HERITAGE IMPACT ASSESSMENT

PROPOSED AFRISAM CEMENT PLANT, MINE AND ASSOCIATED INFRASTRUCTURE IN SALDANHA, WESTERN CAPE

As part of the Environmental Impact Assessment

Prepared for

Aurecon South Africa (Pty) Ltd

On behalf of

Afrisam (South Africa) (Pty) Ltd

September 2011

Prepared by:

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DECLARATION

by the independent person who compiled a specialist report or undertook a specialist process

I …David John Halkett……, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input /study to be true and correct, and
- 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;
- have and will not have no vested interest in the proposed activity proceeding;
- 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;
- 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;
- 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
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.

Signature of the specialist:

ACO Associates cc

Name of company:

28th June 2012

Date:

1. INTRODUCTION

The following is a short integrated summary of the findings of specialist heritage studies undertaken as part of the Environmental Impact Assessment for the proposed Afrisam cement plant, mine and associated infrastructure in Saldanha (Figure 1). Only the specialist heritage related reports identified in the NID comment from HWC (see Appendix 2) have been included in the HIA, with the addition of the Visual study. While not specifically requested, it appears to be a significant component of the project. The full unedited specialist reports including Palaeontology, Archaeology and Visual can be found in Appendices 2 - 4.

2. PROJECT DESCRIPTION

2.1 The Project

AfriSam (South Africa) (Pty) Ltd (hereinafter referred to as AfriSam) proposes to construct a cement plant and associated infrastructure in the Saldanha region, in order to re-enter the cement market in the western Cape. The project components are shown in local geographical context on Figure 1. The proposed project includes the mining of limestone and clay by its wholly owned subsidiary company, National Portland Cement Company (Pty) Ltd (hereinafter referred to as NPCC). The limestone and clay would then be transported to the cement plant by road or by conveyor. Initially, quarrying is planned to proceed by expansion of the two existing quarries in the Southern Limestone Quarry mining area.

ACO Associates were appointed by Aurecon on behalf of AfriSam to investigate the proposed quarry sites, the proposed cement plant site, and a proposed haul road and conveyor system routes. The Archaeological assessment was undertaken and compiled by Mr D Halkett and will form an appendix to the overall Integrated Heritage Impact Assessment which will also include summaries of the conclusions of the other Heritage related studies.

An EIA was previously conducted in 1997 for a similar project (Alpha Saldanha Cement Project). For various reasons however, the project was never carried through to finality. Both Archaeological and Palaeontological Specialist Assessments were undertaken at that time and included in an EIA report compiled by Mark Woods Consultants (Avery and Kaplan 1997, Roberts 1997 in Wood 1997). Both specialist reports remain highly relevant to this project, but have been re-assessed due to changes in legislation and knowledge. More archaeological work took place recently (Sept 2011) when fieldwork was undertaken as part of the current project to assess prospecting drilling locations which were required to assess the limestone ore body, and the observations from that study have been integrated into this report.

2.2 The site and project components

The project comprises a number of components located in the Saldanha Bay area (Figure 1).

2.2.1 Proposed cement factory

Located on Farm 1139, approximately 4km north-east of the town of Saldanha. The site is surrounded on 3 sides by existing heavy industrial activity including Saldanha Steel, Duferco, the Sishen Saldanha railway, port iron ore stockpile and loading facilities.

2.2.2 Proposed limestone and clay quarries

The southern area of the limestone quarry (hereafter referred to as **southern limestone quarry**): Located on Portions 8, 15 and 23 of Kliprug 282, approximately 1 km to the north west of the town of Saldanha, and directly north of Diazville, approximately 6.8km south west of the proposed cement factory site.

Figure 1: The Location of the project components in local geographical context. Factory site (magenta polygon), Clay quarry (purple polygon), Primary mining areas/quarries (red polygons), Maximum mining area (brown shaded polygons), Possible Haul road (light green line), Possible Conveyor (yellow line), Afrisam owned farms, outer boundaries (blue, pink and dark green polygons). A servitude is registered over the transport corridor between mine and factory site. The green bounded farms are proposed conservation areas if the project goes ahead.

The northern area of the limestone quarry (hereafter referred to as the **northern limestone quarry**): Located on Portion 9 of Kliprug 282 and Portion 7 of Jacobs Bay 109, north of the southern limestone quarry, approximately 3 km east of Jacobs Bay and approximately 7.8km west of the proposed cement factory site.

Holvlei clay quarry: Located on Portion 4 of Holvlei 120, north of Portion 9 of Kliprug 282 and Portion 7 of Jacobs Bay 109, approximately 3 km inland of the western coastline, 2km north of the Jacobs Bay Road and approximately 9km north-west of the proposed cement factory site (this quarry will only be used if other sources of clay are not available within the proposed mining footprint).

A number of the farms are already owned by Afrisam. The farms outlined in blue on Figure 1 will be directly affected by quarrying activities while the farms outlined in dark green will largely be given over to conservation if the project is authorised. The only use might be at the southern end to provided access to the Holvlei clay quarry.

2.2.3 Proposed Haul road and/or Conveyor routes

The following two transportation alternatives are currently being considered for the transportation of raw materials to the proposed cement factory and the final choice will depend on the assessment of the components in terms of a number of factors both economic and environmental. Initial conclusions suggest:

- Conveyor belt system (possible)
- Construction of a private haul road (likely).

The proposed enclosed **conveyor system**, if used, would extend for approximately 9 km, from the southern limestone quarry in an easterly direction into the proposed cement factory site. To ensure that all material can be efficiently transported, a crusher would need to be located at the cement factory site.

Based on surrounding topography, the proposed **private road** would extend (in a northerly direction) from the southern limestone quarry. The proposed road would then extend for approximately 9 km east, before it linked into the proposed cement factory site. The proposed private road would follow a similar route to that of the proposed conveyor system, other than just east of the southern limestone quarry where it requires re-alignment due to the topography.

2.3 Project phases

The proposed project would be undertaken in two phases. The approximate timing of the proposed operational phases is as follows:

- Phase 1: 2014 - 2021
- Phase 2: 2022 - 2112

The timeframe for the proposed mining activities would vary, based on market demand. The suggested timing is a guideline, based on the approximate volumes of limestone present in the area.

Assessment based on information provided for the time period 2012 – 2042 has a high confidence level. Certainty is reduced as time periods increase and the existing time frame until 2112 limits the predictability for assumptions and therefore has a decreased confidence level.

2.3.1 PHASE 1: (approximately 2014 – 2021)

Phase1 of the proposed project would include the following activities/ components:

- The erection and commissioning of a grinding plant (to mill clinker), and a storage and packing facility to market cement to the Western Cape market, including:

- The construction of enclosed storage facilities, covering a total area of 11 000 m2 for the storage of clinker, limestone and gypsum at the proposed cement plant;
- The installation of a vertical roller mill, with a total height of approximately 50 m; and
- The construction of cement storage facilities as well as packing and dispatch facilities.

AfriSam currently mines up to 40 000 tpa of limestone, for use as agricultural lime, under its mining right, with a limited footprint, at the existing Tabakbaai quarry area. Phase 1 will undertake the mining of an additional 170 000 tpa (approximate maximum) of limestone from the quarry footprint. Clinker would be sourced from an associate foreign company via the Saldanha Port facility, or from Afrisam's Ulco cement plant near Kimberley. The proposed construction of the grinding plant facility would take approximately 24 months.

2.3.2 PHASE 2: (Approximately 2022 – 2112)

Phase 2 of the proposed project would include the following activities/ components:

- The erection of a clinker manufacturing facility with an annual production capacity of 600 000 tpa, including:
    - The construction of a pre-calciner kiln system. The pre-heater tower is expected to have a total height of approximately 80 m and cover a total area of 400 m2.
    - Construction of additional storage and handling facilities for limestone, clay, gypsum and clinker, to accommodate the increased production levels.
    - The installation of a second vertical roller mill, with a total height of 50 m.
    - The construction of a second packing and palletizing line.
    - Mining within the quarry footprint, with the existing limestone production increasing to a total of 1.2 million tpa, delivered to the proposed cement plant site.
    - Mining of approximately 120 000 tpa of clay from the proposed Holvlei clay quarry, including transport to the proposed cement plant via the transport corridor.
    - The construction of a transport corridor.

Due to the expected production during Phase 2, a maximum of 1.2 million tons of limestone would need to be transported from the limestone quarries to the proposed cement plant site per annum. In order to transport the suggested volumes (expected in Phase 2), two transportation alternatives are being considered:

- Conveyor system: The proposed enclosed conveyor system would extend along the proposed transportation corridor for approximately 9 km, from the eastern border of the quarry footprint in an easterly direction into the proposed cement plant site. To ensure that all material is efficiently transported, the proposed crusher would need to be located at the quarry site, at the start of the conveyor.

- Proposed private road: Based on surrounding topography, the proposed private road would begin at the eastern quarry border, in a similar position as proposed for the conveyor, but may require following topographical contours for a short distance prior to re-aligning itself with the transportation corridor. Internal quarry haul roads would be constructed to the point where the transportation corridor meets the quarry. Under this alternative, the crusher would be located at the plant site.

3. SPECIALIST HERITAGE REPORT SUMMARIES

Figure numbers refer to those in the specialist report if not included in the abstracts.

3.1 Palaeontological Impact Assessment - John Pether

The proposed AfriSam project area (Figure 1) is adjacent to Saldanha Bay and entails a cement factory based on the local "limestone" resource of mainly ancient dune rocks comprised chiefly of sand grains that are tiny, calcareous shell fragments.

The Prospect Hill Formation (Figure 2 - this section) will be the prime, long-term source of lime for the proposed cement plant, due to its high $CaCO_3$ content. Initially, quarrying is planned to proceed by expansion of the two existing quarries in the Southern Limestone Quarry mining area (Figures 2 & 3).

The Upper Quarry has its footwall in **Prospect Hill Formation** aeolianite at ~45 m asl. and does not expose the underlying marine formation. The Prospect Hill Formation must be underlain by older, fossiliferous marine sediments of likely mid-Miocene age ("**Saldanha Formation**", ~16 Ma). These deposits could be exposed in the footwall of the quarries at some time in the future.

The Lower Quarry exposes the granitic bedrock at 20-25 m asl., upon which are shelly marine deposits of the **Uyekraal Formation**. These are overlain by aeolianite of the **Langebaan Formation** (Diazville Member).

The Holvlei Clay Quarry will exploit weathered bedrock of granitic and/or Malmesbury shale origin. However, this lies beneath partly Prospect Hill Fm. aeolianites and calcrete and partly beneath Unit Q2, **Springfontyn Formation** deposits that overlap the site from the east (Figure 2).

The transport corridor, on leaving the mining area, crosses over the hill where granite is thinly overlain by Q2 cover. It then traverses the flat plain 10-12 m asl., where the thickening Q2 unit is overlain by Q1 sands. Where the route meets the Saldanha rail link it rises slightly and crosses onto and traverses the Langebaan Formation.

The cement plant is situated on Langebaan Formation aeolianite and calcrete (Figure 2), mainly under thin Q1 cover.

Mining and construction activities (excavations) will result in a negative direct impact on the fossil content of the affected subsurface. Fossils and significant observations will be lost in the absence of management actions to mitigate such loss. This loss of the opportunity to recover fossils and their contexts when exposed at a particular site is irreversible.

Conversely, mine pits and construction excavations furnish the "windows" into the coastal plain depository that would not otherwise exist and thereby provide access to the hidden fossils. The impact is positive for palaeontology, provided that efforts are made to watch out for and rescue the fossils. There remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss.

Acceptable mitigation will require the recovery and permanent archiving of samples that adequately reflect the diversity of palaeontological resources in these deposits. The mining operation can be turned into a positive impact by appropriate mitigation. The problems in different interpretations of the geological history of the area are mentioned in Sections 5 and 6 and the questions that arise can be addressed by the discovery of more fossils of various kinds.

A draft proposal with procedures for the mitigation of mining impacts on palaeontological resources is presented in Section 11 of this report. It is envisaged that the IZIKO SA Museum, HWC, the Council for Geoscience and the West Coast Fossil Park will all be involved at various levels in the monitoring and rescue of fossil material during the quarrying operations.

It is recommended that the bulk earth works involved in the construction of the cement factory and the transport corridor be monitored by on-site personnel. Section 12 of the specialist report outlines monitoring by construction personnel in terms of general Fossil Find Procedures for inclusion in the Construction Phase EMP. In the event of fossil finds, the appointed palaeontologist will assess the information and liaise with the manager and the ECO and a suitable response will be established. If an important find, a field inspection must be undertaken to document and sample fossiliferous strata that may be exposed

It is recommended that the contracted palaeontologist carry out field inspections at appropriate stages in the making of the larger and deeper excavations, particularly in the Langebaan Formation. The aim of field inspection is to examine a representative sample of the various deposits exposed in the excavations, recording context, fossil content and to take samples.

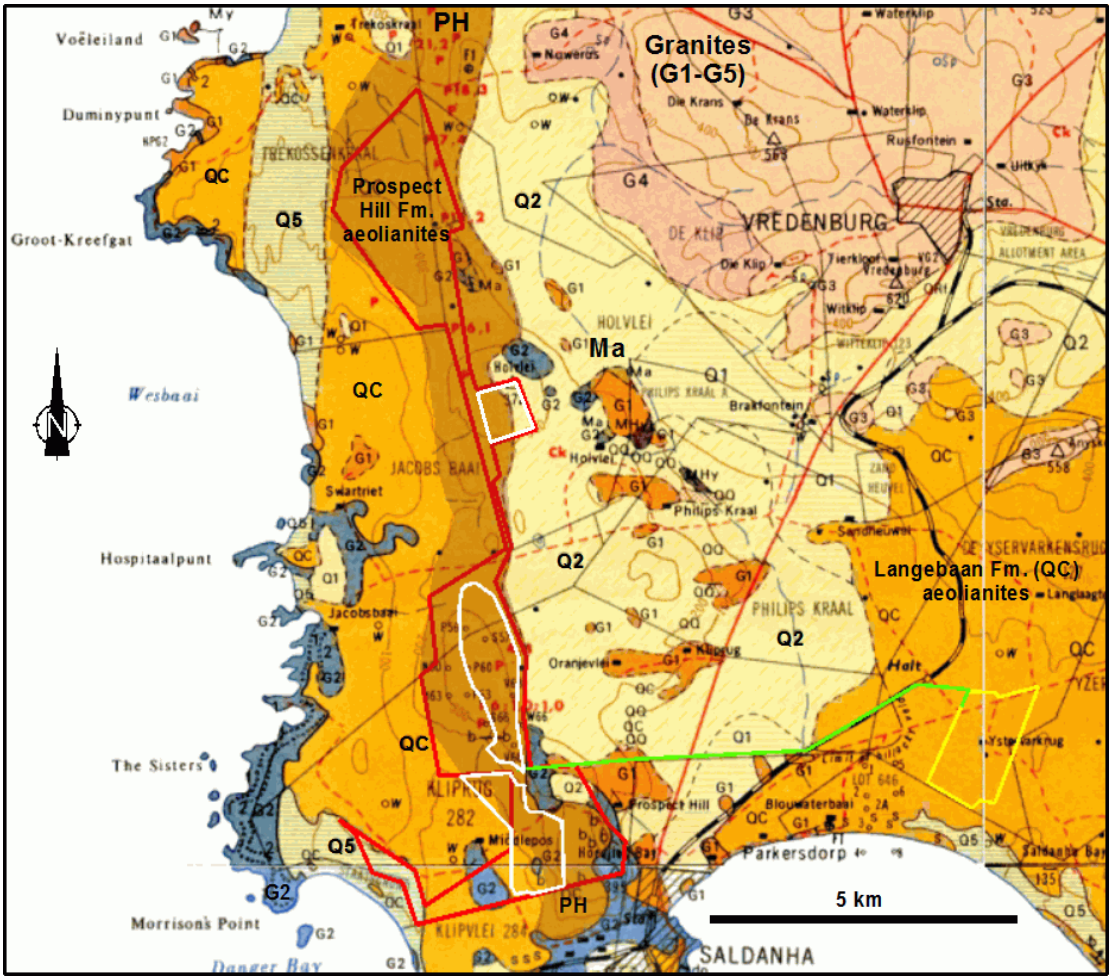

Figure 2: Surface geology of the project study area. From Visser & Schoch (1972), 1:125000 Map Sheet 255: 3217D & 3218C (St Helenabaai), 3317B & 3318A (Saldanhabaai). Refer to Figure 1. Legend below in order of youngest to oldest formations.

Q5: Recent windblown sands and dunes along the beach are mapped as unit Q5. Prominent dune plumes extend north from sandy beaches. Called the **Witzand Formation**.
Q1: Another surface unit is the recent soil-unit Q1, white to slightly-reddish sandy soil, which is mainly a stabilized sand sheet blanketing the underlying geology.
Q2: An older surface unit Q2, shallow sandy soil with heuweltjies (heuweltjiesveld), occurs inland the coast. Incipient calcretes occur in Q2. It overlies the Langebaan "Limestone" Formation. Thick quartzose sand deposits beneath Q2 are called the **Springfontyn Formation**.
QC: The **Langebaan "Limestone" Formation**, aeolianite Unit QC, is underlain mainly by marine deposits of Pliocene age (**Varswater** & **Uyekraal** fms).
PH: The **Prospect Hill Formation.** Part of the Langebaan Fm between Saldanha Bay and Paternoster has now been separated as this new formation, due to fossil finds indicating that it is significantly older than the other aeolianites included in the Langebaan Formation. This is shown by the brown overlay in Figure 2.
G1, G2, G3, G4 and **G5** are outcrops of various bedrock granites of **the Cape Granite Suite**.
Ma: Bedrock outcrops of **Malmesbury Group** metasediments.

3.2 Archaeological Impact Assessment - Dave Halkett

Archaeological resources have been observed within the AFRISAM project areas.

The oldest remains were reported by Kaplan in the initial surveys of the properties in 1997 when he reported finding **ESA** artefacts in ploughed lands in the vicinity of the proposed Holvlei quarry. Similar artefacts were not found during the latest assessment, but there is ample evidence from the local area to support such observations. It is likely that if they are present, they are likely to be buried below the mantling sands covering most of the area. Occasionally ploughing brings buried objects to the surface.

Similarly, **MSA** artefacts are well documented from the local area and are often found in areas where the limestone has been disturbed by recent human activity as they too are often buried within cavities within the limestone. Some surface material was located during this survey, but tended to be isolated artefacts rather than concentrated scatters. Kaplan reported scatters of higher density during the 1997 survey but thick vegetation now, and poor site Locational data from the previous survey, has prevented re-location of those resources or at least making a confidant statement as to what we have found can be linked to his observations.

LSA sites are well distributed throughout the project area. These tend to be recognised by the presence of marine shell fragments on the surface, or brought to surface by the activities of moles. There is a suggestion that at least some material of this age lies below the surface, often in ploughed land, but occasionally in areas of minimal disturbance. As with other parts of the Vredenburg Peninsula, small outcrops of granite have attracted pre-colonial visits. As these areas are usually not favourable for ploughing, archaeological sites tend to survive more readily in those areas. A small hill within the project area contains both granite outcrops and a number of archaeological sites. We have suggested that this hill should be a no-go area (although mining is not proposed here per se) but that the proposed haul road that might have crossed it should be relocated to the east. This would avoid having to mitigate a number of sites. A number of semi circular arrangements of limestone blocks are believed to represent kraals or hut bases. At this time, the lack of visible associated artefacts means we cannot unequivocally ascertain their age. They may be pre-colonial, but are more likely to be from the more recent past. Further work on LSA sites is suggested if they are to be impacted by mining or associated activities.

More recent **Historical** remains are present in the form of vernacular buildings built from the abundant limestone chunks and blocks of the area. While on the quarry areas they tend to be in ruinous state, a small complex of buildings on the proposed cement factory site has been in use until recent times. While some structures can be identified on an aerial photograph of 1938, others are more recent. It would appear that the structures there now have for the most part replaced the originals. Kraal walls are built with limestone and mud and have been plastered in more recent times. The context of this farm is largely compromised by the surrounding heavy industry, and proposals to increase the size of the port. Although, such activities such not be a reason to compromise heritage, the complex lacks any distinctive architectural qualities to warrant its conservation. All the structures that will be impacted by mining or related infrastructure should be documented and demolished if necessary.

Perhaps the most difficult to identify during surface archaeological surveys, are the **buried** sites, which, on the balance of probabilities, must exist here, but whose location we cannot predict. There are several instances of older sites being found within limestone deposits in the immediate region. Of particular interest will be sites from the MSA which may be similar to those at the so called sites of Sea Harvest and Hoedjiespunt at the Saldanha harbour, which contained clear evidence of coastal exploitation by pre-modern humans before 60,000 years ago. These may occur in hollows and cavities in the limestone, formed in the distant past and used as dwelling places, and subsequently to be covered by eroding deposits and windblown sands. These will be in similar contexts as palaeontological sites formed by the activities of bone accumulating animals and on occasion will overlap. The abundant calcium carbonate within the limestone deposits contributes greatly to the good preservation of bone both here and in the broader region.

