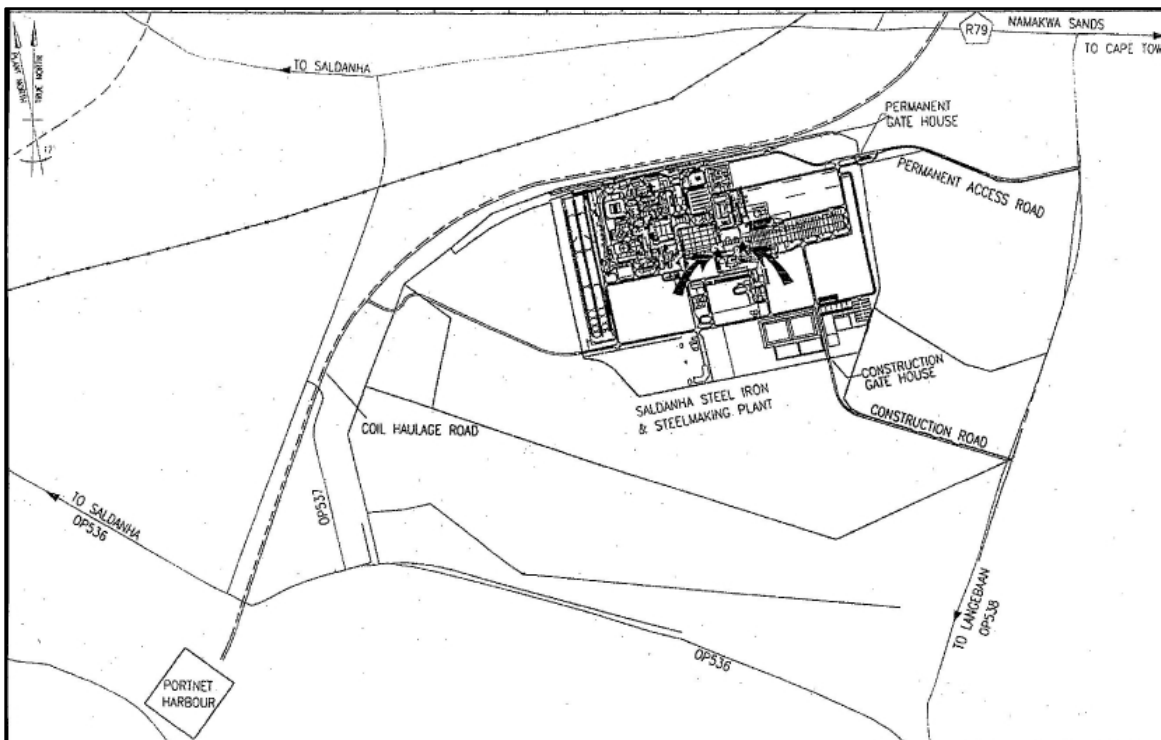


Figure 14. Location of fossils (arrowed) recovered during deep foundation excavation on Saldanha Steel precinct (Roberts 1997b).

Palaeontological Potential

A fossil record along the entire project area does not exist. However, based on the distribution and nature of known sites, sufficient information is available to make at least general assumptions of what may be expected in many areas. It is noted, however, that sub-surface palaeontological potential cannot properly be assessed superficially without digging.

It is entirely possible that excavations into sediments not normally accessible to palaeontologists will be encountered in sub-surface deposits of the Langebaan and Velddrif Formations. However, rather than treating this as a negative, implementation of appropriate management may enable observations otherwise impossible to be made and provide opportunities to recover important fossil material.

Portions of the proposed project area have been heavily disturbed by agriculture and these surfaces have been adequately covered during the foot survey, without revealing Palaeontological or Pleistocene archaeological remains other than terrestrial molluscs and insect burrows; these latter are ubiquitous and will have no effect on the project.

However, it is not possible to exclude the possibility that sparsely-distributed sub-surface fossils may be encountered during excavations. Small pockets of bone can occur, for instance, where bone accumulators like hyaenas, jackals or porcupines used holes/burrows dug by aardvarks; older and younger sediments, too, may contain ancient wetland deposits and/or more-recent sub-fossils, which would require appropriate recording.

Areas with good palaeontological records are shown, but do not preclude the possibility that palaeontological and/or Pleistocene archaeological remains could be found anywhere. Current knowledge is adequate to make predictions at the former and, to a certain extent the latter. The other areas are unknown, although it can be predicted that sparse fossils may be encountered.

As examples of potential, the richness of the globally important Langebaanweg (West Coast Fossil Park) fossil landscape (Hendey, 1981) and sites, such as Saldanha Steel (Roberts 1997b), Prospect Hill (Roberts and Brink 2002), Elandsfontein (Klein, *et al.*, 2007), Sea Harvest (Grine and Klein 1993), Hoedjiespunt 1 (Berger and Parkington 1995), (Brink 2005) Duinefontein 2 (Cruz-Uribe, *et al.*, 2003) and the Swartklip hyaena accumulation (Klein, 1975) and their important contributions to knowledge of past animal life should be noted.

Impact Assessment

Impacts are likely to be consistent across the servitude and power facility and are combined in Table 3.

Given that the depth of ancillary facilities is unknown, it is noted that, should they encounter earlier Formations than the Langebaan and Velddrif, mitigation may be at a different level of detail.

Impacts during construction are possible in all areas. Loss of material would be irreversible. Appropriate mitigation (see Recommendations) would alleviate this.

Cumulative impacts are possible in all areas in future if further excavation contemplated.

Gas Line: Proposed line (Figure 7) is supported.

No palaeontological preference over alternative areas Site A (adjacent to Saldanha Steel) or Site B (adjacent to Bluewater).

Table 3: Potential impact to buried Palaeontology

| | | |
|---|---------------------------|-----------------------------|
| Nature: Disturbance and destruction of Pleistocene palaeontological material by construction of the pipeline and power plant | | |
| | Without Mitigation | With Mitigation |
| Type | Direct | Direct |
| Extent | Local | Local |
| Duration | Permanent (Irreversible) | Permanent |
| Scale | Medium | Small |
| Frequency | Unknown | |
| Likelihood | Likely | Unlikely |
| Impact Magnitude | Medium | Negligible Impact Magnitude |
| Receptor Sensitivity | High | Low |
| Impact Significance | High | Low |
| Status (positive or negative) | High | Negligible |
| Irreplaceable loss of resources? | Yes | Negligible |
| Can impacts be mitigated? | Yes | |
| <p>Mitigation: Impacts are expected to be low. It is recommended that:</p> <ul style="list-style-type: none"> • Excavations be monitored by suitably-qualified person with palaeontological experience. • If any palaeontological material is uncovered during construction, protocols established in EMP to kick in (possible collection, stoppage in specific area, recording, etc). If permit not already acquired by monitor, work must stop in that area and Heritage Western Cape must be notified (Telephone: 021 483 9685). • Collected material to be placed in Iziko SA Museum Cenozoic Collections. • If Human remains are encountered: SAPS and SAHRA (Telephone: 021 462 4502) must be notified immediately and work in that area stopped until assessed by appropriately-qualified person. | | |
| <p>Cumulative impacts: The cumulative impact of increased development on the sensitive palaeontological resources of the Saldanha Bay area is high, if mitigation measures are not applied. If mitigation, in the form of monitoring, as described above, is implemented, then the benefits of the development will be positive.</p> | | |
| <p>Residual impacts: N/A</p> | | |

Cumulative Impacts

Within the last 30 years, Saldanha Bay has been transformed into a significant center of heavy industry within the Western Cape. Since the construction of the bulk terminal and dredging of the bay to accommodate large bulk carriers in the 1970's, several other companies have developed large operations in the area, namely the Saldanha Steel smelter, and the Namakwa Sands Smelter which both use the Port of Saldanha's general cargo facilities. Thus, within a relatively short period of time the northern edge of the bay has been transformed from windswept wilderness into a near-industrial landscape.

Hart & Pether (2008) note that the palaeontological sequence of the Saldanha – Langebaan areas is therefore well described. Numerous palaeontological impact assessment reports have been produced over the last two decades (see References at the end of this report). The reports are unanimous in noting the significance of the palaeontological resources. However, the

distribution of resources is patchy and unpredictable and the resources have never been found to be a fatal flaw in development.

Palaeontological material are likely to be destroyed by bulk earthmoving and mining operations; however palaeontological resources tend to be extensive (depending on the resource) and are rather more resistant to impact than archaeological material for the simple reason is that there is more of it. Because palaeontological material is often very deeply buried, scientists often rely on human intervention in the land surface to collect data. Aside from natural exposures, open cast mines, quarries and deep road cuttings often present the only opportunities for palaeontologists to examine deep sediments which under normal circumstances they may not have access to.

In summary, provided that palaeontologists can use the opportunity arising from major construction works to adequately sample and record profiles and exposed material as part of the environmental management process, a potential negative impact can be transformed into a positive opportunity to increase the levels of knowledge about a locality and its past environments.

Mitigation

Heritage Permits Required

- The primary heritage legislation that needs to be considered is The South African Heritage Resources Act 25 of 1999, amendments and regulations (www.sahra.org.za). All heritage material, including human burials, is included.
 - Clearance in terms of the National Heritage Act of 1999 and the National Environmental Management Act (NEMA, Act 107 of 1998) will be required before a development can proceed. Legislation vested in other State institutions, such as the Departments of Mineral Resources and Water Affairs may also apply.
 - A permit for the disturbance and removal of palaeontological material will be required from the Western Cape Provincial Heritage Agency; potential delays could be minimized by the appointed specialist obtaining a permit before mining is initiated.
 - If human remains are encountered, or presence of a burial is suspected, the South African Heritage resources Agency (SAHRA) must be notified immediately; no bones may be further moved until an archaeologist or appropriately-qualified palaeontologist has assessed them and a permit from SAHRA, in such cases, is granted. SAHRA must be contacted immediately through the appointed specialist and laid down procedures, including notification of the SAPS, must be followed.

Recommendations

1. Sub-surface excavations should be monitored by a palaeontologist or archaeologist with appropriate palaeontological experience. The frequency of this to be worked out *a priori* with the contractor to minimize time spent on site.

2. Potential impacts are manageable. Protocols for dealing with palaeontological monitoring and possible further mitigation must be included in the Environmental Management Plan (EMP).
3. Any material recovered will be lodged in the Cenozoic collections of Iziko South African Museum.
4. Funds must be available *a priori* to cover costs of fieldwork and one date should the need arise.