Both the buried Palaeontological and Archaeological heritage will have to be assessed and mitigated by way of an ongoing monitoring program. Mining activities will have to assessed regularly for evidence of both these resources. There will be some overlap between the two types of resources and as such some possibilities exist for a joint monitoring exercise. If managed correctly, mining may have positive outcomes for both the disciplines of palaeontology and archaeology by providing additional windows into the buried past.

We believe that overall, there is little surface archaeology that would prevent the proposed activities from proceeding (taking cogniscence of the recommendations of the palaeontological and visual specialists), although some mitigation of surface LSA heritage resources is required in advance of mining on the sites that will be impacted. Although many are ephemeral, this seems to bear out the pattern of usage of the Vredenburg Peninsula during the Later Stone Age. We have proposed that a no go area be established to encompass a small hill with granite outcrops on it. While not part of the mining program per se, a haul road was proposed to cross over it. If agreed, a number of archaeological sites will be preserved. A number of ruined vernacular buildings should be mapped and recorded before they are impacted. Of greater concern is the material of greater antiquity that is likely to be buried within the hillsides. This material is rare and elsewhere in the Saldanha area demonstrates some of the earliest use of marine resources. It can be of international scientific importance. A clearly stated, consistent monitoring and mitigation program must be negotiated and implemented by AFRISAM to manage impacts on all these resources.

3.3 Draft Visual Impact Assessment - Steven Stead

Saldahna Bay is a town created by both tourism and industrial development. The *high* scenic quality of the critical biodiversity and west coast landscapes combined with the *lower* scenic quality of the well established industrial and mining areas make the overall scenic quality *moderate*. Saldahna has been identified as an industrial growth node and the existing Saldahna SDF has incorporated the proposed mining areas into the regional planning. However, the Saldahna Municipality SDF planning has yet to be recognised by the Western Cape Province. The proposed mining areas also include fynbos vegetation, which have been defined as Critical Biodiversity Areas by the C.A.P.E. Fine-scale Biodiversity Planning Project (WCPSDF). This document recommends that the project sites be managed in a manner compatible with biodiversity conservation and be restored to a natural state and that the loss of CBA areas are adequately offset in terms of DEA&DP guidelines and best practice. The certainty of decision is reduced as the proposed life of mine is 100 years. The long time frame of the project (2012 – 2112) limits the confidence levels. It must be recognized that the surrounding landscape character (and sense of place) is likely to change during this time period. Detailed 3D modelling of the proposed landscape modifications was provided which has assisted in understanding the impacts.

The proposed cement plant will be developed in two phases and is located on an industrial site adjacent to existing large factory structures. The surrounding sense of place is strongly associated with the Saldanha Steel plant and harbour. The proposed plant landscape modification would not significantly change the established industrial landscape character even though it is a large size, height and scale. It is also recommended that lighting mitigations be implemented to reduce further light pollution in the area, avoiding the use of pole-top security lighting and installing fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. The area shown in Point 1 on the Mitigations Map in Figure 2 should be retained as undeveloped for screening and biodiversity purposes. Structures should be matt cement grey or painted dark reddish brown based colours that would blend in with the colours of the surrounding landscape *(See Figure 2 (this section): Mitigation Map point 1 and 2).*

The plant would be linked to the quarry via an access road and possibly a conveyor system. It is recommended that the R45 road is crossed via an underpass for both transport options. Due to the conveyor system requiring a crusher on top of the hill, visual preference is for the road option. Mitigation is required which would include that the haul road is tarred, re-aligned around the steep slope area to the west of the R399 road which should be cut in if possible and a low screening wall created on the valley side. The cut face will have to be rehabilitated to veld grass. *(See Mitigation Map point 3 and 4).*

Three quarry sites were assessed: the southern, northern limestone quarries and the proposed Holvlei Clay Quarry to the north of the Jacobsbaai Road. The southern quarry is an expansion of the existing Prospect Hill quarry. Hence, visual character will be strongly associated with the existing quarry landscape, as well as the Saldanha west residential areas and Middelpos informal settlement area. To reduce the visual intrusion to proximate residential receptors, it is recommended that a 3 m undulating screening berm is built to the west of the quarry site. The upper eastern extent the quarry should curve on the edges to align more naturally with the hill topography. A maximum 30 degree slope is recommended to allow for effective rehabilitation *(See Mitigation Map point 5).* As the upper extent of the quarry is visually prominent, it is recommended that mined areas are effectively rehabilitated to fynbos as per the botanical specialist's recommendations.

A large portion of the proposed northern limestone quarry is located on the skyline. Should the No-go option be exercised to meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, (DEA&DP. 2002) it is likely that the project would be threatened. Given the current inclusion of the mine in the Saldanha SDF and the recognition of Saldahna as a development zone, the VIA has not recommended this area as a No-go area. However, due to this skyline area potentially generating higher levels of permanent visual intrusion which will not meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, it is recommended that the proposed mine plan for this area be amended. The plan needs to depict the final post-mine skyline as a smooth and continuous line that mirrors the existing skyline, but must be lowered by approximately 4 m on the ridgeline (Skyline Comparison Map below). Should this not be provided, the No-go option for skyline

mining is recommended. The proposed northern section of the quarry is adjacent to the Jacobsbaai Road which is an important tourist route. It is recommended that the mine is set back from the north-east corner where an existing low mound will afford some natural visual screening (See Figure 3: North Quarry Mitigation Map). To control the dust and reduce visual intrusion, the mining must be undertaken in such a way that concurrent rehabilitation can take place with quarrying working in a 200 m cut face, and restored with face rip benches and rehabilitated concurrently (as per the botanical specialist's specifications).

A low berm needs to be created to the west of the low mound parallel to the road to connect to the hill area. The berm needs to be formed by topsoil removed from the limestone fynbos in the southern quarries which will not be rehabilitated back to limestone fynbos. The screening berm needs to appear natural and it is recommended that an accredited landscape architect be utilised for the design and construction. The existing quarry at S5 can be included into quarry areas and be rehabilitated afterwards. Visual buffer on the Jacobs Bay road should be curved to align with the topography and to allow a more effective north south critical biodiversity corridor. The road must be realigned along the edge of the quarry area and not cut through the buffer area. (See Mitigation Map point 6 and 7).

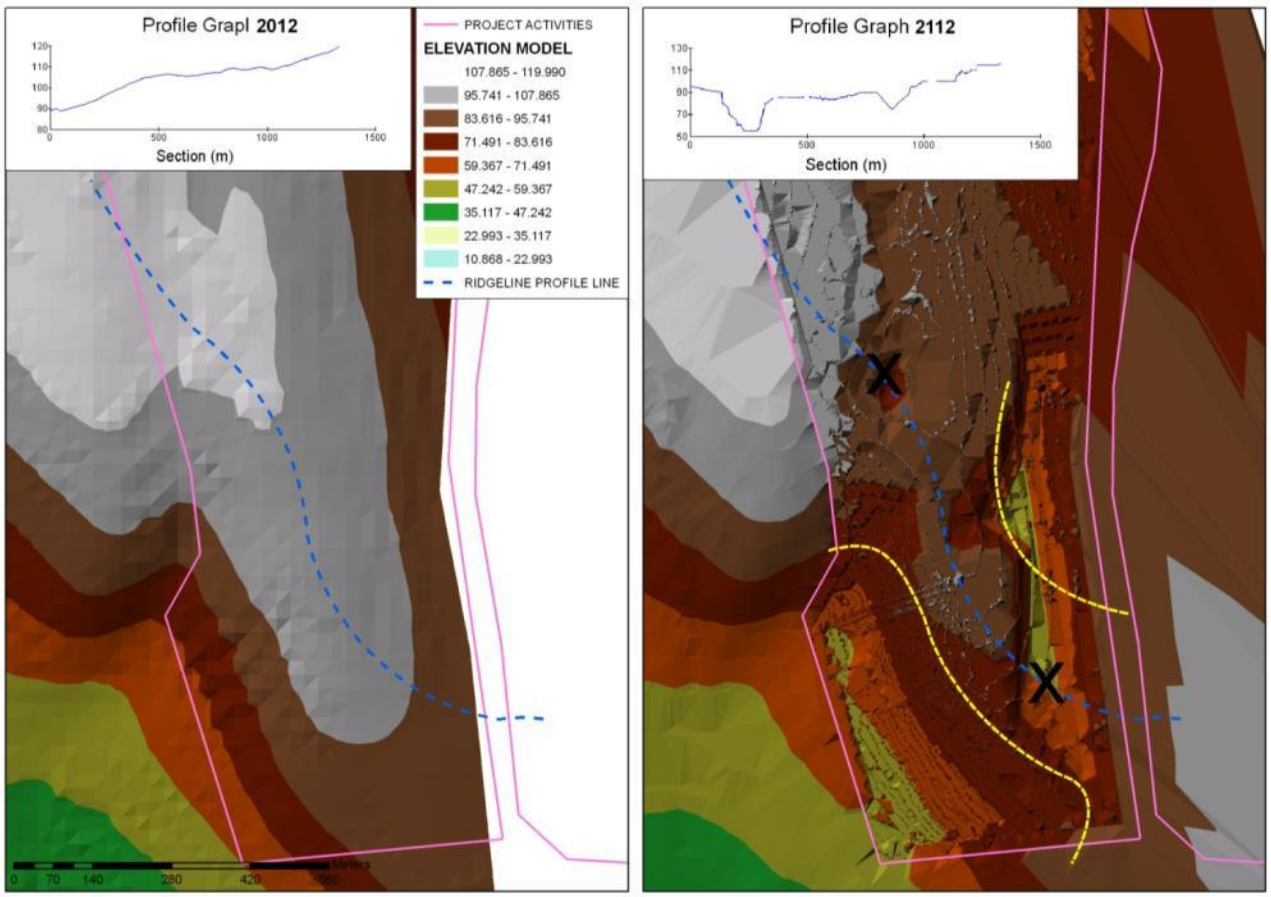

Figure 1: Skyline comparison Map

The proposed Holvlei clay quarry is located on top of a hill. Visual intrusion to surrounding low lying receptors could be limited reducing the southern extent of the quarry areas so that the bulk of the cutting of the quarry is located on the top of the hill. Quarry edges to be curved to align with the topography *(See Mitigation Map point 8).*

Due to the close proximity of the proposed mine to the town of Saldanha, the post mine landscape is important and can result in landscape sterilization if not adequately managed. It is recommended that areas closer to Saldanha Bay residential areas (south quarry) should not be rehabilitated to limestone fynbos but rather to public open space or sport facilities in the post mine land use that can be incorporated into the town. Areas away from the urban edge (on top of the hill) need to be rehabilitated to limestone fynbos and be formally protected within a proclaimed conservation areas, in conjunction with the other surrounding critical biodiversity areas that remain. The proposed thin strip

of the northern conservation area does not have any visual value in terms of defining CBA landscape character value as it is too narrow. It is recommended that adjacent areas to the west of the proposed thin strip is also incorporated into the critical biodiversity corridor as part of the biodiversity offset and total area provided with formal conservation status *(See Mitigation Map point 9).*

Even though the proposed mining does conform to the Saldanha SDF, the potential visual impacts are defined as having a ***high significance***. This is due to the size, scale and long time period associated with the proposed mining landscape modifications, as well as the loss of CBA vegetation. Should permissions for the mining be granted, it must be recognised that the area will be strongly associated with mining for a period of 100 years which would entrench the currently degraded landscape of the Western Saldanha areas. The mining could influence the 'west-coast' landscape character and sense of place of the Jacobsbaai area. The loss of the CBA limestone fynbos vegetation needs to be adequately offset in terms of DEA&DP guidelines. Due to the large areas which will be lost, this decision needs to be carefully considered as it could set a precedent for CBA offsets in the future. It is recommended that the mine plan be reviewed every twenty years.

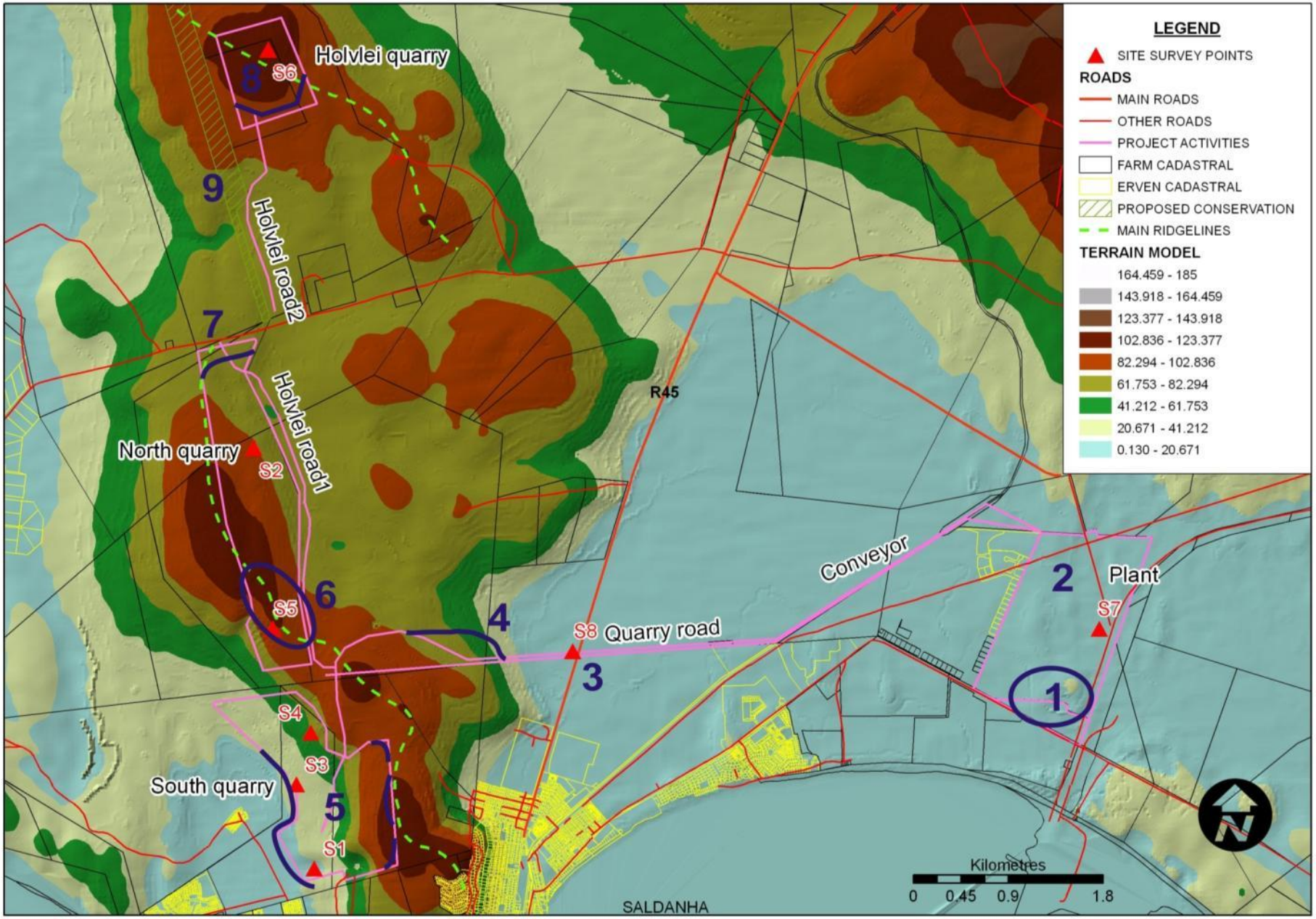

Figure 2: Mitigation Map

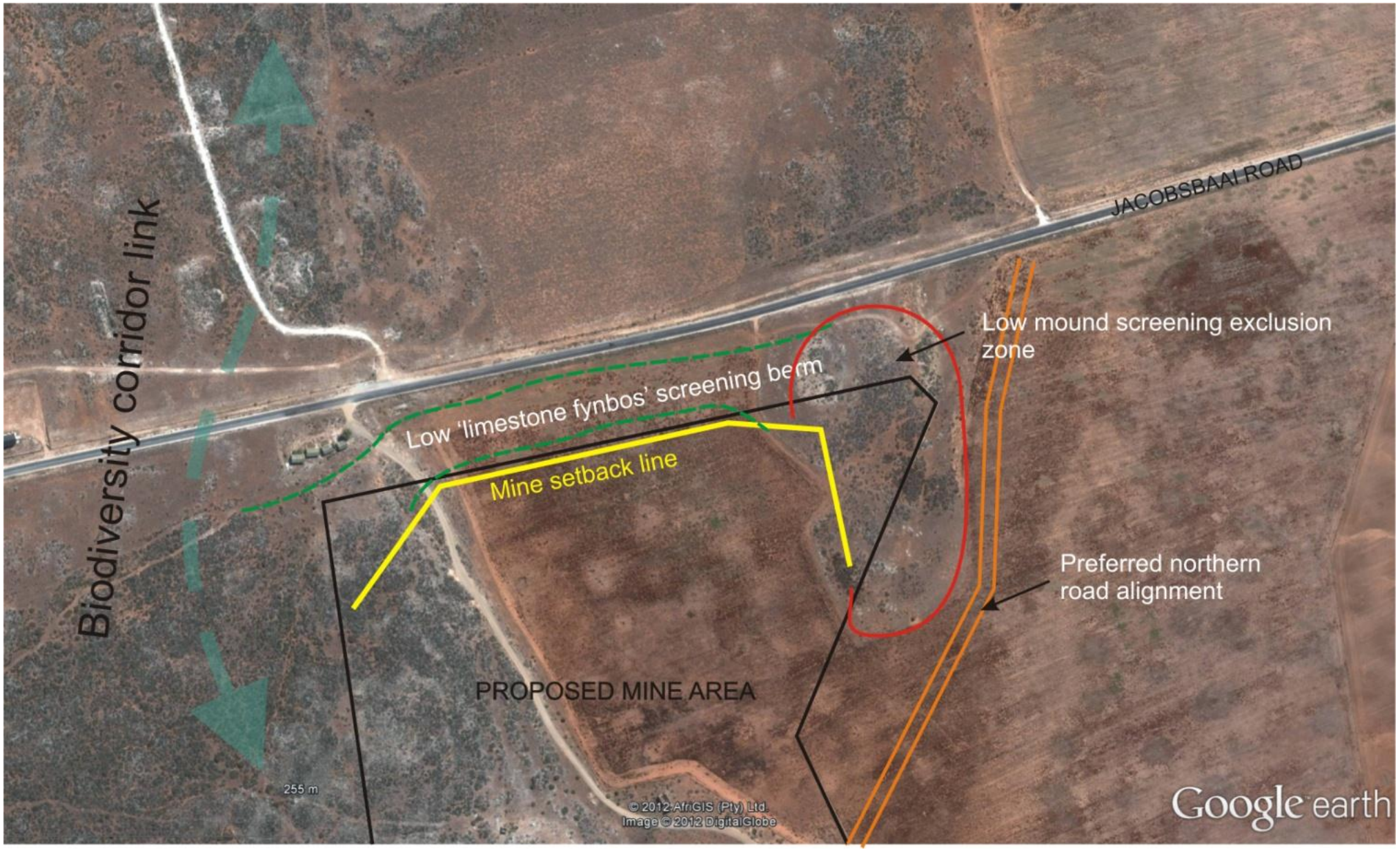

Figure 3: North Quarry Mitigation Map

4. INTEGRATED HERITAGE CONCLUSIONS AND RECOMMENDATIONS

Although an attempt has been made to concisely cover the salient points of the heritage studies I this section, it is aimed only at giving a quick overview of the issues surrounding the heritage aspects of the project. Some detail is omitted for brevity. The author has made some grammatical alterations in linking the various points to assist the reading.

Palaeontology: Mining and construction activities (excavations) will result in a negative direct impact on the fossil content of the affected subsurface. Fossils and significant observations will be lost in the absence of management actions to mitigate such loss. Mine pits and construction excavations furnish the "windows" into the coastal plain depository that would not otherwise exist and thereby provide access to the hidden fossils. The impact is positive for palaeontology, provided that efforts are made to watch out for and rescue the fossils. There remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss.

It is recommended that the bulk earth works involved in the construction of the cement factory and the transport corridor be monitored by on-site personnel. Section 12 of the specialist report outlines monitoring by construction personnel in terms of general Fossil Find Procedures for inclusion in the Construction Phase EMP. In the event of fossil finds, the appointed palaeontologist will assess the information and liaise with the manager and the ECO and a suitable response will be established. If an important find, a field inspection must be undertaken to document and sample fossiliferous strata that may be exposed

It is recommended that the contracted palaeontologist carry out field inspections at appropriate stages in the making of the larger and deeper excavations, particularly in the Langebaan Formation. The aim of field inspection is to examine a representative sample of the various deposits exposed in the excavations, recording context, fossil content and to take samples.