Environment Management Plan (EMP)

Palaeontological Points for EMP

- Other examples exist, but Pether (2010b) and Roberts and Braun (2014) provide outlines for the development of a Palaeontological Management Plan and protocols, which can be adapted to specific circumstances in consultation with an appropriately-qualified palaeontologist. In this context, each project should be assessed in its own right.
- Training in the nature and value of palaeontological and archaeological remains should be provided to project staff and equipment operators.
- Excavations will provide an opportunity to assess the sub-surface palaeontological potential and geology of the site.
- All fossils are protected by law. Should anything of a palaeontological nature be encountered on site by the Contractor (or any other party), e.g. bones or wetland deposits, work is to be stopped in that area immediately, and the OM / Principal Agent notified. Failure to do so will result in a penalty and this must be carefully explained to workers during the Environmental Education Programme undertaken by the OM. The author of this report can assist with training in basic recognition of palaeontological material.
- In the event of palaeontological material being encountered, the OM will demarcate the area and notify the appointed specialist (palaeontologist/ archaeologist with appropriate experience) who will view the material and ascertain whether further study of the area is required.
- Should the specialist confirm a genuine fossil or sub-fossil and recommend further study of the area, work in the applicable area is to cease until further notice while arrangements are put in place. Heritage Western Cape (HWC) is to be informed immediately by the OM.
- Should any human remains be disturbed, exposed or uncovered during excavation, these shall immediately be reported to the South African Police Service and, if suspected that the remains are older than 60 years, the SAHRA (tel 021 462 4502) and Heritage Western Cape (HWC).
- Removal of discovered palaeontological remains, by a contracted specialist shall be at the Developer's expense.

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Appendix A

Profile Dr Graham Avery

Graham Avery, a retired archaeozoologist, grew up in East London and worked at Iziko South African Museum for more than 40 years. In the Archaeology Department he administered the Archaeological Data Recording Centre, conducted research, curated archaeological artefact and faunal collections and became Head; with the establishment of Iziko he moved to Cenozoic Studies in the Natural History Collections Department. In his tenure in the Natural History Department he fulfilled the role of curator, scientist and mentor of new staff.

His Masters dissertation (UCT, 1976) was on Open Coastal Shell Middens between Cape Agulhas and Kleinmond and his PhD (UCT, 1990) was on Birds, Pleistocene Palaeoenvironments and Palaeoecology at Eland's Bay Cave, Die Kelders Cave and Nelson Bay Cave.

As an archaeozoologist his research focuses on the palaeoecology of past humans and animals, particularly birds, within the framework of changing terrestrial and coastal environments, including sea levels during the Pleistocene and Holocene primarily in the area between Eland's Bay and Cape Agulhas studying coastal shell middens, tidal fish traps and palaeontological occurrences like Spreeuwalles (Saldanha Bay), Elandsfontein (near Hopefield) and Duinefontein 2 (Koeberg Nature Reserve). He conducted monthly surveys for beached seabirds and seals over twenty nine years, using the results to elucidate Middle and Later Stone Age exploitation of seabirds. He has identified and assembled comparative samples of large raptor, jackal, porcupine and hyaena prey for biologists and taphonomic assessments that can improve our understanding of past human and predator behaviour. He has worked in South Africa, Zambia, Kenya and France and has co-directed excavations at Die Kelders Cave 1, Duinefontein2 and Ysterfontein 1 with Dr Richard Klein (Stanford University, USA) and his teams.

As a consequence of his research he has acquired significant knowledge of and experience in the Quaternary and other deposits of the Western Cape and the fossils they contain.

He has been involved in completed exhibits on South African archaeology and rock art, Robben Island, Darwin in the Cape, *Australopithecus sediba*, public outreach at Die Kelders Cave (aka Klippgat) and is currently working on an outreach project at Ysterfontein.

In retirement he continues his palaeoecological research on birds and mammals from archaeological, palaeontological and predator accumulations and has conducted a number of Palaeontological Impact Assessments (PIAs) in Quaternary contexts of the Western Cape.

He joined the South African Archaeological Society as a 12 year old, served as Western Cape Secretary/Functions Organizer in the 1970s and has recently been elected Vice-President. He is a member and Past President of the Southern African Association of Professional Archaeologists (accredited for Cultural Resource Management), a member and Councillor of the Royal Society of South Africa, an Honorary Member and Past President of the Wildlife and Environment Society of South Africa, a member of the Advisory Board for the Percy FitzPatrick Institute of African Ornithology's, a member of the Permits Committee of Amafa and a member of the Scientific Advisory Board, Cape Town Science Centre. He is Editor of the Royal Society's *RSSAfNews* and has edited *Piscator*, the Journal of the Cape Piscatorial Society.

Curriculum Vitae Dr Graham Avery

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Professional Qualifications

- ❑ PhD (archaeology) 1990 “*Archaeological and palaeoenvironmental interpretation of avian remains from archaeological sites*”. University of Cape Town.
- ❑ MA (archaeology) 1976 “*Systematic Investigation of Coastal Shell Middens in the South Western Cape*”. University of Cape Town.
- ❑ BA (Archaeology, Social Anthropology, African History, History and Geography) 1969 University of Cape Town.

Current Positions

Retired 31 January 2012.

Associate Natural History Collections Department, Cenozoic Studies, Iziko South African Museum (April 2012–).

Research Associate, Archaeology Department, University of Cape Town (July 2012–).