Archaeology: We believe that overall, there is little surface archaeology that would prevent the proposed activities from proceeding (taking cogniscence of the recommendations of the palaeontological and visual specialists), although some mitigation of surface LSA heritage resources is required in advance of mining on the sites that will be impacted. Although many are ephemeral, this seems to bear out the pattern of usage of the Vredenburg Peninsula during the Later Stone Age. We have proposed that a no go area be established to encompass a small hill with granite outcrops on it. While not part of the mining program per se, a haul road was proposed to cross over it. If agreed, a number of archaeological sites will be preserved. A number of ruined vernacular buildings should be mapped and recorded before they are impacted. Of greater concern is the material of greater antiquity that is likely to be buried within the hillsides. This material is rare and elsewhere in the Saldanha area demonstrates some of the earliest use of marine resources. It can be of international scientific importance. A clearly stated, consistent monitoring and mitigation program must be negotiated and implemented by AFRISAM to manage impacts on all these resources. This is a long term project intended to extend to 2112, and as such, the monitoring and mitigation program will have to be reviewed from time to time to reflect the additional knowledge of the site that will become known. The authrities will have to ensure compliance over this extended period.

Visual: Saldahna Bay is a town created by both tourism and industrial development. The *high* scenic quality of the critical biodiversity and west coast landscapes combined with the *lower* scenic quality of the well established industrial and mining areas make the overall scenic quality *moderate*. Saldahna has been identified as an industrial growth node and the existing Saldahna SDF has incorporated the proposed mining areas into the regional planning.

The proposed mining areas also include fynbos vegetation, which have been defined as Critical Biodiversity Areas by the C.A.P.E. Fine-scale Biodiversity Planning Project (WCPSDF). This document recommends that the project sites be managed in a manner compatible with biodiversity conservation and be restored to a natural state and that the loss of CBA areas are adequately offset in terms of DEA&DP guidelines and best practice.

The long time frame of the project (2012 – 2112) means that the surrounding landscape character (and sense of place) is likely to change during this time period.

The proposed cement plant will be developed in two phases and is located on an industrial site adjacent to existing large factory structures. The surrounding sense of place is strongly associated with the Saldanha Steel plant and harbour. The proposed plant landscape modification would not significantly change the established industrial landscape character even though it is a large size, height and scale. Lighting mitigations are suggested to reduce further light pollution in the area. Structures should be matt cement grey or painted dark reddish brown based colours that would blend in with the colours of the surrounding landscape.

Visual preference is for various reasons for the road option for transferring mined material to the cement plant

Three quarry sites were assessed: the southern, northern limestone quarries and the proposed Holvlei Clay Quarry to the north of the Jacobsbaai Road. The southern quarry is an expansion of the existing Prospect Hill quarry. Hence, visual character will be strongly associated with the existing quarry landscape. To reduce the visual intrusion to proximate residential receptors, it is recommended that a 3 m undulating screening berm is built to the west of the quarry site amongst other suggestions.

A large portion of the proposed northern limestone quarry is located on the skyline. Given the current inclusion of the mine in the Saldanha SDF and the recognition of Saldahna as a development zone, the VIA has not recommended this area as a No-go area. the proposed mine plan for this area should be amended to leave a smooth sjyline post mining, and the northern section of the quarry that is adjacent to the Jacobsbaai Road be setback to make use of natural and man-made screening.

The proposed Holvlei clay quarry is located on top of a hill. Visual intrusion to surrounding low lying receptors could be limited reducing the southern extent of the quarry areas so that the bulk of the cutting of the quarry is located on the top of the hill.

Due to the close proximity of the proposed mine to the town of Saldanha, the post mine landscape is important and can result in landscape sterilization if not adequately managed. It is recommended that areas closer to Saldanha Bay residential areas (south quarry) should not be rehabilitated to limestone fynbos but rather to public open space or sport facilities in the post mine land use that can be incorporated into the town. Areas away from the urban edge (on top of the hill) need to be rehabilitated to limestone fynbos and be formally protected within a proclaimed conservation areas, in conjunction with the other surrounding critical biodiversity areas that remain.

Even though the proposed mining does conform to the Saldanha SDF, the potential visual impacts are defined as having a ***high significance***. This is due to the size, scale and long time period associated with the proposed mining landscape modifications, as well as the loss of CBA vegetation. Should permissions for the mining be granted, it must be recognised that the area will be strongly associated with mining for a period of 100 years which would entrench the currently degraded landscape of the Western Saldanha areas. The mining could influence the ‘west-coast’ landscape character and sense of place of the Jacobsbaai area. The loss of the CBA limestone fynbos vegetation needs to be adequately offset in terms of DEA&DP guidelines. Due to the large areas which will be lost, this decision needs to be carefully considered as it could set a precedent for CBA offsets in the future. It is recommended that the mine plan be reviewed every twenty years.

APPENDIX 1: NID Comment

Our Ref: HM\WEST COAST\SALDANHA BAY\SALDANHA BAY\AFRISAM CEMENT PLANT, LIMESTONE AND CLAY QUARRIES

Enquiries Troy Smuts
Tel: 021 483 9543
Email: justin.bradfield@pgwc.gov.za

Date: 18/07/2012
Case No: 111117JB32
Auto IDs: 1814 - 1936

iLifa leMveli iNkitho Kapa
Erfenis Wes-Kaap
Heritage Western Cape

RESPONSE TO NOTIFICATION OF INTENT TO DEVELOP
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

Attention: Mr Charles Norman
Aurecon
PO Box 509
George
6530

CASE NUMBER: 111117JB32
NID: PROPOSED CONSTRUCTION OF THE AFRISAM CEMENT PLANT, LIMESTONE AND CLAY QUARRIES AND ASSOCIATED INFRUSTRUCTURE IN ON FARM 1139, FARM KLIPRUG 282, FARM JACOBS BAY 109 AND FARM HOLVLEI 120, SALDANHA, WESTERN CAPE

The matter above has reference.

Your NID dated 8 May 2012 was tabled and the following was discussed:
1. The sites are located approximately 1km to 7 km away from Saldanha.
2. The proposal is to construct a cement factory and 2 lime quarries and one clay quarry.
3. The geology of the Prospect Hill formation could be impacted.
4. Archaeological resources from the Late and Middle Stone age could be impacted on.
5. Fossils are know to be preserved in limestone formations and could be impacted on.
6. Unmarked graves may be encountered

1. Since there is reason to believe that heritage resources will be impacted upon, HWC requires an HIA in terms of S. 38(3) of the NHRA (Act 25 of 1999) assessing the impacts on the following heritage resources which it has identified; an archaeological study and palaeontological study with an integrated set of recommendations is required.

Terms and Conditions:

Heritage Western Cape 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 above.

Yours faithfully

C. B. Hall

Andrew B Hall
Chief Executive Officer
Heritage Western Cape

www.capegateway.gov.za/culture_sport

Street Address: Protea Assurance Building, Green Market Square, Cape Town, 8000 • **Postal Address:** Private Bag X9067, Cape Town, 8000
• **Fax:** +27 (0)21 483 9842 • **E-mail:** hwc@pgwc.gov.za

Straatadres: Protea Assuransie-gebou, Groentemarkplein, Kaapstad, 8000 • **Posadres:** Privaatsak X9067, Kaapstad, 8001
• **Fax:** +27 (0)21 483 9842 • **E-pos:** hwc@pgwc.gov.za

APPENDIX 2: Palaeontological Impact Assessment

PALAEONTOLOGICAL IMPACT ASSESSMENT
(Desktop Study)

PROPOSED CONSTRUCTION OF THE AFRISAM CEMENT PLANT, LIMESTONE AND CLAY QUARRIES AND ASSOCIATED INFRASTRUCTURE AT SALDANHA BAY, WESTERN CAPE

By
John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)
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Prepared at the Request of

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For
AfriSam (South Africa) (Pty) Ltd.

7 August 2012

CONTENTS

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SUMMARY

The proposed Afri-Sam project area (Figure 1) is adjacent to Saldanha Bay and entails a cement factory based on the local "limestone" resource of mainly ancient dune rocks comprised chiefly of sand grains that are tiny, calcareous shell fragments.

The Prospect Hill Formation (Figure 2) will be the prime, long-term source of lime for the proposed cement plant, due to its high $CaCO_3$ content. Initially, quarrying is planned to proceed by expansion of the two existing quarries in the Southern Limestone Quarry mining area (Figures 2 & 3).

The Upper Quarry has its footwall in **Prospect Hill Formation** aeolianite at ~45 m asl. and does not expose the underlying marine formation. The Prospect Hill Formation must be underlain by older, fossiliferous marine sediments of likely mid-Miocene age ("**Saldanha Formation**", ~16 Ma). These deposits could be exposed in the footwall of the quarries at some time in the future
.
The Lower Quarry exposes the granitic bedrock at 20-25 m asl., upon which are shelly marine deposits of the **Uyekraal Formation**. These are overlain by aeolianite of the **Langebaan Formation** (Diazville Member).

The Holvlei Clay Quarry will exploit weathered bedrock of granitic and/or Malmesbury shale origin. However, this lies beneath partly Prospect Hill Fm. aeolianites and calcrete and partly beneath Unit Q2, **Springfontyn Formation** deposits that overlap the site from the east (Figure 2).

The transport corridor, on leaving the mining area, crosses over the hill where granite is thinly overlain by Q2 cover. It then traverses the flat plain 10-12 m asl., where the thickening Q2 unit is overlain by Q1 sands. Where the route meets the Saldanha rail link it rises slightly and crosses onto and traverses the Langebaan Formation.

The cement plant is situated on Langebaan Formation aeolianite and calcrete (Figure 2), mainly under thin Q1 cover.

Mining and construction activities (excavations) will result in a negative direct impact on the fossil content of the affected subsurface. Fossils and significant observations will be lost in the absence of management actions to mitigate such loss. This loss of the opportunity to recover fossils and their contexts when exposed at a particular site is irreversible.

Conversely, mine pits and construction excavations furnish the "windows" into the coastal plain depository that would not otherwise exist and thereby provide access to the hidden fossils. The impact is positive for palaeontology, provided that efforts are made to watch out for and rescue the fossils. There remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss.

Acceptable mitigation will require the recovery and permanent archiving of samples that adequately reflect the diversity of palaeontological resources in these deposits. The mining operation can be turned into a positive impact by appropriate mitigation. The problems in different interpretations of the geological history of the area are mentioned in Sections 5 and 6 and the questions that arise can be addressed by the discovery of more fossils of various kinds.

A draft proposal with procedures for the mitigation of mining impacts on palaeontological resources is presented in Section 11 of this report. It is envisaged that the IZIKO S. A. Museum, HWC, the Council for Geoscience and the West Coast Fossil Park will all be involved at various levels in the monitoring and rescue of fossil material during the quarrying operations.

It is recommended that the bulk earth works involved in the construction of the cement factory and the transport corridor be monitored by on-site personnel. Section 12 outlines monitoring by construction personnel in terms of general Fossil Find Procedures for inclusion in the Construction Phase EMP. In the event of fossil finds, the appointed palaeontologist will assess the information and liaise with the manager and the ECO and a suitable response will be established. If an important find, a field inspection must be undertaken to document and sample fossiliferous strata that may be exposed

It is recommended that the contracted palaeontologist carry out field inspections at appropriate stages in the making of the larger and deeper excavations, particularly in the Langebaan Formation. The aim of field inspection is to examine a representative sample of the various deposits exposed in the excavations, recording context, fossil content and to take samples.

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1. INTRODUCTION

AfriSam (South Africa) (Pty) Ltd (AfriSam) proposes to construct a cement plant at Saldanha Bay , to re-enter the cement market in the Western Cape. The cement factory will be based on the local limestone resource of ancient dune rocks that are comprised chiefly of sand grains that are tiny, calcareous shell fragments derived from the wearing down of marine shells on ancient beaches and blown inland. The mining rights to the calcareous aeolianites extend northward from Saldanha Bay (Figure 1) and are owned by AfriSam's (wholly owned) subsidiary company National Portland Cement Company (Pty) Ltd.

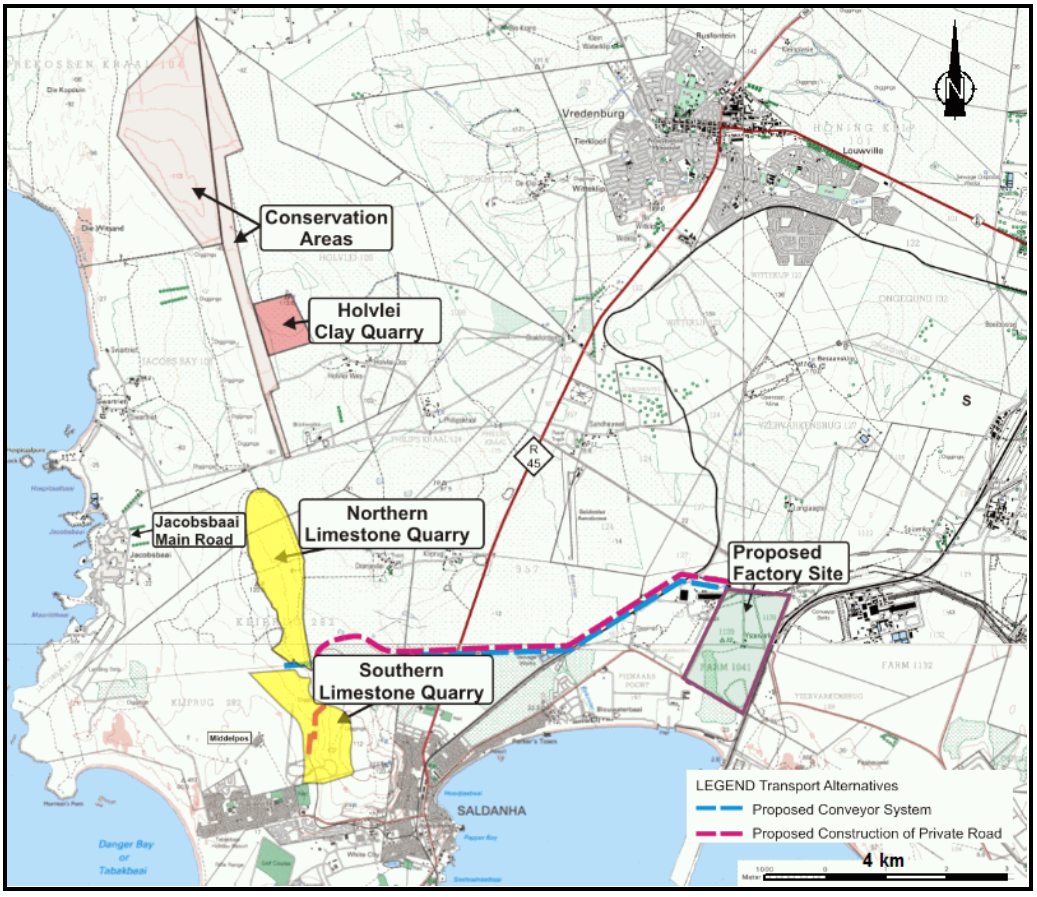

Figure 1. Project components of the proposed limestone dune-rock quarrying and cement manufacturing operations. Adapted from "Locality Map.jpg" supplied by Aurecon.

The project components (Figure 1) involve:

- Cement factory located in the industrial area near the ore terminal and the Saldanha Steel plant.
- Southern Limestone Quarry mining area on Kliprug 282, Portions 8, 15 & 23.
- Northern Limestone Quarry mining area. Kliprug 282/9 and Jacobs Bay 109/7.
- Holvlei Clay Quarry on Holvlei 120/4.
- Proposed transportation corridor, with alternatives:
    - Conveyor belt system.
    - Construction of a private road.
- Proposed declaration of conservation areas (Trekkossenkraal 104/2, Holvlei 120/3).

In terms of its current mining right, NPCC mines up to 40 000 tonnes per annum (tpa) of aeolianite for agricultural lime from the existing quarries in the Southern Limestone Quarry area (Tabakbaai quarry).

Phase 1 of the proposed project (2014 – 2021) is planned to involve mining by NPCC of approximately 170 000 tons/annum (tpa) of limestone from the Southern Limestone Quarry, by extension of the existing Tabakbaai quarry.

Phase 2 (2022 – 2112) is planned to involve mining in both the southern and northern limestone quarries and an expanded cement plant, with the limestone production increasing to a total of 1 200 000 tpa. Approximately 120 000 tpa of clay additive would be mined from the proposed Holvlei Clay Quarry. One of the alternatives for the ore transport corridor will be implemented. (Source: EIA App form_DEADP~140611 Final.pdf.)

Various feasibility studies for the exploitation of the limestone reserves on land owned by NPCC have been conducted since 1974 (ATS/SAL2010/00, 02 Project Background R01.docx). An Environmental Impact Assessment (EIA) process for a clinker production line of 2000 t/day was initiated in 1996, but the project did not go ahead due to unfavourable market conditions. The aforementioned EIA (Alpha Saldanha Cement Project) included an Archaeological Impact Assessment (AIA) (Avery & Kaplan, 1997) and a Paleontological Impact Assessment (PIA) (Roberts, 1997). These are comprehensive reports with recommendations for mitigation that remain applicable.

A new Paleontological Impact Assessment has been commissioned for the current proposal.

5. TERMS OF REFERENCE

Assess and comment on the impacts on Palaeontology for the construction and operational phases of the project (the lifespan of the facility).

Review the previous relevant study/ies undertaken as part of the previous EIA for the project and utilize the information, where relevant, for the updated Paleontological Impact Assessment.

Review and update the Paleontological impact assessment, evaluating:

a) magnitude, frequency of occurrence, duration and probability of impacts;
b) the local, regional, national and international significance of predicted impacts;
c) the level of confidence in findings relating to potential impacts.

Recommendation of mitigating measures to address predicted impacts.

List any additional permitting and/or licensing requirements.

Prepare the necessary documentation for the required palaeontological authorizations.

Make available own reports to all other specialists for alignment of the specialist reports.

The assessment must take into account public comments received during the Public Participation process as well as the applicable South African standards and Western Cape Guidelines.

6. APPLICABLE LEGISLATION

The National Heritage Resources Act (NHRA No. 25 of 1999) protects archaeological and palaeontological sites and materials, as well as graves/cemeteries, battlefield sites and buildings, structures and features over 60 years old. The South African Heritage Resources Agency (SAHRA) administers this legislation nationally, with Heritage Resources Agencies acting at provincial level.

According to the Act (Sect. 35), it is an offence to destroy, damage, excavate, alter of remove from its original place, or collect, any archaeological, palaeontological and historical material or object, without a permit issued by the South African Heritage Resources Agency (SAHRA) or applicable Provincial Heritage Resources Agency, *viz*. Heritage Western Cape (HWC).

Notification of SAHRA or the applicable Provincial Heritage Resources Agency is required for proposed developments exceeding certain dimensions (Sect. 38).

Perhaps here it is appropriate to note that, in the National Heritage Resources Act, “palaeontological” is defined to mean “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." (my italics). Certainly, in the case of phosphatic sand, lime-sand/shell-grit mines and "kieselguhr"/diatomite mines, microfossils form part of the "*fossiliferous rock intended for industrial use"*. However, they are abundant, do not require specialized and time-consuming collection techniques and representative samples are easily acquired for archival/study purposes. Similarly, quarried shell beds are easily sampled.

In addition to this intrinsic fossil content of the industrial resource, there are rare shell and bone macrofossils sparsely scattered and locally concentrated within both overburdens and orebodies. These are not the primary component intended for industrial/commercial use. Happily, this is generally recognized and it has been primarily due to the large excavations made by mining, and the support of mining companies, that much of the present-day knowledge of the coastal-plain record has been rendered possible.

A permit from Heritage Western Cape (HWC) is required to excavate fossils. The applicant should be the qualified specialist responsible for assessment, collection and reporting (palaeontologist).

A permit will also be required by a delegated management official on the mine, in order to rescue or collect fossil material in danger of destruction/loss.

7. APPROACH AND METHODOLOGY

7.1 Available Information

A considerable volume of scientific literature (several hundred published articles) has issued from the fossil finds made in the Saldanha area, most famously from finds in the old Langebaanweg phosphate mine that is now the West Coast Fossil Park. Most of these are specialist studies specific to the nature and identity of the various fossil species. The important information for this study are the articles dealing with the broader stratigraphy, palaeoenvironments, fossils and ages of the formations.

The main information for the area is Visser & Schoch (1972, 1973) and the accompanying geological map, the relevant part of which is reproduced as Figure 2. Rogers (1980) provided a regional perspective of the subsurface on the basis of a borehole drilling programme by the Geological Survey and Dept. of Water Affairs. The exposures provided by mining and exploratory drilling greatly expanded the knowledge of the stratigraphy and fossil record of the area: Tankard (1974, 1975a,b), Dingle *et al.* (1979), Hendey (1981a,b,c), Dingle *et al.* (1983), Hendey (1983a,b,c), Hendey and Dingle (1990).

Since the 1997 AIA and PIA, there have been some improvements in the understanding of the Cenozoic geology of the Saldanha area (Pether *et al*., 2000; Roberts & Brink, 2002; Roberts *et al*., 2006). A recent review of the age evidence from the various stratigraphic formations provides the latest results of research (Roberts *et al*., 2011). Other references are cited in the normal manner and included in the References section.