Positions Held

- ❑ Archaeozoologist, Curator of Quaternary Collections, Cenozoic Studies Section, Natural History Department, Iziko South African Museum (2002–January 2012). [moved to Natural History Collections Department when Iziko came into being]
- ❑ Head of Human Sciences Division, South African Museum (1993–2002).
- ❑ Head of Archaeology Department, South African Museum (1990–1993).
- ❑ Acting Head of Archaeology Department, South African Museum (1985–1990).
- ❑ Researcher, Archaeology Department, South African Museum (1980–2002).
- ❑ Manager: Archaeological Data Recording Centre, South African Museum (1974–1979).
- ❑ Environmental Archaeologist, South African Museum (1970–1973).
- ❑ Manager (temporary): Archaeological Data Recording Centre, South African Museum (1969).

Research

Research Interests

The Late Quaternary palaeoecology of south-western Africa covering material from the Pliocene to the Holocene:

- ❑ Archaeozoological studies—mammals, birds and molluscs in the palaeo-ecological and human history of South Africa;

Experimental and comparative actualistic studies – taphonomy of human and non-human bone accumulations resulting from carnivores, scavengers and raptors, such as hyaenas, jackals, leopards, eagles and the larger owls. These include a 29-year long-term project monitoring beached birds and mammals;
- ❑ Past climates and environments using evidence from birds and mammals (including pollens from hyaena coprolites); and
- ❑ The application of archaeozoological and palaeontological research to modern issues of global change, conservation, heritage resource management and education.

Research Projects

- ❑ Taphonomy of Verreaux's Eagle prey (with Aaron Armstrong, University of Minnesota). Paper Published in Journal of Archaeological Science.
- ❑ Prey of Verreaux's Eagles in the Cedarberg and Sandveld (with Megan Murgatroyd, UCT) – Paper in press Avian Biology.
- ❑ Prey of African Crowned Eagle in Urban areas of Kwazulu Natal (with Malan, et al.). 2008 – 2014. Paper published Ostrich.
- ❑ Taphonomy and pathology of seal remains from the Langebaanweg Early Pliocene fossil site (with R. Govender, Iziko Museums of South Africa).
- ❑ Interpreting the environment of human development in eastern Africa (with D.M. Avery, Iziko SA Museum and F.K. Manthi and S. Mucila, National Museums of Kenya. Funding from PAST 2009 – ongoing.
- ❑ Spreeuwalle Late Pleistocene Wetland on The Western Cape Coast, South Africa, And its Implications for the Pleistocene History of the Fynbos (with R.G. Klein, Stanford University, USA, C. Cordova, Oklahoma State University, USA, E. Bergh, Iziko South African Museum, Warren Sharp, UC Berkeley, USA and Julie Luyt, University of Cape Town). Funding From Leakey Foundation and PAST. 2003 – Ongoing.
- ❑ Uniab brown hyaena den: Taphonomy of a modern hyaena den on the Uniab delta fan, Skeleton Coast Park, Namibia (with P. Fosse, CNRS, Université de Toulouse Mirail, France, J-B. Fourvel, Université de Toulouse Mirail, France, J-F. Tournepiche, Angolême Museum, D.M. Avery, Iziko Museums of South Africa, R. Loutit and S. Braine).
- ❑ Pathologies on Gemsbok at the Uniab brown hyaena den (with R. Govender, Iziko Museums of South Africa).
- ❑ Human behavior, taphonomy, biodiversity and palaeoecology from osteological remains of birds from archaeological and palaeontological sites in the western and Eastern Cape Provinces: Includes a range of Middle and Late Pleistocene occurrences.
- ❑ CNRS/NRF International Co-operation Project on taphonomy of spotted hyaena bone accumulating habits. (with P. Fosse, CNRS, Université de Toulouse Mirail, France, J-F. Tournepiche, Angolême Museum and J-B Fourvel, Université de Toulouse Mirail, France). 2002 – ongoing.
- ❑ Late Pleistocene Middle Stone Age shell midden at Ysterfontein (with R.G. Klein, Stanford University, T.E. Steele, UC Davis, D. Halkett, University of Cape Town): excavation and study of

the bird remains. 2002–2007. Paper published in South African Archaeological Society Goodwin Series.