Differences in the interpretation of the coastal-plain stratigraphy of the Saldanha area exist between different researchers. The outline of the geological history presented below reflects the author's own perspective, based on research and field observations of coastal-plain deposits between northern Namibia and the southern Cape. Such differences in interpretation will be elucidated only where germane to this report.

7.2 Assumptions and Limitations

It is generally not possible to predict the buried fossil content of an area other than in general terms, based on what has been previously observed of the fossil content of a particular formation in a particular area. In many cases the information on fossil content is limited to the basics, such as in the case of geological mapping when the fossils are not the immediate focus.

In particular, in coastal-plain deposits the important fossil bone material is generally sparsely scattered and unless large and obvious, is not generally seen, underestimating the fossil prevalence. Much depends on careful scrutiny of exposures and on spotting this material as it is uncovered during digging *i.e.* by monitoring excavations.

8. REGIONAL GEOLOGICAL SETTING

8.1 The Bedrock

The older bedrock of the region consists of **Malmesbury Group** shales (**Ma** in Figure 2) that along the coast have mostly been eroded away to below sea level. Their origin dates from over 550 Ma (Ma meaning million years ago, Mega-annum), when muddy sediments, impure limestones and subsea basalts were deposited into the Adamastor Ocean that once existed on the western margin of the early continent (Gresse *et al*. 2006).

Subsequently, during the assembly of supercontinent Gondwana, continental drift closed up the Adamastor Ocean and its infill was compressed and welded onto the older part of southwestern Africa, metamorphosing the muds and lavas into tightly-folded shales and metavolcanic greenstones. During this process, between 550 and 515 Ma, the compressed Malmesbury Group was intruded at depth by molten magmas that solidified and crystallized to become the "**Cape Granites**" (Figure 2, **G1-G5**). The granites are now exposed as hills in many places, such as around Darling and Vredenburg, and outcrop along the shoreline.

These bedrock formations are not of palaeontological interest.

8.2 The Coastal-plain Sandveld Group

A vast amount of geological time intervenes between these bedrock formations and the deposits that cover them on the coastal plain. Much has been eroded away subsequent to Gondwana rifting and continental breakup from ~150 Ma. The "Gondwana" sediments of the Cape and Karoo Supergroups have been eroded off the Saldanha area coastal plain, re-exposing again the once deeply-buried "basement" of Malmesbury shales and Cape Granites. By the beginning of the Cenozoic Era ~65 Ma, the essentials of the coastal bedrock topography were probably in place. The bedrock had been faulted into high and low areas during rifting, called horsts and grabens, and the latter low-lying graben blocks strongly influenced the developing coastline and river courses. The succession of deposits now overlying the coastal-plain bedrock is the **Sandveld Group** which is comprised of the formations tabulated in Table 1.

The lower formations, (Elandsfontyn, Saldanha, and most of the Varswater) are not exposed, being buried beneath aeolian sands of the Prospect Hill, Langebaan and Springfontyn formations and thus do not feature on the geological map (Figure 1).

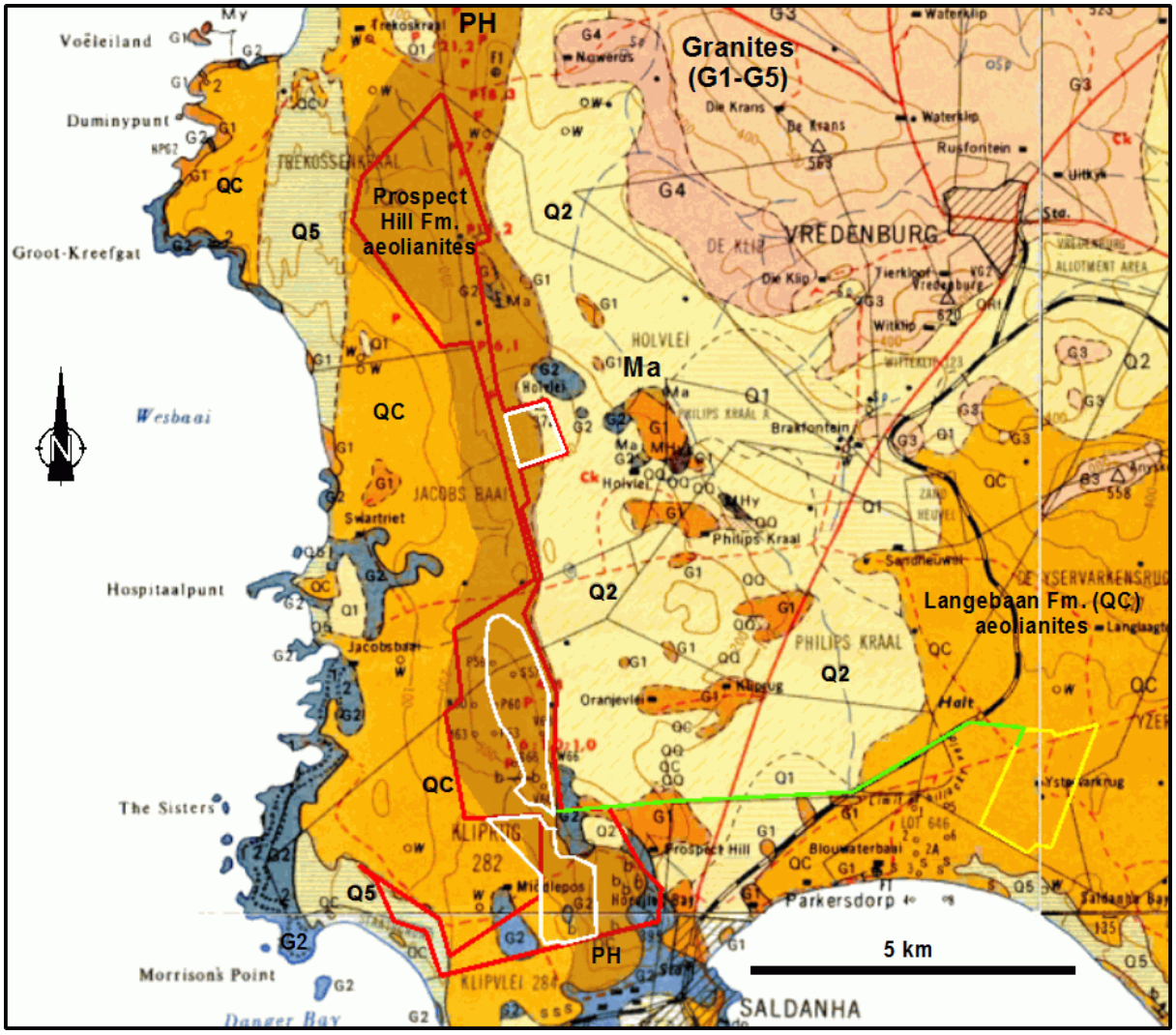

Figure 2. Surface geology of the project study area. From Visser & Schoch (1972), 1:125000 Map Sheet 255: 3217D & 3218C (St Helenabaai), 3317B & 3318A (Saldanhabaai). Refer to Figure 1. Legend below in order of youngest to oldest formations.

Q5: Recent windblown sands and dunes along the beach are mapped as unit Q5. Prominent dune plumes extend north from sandy beaches. Called the **Witzand Formation**.

Q1: Another surface unit is the recent soil-unit Q1, white to slightly-reddish sandy soil, which is mainly a stabilized sand sheet blanketing the underlying geology.

Q2: An older surface unit Q2, shallow sandy soil with heuweltjies (heuweltjiesveld), occurs inland the coast. Incipient calcretes occur in Q2. It overlies the Langebaan "Limestone" Formation. Thick quartzose sand deposits beneath Q2 are called the **Springfontyn Formation**.

QC: The **Langebaan "Limestone" Formation**, aeolianite Unit QC, is underlain mainly by marine deposits of Pliocene age (**Varswater** & **Uyekraal** fms).

PH: The **Prospect Hill Formation.** Part of the Langebaan Fm between Saldanha Bay and Paternoster has now been separated as this new formation, due to fossil finds indicating that it is significantly older than the other aeolianites included in the Langebaan Formation. This is shown by the brown overlay in Figure 2.

G1, G2, G3, G4 and **G5** are outcrops of various bedrock granites of **the Cape Granite Suite**.

Ma: Bedrock outcrops of **Malmesbury Group** metasediments.

TABLE 1. Formations of the Sandveld Group – current lithostratigraphy.

SANDVELD GROUP	Age and lithology
Witzand Formation	Q5. Holocene and recently active dune fields and cordons
Springfontyn Formation	Q2 & Q1. Quaternary to Holocene calcareous sandstone (aeolianite) with interbedded palaeosols
Velddrif Formation	Quaternary estuarine coquina, calcarenite, sand and conglomerate Raised beaches along coast.
Langebaan Formation	QC. Late Pliocene to Late Quaternary aeolianites
Prospect Hill Formation	PH. Late Miocene aeolianite
Varswater Formation	Mio-Pliocene littoral and shallow marine sandstone, coquina and conglomerate
Elandsfontyn Formation	Early- mid-Miocene fluvial muds, peats, sands and gravels
Adapted from Roberts *et al.*, 2006.	

Although Table 1 represents the current official stratigraphy as published (*e.g*. in Roberts *et al*. (2006)), the classifications are always "work in progress" and partly reflect the historical growth of observations and different approaches in classification. The stratigraphic approach of the SA Committee for Stratigraphy is lithostratigraphic and historically based on lithology (sediment composition and texture) and not explicitly based on sea level history. The latter approach (sequence/dynamic stratigraphy) is appropriate to coastal-plain stratigraphy, which has been formed by repeated cycles of marine transgressions and regressions. In this approach, a marine formation includes that package of deposits that relates to a particular sea-level cycle of rising and falling sea level. This approach is now possible because the histories of sea-level fluctuations, global ice volumes and palaeoclimate/palaeoceanography is much better established.

For the purposes of this report the application of the sea-level history/sequence stratigraphic approach affects the wider distribution or correlation of the Varswater Formation, away from the stratotype, reference section at the West Coast Fossil Park, as explained in the section "Marine Formations" below.

8.3 The Elandsfontyn Formation

High sea levels occupied the "early" coastal plain at times of global warming during the late Cretaceous and Eocene, subjecting it to marine planation. These palaeoshorelines were up to about 200 m asl., but it seems unlikely that any such marine deposits now remain in the Saldanha area. Low sea levels during Oligocene global cooling caused the coastal-plain rivers to incise their courses into the bedrock, producing valleys that are now deeply buried. During the early Miocene about 20 Ma, rising sea level caused the rivers in the valleys to "back up", filling the valleys with river (fluvial) sediments and peat beds with plant fossils. Known only from boreholes, this fluvial valley fill is the **Elandsfontyn Formation**, up to 60 m thick in places and the oldest formation of the Sandveld Group (Rogers, 1980, 1982). The peaty beds contain fossil pollen indicative of yellowwood forest vegetation with palms and the depositional environments are interpreted to be those of meandering rivers under humid climatic conditions (Coetzee, 1978; Rogers, 1982; Hendey, 1981a). The fossil pollen assemblage broadly suggests an early to middle Miocene age.

The Elandsfontyn Formation will not be intersected in the mining operation or construction earthworks.

8.4 Marine Formations

1.1.1 Local and Global Sea-level History

On the Namaqualand coastal plain the marine deposits of the three major sea-level cycles are preserved and have been repeatedly exposed in the open pits created by diamond mining. This has enabled testing of the stratigraphic framework at numerous localities along ~400 km of coast between Doringbaai and Alexander Bay, as well as farther northwards into Namibia.

These three marine formations are large and together make up >90% of preserved marine deposits, the remainder being the small Quaternary "raised beaches" right at the coast. They are separated by erosional contacts and sometimes by intervening terrestrial deposits. The three formations are sufficiently separated in time and by palaeoceanographic changes that each has a distinct, distinguishing fossil content. Within each formation there is an internally-consistent geometry of marine palaeoenvironments.

Each formation extends seawards from its highest palaeoshoreline (transgressive maximum). These are, from oldest to youngest, at ~90, ~50 and ~30 m asl. The ~90 m, ~50 m and ~ 30 m asl. palaeoshorelines do not reflect the actual sea-level (relative to the present level) that was attained during each transgression. Instead, uplift of the subcontinent edges has raised the palaeoshorelines to their present elevations. Previously these three formations have been referred to as the 90 m Package, the 50 m Package and the 30 m Package, but are now also called the Kleinzee, Avontuur and Hondeklipbaai formations, respectively.

Fossils and other evidence indicates that the ages of these three large formations are mid-Miocene (~16 Ma), early Pliocene (5-4 Ma) and mid-Pliocene (~3 Ma). These ages correlate with the Mid Miocene Climatic Optimum, the Early Pliocene Warm Period and the Mid Pliocene Warm Period which are times of global warming when melting of the Antarctic ice cap raised sea levels and the coastal plain was "transgressed", eroding a marine unconformity on bedrock and earlier formations and leaving behind marine sediments when sea level receded again.

The complication that arises with respect to the definition/distribution of the Varswater Formation in the wider Sandveld region is that it subsumes or includes the deposits of these separate marine episodes. In general, the occurrence of phosphatic sands in boreholes has been correlated with the Varswater Formation. Such phosphatic sands have been identified up to ~90 m asl. in boreholes, as well as extending down to and beyond the current shoreline of Saldanha Bay. Such a wide-ranging distribution of a single marine formation is suspicious when viewed against the sea-level record and associated stratigraphy defined further north on the Namaqualand coast. Furthermore, each Namaqualand formation also has a phosphatic component and phosphatic sands do not distinguish them from each other. Similarly, in the Sandveld region the presence of phosphatic sands does not distinguish the real marine formations that are subsumed in the Varswater Formation.

1.1.2 The Saldanha Formation

Perceived mid-Miocene marine deposits have been named the "Saldanha Formation" by Tankard (1975b). However, the pinning down of this formation to a specific section has proved elusive and its existence controversial (*e.g*. Dingle *et al*., 1983). The stratotype, at the "Bomgat" on the Hoedjiespunt peninsula, is of mid-Pliocene age (Uyekraal Fm.). The reference stratotype in the Langebaanweg mine was evidently below the general floor of the quarry and its existence has never been confirmed. The named occurrence at Ysterplaat is of Pliocene age, based on fossil shells found subsequently by the writer.. Only the occurrences on the Namaqualand coast referred to by Tankard (1975b) can be now be confirmed as mid-Miocene of age (pers. obs.).

Phosphatic sands are recorded up to ~90 m asl. in the Elandsfontyn borehole S22 south of Langebaanweg (Rogers, 1980). These are of assumed marine origin and have been correlated with the Varswater Formation. This leads to the early Pliocene Varswater Formation being associated with

a transgression to 90 m asl. (Roberts *et al*., 2011). However, early Pliocene marine deposits along Namaqualand do not exceed ~50 m asl. and such high sea level in the early Pliocene is also negated by the deep-sea oxygen-isotope record which is incompatible with major Pliocene deglaciation of Antarctica and very high sea levels (Hodell & Venz, 1992).

It is proposed that these high-elevation, ostensibly-marine, phosphatic sands may be of mid-Miocene age. Should this be so, the name "Saldanha Formation" has historical precedence. In any event, it remains to be proven that these high-elevation phosphatic sands are indeed *in-situ* marine deposits and not aeolian deposits reworked from the preceding marine formation.

Other evidence of this time when the sea lapped high against the Saldanha granite hills is the phosphate mineralization on coastal summits, originating when they were islands and offshore seabird roosts covered in guano. The phosphorus leached from the guano and impregnated the underlying granite, forming a kind of "mineralogical fossil".

When sea level receded from the mid-Miocene high, the coastal plain below ~90 m asl. would have been covered with marine sediments. Marine deposits, such as rounded gravels or phosphatic marine sands, occurring in the 50-90 m asl. range, are likely of mid-Miocene age. The thickness of the Miocene marine deposits will have been reduced by erosion and deflation and the residua will be weathered and disguised. Considerable thicknesses of "phosphatic marine section" are suspect and very likely include aeolian deposits.

Small, thin patches of residual mid-Miocene deeper-marine, inner-shelf deposits, preserved beneath Pliocene formations at low elevations, are a common feature in the Namaqualand record. These isolated patches, rarely thicker than 0.5 m thick and a few tens of metres in extent, have preserved the shelly fauna, enabling recognition of their Miocene age. They should also occur in the Sandveld Group, beneath the Varswater and Uyekraal formations.

In short, the mid-Miocene "Saldanha Formation" certainly exists in the subsurface of the Saldanha area, but it is yet to be unequivocally identified. As mentioned above, the initial phase of the "Konings Vlei Gravel Fm." could have been formed during the mid-Miocene. This remains an open question, only to be resolved by more fossil finds. The equivalent of the Saldanha Formation is the marine Kleinzee Formation, which extends seawards from a maximum ancient shoreline which is now is now uplifted to ~90 m asl. along the West Coast, with prograded, diamondiferous marine gravels occurring seaward of a prominent slope "nick" or even vertical "fossil" sea cliffs.

1.1.3 The Varswater Formation at Langebaanweg

1.1.3.1 The Lower Varswater Formation

At Langebaanweg (LBW), the carbonaceous silts and clays of the Elandsfontyn Formation pass upwards into clayey, greyish-green fine sand with reddish mottles. This unit has been called the **Langeenheid Clayey Sand Member** (LCSM) of the Varswater Formation. Macrofossils have not been found in it, but observations are limited as it is known mainly from boreholes and is below quarry footwall at Langebaanweg. Plant microfossils (phytoliths) are present (Rossouw *et. al.,* 2009). The reddish mottling of the LCSM suggests that it was later weathered during exposure on land (subaerial palaeoweathering).

The LCSM is interpreted as estuarine sediments deposited as the mid-Miocene rising sea level flooded into the valley embayments (Roberts *et al*., 2011). The LCSM can be regarded as the upper, terminal member of the Elandsfontyn Formation (rather than the lowest member of the Varswater Formation), deposited when rising sea-level led to estuarine environments conformably succeeding the river deposits in the palaeovalleys. On the other hand, these beds are distinct from the underlying fluvial and marshy deposits of the Elandsfontyn Fm. They form a significant part of the stratigraphy, averaging 10 m in thickness. Although this unit is restricted to the palaeovalleys, its occurrences are expected to be a feature of regional extent. In terms of sea-level history, the LCSM can be viewed as the "transgressive system tract" of the Saldanha Formation.

The LCSM was eroded and overlying the erosion surface is the marine **Konings Vlei Gravel Member** (KGM) (or "Gravel Member" of preceding literature), a fossiliferous, polyphase phosphatic gravel, formed by phases of erosion and re-cementation of phosphatic sandstone. In the Langebaanweg embayment, the KGM unit thickens from ~2 m in the north to ~8 m in the southwest. Where thickly preserved, sandy sediments with pockets of fossil warm-water marine molluscs, scattered shark teeth and rare mammalian bones occur. A shallow marine origin is envisaged for the KGM, with contemporaneous cementing of phosphatic sand being episodically disrupted by high-energy storm events, generating intraformational gravels that were later re-cemented.

It has been suggested that the KGM is a condensed record of Middle to Late Miocene transgression and regression (Hendey, 1981a,b) and that the initial phase of the "Gravel Member" was deposited during the mid-Miocene sea-level high. This would make it (at least partly) equivalent to the Saldanha Formation. However, the presence of the three-toed horse *Hippotherium cf. primigenium* indicates an age younger than ~10.6 Ma (Geraads *et al*., 2002) and would exclude this possibility.

On the basis that the *Hippotherium* fossils approximately reflect the age of the KGM, Roberts *et al*., (2011) propose that the KGM may have been deposited during a late Miocene sea level highstand. Fossils of similar age have been found in Namaqualand, namely the bear-dog *Agnotherium* sp. (13 - 12 Ma) and the gomphothere *Tetralophodon* (12 - 9 Ma), seemingly suggesting that biostratigraphic equivalents of the KGM are represented in this region. However, the author has personal knowledge of these finds and they occurred in the basal gravels of the early Pliocene Avontuur Formation and must have been reworked from pre-existing terrestrial deposits of 13-9 Ma age range.

The age of the KGM is not well constrained and its polyphase origin makes it problematic. The shell fossils postdate the earliest, worn, hard phosphatic sandstone, but the two samples came from different phases of reworking, early and late. Only a very small assemblage of fossil shells has been obtained. This assemblage has more in common with Pliocene assemblages than with those of middle Miocene age (pers. obs.). Given that the KGM has been established from boreholes to be up to 8 m thick, it remains feasible that in part it is of mid-Miocene age, but it seems that the last events affecting the KGM were during the early Pliocene transgression, in the form of an initial marine incursion into the LBW embayment.

1.1.3.2 The Upper Varswater Formation

The overlying **Langeberg Quartz Sand Member** (LQSM) is a shallow estuarine deposit consisting of river floodplain, salt marsh and tidal-flat environments, laid down when the shoreline of the rising sea-level was just west of E Quarry and a beach-barrier or spit had formed across the estuary mouth. Composed of pale quartz sands, muddy silts and peats, it is only up to ~2 m thick. It is richly fossiliferous, with a diversity of bones, shells and microfossils reflecting the various environments.