- ❑ Records of Middle and Upper Pleistocene birds in fossil and archaeological sites. – ongoing.
- ❑ Palaeo-ecology of the Western Cape Coast. (with Klein, R.G., Stanford University, L. Scott, University of the Free State). Funded initially by NRF grant to A. Chinsamy-Turan, Iziko Museums of Cape Town). 2002 – ongoing.
- ❑ Prey of black sparrow hawks in the western Cape (with R. Simmons, Percy FitzPatrick Institute for African Ornithology, University of Cape Town, and O. Curtis, Cape Technikon Nature Conservation MA student). 2002 – ongoing.
- ❑ Cercopithecoid and other remains in crowned and black eagle prey assemblages. (with J. P. Kerbis, Field Museum, Chicago, USA; G. Malan, Tshwane University of Technology; A. Armstrong, University of Minnesota, USA). 2001 – ongoing.
- ❑ Co-Director of Duinefontein Project (with R.G. Klein, Stanford University and K. Cruz-Uribe, Northern Arizona University): excavation and overall interpretation; avian remains; palaeo-environment (carbon and oxygen isotopes with J. Lee-Thorp, University of Cape Town); pollens in hyaena coprolites (with L. Scott). NSF and Leakey Foundation funding allocated to RGK. 1997–2002. Various publications.
- ❑ Co-Director of Die Kelders Cave Project (with R.G. Klein Stanford University, F.E. Grine and C. Marean, State University of New York at Stony Brook). NSF funding allocated to RGK. 1992–1995. Various publications.
- ❑ Prey of black, martial and crowned eagles in the Cape Province (with A. Boshoff and G.N. Palmer, Cape Nature Conservation). 1988–1994. Papers published.
- ❑ Late Quaternary palaeoecology of south-western Africa – avian fauna project, taphonomy of modern and archaeological/fossil bone accumulations and an investigation of the Middle Pleistocene hominid and other occurrences at the Elandsfontein fossil site, south-western Cape. Funding through colleagues involved in the project. Now part of “Palaeo-ecology of the Western Cape Coast Project” 1980 – ongoing.
- ❑ Avian fauna, palaeoenvironments and palaeoecology in the Pleistocene/Holocene of the southern and western Cape (PhD). Funding through colleagues involved in excavation projects. 1978–1990.
- ❑ Monthly survey of dead seabirds and marine mammals on South African beaches. 1977–2006.
- ❑ Archaeological salvage of historical material from the Cape Town Station Concourse and Golden Acre Sites. Excavation and preservation of Wagenaar's Reservoir. 1974–1979.
- ❑ Systematic investigation of open-station shell midden sites along the south-western Cape coast (MA). CSIR, HSRC, Museum funding to GA. 1970–76 (MA).

Fieldwork Experience

- ❑ Extensive fieldwork (survey and excavation) at a range of archaeological and palaeontological sites dating from the Miocene to the Holocene (see Appendices 1 & 2).
- ❑ Surveys and collections of modern prey of mammals and raptors for taphonomic and palaeo-environmental studies.
- ❑ Monthly surveys for beached seabirds birds and marine mammals over 29 years.

- Initial development of the avian comparative osteology collection and contributions to its subsequent expansion and to that of the mammal comparative osteology collection. Assisted in the collection of barn owl pellets and in bird atlassing. This and other study material (above) led to the establishment of the Iziko Taphonomic Collection in Cenozoic Studies.

Curatorial and Museology

Collections Management

Planning, management, curation and co-ordination of the archaeological, physical anthropology and Quaternary collections of Iziko SA Museum, as well as the Archaeological Data Recording Centre. Using databases of different types. Writing contracts for collections, external loans and impact assessments. Overseeing the input of the archaeological, physical anthropology caste and Quaternary mollusc collections on Excel spreadsheets to make them more accessible and contributing to the improvement and upgrading of the LogosFlow Humanities Database, used by the African Studies section. Assisting in the development of a LogosFlow Archaeology/Quaternary Database to capture data for individual cultural items, fossils and assemblages with a view to simplifying transfer of data already on spreadsheets to an Access relational database.

Collections Policy Development

Assisting in the development of Archaeology, Human Remains and Palaeontology collection policies.

Sensitive Collections

Best practices for sensitive collections (human remains). Organized a workshop on sensitive collections, the results of which led to greater understanding of museum and social issues, which have significantly changed the way in which many museums in South Africa treat human remains in particular. Contributed to public forums on the issues of museums and human remains and a member of the Iziko Reference Group on Human Remains, which developed Iziko's current Policy on Human Remains.

Collection Development and Access

Development of the archaeology, Quaternary, Comparative Osteology and Taphonomy collections. Encouraged researchers to use the museum as an institutional base and to deposit their material in Iziko's collections leading to significant additions to Iziko holdings at virtually no cost to the museum. As visitors, they have helped to create critical mass in cultural archaeology, archaeozoology, and Quaternary palaeontology, added scientific value to the collections and enhanced public and academic perceptions (local and international) of the museum.

Marketing Iziko's archaeological and Quaternary collections, which have been increasingly studied by local and international researchers and postgraduate students.

Cultural Resource Management (CRM)

Extensive experience in this field. See Honorary Positions and Appendix 1.

Contributions to Development and Training

Lectures to university and technikon students and courses on the curation and conservation of collections and collection management. Provided in-service training and mentoring for museum staff, university students, postdocs and interns. Participated in training programmes for tour guides and museum volunteers.

Organizational and Management

See also under Honorary Positions.

Other training

- ❑ Workshop on Employment Relations February 2008 (Prof. Barney Jordaan)
- ❑ Rating Staff Performance, May 2008 (Iziko).
- ❑ Workshop on Managing Behavioural Change July 2006 (Simply Talented).
- ❑ Workshop on Competency-Based Interviews July 2006. (Willem Conradie).
- ❑ Workshop on Strategic Implementation Of The Employment Equity Act, March 2005 (Brian Williams Consultancy).
- ❑ Workshop on Performance Management 2005 (Iziko).
- ❑ Workshop on Hiv-Aids 2005.
- ❑ Workshop on Developing A Constitution For The Employment Equity Consultative Forum 2005 (Brian Williams).
- ❑ In-service-training in archaeological data management and on the curation and conservation of archaeological and Quaternary collections.
- ❑ Corporate Business & Management Training Course “Principles of Management” 2002.
- ❑ Effective Meetings 2003. (Non-Profit Resource Training Course).
- ❑ Introduction to Fundraising in South Africa 2001 (Non-Profit Resource Training Course).