The **Muishond Fontein Pelletal Phosphorite Member** (MPPM) is the main phosphatic-sand bearing unit of the Varswater Formation. Its formation reflects the increasing inundation of the area by rising sea level. Deposition took place in an expanded estuarine system; seals and fishes reflect the aquatic estuarine habitat. The MPPM becomes more open-marine in the upper part, with marine microfossils, fish teeth and shell fragments, but very few bones, and evidently reflects deposition in a deepening embayment.

The fossil bone beds occur in channels incised into the lower MPPM and LQSM and in the lags of stacked channel fills embedded in the MPPM estuarine deposits. The channels originated when sea-level temporarily receded during a regressive episode in the overall transgressive regime. The estuarine deposits were exposed and a local stream system incised into them, concentrating bones from the LQSM and delivering "new" bones from the surrounding catchment, for a brief period until sea-level rose again (Roberts *et. al.,* 2011).

The extensive vertebrate assemblage recovered from the Langebaanweg quarry indicates an early Pliocene age for the LQSM and MPPM (Hendey, 1981a, 1981b). A review of the existing data

(Roberts *et. al.,* 2011) indicates an age of ~5-5.2 Ma, when the early Pliocene transgression was nearing its maximum.

The Upper Varswater LQSM and MPPM were deposited in an overall deepening environment during sea-level rise/transgression into a large, low-gradient embayment. Sediment supply debouched from the palaeo-Berg River was sufficient to build up a thick record during the transgression, being trapped in the embayment that was protected from high wave energy, open-coast conditions.

1.1.4 The Varswater Formation in the wider region

At LBW E Quarry the MPPM attains a maximum elevation of ~45 m asl. (Roberts et al., 2011). Tankard (1974) estimated the transgression maximum at 50-55 m asl., based on boreholes. When the sea level receded again (a regression) the shoreline would have built out seawards (prograded), covering the previous MPPM with shallow, shoreface and beach deposits (a regressive sequence). However, these regressive deposits have not been identified at LBW and are in fact "missing". This is due in part to the low wave energy setting; the zone of wave-influenced seabed is shallow and the associated deposits are consequently relatively thin. The subaerially-exposed beach and shoreface sediments of the prograded shoreline would then have been subjected to erosion by streams and wind, removing the regressive deposits altogether.

In contrast with the record of transgression preserved in the LBW embayment, the sedimentary record of sea-level change on the wave-exposed, high-energy open coast preserves the deposits of sea-level regression. Due to the steeper gradients along the open-coast, transgression deposits are largely destroyed when sea level later regressed, by the highly energetic shoreface that is imposed upon the earlier, finer-grained, deposits of deeper-water. For instance, the three main formations on the narrow, steeper coastal plain of Namaqualand are all prograded shoreline deposits built out during falling sea level. Only eroded patches of transgression deposits are preserved in low topography.

Similarly, in the wider Saldanha area, outside of the embayments, the regression from the early Pliocene sea-level high would have left a regressive sequence mantling the emerged coastal plain, then subject to general deflation by wind and transformation into aeolianites and also locally eroded by drainages. This setting applies to the narrow coastal plain of the Vredenburg Peninsula. These deposits correlate with the Avontuur Formation of the West Coast, from which "Langebaanian Age" terrestrial and marine mammal fossils have been recovered.

1.1.5 The Uyekraal Shelly Sand Formation

In the Saldanha embayment west of the West Coast Fossil Park, a flat plain underlain by marine deposits extends from ~25 m asl. towards the coast. It has a capping hardpan calcrete formed in terrestrial deposits, beneath which is green-hued shelly, gravelly sand with phosphatic casts (steinkerns) of molluscs and shark teeth (Rogers, 1982, 1983). These subsurface phosphatic sands and gravels have also been included in the Varswater Formation (*e.g*. figures 1, 6 & 12 in Roberts *et al*., 2011). However, Rogers (1980, 1983) clearly recognized that these marine deposits are younger than the Varswater Formation just inland at LBW and proposed they be called the Uyekraal Shelly Sand Member of the Western Cape equivalent of the Bredasdorp Formation.

Subsequently, Rogers, in Rogers *et al*. (1990), informally renamed these deposits as the **Uyekraal Shelly Sand Formation** of the Sandveld Group. The validity of this formation is entirely supported, because the Uyekraal marine beds are spatially consistent with being equivalent to 30 m Package deposits (the Hondeklipbaai Formation), seen in Namaqualand diamond mines as a substantial, prograded marine formation built out seawards from a sea-level maximum of 30-35 m asl. (Pether, 1994; Pether, in Roberts *et al*., 2006). This correlation is confirmed on the basis of extinct fossil shells common to both formations.

Sea level rose again in the middle Pliocene (~3.0 Ma) to a level now ~30-35 m asl., over-riding and eroding the deposits of the Varswater Formation, then depositing a regressive sequence when the shoreline prograded. Exposures of the outer, eroded edge of the Uyekraal Shelly Sand Formation, distinguished by coastal outcrops with extinct and warm-water fossil shells, occur at Langebaan,

Leentjiesklip, Bomgat, Sea Harvest and Elandspunt. This formation is also exposed in the lower quarry at Diazville. It underlies the Saldanha Steel site where it was encountered beneath ~10 m of aeolianite. Due to its depth it is not likely to be encountered in the factory site.

1.1.6 The Velddrif Formation

During the Quaternary period there were brief intervals of global warming (interglacials), of which the present time is an example, when sea levels were similar to the present level or several metres above or below present level. The higher sea levels are the Quaternary "raised beaches" found at low elevations (<15 m asl.) around the coast, where they are exposed in cliffs beneath dune rocks, on top of low marine platforms fringing the coast and within the lower reaches of valleys, *e.g.* the Berg River. They comprise the Velddrif Formation. This formation does not feature within the scope of the mining area. It probably underlies the southern part of the factory site, but is not expected to be encountered unless deep excavations are made there.

8.5 Aeolian Formations

Aeolianites or "dune rocks/fossil dunes" overlie the marine deposits of the coastal plain. They rest on wind-deflation erosion surfaces formed on the marine deposits and are comprised of sand reworked from the marine deposits by wind and also blown off the beaches of the receding sea levels. The aeolianites are evident in the coastal landscape as the ridges, low hills and mounds beneath a capping calcrete crust, or "surface limestone" in old terminology.

1.1.7 The Prospect Hill Formation

The Prospect Hill Formation is the inner aeolianite ridge stretching north from Saldanha Bay up the coast to near Paternoster (Figure 2). The aeolianite has been found to include fossil eggshell fragments of extinct ostriches (*Diamantornis wardi*) and extinct land snail forms (Roberts & Brink, 2002). Previously included in the Langebaan Formation, the separation of this aeolianite as a distinct formation is also justified by it being lithologically distinct from the younger aeolianites that abut it. The dating of *Diamantornis wardi* occurrences in Namibia, East Africa and Arabia indicates an age of 12-9 Ma (Stidham, 2008), making this one of the oldest coastal dune systems in South Africa (Roberts & Brink, 2002).

1.1.8 The Langebaan Formation

The Langebaan Formation or "Langebaan Limestones" (Figure 2, deep yellow, QC) incorporates various younger aeolianites of different ages, as an "amalgam" of the dune plumes that formed on the coastal plain, at differing places and times. This is reflected in the different ages indicated from fossils found at various places. For example, a Pliocene or younger age (Lower Quarry near Diazville, Roberts & Brink, 2002) and an early Quaternary age (Skurwerug, Hendey & Cooke, 1985). Middle and late Quaternary ages are indicated by relationships to Last Interglacial (~125 ka) and earlier shoreline deposits and by dating of aeolianites by luminescence methods (OSL) (Roberts *et al*., 2009).

1.1.9 The Springfontyn Formation

The Springfontyn Formation is an informal category that accommodates the mainly non-calcareous, windblown sand sheets and dunes that have covered parts of the landscape during the Quaternary. Its areal extent is depicted on the geological map (Figure 2) in pale yellow hues wherein Visser & Schoch (1972, 1973) differentiate the coversands by their surface appearance into 2 surficial units, **Q2** (older cover) and **Q1** (younger cover). The Springfontyn Fm. consists of the sequences beneath these "coversands", *i.e*. SubQ2 and SubQ1.

Developed around the granite hills is the extensive surface unit, **Unit Q2** (Figure 2). It is mapped where there is an underlying thickness of deposits post-dating the Langebaan "Limestone" aeolianites. Unit Q2 is characterized by its surface manifestation as the distinct "heuweltjiesveld", the densely dot-patterned landscape of low hillocks seen in aerial images. Their formation is partly related to termite activity, but they seem to be mainly related to clumpiness of woody shrubs produced by positive feedback ecological processes over a long time. The "heuweltjiesveld" is merely the

surface-soil characteristic of Unit Q2. Not much detail is known about Unit Q2 at depth (Sub-Q2). Pedogenic layers of ferruginous concretions, clayey beds and minor calcretes occur among sandy-soil beds. Clearly Sub-Q2 will differ from place to place according to the local setting, but is mainly windblown sandsheets and degraded dunes. Near bedrock outcrop and on slopes, Sub-Q2 will likely comprise local colluvial/hillwash/sheetwash deposits, small slope-stream deposits, alluvium in the lower valleys and possibly vlei and pan deposits. A few OSL dates provide ages of ~150 to ~600 ka, reflecting the accumulation of Sub-Q2 in the middle Quaternary (Chase, 2005; Chase & Thomas, 2007; Roberts *et al.*, 2011).

Figure 3. Simulated oblique aerial view (looking north) showing the extant quarries, the lower and upper Tabakbaai quarries in the foreground. Google Earth.

Surface **Unit Q1** (Figure 2) is a younger "coversand" geological unit and is "white to slightly-reddish sandy soil" (Visser & Toerien, 1971; Visser & Schoch, 1973). These are patches of pale sand deposited in geologically-recent times. The OSL-dating results from coversand along the West Coast indicate several periods of deposition of Q1 during the last 100 ka (Chase & Thomas, 2007).

1.1.10 The Witzand Formation

The latest addition of dunes to the coastal plain is Unit **Q5** (Figure 2), otherwise known as the Witzand Formation (Rogers, 1980), comprising sands blown from the beach in the last few thousand years. It does not occur in the area of interest.

8.6 Summary Sandveld Group Stratigraphy

Table 2 summarises the revised view of the Sandveld Group utilized herein.

TABLE 2. Formations of the Sandveld Group – revised stratigraphy.

FORMATION	Age and description	Sensitivity
WITZAND	Holocene and recently active dune fields and cordons <~12 ka.	Mainly archaeological sites.
SPRINGFONTYN	Quaternary to Holocene, mainly quartzose dune and sandsheet deposits, interbedded palaeosols, basal fluvial deposits <~2 Ma.	Fossil bones very sparse, high signif. Basal BQF-type deposits locally – high signif.

LANGEBAAN	Late Quaternary aeolianites <~3 Ma.	Fossil bones mod. common, local to high signif.
VELDDRIF	Quaternary raised beaches & estuarine deposits, <~1.2 Ma. Sea-levels below ~15 m asl.	Shell fossils common, local signif. Fossil bones very sparse, high signif.
Marine erosion surfaces below ~15 m asl.		
LANGEBAAN	Late Pliocene to mid-Quaternary aeolianites <~3 Ma.	Fossil bones mod. common, local to high signif.
UYEKRAAL (2)	Mid-Pliocene marine deposits ~3 Ma. Sea-level max. ~35 m asl	Shell fossils common, local signif. Fossil bones very sparse, high signif.
Marine erosion surface to ~35 m asl.		
LANGEBAAN	Earlier Pliocene aeolianites <~3 Ma.	Fossil bones mod. common, local to high signif.
VARSWATER	Later early Pliocene regressive deposits of wider area. 5-4 Ma. Sea-level max. ~50 m asl	Fossil bone rare, high signif. Poorly known, fossil shells of high signif.
VARSWATER	Early Pliocene transgressive marine deposits in embayments (upper KGM?, LQSM and MPPM members). Later early Pliocene regressive deposits of wider area. 5-4 Ma. Sea-level max. ~50 m asl	Fossil bone common locally, high signif. Shells very sparse, high signif.
Marine erosion surface to ~60 m asl.		
PROSPECT HILL	Miocene aeolianite 12-9 Ma?	Fossils very sparse – high signif.
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 signif. if found.
Marine erosion surface to ~100 m asl.		
LANGEENHEID CLAYEY SAND (1)	Mid Miocene early-transgression estuarine deposits (prev. LCSM Member in lower Varswater Fm.). 18-17 Ma.	Plant microfossils – high signif.
ELANDSFONTYN	Oligocene-early Miocene fluvial muds, peats, sands and gravels, ~26-18 Ma.	Plant fossils – high signif.
PRE-SANDVELD GROUP BEDROCK		
(1) Previously a member of the LVF.	(2) Previously subsumed in the UVF.	UVF: Upper Varswater Fm. LVF: Lower Varswater Fm.

9. GEOLOGY AND PALAEONTOLOGY OF THE AFFECTED FORMATIONS

From Figure 2 it is apparent that the Prospect Hill Formation calcareous aeolianite will be the prime, long-term source of lime for the proposed cement plant, due to its high $CaCO_3$ content.

Initially, quarrying is planned to proceed by expansion of the two existing quarries in the Southern Limestone Quarry mining area (Figures 2 & 3). Previous work has referred to these quarries as the Upper and Lower Diazville quarries (Dale & McMillan, 1990), the Upper and Lower Prospect Hill quarries (Roberts & Brink, 2002) and the Upper and Lower Tabakbaai quarries (Franceschini & Compton, 2004).

The Upper Quarry has its footwall in **Prospect Hill Formation** aeolianite at ~45 m asl. and does not expose the underlying marine formation. The Lower Quarry exposes the granitic bedrock at 20-25 m asl., upon which are shelly marine deposits of the **Uyekraal Formation**. These are overlain by aeolianite of the **Langebaan Formation** (Diazville Member).

The Holvlei Clay Quarry will exploit weathered bedrock of granitic and/or Malmesbury shale origin. However, this lies beneath partly Prospect Hill Fm. aeolianites and calcrete and partly beneath Unit **Q2**, **Springfontyn Formation** deposits that overlap the site from the east (Figure 2).

The transport corridor, on leaving the mining area, crosses over the hill where granite is thinly overlain by Q2 cover. It then traverses the flat plain 10-12 m asl., where the thickening Q2 unit is overlain by Q1 sands. Where the route meets the Saldanha rail link it rises slightly and crosses onto and traverses the Langebaan Formation.

The cement plant is situated on Langebaan Formation aeolianite and calcrete (Figure 2), mainly under thin Q1 cover.

9.1 The Prospect Hill Formation in the Upper Quarry

The Prospect Hill Formation stratotype graphic section (Roberts, 2006) in the Upper Quarry is presented in Figure 4. It is a typical aeolianite with respect to its sedimentary structures, trace fossils and the context of fossil bird and mammal remains. The colour of the aeolianite is pale reddish-yellow due to faint staining of grains by the breakdown of the sparse, iron-bearing mineral content. Together with generally higher calcareous content and the occurrence of giant fossil Trigonephrus snails, the red hue distinguishes this formation from younger aeolianites nearby. The description below is from Roberts & Brink (2002) and Franceschini & Compton (2004).
(rhizoliths) are ubiquitous. The lack of major calcrete palaeosols in the lower ~30 m of the section indicates more or less continuous accumulation.

The lowermost 3 m exposed consists of coarser (calcareous sandstone) that passes up into fine to medium-grained calcarenite with large-scale, dune-slipface crossbedding in beds up to 5 m thick and smaller, wedge-shaped beds. The sand was transported from beaches to the south. Deflation surfaces (blowouts) marked by coarser lags separate episodes of dune accumulation. Fossil roots (rhizoliths) are ubiquitous. The lack of major calcrete palaeosols in the lower ~30 m of the section indicates more or less continuous accumulation.

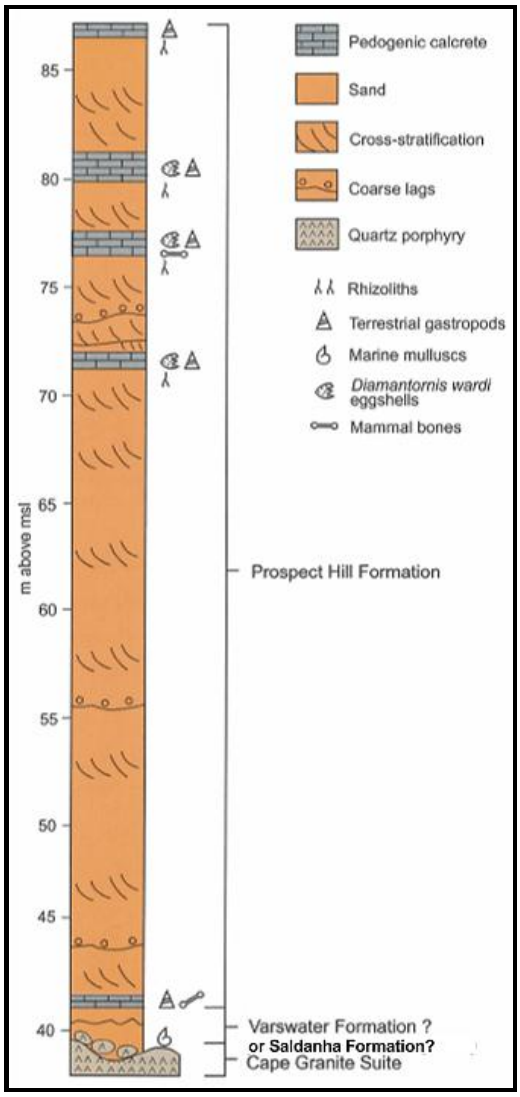

Figure 4. Graphic section of the Prospect Hill Formation. From Roberts (2006c).

In the upper ~20 m of the section are 4-6 hard calcretes up to 2.5 m thick, with gradational lower boundaries passing down into the more friable, bioturbated aeolianite. The calcretes are palaeosols associated with longer-lived palaeosurfaces that mark pauses in aeolian depositions and stabilization of the dunes by vegetation. Brecciation and re-cementing of the calcretes is apparently a common feature. Brecciation and re-cementing can be caused by displacive growth of cements, but may also reflect exposure of the calcrete to surface processes and erosion and downslope transport, *i.e*. calcrete talus.

Land snails are the most common fossils and occur sparsely throughout the aeolianite, but are most abundant in the calcrete palaeosols. These are mainly *Trigonephrus* which is typical of the aeolianites of the West Coast. Notably, a giant, extinct form of *Trigonephrus* occurs in the Prospect Hill Formation. This form is about twice the size of the *Trigonephrus* specimens found in younger aeolianites of the Langebaan Formation and its occurrence is the main criterion for identifying the formation farther afield. The extinct land snail *Phortion occidentalis* is less common than *Trigonephrus*. It was first described from Langebaan Formation aeolianite forming Anyskop at the LBW mine.

The carapaces of tortoises are the most common vertebrate fossils in the Prospect Hill Formation and again this is typical of aeolianites in general and they are most abundant in the calcrete palaeosols. Roberts (1997) notes that the abundance of fossil tortoises in the Prospect Hill Formation Member far exceeds that in younger, Langebaan Formation aeolianites. Extinct fossil tortoises are known from

the Miocene of Namibia and from the Varswater Formation. However, the identity of the fossil tortoises in the Prospect Hill Formation has not been established.

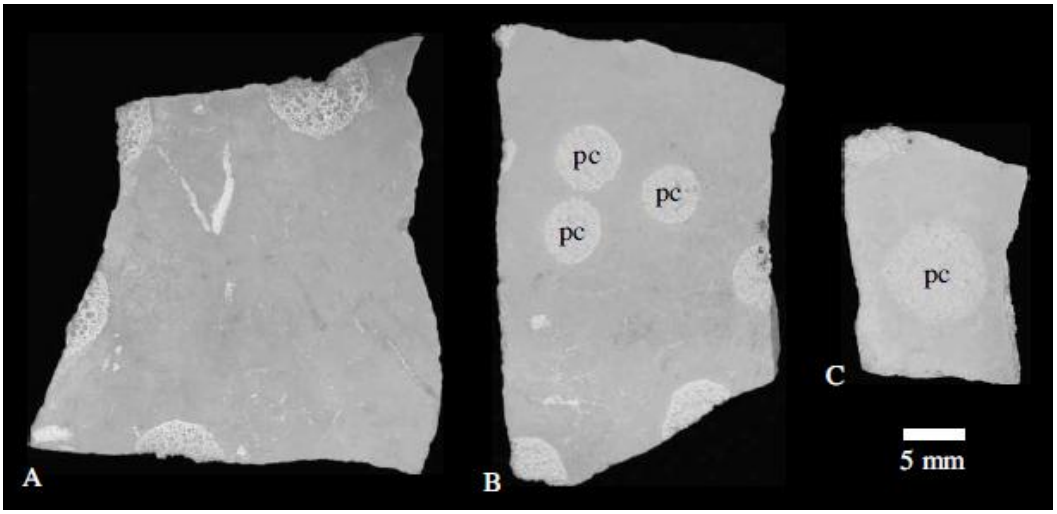

Figure 5. Fossil eggshells of Diamantornis wardi, pc = pore complex. From Stidham (2008).

Fossil ostrich eggshell fragments (Figure 5) were found *in situ* in three pedogenic calcrete layers at the top of the Upper Quarry section. The uppermost calcrete is ~3m from the top of the Prospect Hill Formation and is fossiliferous over the entire length of exposure, a distance of almost 300m. The underlying two calcretes are sparsely fossiliferous (Roberts & Brink, 2002). The fossil eggshell has not been found farther north in the formation. As mentioned, the eggshell fragments are identified as *Diamantornis wardi* which has an age range of 12-9 Ma (Stidham, 2008) on the basis of dated occurrences in Namibia, East Africa and Arabia. This is the main evidence for the Miocene age of the Prospect Hill Formation.

The bones of fossil mammals occur sparsely within or immediately beneath the calcrete layers, as isolated finds or bone scatters of several specimens. Finds include the metapodial of the extinct three-toed horse *Hipparion* and the leg-bone, pelvis and vertebrae of an unsual bovid about the size of an eland.

Microfossils the size of sand grains occur in the aeolianite. These are benthonic foraminifera and the species present suggest a correlation with the 50 m Package of the West Coast (Dale & McMillan, 1999). This would imply that the Prospect Hill aeolianites were derived from beaches deposited during regression from the early Pliocene highstand (*i.e*. the aeolianite postdates the regressive tract of the Varswater Formation). This is in clear conflict with the age indicated by the occurrence of as *Diamantornis wardi*.

Marine deposits are exposed in the railway cutting ~1 km south of the Upper Quarry. They are overlain by Prospect Hill Formation aeolianite bearing the giant form of *Trigonephrus*. However, the few fossil shells present are common in early Pliocene marine deposits of Namaqualand. On this basis, the Prospect Hill Formation postdates the 50 m Package/regressive tract of the Varswater Formation.

The strontium isotope values of various biogenic sand components indicate a latest Miocene/early Pliocene age for the Prospect Hill Formation (Franchesini & Compton, 2004). The latter also propose that the aeolianite was derived from the regressive tract of the Varswater Formation. However, strontium isotope dating lacks resolution in the Pliocene time interval and is further bedevilled by post-depositional alteration of the $^{87}Sr/^{86}Sr$ isotope ratio in emerged marine deposits. This problem is further illustrated below.

The Prospect Hill Formation must be underlain by older marine sediments. If the Miocene age (12-9 Ma) for the aeolianite is accepted, these marine deposits are likely to be of mid-Miocene age, *i.e*. the

Saldanha Formation, ~16 Ma). These deposits could be exposed in the footwall of the Upper Quarry by future mining. If fossil shell is preserved, the age of these marine deposits can be confirmed as the Miocene fossil shells are distinct from the shells found in younger, Pliocene marine deposits.

These differences between the types of fossil evidence highlight the importance of obtaining more fossils from the Prospect Hill Formation and, if possible, from the underlying marine deposits.

9.2 The Uyekraal Shelly Sand Formation in the Lower Quarry

Marine deposits ~2.3 m thick with fossil shells are exposed in the Lower Quarry (Figure 6). The shell assemblage, which includes the zone fossils *Donax rogersi* and *Fissurella glarea*, is consistent with the deposits correlating with the mid-Pliocene 30 m Package (Hondeklipbaai Formation) of the West Coast Group farther north (personal observations). Furthermore, the spatial setting is also consistent with this correlation. The microfossil assemblage is that of the 30 m Package (Dale & McMillan, 1999).

On this basis the marine beds in the Lower Quarry postdate the Prospect Hill Formation and between the Upper and Lower Quarries there must be a marine-eroded surface or "cliff" along the seaward edge of the Prospect Hill aeolianites.

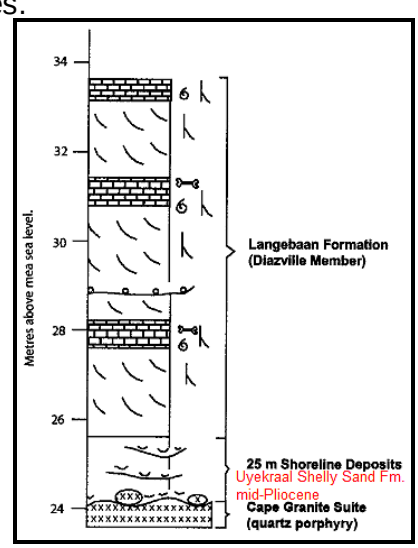

Figure 6. Geological section of the Lower Quarry. From Roberts & Brink (2002).

In contrast, the strontium isotope values of biogenic sand components from the Lower Quarry marine deposits do not distinguish them from the Prospect Hill Formation. Franchesini & Compton (2004) conclude that both the Lower and Upper Quarry are the same age and correlate with the Varswater Formation. This conclusion is clearly at odds with the biostratigraphic evidence. The problem is highlighted by the age ranges produced from the strontium data that span from the early Quaternary ~1.2 Ma to the late Miocene up to ~8.1 Ma. A strontium-isotope West Coast dating programme was carried out by De Beers Marine, with analyses undertaken at Cambridge University under the supervision of Dr Harry Elderfield. Similarly, it was found that the technique produced a wide scatter of ages for samples from the 50 m and 30 m Packages. It was concluded that the combination of poor resolution in the Pliocene interval, coupled with post-depositional alteration of the Sr ratios, limited the usefulness of the technique.

Franchesini & Compton (2004) found a *Donax serra*-bearing unit in the Lower Quarry which produced a maximum age of ~2.2 Ma. They postulated that an early Quaternary transgression to 25 m asl. lapped into the Lower Quarry area. The marine deposits in the railway cutting were considered to be the same age. These conclusions were taken to task by Cole (2005) and defended by Compton & Francheschini (2005). However, the existence of this unit remains untested.

Further observations are therefore required in the Lower Quarry, in order to clarify these issues. In particular, the fossil shell assemblage/s present need to be sampled and analysed in more detail.

Ongoing mining should also reveal more of the geometry of the deposits, particularly in the area between the Upper and Lower quarries.

Other fossils that occur in the Lower Quarry marine unit are shark teeth and other fish teeth, abraded mammalian bone fragments and occasional mammal teeth. These are reworked from pre-existing deposits. If identifiable, the mammal teeth would therefore provide a maximum age for the marine deposit.

9.3 The Langebaan Formation in the Lower Quarry

The marine deposits are overlain by ~9 m of aeolianite (Figure 6) distinguished from the Prospect Hill Formation aeolianite by their colour and the occurrence of normal-size *Trigonephrus*. This unit has been named as the Diazville Member (Roberts & Brink, 2002).

It is a typical aeolianite, with dune cross-bedding separated by deflation lags and calcrete palaeosols with root casts. The land snails, including also *Phortion occidentalis*, occur in association with the calcretes. In the railway cutting the Langebaan Formation aeolianites overlie the calcreted top of the Prospect Hill aeolianites.

Fossil bones occur sparsely in these aeolianites and include tortoises and large bovid bones, the latter being more easily seen. A large buffalo is probably represented, but the material is too incomplete for diagnosis. Fossil teeth of a small, kudu-like antelope were found. These finds are not likely to be older than Pliocene (Roberts & Brink, 2002).

The fossil bones seen hitherto emphasize that although this material is sparse, it is present and a diligent alert for their occurrence should produce more material. The existing faces of the quarry should be carefully inspected. Specimens of the fossil tortoises must be obtained.

9.4 The Langebaan Formation and the factory Site

The eastern part of the transport corridor and the proposed cement factory site is situated on thinly-covered Langebaan Formation aeolianites. The gently-undulating topography of the factory site is mainly between 10-15 m asl., rising to ~20 m asl. where a subdued dune ridge is situated approximately in the centre of the site.

Observations in excavations on the Saldanha Steel site, near the Namakwa Sands plant and in the SALKOR railhead area revealed that a particularly thick calcrete underlies much of the area. Such thick calcrete develops beneath long-lived surfaces on old formations, where increments of deposition have been small. The thick calcrete is polyphase in origin and disguised within it are discrete, small phases of sand deposition separated by cryptic palaeosurfaces on which fossils may occur. This thick calcrete is expected to occur beneath the lower-elevation parts of the site. Sporadic fossil bone finds are a feature of the area (Figure 7). Fossils in calcretes are quite difficult to spot as they are usually coated with white limey deposit and do not stand out well amongst the nodules and general bumpiness of a fresh exposure.

Figure 7. Example of fossil antelope jaw from a shallow trench into the calcrete capping of the Langebaan Formation at SALKOR. Image courtesy André Carstens.

Excavations in the more elevated areas of aeolianite ridges reveal typical separated calcretes *cf*. the aeolianite exposures in the Lower Quarry. The bone concentrations most commonly found are due to hyaenas. The bones occur in the lairs of hyaenas, such as tunnels made into the softer material beneath a calcrete "roof" (Figure 8). These most often occur on slopes where some erosion of the calcrete, producing overhangs and crevices, has facilitated the making of a burrow. Burrows made by aardvarks are also exploited by hyaenas. Hyaena lairs can be found at depth in the aeolian deposits, where they relate to buried palaeosurfaces.

9.5 The Langebaan Formation in the Wider Area

The Langebaan Formation aeolianites have been a prime source of information on the Quaternary faunas and archaeology of the Cape. The fossils that have been found in the aeolianites are of profound scientific value, raising international interest in the region.

At Elandsfontein a fossil interdunal vlei was exposed by deflation, the large number of fossil bones and ESA tools indicate an age of ~600 ka (Klein *et al*., 2007). Notably, prior to the wind erosion of coversands at Elandsfontein, there would have been no indication of the fossil wealth just below, which included a cranium of the pre-modern human *Homo heidelbergensis*.

At Geelbek Dunefield the deflation hollows located between the wind-blown, actively-mobile sand dunes are a source of mammalian fossils and Stone Age tools, with more being constantly exposed. The older aeolianites surrounding Geelbek dunefield exhibit three sequential calcretes which are dated at ~250, ~150 and ~65 ka, *i.e*. stability/soil formation during glacial periods (Felix-Henningsen et al., 2003).

Figure 7. Fossil bone concentration (circled) in the infill of a cavity below the calcrete capping of the Langebaan Formation.

At Spreeuwal on the shore of Saldanha Bay, fossil vlei deposits are exposed in the intertidal zone and contain large mammal bones and some MSA artefacts (Avery & Klein, 2009). The larger mammal component includes extinct species and others not recorded historically in the Western Cape. Small mammals, birds, reptiles, amphibians, freshwater gastropods and ostracods also occur.

At Kraalbaai the aeolianite with human tracks preserved in it (Kraal Bay Member) is dated to 117-79 ka (Roberts & Berger, 1997). Dating of aeolianites near Cape Town by luminescence methods shows accumulation during MIS 7 and MIS 5 (interglacials), with calcrete formation in the intervening glacial (ice age) periods (Roberts *et al*., 2009).

Examples of hyaena bone accumulations in dens within the partly-lithified dune rocks are the Sea Harvest and Hoedjiespunt sites in Saldanha Bay. Hoedjiespunt is the find site of fossil teeth of a hominid in deposits 200-300 ka old. The Sea Harvest site produced an essentially modern human tooth that is older than 40 ka. Both sites provided considerable samples of the faunas of those times, thanks to the brown hyaenas.

9.6 The Springfontyn Formation along the Transport Corridor

The quartzose sands of the Springfontyn Formation have low fossil potential and fossils have seldom been recorded. The Springfontyn Formation aeolianites date from at least ~600 ka, if not older and, in parts, may be of similar ages as parts of the Langebaan Fm., but derived from less calcareous sources and/or deposited in settings more prone to subsequent groundwater leaching in water tables. The reworking of older coastal-plain deposits was likely the major sediment source. It is also possible that decalcified marine sands have not been recognized as marine in origin, especially if only encountered in boreholes, and been included in the Springfontyn Fm.

The Springfontyn Formation has clearly accumulated episodically over a considerable time span and thus will include palaeosurfaces with bone fossils and other settings such as vlei deposits with considerable fossil potential. Earth works should be basically monitored during the Construction Phase EMPs, with Fossil Find reporting procedures in place and a palaeontologist on standby. It is expected that the more substantial earthworks will be associated with the crossing of the R45 main

road. Another sensitive location would be the crossing of the Bok Rivier. Elsewhere the subsurface disturbance associated with the construction of the transport corridor is expected to be superficial.

10. IMPACT ASSESSMENT

The primary impact on fossil resources is the long term mining of chiefly the Prospect Hill Formation. The impacts at the proposed cement factory site and along the transport corridor relate only to the bulk earth works involved in the construction phases.

10.1 Nature of the Impact

Mining and construction activities (excavations) will result in a negative direct impact on the fossil content of the affected subsurface. Fossils and significant observations will be lost in the absence of management actions to mitigate such loss. This loss of the opportunity to recover fossils and their contexts when exposed at a particular site is irreversible.

Conversely, mine pits and construction excavations furnish the "windows" into the coastal plain depository that would not otherwise exist and thereby provide access to the hidden fossils. The impact is positive for palaeontology, provided that efforts are made to watch out for and rescue the fossils. There remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss.

10.2 Extents

The physical extent of impacts on potential palaeontological resources relates directly to the extents of subsurface disturbance, *i.e*. site specific.

Notwithstanding, the cultural, heritage and scientific impacts are of regional to national extent, as is implicit in the NHRA 25 (1999) legislation and, if scientifically important specimens or assemblages are uncovered, are of international interest. This is evident in the amount of foreign-funded research that takes place by scientists of other nationalities. Loss of opportunities that may arise from a significant fossil occurrence (tourism, employment) filters down to regional/local levels.

There is therefore a duality in the assigning of the "extent" of the impact of bulk excavations on fossil resources. The Impact Tables (Tables 3-5) attempt to reflect this aspect.

10.3 Magnitude

Thus the potential impact of bulk earth works on fossil resources is high in the absence of mitigation. It is quite likely that scientifically valuable fossils may be lost in spite of mitigation.

10.4 Duration

The impact of both the finding or the loss of fossils is permanent. The found fossils must be preserved "for posterity"; the lost, overlooked or destroyed fossils are lost to posterity.

10.5 Probability

The likelihood of impact is definite with respect to the mining, probable with respect to the construction of the cement factory on the Langebaan Formation and unlikely with respect to the the transport corridor traversing mainly surficial sands.

10.6 Reversibility

The loss of fossil material such as rare fossil bone is irreversible.

10.7 Status of the Impact

Negative without mitigation, positive with mitigation.

10.8 Confidence

The level of confidence of the probability and intensity of impact is certain with respect to the mining, sure with respect to the construction of the cement factory on the Langebaan Formation and unsure with respect to the transport corridor traversing mainly surficial sands.

10.9 Significance

Note that the presence of fossils in the subsurface does not have an *a priori* influence on the decision to proceed with the mining. However, mitigation measures are essential. It is probable that sparse, valuable bone fossils will go undetected, even with the most diligent mitigation practicable. On the other hand, the finding and recovery fossils will have a positive impact ranging from local to international in extent, depending on the nature of the finds.

The general significance of coastal-plain fossils involves:

- The history of coastal-plain evolution.
- The history of past climatic changes, past biota and environments.
- Associations of fossils with buried archaeological material and human prehistory.
- For radiometric and other dating techniques (rates of coastal change).
- Preservation of materials for the application of yet unforeseen investigative techniques.

Specific significant aspects of the fossil content of the various formations has bee outlined in Section 6 above.

Table 3 – Impact table - Mining

Locale	**Quarries**	
	Without mitigation	**With mitigation**
Extent	Local/regional	Local/regional
Magnitude	High	Medium
Duration	Long	Long
SIGNIFICANCE	**HIGH (-)**	**MED-HI (- & +)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Status	Negative	Positive
Irreplaceable loss of resources?	Yes	Partly
Can impacts be mitigated?	Partly	
Mitigation:	Monitoring and inspection of excavations.	

Table 4 – Impact Table - Cement Factory Site

Locale	**Cement Factory Site**	
	Without mitigation	**With mitigation**
Extent	Local/regional	Local/regional
Magnitude	Medium	Low
Duration	Long	Long
SIGNIFICANCE	**MED-HI (-)**	**LOW-MED (- & +)**
Probability	Probable	Probable
Confidence	Sure	Sure

Reversibility	Irreversible	Irreversible
Status	Negative	Positive
Irreplaceable loss of resources?	Yes	Partly
Can impacts be mitigated?	Partly	
Mitigation:	Monitoring and inspection of excavations.	

Table 5 – Impact Table - Transport Corridor

Locale	**Transport Corridor**	
	Without mitigation	**With mitigation**
Extent	Local	Local
Magnitude	Low	Low
Duration	Long	Long
SIGNIFICANCE	**LOW (-)**	**LOW (- & +)**
Probability	Unlikely	Unlikely
Confidence	Unsure	Unsure
Reversibility	Irreversible	Irreversible
Status	Negative	Positive
Irreplaceable loss of resources?	Yes	Partly
Can impacts be mitigated?	Partly	
Mitigation:	Monitoring and inspection of excavations.	

For comparison with the 1997 impact assessment, Table 6 below is reproduced from Avery & Kaplan (1997).

Table 6 – Impact Table - Avery & Kaplan (1997)

Locale	**Quarries & Crushing Plant**	**Cement Factory Site**	**Conveyor System**
Extent	International	International	International
Duration	Permanent	Permanent	Permanent
Intensity	High	High	High
Probability of Occurrence	Definite	Definite	Probable
Significance - with mitigation	Low/Med/High	Low/Med	Low/Med
Significance – no mitigation	Med/High	Med/High	Med/High
Status of the Impact	Negative	Negative	Negative
Confidence	High	I High	High

11. MITIGATION

11.1 The Mining Operation

It is recommended that a long term mitigation plan be formulated for the quarrying operation. The following paragraphs are excerpted from the Executive Summary of the previous PIA (Roberts, 1997).

The inevitable loss of valuable fossils as a consequence of mining operations, would be counterbalanced by the acquisition of a fossil archive which may otherwise have remained concealed indefinitely; the proviso here is that adequate mitigatory measures are implemented, including:

- **Access**. Ready access to the site by mitigators and associated personnel should be permitted by the mining company.
- **Training**. AfriSam Project staff should be adequately trained in the detection and in certain instances, collection of fossil material.
- **Communication**. The mitigators should be timeously informed of important fossil discoveries.
- **Motivation**. Successful mitigation will largely hinge on the voluntary cooperation of the AfriSam Project staff. The mitigators should motivate personnel via lectures, feedback on the significance of fossil finds and their publicization.
- **Documentation**. AfriSam should assist in the onsite documentation of fossil finds, including provision of suitable storage facilities, materials and labour.
- **Costs**. The underlying philosophy is that the need to create an artificial fossil archive is precipitated by the destruction of the natural *in situ* archive. The mining company should therefore be liable for the costs incurred in the creation of the new archive. As a general guide, the costs of onsite mitigatory measures and preliminary curation at scientific institutions should be borne by AfriSam. The costs of subsequent study of the fossils should be the responsibility of the scientific organisation concerned.

The above aspects are elaborated further in Section 11 which is the update of the original 1997 draft proposals for mitigation of the mining operation.

It is envisaged that the IZIKO S. A. Museum, HWC, the Council for Geoscience and the West Coast Fossil Park will all be involved in some way at various times in the monitoring and rescue of fossil material during the quarrying operations.

11.2 The Construction Phases of the Cement factory and Transport Corridor

The potential impact has a moderate influence upon these components of the proposed project, consisting of implemented mitigation measures recommended below, to be followed just prior to and during the construction phase.

Monitoring by on-site personnel and field inspections by a palaeontologist/trained fossil excavator are recommended during construction of excavations. Section 12 outlines monitoring by construction personnel in terms of general Fossil Find Procedures for inclusion in the Construction Phase EMP. In the event of fossil finds, the appointed palaeontologist will assess the information and liaise with the manager and the ECO and a suitable response will be established. If an important find, a field inspection must be undertaken to document and sample fossiliferous strata that may be exposed.

It is recommended that the contracted palaeontologist carry out field inspections at appropriate stages in the making of the excavations, particularly in the Langebaan Formation. The aim of field inspection is to examine a representative sample of the various deposits exposed in the excavations, recording context, fossil content and to take samples.

When the specific sites of bulk earth works are chosen, the mitigation recommendations can be amended to be more specific. The contracted palaeontologist will liaise with AfriSam and Aurecon (or

the appointed environmental contractor) about the specifics of setting up a monitoring and inspection programme.