Active member of Iziko’s Employment Equity Consultative Forum from its inception to the end of 2005 (representing the Professionals Group and White Males) and drafted its Constitution.

Extensive organizational, management and leadership experience; led and co-operated on research, collection and exhibition projects, within and across departments and institutions, from inception to completion, making effective use of limited human and other resources. For two years I supervised and re-motivated the curatorial and preparation staff responsible for the mammal and avian comparative osteological collections. I have developed and managed divisional budgets and supervised project teams. I am proficient at scheduling and running meetings, discussions, conferences and workshops. I have, with other staff, encouraged researchers and students to study Iziko collections and developed a supportive environment that has led to increased numbers of research visitors.

I was involved in strategic planning and goal-setting in the museum and other organizations, particularly WESSA, a Non-Government Environmental Organization with a multi-million Rand budget. Member of the South African Museum committee responsible for the development of its structure, which was introduced in 1993 and involved in developing structural advances in post-Apartheid Iziko, as an elected member of the Workflow Forum and in various consultative processes.

I was instrumental in the initiation of discussions that led to the successful formal partnership and joint honorary appointments between the University of Cape Town and the South African Museum.

Public Programmes, Public Understanding of Archaeology and Palaeontology and Communication

I have a fundamental respect for the power of knowledge and its role in maintaining human dignity coupled with a wish to pass on information I am privileged to have gained through my studies and experiences. I am an enthusiastic communicator with excellent “people”, oral and written skills, which enable me to share my knowledge with a wide range of age-groups, educational levels and social backgrounds.

I have applied the results of my archaeozoological and palaeontological research to training, education and tourism/recreation. I have lectured extensively to adult and learner audiences, tertiary level students and conferees, and conducted behind-the-scenes activities and excursions for the same groups. I have regularly contributed to the museum’s Summer and Winter School programmes and the

development of teacher and learner resources and the museum's online resources. I was web co-ordinator for the Natural History Collections Department.

- ❑ The museum's public programmes are its link with its public and a key measure of the success with which we address transformation and empowerment. As my contribution in this sphere I have, for instance, been involved in re-contextualizing the San Diorama, the "*Ulwazi Lwemvelo - Indigenous Knowledge in South Africa*" exhibit and the whale exhibit and have helped publish a teaching resource. These illustrate my commitment to empowerment and the development of partnerships with other institutions and local communities.
- ❑ Initiating and assisting in the planning, co-ordination and leadership of a number of exhibitions (archaeology, rock art, Robben Island, indigenous knowledge, Blombos Cave artefacts, *Search for Our Early Ancestors*, *Natural Selection, Darwin and the Cape* and *Australopithecus sediba*) and exhibition planning for "Origins", "New Cenozoic", "Human Journey", "San Diorama" and "Links between natural history and culture").
- ❑ Outreach projects that led to exhibits at Cape Town's Golden Acre (17th century Wagenaar's Reservoir, 19th century Maclear's Beacon), the Elandsfontein fossil site at the Hopefield Information Centre and the development of information boards for the Klipgat Cave (Die Kelders). Currently part of a team developing information boards for the Ysterfontein 1 archaeological site.
- ❑ Interviews by and features in the media, including the press, television and documentary films, the most recent being the "Shorelines" documentary.
- ❑ Cultural Resource Management. Heritage impact assessments, site preservation and cultural tourism related to archaeological and palaeontological sites.
- ❑ Compiling, with A. Galla (Australia), and coordinating the publication of "*Changing the Paradigm: a Plan for Diversifying Heritage Practice in South Africa*", a discussion document on the transformation of South African museums, for SAMA, that arose from the proceedings of the South African Museums Association Cross-Cultural Workshops, which were held at museums around South Africa.
- ❑ Organization of a workshop on "Sensitive Collections" and member of reference group that developed Iziko Museum's Policy on Human Remains.

Membership of Professionally-Related Societies

- ❑ Royal Society of South Africa.
- ❑ Association of Southern African Professional Archaeologists (ASAPA). Professional Member #008 with Cultural Resource Management (CRM) accreditation.
- ❑ South African Society for Quaternary Research (SASQUA).
- ❑ International Council for Archaeozoology (ICAZ).
- ❑ South African Archaeological Society.
- ❑ Southern African Museums Association (SAMA) (Life Member).

Other Primary Interests

Conservation, particularly participation in processes aimed at engendering and promoting civil and State understanding and the implementation of sound practices in environment and resource use. To this end, I have been active in promoting the principles, policies and actions of WESSA of which I have been a

Avery: PIA Gas-Fired Independent Power Plant, Saldanha Bay

Regional Chairman, National Councilor, Board member and, as national President, Chairman of the Council and Board of Directors. I am a strong and active supporter of the Society's initiatives in environmental education and conservation, empowerment of communities and networking with other environmental NGOs.

Honorary Positions

Vice-President, South African Archaeological Society (2016-2018).
Honorary Research Associate, Iziko South African Museum (2012-).
Research Associate, Archaeology Department, University of Cape Town (2012-).
Editor *RSSAfNews* (2012-).
Editor *Piscator* (2012-2015).
Council Member Royal Society of South Africa (RSSAf) (2010-2016).
Member Cape Town Science Centre Scientific Advisory Board (2008-).
Member of Cape Nature Klipgat Development Group (2004-2007).
Past President and Honorary Life Member Wildlife and Environment Society of South Africa (WESSA) (2004-).
Member: Permit Review Committee, Amafa aKwaZulu-Natali (Heritage KwaZulu-Natal) (2001-ongoing).
Chairperson, Southern African Association of Archaeologists (now ASAPA) (2000-2004).
Specialist Advisor: Archaeology, Palaeontology & Meteorite Permit Committee, South African Heritage Resources Agency (SAHRA) (2000-2003).
Research Associate, University of Cape Town (UCT/Iziko MOU) (1999-2011).
Member of the Percy FitzPatrick Institute for African Ornithology Advisory Board (Representing WESSA) (1999-).
Trustee, World Wildlife Fund South Africa (WWF SA) (1999-).
Trustee, Klipgat Trust for coastline and heritage between Die Kelders Cave (Klipgat) and Gansbaai (1998-).

Awards (Other than Grants)

Honorary Life Membership of the Wildlife and Environment Society of South Africa (WESSA) (2004).
Heritage Award Amafa Akwazulu Natali (conservation of heritage in KwaZulu Natal).

Personal References

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Dr Richard Lewis (Consultant in Business Management and Labour Law)

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Prof. C. Garth Sampson (archaeologist)

Appendix 1 – Publications/Reports

In Preparation, Submitted and In Press

Murgatroyd, M., Avery, G. Underhill, L.G. and Amar, A. **In Press**. Adaptability of a specialist predator: The effects of land use on diet diversification and breeding performance of Verreaux's eagles". *Avian Biology*.

Cordova, C. & G. Avery (**Submitted May 2016**) African savanna elephants and their vegetation associations in the Cape Region, South Africa: Opal phytoliths from dental calculus on prehistoric, historic and reserve elephants. *Quaternary International*.

Govender, R. and Avery, G. **Submitted 2015**. Bone pathologies on Gemsbok *Oryx gazella*, from Uniab River fan, Skeleton Coast Park, Namibia.

Garcia-Heras, M. S., F. Mougeot, R. E. Simmons, G. Avery, M. Avery and B. Arroyo 2016 **In Prep** Assessing the diet of a vulnerable raptor species endemic from southern Africa, the Black Harrier *Circus maurus*. *Ostrich*

Avery, G. **In prep**. A new Pliocene species of *Arctocephalus* (Pinnipedeae: Otariidae) from the west coast of South Africa.

Avery, G. Klein, R.G., Cordova, C., Bergh, E., Sharp, W. and Luyt, J. **In Prep**. Spreeuwalle: a Late Pleistocene Wetland on the Western Cape Coast, South Africa, and its Implications for the Pleistocene History of the Fynbos.

Avery, G. Fosse, P., Fourvel, J-B., Tournepiche, J-F., Rudi Loutit, R. Avery, D.M. and Braine, S. **In Prep**. Modern brown hyaena (*Parahyaena brunnea*) bone accumulation in the Uniab River coastal fan, Skeleton Coast Park, Namibia, and taphonomic implications.

Avery, G. **In Prep**. Middle Pleistocene birds from the Western Cape Province, South Africa.

Avery, G., Scott, L., Fosse, P., Fourvel, J-B. and Tournepiche, J-F. **In Prep**. Late Holocene vertebrate fauna and vegetation from a Brown Hyaena *Parahyaena brunnea* den in the Sutherland District, Western Cape Province, South Africa.

Articles

Malan, G.E. Strydom, S. Schultz & G. Avery 2016. Diet of the nesting African Crowned Eagles *Stephanoaetus coronatus* in emerging and forest-savanna habitats in KwaZulu-Natal, South Africa. *Ostrich* 87: 145-153.

Fourvel, Jean-Baptiste, Philippe Fosse and Graham Avery 2015. Spotted, striped or brown? Taphonomic studies at dens of extant hyaenas in eastern and southern Africa. *Quaternary International* 369: 38-50.

Aaron Armstrong and Graham Avery 2014. The taphonomy of Verreaux's Eagle (*Aquila verreauxii*) prey accumulations from the Cape Floral Region of South Africa: implications for archaeological interpretations. *Journal of Archaeological Science* 52: 163-183.

Avery, G. 2011. Holocene avian remains, human behaviour and seasonality on the South African coast. In: Jousse, H. and Lesur, J. (eds). *People and Animals in Holocene Africa. Recent Advances in Archaeozoology. Reports in African Archaeology* 2: 110-122.

Avery, D.M. and Avery, G, 2011. Micromammals in the Northern Cape Province, South Africa: past and present. *African Natural History* 7: 9-39.

Avery, G. and Klein, R. 2011. Review of fossil phocid and otariid seals from the southern and western coasts of South Africa. *Transactions of the Royal Society of South Africa* 66(1): 14- 24.

Fosse, P., Philippe Fosse, Graham Avery, Nuria Selva, Wojciech Smietana, Henryk Okarma, Adam Wajrak, Jean-Baptiste Fourvel et Stéphane Madelaine 2011. Taphonomie comparée des os longs d'ongulés dévorés par les grands prédateurs modernes d'Europe et d'Afrique (*C. lupus*, *P. brunnea*). In: Brugal, J.-P., Gardeisen, A. and Zucker, A. (Eds). *Prédateurs dans tous leurs états. Évolution, biodiversité, interactions, mythes, symboles Rencontres internationales d'archéologie et d'histoire d'Antibes XXXI*: 127-156.