Table 7. Basic measures for the Construction EMPs

OBJECTIVE: To see and rescue fossil material that may be exposed in the various excavations made for installation of foundations and other infrastructure.		
Project components	Foundation excavations, trenches for pipes, cabling etc, spoil from excavations.	
Potential impact	Loss of fossils by their being unnoticed and/ or destroyed.	
Activity/ risk source	All bulk earthworks.	
Mitigation: target/ objective	To facilitate the likelihood of noticing fossils and ensure appropriate actions in terms of the relevant legislation.	
Mitigation: Action/ control	**Responsibility**	**Timeframe**
Inform staff of the need to watch for potential fossil occurrences.	AfriSam, Aurecon, the ECO & contractors.	Pre-construction.
Inform staff of the procedures to be followed in the event of fossil occurrences.	ECO/specialist.	Pre-construction.
Monitor for presence of fossils	Contracted personnel and ECO.	Construction.
Liaise on nature of potential finds and appropriate responses.	ECO and specialist.	Construction.
Excavate main finds, inspect pits & record selected, key/higher-risk excavations.	Specialist.	Construction.
Obtain permit from HWC for finds.	Specialist.	Construction
Performance Indicator	Reporting of and liaison about possible fossil finds. Fossils noticed and rescued.	
Monitoring	Due effort to meet the requirements of the monitoring procedures.	

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13. GLOSSARY

~ (tilde): Used herein as "approximately" or "about".

Aeolian: Pertaining to the wind. Refers to erosion, transport and deposition of sedimentary particles by wind. A rock formed by the solidification of aeolian sediments is an aeolianite.

AIA: Archaeological Impact Assessment.

Alluvium: Sediments deposited by a river or other running water.

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

asl.: above (mean) sea level.

Bedrock: Hard rock formations underlying much younger sedimentary deposits.

Calcareous: sediment, sedimentary rock, or soil type which is formed from or contains a high proportion of calcium carbonate in the form of calcite or aragonite.

Calcrete: An indurated deposit (duricrust) mainly consisting of Ca and Mg carbonates. The term includes both pedogenic types formed in the near-surface soil context and non-pedogenic or groundwater calcretes related to water tables at depth.

Clast: Fragments of pre-existing rocks, *e.g*. sand grains, pebbles, boulders, produced by weathering and erosion. Clastic – composed of clasts.

Colluvium: Hillwash deposits formed by gravity transport downhill. Includes soil creep, sheetwash, small-scale rainfall rivulets and gullying, slumping and sliding processes that move and deposit material towards the foot of the slopes.

Coversands: Aeolian blanket deposits of sandsheets and dunes.

Duricrust: A general term for a zone of chemical precipitation and hardening formed at or near the surface of sedimentary bodies through pedogenic and (or) non-pedogenic processes. It is

formed by the accumulation of soluble minerals deposited by mineral-bearing waters that move upward, downward, or laterally by capillary action, commonly assisted in arid settings by evaporation. Classified into calcrete, ferricrete, silcrete.

ESA: Early Stone Age. The archaeology of the Stone Age between 2 000 000 and 250 000 years ago.

EIA: Environmental Impact Assessment.

EMP: Environmental Management Plan.

Ferricrete: Indurated deposit (duricrust) consisting predominantly of accumulations of iron sesquioxides, with various dark-brown to yellow-brown hues. It may form by deposition from solution or as a residue after removal of silica and alkalis. Like calcrete it has pedogenic and groundwater forms. Synonyms are laterite, iron pan or "koffieklip".

Fluvial deposits: Sedimentary deposits consisting of material transported by, suspended in and laid down by a river or stream.

Fm.: Formation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the disturbance or structure produced in sediments by organisms, such as burrows and trackways.

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).

HIA: Heritage Impact Assessment.

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

LIG: Last Interglacial. Warm period 128-118 ka BP. Relative sea-levels higher than present by 4-6 m. Also referred to as Marine Isotope Stage 5e or "the Eemian".

Midden: A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.

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

OSL: Optically stimulated luminescence. One of the radiation exposure dating methods based on the measurement of trapped electronic charges that accumulate in crystalline materials as a result of low-level natural radioactivity from U, Th and K. In OSL dating of aeolian quartz and feldspar sand grains, the trapped charges are zeroed by exposure to daylight at the time of deposition. Once buried, the charges accumulate and the total radiation exposure (total dose) received by the sample is estimated by laboratory measurements. The level of radioactivity (annual doses) to which the sample grains have been exposed is measured in the field or from the separated minerals containing radioactive elements in the sample. Ages are obtained as the ratio of total dose to annual dose, where the annual dose is assumed to have been similar in the past.

Palaeontology: The study of any fossilised remains or fossil traces of animals or plants which lived in the geological past and any site which contains such fossilised remains or traces.

Palaeosol: An ancient, buried soil whose composition may reflect a climate significantly different from the climate now prevalent in the area where the soil is found. Burial reflects the subsequent environmental change.

Palaeosurface: An ancient land surface, usually buried and marked by a palaeosol or pedocrete, but may be exhumed by erosion (*e.g.* wind erosion/deflation) or by bulk earth works.

Peat: partially decomposed mass of semi-carbonized vegetation which has grown under waterlogged, anaerobic conditions, usually in bogs or swamps.

Pedogenesis/pedogenic: The process of turning sediment into soil by chemical weathering and the activity of organisms (plants growing in it, burrowing animals such as worms, the addition of humus *etc.*).

Pedocrete: A duricrust formed by pedogenic processes.

PIA: Palaeontological Impact Assessment.

SAHRA: South African Heritage Resources Agency – the compliance authority, which protects national heritage.

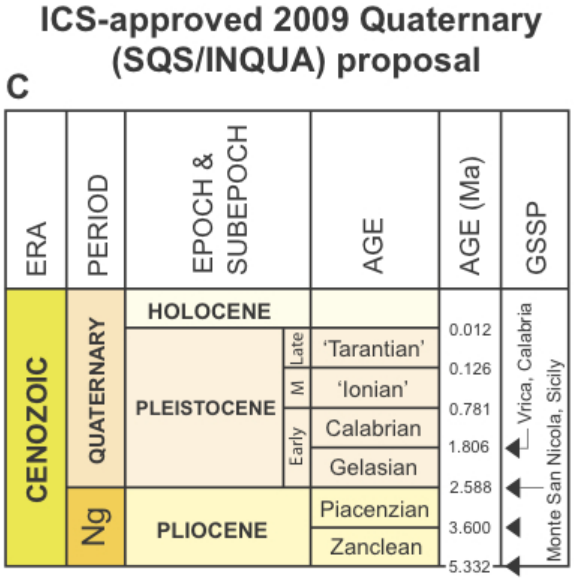
Stone Age: The earliest technological period in human culture when tools were made of stone, wood, bone or horn. Metal was unknown.

13.1 Geological Time Scale Terms (youngest to oldest).

ka: Thousand years or kilo-annum (10^3 years). Implicitly means "ka ago" *i.e*. duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present. Sometimes "kyr" is used instead.

Ma: Millions years, mega-annum (10^6 years). Implicitly means "Ma ago" *i.e.* duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present.

Holocene: The most recent geological epoch commencing 11.7 ka till the present.



Pleistocene: Epoch from 2.6 Ma to 11.7 ka. Late Pleistocene 11.7–126 ka. Middle Pleistocene 135–781 ka. Early Pleistocene 781–2588 ka (0.78-2.6.Ma).

Quaternary: The current Period, from 2.6 Ma to the present, in the Cenozoic Era. The Quaternary includes both the Pleistocene and Holocene epochs. The terms early, middle or late in reference to the Quaternary should only be used with lower case letters because these divisions are informal and have no status as divisions of the term Quaternary. The sub-divisions 'Early', 'Middle' or 'Late' apply only to the word Pleistocene. As used herein, early and middle Quaternary correspond with the Pleistocene divisions, but late Quaternary includes the Late Pleistocene and the Holocene.

Pliocene: Epoch from 5.3-2.6 Ma.

Miocene: Epoch from 23-5 Ma.

Oligocene: Epoch from 34-23 Ma.

Eocene: Epoch from 56-34 Ma.

Paleocene: Epoch from 65-56 Ma.

Cenozoic: Era from 65 Ma to the present. Includes Paleocene to Holocene epochs.

Cretaceous: Period in the Mesozoic Era, 145-65 Ma.

Jurassic: Period in the Mesozoic Era, 200-145 Ma.

Precambrian: Old crustal rocks older than 542 Ma (pre-dating the Cambrian).

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14. Draft procedures for the mitigation of mining impacts on palaeontological resources at the proposed Afrisam Saldanha Cement Project

14.1 Contact persons

AfriSam Saldanha Cement Project

To be determined.

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Should the contact persons not be available, another alternate must be designated. At least 2 weeks notice of any change of contact person(s) must be given.

14.2 Access to site

11.2.1 AfriSam Saldanha Cement Project, or their representative, will allow the appointed mitigation specialist and any other academic specialists, nominated by Heritage Western Cape or the South African Museum, access to the site to monitor the exposure of fresh sections and to conduct sampling.

11.2.2 Site visits must be arranged telephonically 48 hours in advance with the contact person for the mine listed in 1 above.

11.2.3 Persons not included in this document must be accompanied by a contact person (above), who shall identify himself to the person in charge of the mine. All visitors to the site must be fully conversant with and adhere to all safety regulations and procedures of the mine.

11.2.4 AfriSam Saldanha Cement Project will ensure effective liaison and regular reporting of mining progress to the appointed specialist/South African Museum so that site visits by academic specialists can be planned appropriately.

14.3 Training of personnel

11.3.1 Informal on-site training in appropriate recovery techniques applicable to “normal” fossil finds mustl be provided for AfriSam Saldanha Cement Project staff by the appointed specialist. Removal of any archaeological material must be undertaken by a qualified archaeologist.

14.4 Documentary record of palaeontological occurrences

11.4.1 The mine will make the mining plan available to the appointed specialist, in which the following information will be indicated on the plan by the mine in conjunction with the appointed specialist:

11.4.2 Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the mining period

11.4.3 Locations of samples and measured sections will be pegged and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally.

14.5 Covered storage

11.5.1 AfriSam Saldanha Cement Project shall make provision on site for the dry storage of bulk samples and suitable space and facilities (trays, shelving, trestle-tables and chairs) for preliminary sorting, labelling and packing of fossils material before transportation of the selected samples to the South African Museum.

11.5.2 Material found routinely during mining should be kept in similar conditions.

14.6 Unexpected exposure of palaeontological material

In the event of mining exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as major terrestrial vertebrate and marine vertebrate fossil finds, the following procedure must be adhered to:

11.6.1 The appointed specialist or South African Museum must be notified, by the responsible officer (e.g. the ECO or mine geologist), of major or unusual discoveries during mining, found by the mine geologist or other personnel.

11.6.2 Should a major *in situ* occurrence, including that of new shell facies or bones, be exposed, mining will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the South African Museum, or its designated contractor, have had reasonable opportunity to investigate the find. Such work will be at the expense of AfriSam Saldanha Cement Project.

11.6.3 If no site inspection is conducted or arranged by the appointed specialist or contact person for the South African Museum within 48 hours, or no reasonable extension of time for such an arrangement is asked for, AfriSam Saldanha Cement Project will follow the standard procedure, as established during the early stages of the project, for sampling the finds and continue mining as normal.

11.6.4 Section 12 of this report is a more detailed Fossil Finds guideline.

14.7 Mitigation of mining impact on palaeontological resources

11.7.1 Mitigation of palaeontological material will take place from the start (initial survey of surface topography and existing excavations). A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the South African Museum and West Coast Fossil Park.

11.7.2 Mitigation will involve systematic collection of all fossils discovered, entailing representative samples of abundant fossils (e.g shell beds) and the attempt to capture all rare fossils, particularly vertebrate bone. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and possibly lacquer peels of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

14.8 Functional responsibilities of Afrisam Saldanha Cement Project for the mitigation of mining impacts on palaeontologcal resources

11.8.1 Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the mining operation.

11.8.2 Provide field aid, if necessary, in the supply materials, labour and machinery to excavate, load and transport sampled material from the mine areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the mine area or crushers.

11.8.3 Facilitate systematic recording of the stratigraphic and palaeoenvironmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, providing aid in survey in of positions.

11.8.4 Provide covered, dry storage for samples and facilities for a work area for sorting, labelling and boxing/bagging samples as per 5 above.

11.8.5 Costs of transport to and from Cape Town and as incurred by South African Museum personnel to execute this programme (not applicable to non South African Museum personnel).

11.8.6 Site visit trips by Iziko SAM personnel will be at government rates and will be kept to a minimum as far as possible (maximum 12 trips per year).

11.8.7 Costs of basic curation and storage in the sample archive at the South African Museum (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

14.9 Functional responsibilities of the appointed palaeontologist for the mitigation of mining impacts on palaeontologcal resources at the Afrisam Saldanha Cement Project

11.9.1 Establishment of a representative collection of fossils and an contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata at the South African Museum

11.9.2 Undertake an initial evaluation of potentially affected areas and of available exposures in excavations.

11.9.3 On the basis of the above, and evaluation during the early stages of quarry development, develope, in collaboration with AfriSam Saldanha Cement Project management, more detailed practical strategies to deal with the fossils encountered routinely during mining, as well as the strategies for major finds.

11.9.4 Transport of material from the mine to the South African Museum.

11.9.5 Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at the IZIKO S.A. Museum and Heritage Resources Western Cape. It must fulfil the reporting standards and data requirements of these bodies.

11.9.6 Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

14.10 Functional responsibilities of the iziko south african museum for the mitigation of mining impacts on palaeontologcal resources at the Afrisam Saldanha Cement Project

11.10.1 Labelling, sorting, boxing, shelving, storage and cataloguing of physical and documentary material in the sample archive at the South African Museum. Eventual storage in an electronic data base of the catalogued and documentary material.

11.10.2 Maintenance of the AfriSam Saldanha Cement Project palaeontological archive at the South African Museum.

14.11 Permits

11.11.1 The specialist contracted by AfriSam Saldanha Cement Project will possess the required excavation permit from the Heritage Western Cape (HWC) in respect of palaeontological sites.

11.11.2 The mine officer with responsibility for fossil discoveries must also possess a HWC permit.

15. Fossil find procedures

In the context under consideration, it is improbable that fossil finds will require declarations of permanent “no go” zones. At most a temporary pause in activity at a limited locale may be required. The strategy is to rescue the material as quickly as possible.

The procedures suggested below are in general terms, to be adapted as befits a context. They are couched in terms of finds of fossil bones that usually occur sparsely, such as in the aeolian deposits. However, they may also serve as a guideline for other fossil material that may occur.

In contrast, fossil shell layers are usually fairly extensive and can be easily documented and sampled (See section 12.5).

Bone finds can be classified as two types: isolated bone finds and bone cluster finds.

15.1 Isolated bone finds

In the process of digging the excavations, isolated bones may be spotted in the hole sides or bottom, or as they appear on the spoil heap. By this is meant bones that occur singly, in different parts of the excavation. If the number of distinct bones exceeds 6 pieces, the finds must be treated as a bone cluster (below).

Response by personnel in the event of isolated bone finds

- **Action 1:** An isolated bone exposed in an excavation or spoil heap must be retrieved before it is covered by further spoil from the excavation and set aside.
- **Action 2:** The site foreman and ECO must be informed.
- **Action 3:** The responsible field person (site foreman or ECO) must take custody of the fossil. The following information to be recorded:
    - Position (excavation position).
    - Depth of find in hole.
    - Digital image of hole showing vertical section (side).
    - Digital image of fossil.
- **Action 4:** The fossil should be placed in a bag (*e.g.* a Ziplock bag), along with any detached fragments. A label must be included with the date of the find, position info., depth.
- **Action 5:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of isolated bone finds

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

15.2 Bone cluster finds

A bone cluster is a major find of bones, *i.e*. several bones in close proximity or bones resembling part of a skeleton. These bones will likely be seen in broken sections of the sides of the hole and as bones appearing in the bottom of the hole and on the spoil heap.

Response by personnel in the event of a bone cluster find

- **Action 1:** Immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil that may contain fossils.
- **Action 2:** Inform the site foreman and the ECO.
- **Action 3:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of a bone cluster find

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. It is likely that a Field Assessment by the palaeontologist will be carried out asap.

It will probably be feasible to “leapfrog” the find and continue the excavation farther along, or proceed to the next excavation, so that the work schedule is minimally disrupted. The response time/scheduling of the Field Assessment is to be decided in consultation with developer/owner and the environmental consultant.

The field assessment could have the following outcomes:

- If a human burial, the appropriate authority is to be contacted (see AIA). The find must be evaluated by a human burial specialist to decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an archaeological context, an archaeologist must be contacted to evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an palaeontological context, the palaeontologist must evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.

15.3 Rescue excavation

Rescue Excavation refers to the removal of the material from the just the "design" excavation. This would apply if the amount or significance of the exposed material appears to be relatively circumscribed and it is feasible to remove it without compromising contextual data. The time span for Rescue Excavation should be reasonably rapid to avoid any or undue delays, *e.g*. 1-3 days and definitely less than 1 week.

In principle, the strategy during mitigation is to "rescue" the fossil material as quickly as possible. The strategy to be adopted depends on the nature of the occurrence, particularly the density of the fossils. The methods of collection would depend on the preservation or fragility of the fossils and whether in loose or in lithified sediment. These could include:

- On-site selection and sieving in the case of robust material in sand.
- Fragile material in loose/crumbly sediment would be encased in blocks using Plaster-of Paris or reinforced mortar.

If the fossil occurrence is dense and is assessed to be a "Major Find", then carefully controlled excavation is required.

15.4 Major finds

A Major Find is the occurrence of material that, by virtue of quantity, importance and time constraints, cannot be feasibly rescued without compromise of detailed material recovery and contextual observations.
A Major Find is not expected.

Management Options for Major Finds

In consultation with developer/owner and the environmental consultant, the following options should be considered when deciding on how to proceed in the event of a Major Find.

Option 1: Avoidance

Avoidance of the major find through project redesign or relocation. This ensures minimal impact to the site and is the preferred option from a heritage resource management perspective. When feasible, it can also be the least expensive option from a construction perspective.

The find site will require site protection measures, such as erecting fencing or barricades. Alternatively, the exposed finds can be stabilized and the site refilled or capped. The latter is preferred if excavation of the find will be delayed substantially or indefinitely. Appropriate protection measures should be identified on a site-specific basis and in wider consultation with the heritage and scientific communities.

This option is preferred as it will allow the later excavation of the finds with due scientific care and diligence.

Option 2: Emergency Excavation

Emergency excavation refers to the "no option" situation wherein avoidance is not feasible due to design, financial and time constraints. It can delay construction and emergency excavation itself will take place under tight time constraints, with the potential for irrevocable compromise of scientific

quality. It could involve the removal of a large, disturbed sample by excavator and conveying this by truck from the immediate site to a suitable place for “stockpiling”. This material could then be processed later.

Consequently, emergency excavation is not a preferred option for a Major Find.

15.5 Exposure of fossil shell beds

Response by personnel in the event of intersection of fossil shell beds

- **Action 1:** The site foreman and ECO must be informed.
- **Action 2:** The responsible field person (site foreman or ECO) must record the following information:
    - Position (excavation position).
    - Depth of find in hole.
    - Digital image of hole showing vertical section (side).
    - Digital images of the fossiliferous material.
- **Action 3:** A generous quantity of the excavated material containing the fossils should be stockpiled near the site, for later examination and sampling.
- **Action 4:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of fossil shell bed finds

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. This will most likely be a site visit to document and sample the exposure in detail, before it is covered up.

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APPENDIX 3: Archaeological Impact Assessment

ARCHAEOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED AFRISAM CEMENT PLANT, MINE AND ASSOCIATED INFRASTRUCTURE IN SALDANHA, WESTERN CAPE

As part of the Environmental Impact Assessment

Prepared for

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On behalf of

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September 2011

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DECLARATION

by the independent person who compiled a specialist report or undertook a specialist process

I …David John Halkett……, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- 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;
- have and will not have no vested interest in the proposed activity proceeding;
- 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;
- 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;
- 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
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.

Signature of the specialist:

ACO Associates cc

Name of company:

28th June 2012

Date:

EXECUTIVE SUMMARY

Archaeological resources have been observed within the AFRISAM project areas.

The oldest remains were reported by Kaplan in the initial surveys of the properties in 1997 when he reported finding **ESA** artefacts in ploughed lands in the vicinity of the proposed Holvlei quarry. Similar artefacts were not found during the latest assessment, but there is ample evidence from the local area to support such observations. It is likely that if they are present, they are likely to be buried below the mantling sands covering most of the area. Occasionally ploughing brings buried objects to the surface.

Similarly, **MSA** artefacts are well documented from the local area and are often found in areas where the limestone has been disturbed by recent human activity as they too are often buried within cavities within the limestone. Some surface material was located during this survey, but tended to be isolated artefacts rather than concentrated scatters. Kaplan reported scatters of higher density during the 1997 survey but thick vegetation now, and poor site Locational data from the previous survey, has prevented re-location of those resources or at least making a confidant statement as to what we have found can be linked to his observations.