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Appendix 2 – Field Experience

Experience Gained from others

- ❑ Archaeological Field School, Middelburg Ash Heap Project—volunteer supervisor, C.G. Sampson, University of the Witwatersrand & Southern Methodist University (1990).
- ❑ Langebaanweg fossil site, southwestern Cape—Q.B. Hendey, Palaeontologist, South African Museum (1975).
- ❑ Byneskranskop Cave, southwestern Cape—F.R. Schweitzer, South African Museum (1974)
- ❑ Duinefontein hominid and fossil sites, southwestern Cape—R.G. Klein, University of Chicago (1974).
- ❑ Kangara & Paardeberg Caves, southern Cape—H.J. Deacon, University of Stellenbosch (1973).
- ❑ Nelson Bay Cave, southern Cape—R.R. Inskeep, University of Oxford (1973)
- ❑ Nelson Bay Cave, southern Cape—R.G. Klein, University of Chicago (1971).
- ❑ Die Kelders Cave, southwestern Cape—F.R. Schweitzer, South African Museum (1969-70).
- ❑ De Hangen Shelter, western Cape—J. Parkington, University of Cape Town (1968-69).
- ❑ Klasies River Mouth Caves, southern Cape—J.J. Wymer, University of Chicago (1967).

Own Excavations (excludes small salvage)

- ❑ Ysterfontein MSA midden with R.G. Klein, T.E. Steele and UCT Archaeological Contracts Office. (2005-2007).
- ❑ Spreeuwalle wetland. (2003-).

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- ❑ Duinefontein 2 excavation with R.G. Klein, K. Cruz-Urbe, H.J. Deacon [1997] and UCT Archaeological Contracts Office. (1997-2001).
- ❑ Die Kelders Cave 1 extension excavation with R.G. Klein, F.E. Grine and C.W. Marean. (1992-95).
- ❑ Tierberg Rock Shelter, Prince Albert, Karoo with D.M. Avery. (1990).
- ❑ Khoe-San burials, Milnerton, Cape Town. (1986).
- ❑ Brown hyaena prey accumulation, Salpeterkop, southwestern Cape. (1983-84).
- ❑ Brown hyaena and black-backed jackal prey accumulations, Skeleton Coast Park, SWA/Namibia.1980-89
- ❑ Elandsfontein hominid and fossil site, southwestern Cape. (1980-2007).
- ❑ Pearly Beach open shell midden sites, southwestern Cape. (1973-76).
- ❑ Golden Acre & Station Concourse early colonial sites, Cape Town with M.L. Wilson. (1971-75)
- ❑ Hawston open shell midden, southwestern Cape. (1971-72).

Archaeological and Palaeontological Site Recording and Assessment

Also see under Cultural resource Management Reports (CRM).

- ❑ I have had extensive experience in the location, mapping, survey and recording of archaeological, palaeontological and rock art sites, particularly in the Cape Province. Since 1990 this has been intermittent, but see CRM section regarding EIAs, most of which included site surveys.
- ❑ Archaeological and palaeontological sites at Elandspunt, Langebaan, southwestern Cape with D.M. Avery (1985).
- ❑ Surveys of archaeological and rock art sites on portions of Anysberg, Kaminassie and Outeniqua Mountains, southern Cape for Department of Forestry (1979).
- ❑ Numerous trips recording archaeological and rock art sites, southwestern and southern Cape (1979).
- ❑ Survey of archaeological sites in the Saldanha Bay area, southwestern Cape own and supervising M. Cronin & F. Thackeray (1974).
- ❑ Survey of coastal archaeological sites between Cape Agulhas and Kleinmond, southwestern Cape (1970-71).

Actualistic/Taphonomic

In addition to my own research, I have encouraged scientists I work with to lodge samples in Iziko's Taphonomy Collection, which I established and have developed.

- ❑ Taphonomy of small mammal prey of Verreaux's Eagle (with Aaron Armstrong, University of Minnesota).
- ❑ Remnants of seal-ravaged seabirds, Ysterfontein (2006).
- ❑ Prey of Martial Eagles, Mabuasehube National Park, Botswana with W. Borello, Gaborone, for Botswana Government and South African Museum (1990).
- ❑ Prey of Verreaux's, Martial and Crowned eagles (1990-).
- ❑ Prey of Peregrine and Lanner Falcons (1991-), Pale Chanting Goshawks, Marsh Harriers and Black Sparrowhawks.
- ❑ Excavation of 'modern' brown hyaena bone accumulation, Salpeterkop, Sutherland (1983).
- ❑ Excavation of modern Brown hyaena and Black-backed jackal bone accumulations, Skeleton Coast Park, SWA/Namibia (1982).

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- ❑ Surveys for beached birds and seals, southwestern Cape, southern Cape, Eastern Cape, KwaZulu Natal with members of the African Seabird Group) and Namibia (with Directorate of Tourism & Nature Conservation staff)(1977-2006).
- ❑ Collection of owl pellet and other avian predator prey samples, southwestern Cape (with Cape Department of Nature and Environmental Conservation, D.M. Avery & R.K. Brooke) (1977-ongoing).
- ❑ Intertidal transect and collection of mollusc specimens, southwestern Cape (with Marine Biology Department, South African Museum) (1976).
- ❑ Collection of avian osteological specimens, southwestern, eastern and northern Cape (1971-1985).

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