LSA sites are well distributed throughout the project area. These tend to be recognised by the presence of marine shell fragments on the surface, or brought to surface by the activities of moles. There is a suggestion that at least some material of this age lies below the surface, often in ploughed land, but occasionally in areas of minimal disturbance. As with other parts of the Vredenburg Peninsula, small outcrops of granite have attracted pre-colonial visits. As these areas are usually not favourable for ploughing, archaeological sites tend to survive more readily in those areas. A small hill within the project area contains both granite outcrops and a number of archaeological sites. We have suggested that this hill should be a no-go area (although mining is not proposed here per se) but that the proposed haul road that might have crossed it should be relocated to the east. This would avoid having to mitigate a number of sites. A number of semi circular arrangements of limestone blocks are believed to represent kraals or hut bases. At this time, the lack of visible associated artefacts means we cannot unequivocally ascertain their age. They may be pre-colonial, but are more likely to be from the more recent past. Further work on LSA sites is suggested if they are to be impacted by mining or associated activities.

More recent **Historical** remains are present in the form of vernacular buildings built from the abundant limestone chunks and blocks of the area. While on the quarry areas they tend to be in ruinous state, a small complex of buildings on the proposed cement factory site has been in use until recent times. While some structures can be identified on an aerial photograph of 1938, others are more recent. It would appear that the structures there now have for the most part replaced the originals. Kraal walls are built with limestone and mud and have been plastered in more recent times. The context of this farm is largely compromised by the surrounding heavy industry, and proposals to increase the size of the port. Although, such activities such not be a reason to compromise heritage, the complex lacks any distinctive architectural qualities to warrant its conservation. All the structures that will be impacted by mining or related infrastructure should be documented and demolished if necessary.

Perhaps the most difficult to identify during surface archaeological surveys, are the **buried** sites, which, on the balance of probabilities, must exist here, but whose location we cannot predict. There are several instances of older sites being found within limestone deposits in the immediate region. Of particular interest will be sites from the MSA which may be similar to those at the so called sites of Sea Harvest and Hoedjiespunt at the Saldanha harbour, which contained clear evidence of coastal exploitation by pre-modern humans before 60,000 years ago. These may occur in hollows and cavities in the limestone, formed in the distant past and used as dwelling places, and subsequently to be covered by eroding deposits and windblown sands. These will be in similar contexts as palaeontological sites formed by the activities of bone accumulating animals and on occasion will

overlap. The abundant calcium carbonate within the limestone deposits contributes greatly to the good preservation of bone both here and in the broader region.

Both the buried Palaeontological and Archaeological heritage will have to be assessed and mitigated by way of an ongoing monitoring program. Mining activities will have to assessed regularly for evidence of both these resources. There will be some overlap between the two types of resources and as such some possibilities exist for a joint monitoring exercise. If managed correctly, mining may have positive outcomes for both the disciplines of palaeontology and archaeology by providing additional windows into the buried past.

We believe that overall, there is little surface archaeology that would prevent the proposed activities from proceeding (taking cogniscence of the recommendations of the palaeontological and visual specialists), although some mitigation of surface resources is required in advance of mining on sites that will be impacted. Although many are ephemeral, this seems to bear out the pattern of usage of the Vredenburg Peninsula during the Later Stone Age. Of greater concern is the material that is likely buried within the hillsides. A clearly stated, consistent monitoring and mitigation program must be implemented to manage impacts on these resources.

1. LIST OF DEFINITIONS AND ACRONYMS

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 300 000 and 2 500 000 years ago***.**

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

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

Holocene: *The most recent geological time period, and the more recent part of the Quaternary Period which commenced 11.7 ka years ago.*

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

Midden: *A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.*

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: *The earlier of the two epochs of the Quaternary Period, from about 2 million to 10,000 years ago*

Acronyms

AIA	Archaeological Impact Assessment
ESA	Early Stone Age (older than approximately 300 ka)
GPS	Global Positioning System
HIA	Heritage Impact Assessment (integrating specialist heritage components)
HWC	Heritage Western Cape
ka	Thousand years or kilo-annum (10^3 years).
LSA	Late Stone Age (approximately the last 20 ka)
MSA	Middle Stone Age (approximately 300 - 30 ka)
NHRA	National Heritage Resources Act, No 25 of 1999
NID	Notice of intent to develop application
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority (HWC)

2. INTRODUCTION

2.1 The Project

AfriSam (South Africa) (Pty) Ltd (hereinafter referred to as AfriSam) proposes to construct a cement plant and associated infrastructure in the Saldanha region, in order to re-enter the cement market in

the western Cape. The project components are shown in local geographical context on Figure 1. The proposed project includes the mining of limestone and clay by its wholly owned subsidiary company, National Portland Cement Company (Pty) Ltd (hereinafter referred to as NPCC). The limestone and clay would then be transported to the cement plant by road or by conveyor. Initially, quarrying is planned to proceed by expansion of the two existing quarries in the Southern Limestone Quarry mining area.

ACO Associates were appointed by Aurecon on behalf of AfriSam to investigate the proposed quarry sites, the proposed cement plant site, and a proposed haul road and conveyor system routes. The Archaeological assessment was undertaken and compiled by Mr D Halkett and will form an appendix to the overall Integrated Heritage Impact Assessment which will also include summaries of the conclusions of the other Heritage related studies.

An EIA was previously conducted in 1997 for a similar project (Alpha Saldanha Cement Project). For various reasons however, the project was never carried through to finality. Both Archaeological and Palaeontological Specialist Assessments were undertaken at that time and included in an EIA report compiled by Mark Woods Consultants (Avery and Kaplan 1997, Roberts 1997 in Wood 1997). Both specialist reports remain highly relevant to this project, but have been re-assessed due to changes in legislation and knowledge. More archaeological work took place recently (Sept 2011) when fieldwork was undertaken as part of the current project to assess prospecting drilling locations which were required to assess the limestone ore body, and the observations from that study have been integrated into this report.

2.2 The site and project components

The project comprises a number of components located in the Saldanha Bay area (Figure 1).

2.2.1 Proposed cement factory

Located on the remainder of Farm 1139, approximately 4km north-east of the town of Saldanha. The site is surrounded on 3 sides by existing heavy industrial activity including Saldanha Steel, Duferco, the Sishen Saldanha railway and port stockpile and loading facilities.

2.2.2 Proposed limestone and clay quarries

The southern area of the limestone quarry (hereafter referred to as **southern limestone quarry**): Located on Portions 8, 15 and 23 of Kliprug 282, approximately 1 km to the north west of the town of Saldanha, and directly north of Diazville, approximately 6.8km south west of the proposed cement factory site.

The northern area of the limestone quarry (hereafter referred to as the **northern limestone quarry**): Located on Portion 9 of Kliprug 282 and Portion 7 of Jacobs Bay 109, north of the southern limestone quarry, approximately 3 km east of Jacobs Bay and approximately 7.8km west of the proposed cement factory site.

Holvlei clay quarry: Located on Portion 4 of Holvlei 120, north of Portion 9 of Kliprug 282 and Portion 7 of Jacobs Bay 109, approximately 3 km inland of the western coastline, 2km north of the Jacobs Bay Road and approximately 9km north-west of the proposed cement factory site (this quarry will only be used if other sources of clay are not available within the proposed mining footprint).

A number of the farms are already owned by Afrisam. The farms outlined in blue on Figure 1 will be directly affected by quarrying activities while the farms outlined in dark green will largely be given over to conservation if the project is authorised. The only use might be at the southern end to provided access to the Holvlei clay quarry.

Figure 1: The Location of the project components in local geographical context. Factory site (magenta polygon), Clay quarry (purple polygon), Primary mining areas/quarries (red polygons), Maximum mining area (brown shaded polygons), Possible Haul road (light green line), Possible Conveyor (yellow line), Afrisam owned farms, outer boundaries (blue, pink and dark green polygons). A servitude is registered over the transport corridor between mine and factory site.

2.2.3 Proposed Haul road and/or Conveyor routes

The following two transportation alternatives are currently being considered for the transportation of raw materials to the proposed cement factory:

- Conveyor belt system (possible)
- Construction of a private haul road (likely).

The proposed enclosed **conveyor system**, if used, would extend for approximately 9 km, from the southern limestone quarry in an easterly direction into the proposed cement factory site. To ensure that all material can be efficiently transported, a crusher would need to be located at the cement factory site.

Based on surrounding topography, the proposed **private road** would extend (in a northerly direction) from the southern limestone quarry. The proposed road would then extend for approximately 9 km east, before it linked into the proposed cement factory site. The proposed private road would follow a similar route to that of the proposed conveyor system, other than just east of the southern limestone quarry where it requires re-alignment due to the topography.

2.3 Project phases

The proposed project would be undertaken in two phases. The approximate timing of the proposed operational phases is as follows:

- Phase 1: 2014 - 2021
- Phase 2: 2022 - 2112

The timeframe for the proposed mining activities would vary, based on market demand. The suggested timing is a guideline, based on the approximate volumes of limestone present in the area.

Assessment based on information provided for the time period 2012 – 2042 has a high confidence level. Certainty is reduced as time periods increase and the existing time frame until 2112 limits the predictability for assumptions and therefore has a decreased confidence level.

2.3.1 Phase 1: (approximately 2014 – 2021)

Phase1 of the proposed project would include the following activities/ components:

- The erection and commissioning of a grinding plant (to mill clinker), and a storage and packing facility to market cement to the Western Cape market, including:
    - The construction of enclosed storage facilities, covering a total area of 11 000 m2 for the storage of clinker, limestone and gypsum at the proposed cement plant;
    - The installation of a vertical roller mill, with a total height of approximately 50 m; and
    - The construction of cement storage facilities as well as packing and dispatch facilities.

AfriSam currently mines up to 40 000 tpa of limestone, for use as agricultural lime, under its mining right, with a limited footprint, at the existing Tabakbaai quarry area. Phase 1 will undertake the mining of an additional 170 000 tpa (approximate maximum) of limestone from the quarry footprint. Clinker would be sourced from an associate foreign company via the Saldanha Port facility, or from Afrisam's Ulco cement plant near Kimberley. The proposed construction of the grinding plant facility would take approximately 24 months.

2.3.2 Phase 2: (Approximately 2022 – 2112)

Phase 2 of the proposed project would include the following activities/ components:

- The erection of a clinker manufacturing facility with an annual production capacity of 600 000 tpa, including:
    - The construction of a pre-calciner kiln system. The pre-heater tower is expected to have a total height of approximately 80 m and cover a total area of 400 m2.
    - Construction of additional storage and handling facilities for limestone, clay, gypsum and clinker, to accommodate the increased production levels.
    - The installation of a second vertical roller mill, with a total height of 50 m.
    - The construction of a second packing and palletizing line.
    - Mining within the quarry footprint, with the existing limestone production increasing to a total of 1.2 million tpa, delivered to the proposed cement plant site.
    - Mining of approximately 120 000 tpa of clay from the proposed Holvlei clay quarry, including transport to the proposed cement plant via the transport corridor.
    - The construction of a transport corridor.

Due to the expected production during Phase 2, a maximum of 1.2 million tons of limestone would need to be transported from the limestone quarries to the proposed cement plant site per annum. In order to transport the suggested volumes (expected in Phase 2).

2.4 The receiving environment

Limestone quarries would be situated mostly on the western side of the prominent ridge that runs se - nw from the town of Saldanha. Existing limestone quarries to the east of Middelpos and Diazville have previously been exploited on a small scale, as have two other locations along the ridge to the north. Numerous small pits and traces of earlier prospecting and prospecting-related infrastructure (particularly tracks) dot the area. The ridge itself containing the main limestone reserve is largely under natural vegetation, but to either side where limestone is mantled below deeper soils, the land is entirely given over to agriculture (cereal crops), and in one instance, a clay quarry (not actively used at present). The limestone ridges are highly visible on aerial and satellite imagery and to some degree dominate the landscape. In some places, outcrops of granite protrude particularly in the vicinity of the southern quarry.

Development occurs to the east of the southern limestone quarry in the form of Diazville and Middelpos, and to the south east by a low density residential estate (where few stands have been occupied). Further north, the coastal village of Jacobs Bay lies some 2 km west of the proposed quarrying.

Very little development exists to the north of the R399 - Jacobs Bay road apart from one or two farms and some low density development to the east of Trekoskraal. Apart from the possible Holvlei clay quarry, most of the Afrisam properties will be given over to conservation.

The factory site has been utilised for agriculture in the past and at present is largely used for its marginal grazing. It is surrounded by heavy and light industry of various types. A small farm werf consisting of a few buildings and kraals occurs on the site.

Conveyor and haul road routes mostly traverse agricultural land, except where they cross the ridge closer to the quarries in the west, and in the east where they cross industrial land.

3. METHODS

Plans of the proposed quarry footprints, infrastructure routes and factory site was provided by Aurecon. These were converted to GPS compatible format and loaded onto hand held devices for

use in the field. Walk paths were recorded and observations plotted with the GPS. Notes were made about archaeological and heritage observations and in many instances recorded photographically.

Cogniscence was taken of J. Kaplan's previously recorded site locations in the mining footprint while assessing the current proposals (Avery and Kaplan 1997). Despite the shortcomings of the original archaeological report with respect to site locations (see below), it has been a major source of information to the current study. One of the goals of the current survey was to relocate the Kaplan sites, in order to properly georeference the positions. This was only partly successful.

3.1 Assumptions and limitations

Most of the time, it is only possible to identify archaeological sites that have some presence at the surface. In some cases, disturbance may provide sub-surface windows to assist with observations, but these are frequently chance events and are not always optimally placed. The presence of "**heritage indicators**", or features on the landscape that are known for their association with past human activity, can provide a means to extend predictive possibilities, provided that there is a good body of regional data to support such associations. The Saldanha area is certainly well studied in terms of both archaeology and palaeontology and a number of heritage indicators are in fact present within the project area and will be discussed in Section 4. In spite of such knowledge however, due to prevailing surface conditions it is never possible to identify every surface site, let alone predict the presence of buried material confidently.

A limitation of the current archaeological assessment was the prevailing winter vegetation covering the quarry footprints. These were not ideal conditions for carrying out a surface survey, or for refinding previously identified sites. In addition, Mr Kaplan's observations from his earlier survey were plotted manually on 1:10,000 Orthophotos, and while averaged GPS co-ordinates were assigned to sites, these were at a time when selective availability of satellite signals made for positions with substantial error, and so the plotted positions can only serve as broad local guides of position. As the original orthophotos were no longer available, it was not possible to more accurately gauge the positions of sites where GPS co-ordinates are clearly incorrect. Orthophotos were not replicated in the EIA report meaning that in some cases it has therefore not been possible to relocate sites recorded by him. Walk paths were not provided in his report nor was there any indication given of the level of ground coverage to inform the current assessment. The very brief written descriptions of the site context, location and artefactual material in his report has been of assistance in matching current observations to his recordings. These shortcomings aside however, our survey has demonstrated similar overall site distributions to those of Kaplan, demonstrating to some degree where archaeological sites seem not to occur.

3.2 Available information

A substantial amount of published and unpublished information is available for the Vredenburg/Saldanha area (see bibliography). All of these together provide a good overall baseline information source with direct bearing on the expectation of the types of archaeological resources that will be present within the project area, and the in broad terms, the likely localities where they will be found. Of particular interest are the archaeological/palaeontological sites found within cavities in limestone deposits elsewhere in the Saldanha area and these will be discussed further below.

4. RESULTS

A list of surface sites found during the survey is presented in Table 1, Appendix 1. Indicated on the table are the lat/long site co-ordinates, brief descriptions, grading and proposed mitigation actions. Sites found and described by Kaplan are also included at the end of the table. The positions of the sites on the ground are shown on Figures 2 - 4 in Appendix 2 The "positions" of Kaplan's sites are also indicated. Tracks for the current survey in relation to the planned project components are shown in Figure 5, also in Appendix 2.

The survey is discussed by project component area.

4.1 Cement Plant

4.1.1 Heritage Indicators

Farm buildings
Limestone deposits below ground

4.1.2 Observations

The factory will be constructed on the nw half of the Remainder of farm 1139, this somewhat degraded land lies in the middle of a developing industrial area and is coated (as is most of the broader area) with a pinkish dust residue from the nearby Sishen Saldanha iron ore handling facility. It is used at present on a lease basis for grazing. The site and general context are shown in Plates 1 - 5)

A small farm werf with dwellings and kraals (075) is present on the site. Records in the Surveyor General's database[1] indicate that the piece of land now owned by AFRISAM was once part of a much bigger loan farm granted in 1831, known as Yzervarkensrug (No 127) that is indicated on (Figure 6) with the cement plant site shown for reference. Some of the extant structures are older than others as can be seen from Figure 7. Although not much is known about the farm buildings and precise construction date, some architectural details suggest construction of some elements in the late 19th / early 20th century. We do not believe that the extant buildings are associated with that early loan farm, but rather to later subdivisions of the land. None of the buildings are believed to have any particular heritage value and were never indicated as significant buildings by Hans Fransen when he assessed the broader region (Fransen 2004). Plates 6 - 12 show what the structures appear like today. The buildings are in use but notice has been given to the occupants to vacate.

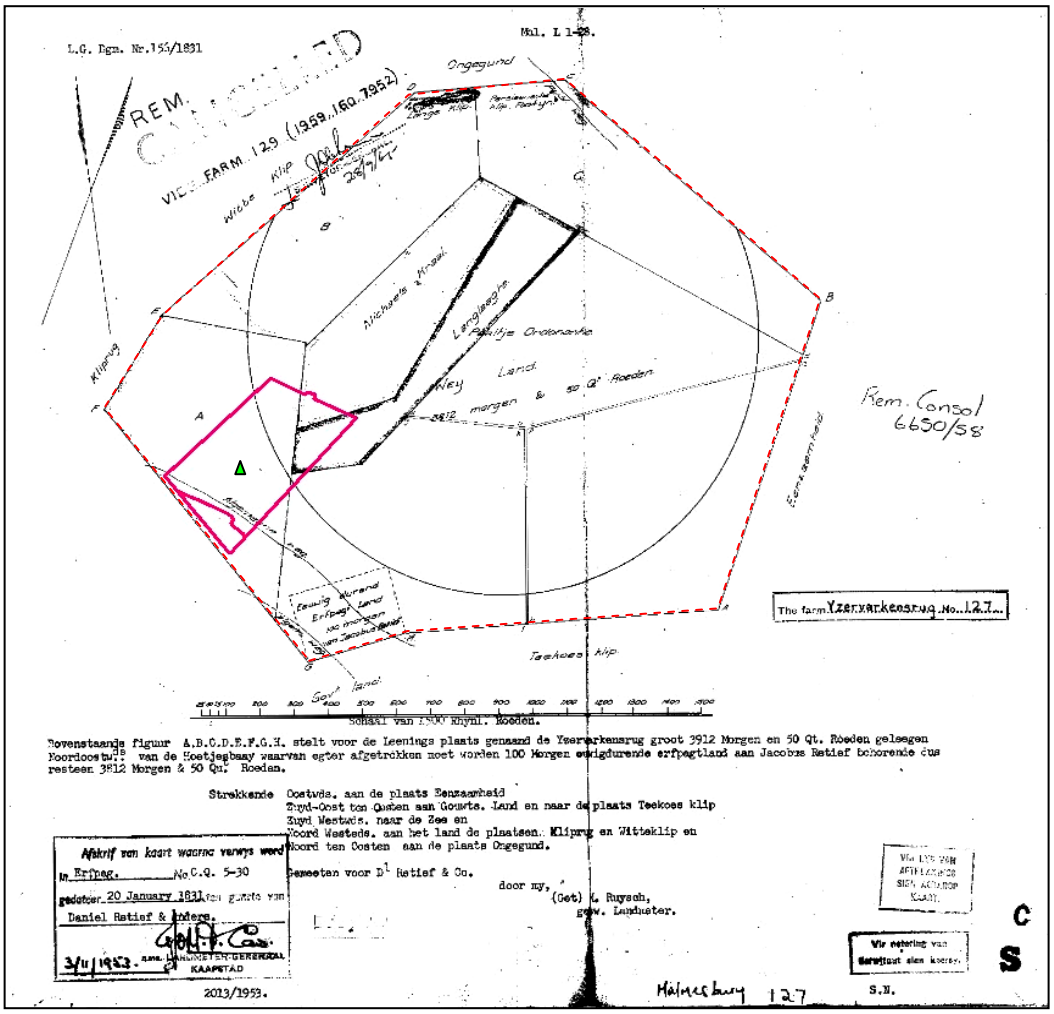
While the buildings have little heritage significance, some are older than 60 years and as such are generally protected by the National Heritage Resources Act of 1999. Permission must be obtained from HWC for demolition, or alteration and re-use of the older buildings which we have determined to be the ones indicated by red polygons on Figure 8.

No LSA surface archaeological material were identified by ourselves although Kaplan describes ephemeral MSA and LSA stone artefacts from at the site of the old Mossgas excavations in the extreme southern portion of the property. The MSA material might have come from below surface during excavations of the site and indicates the possible presence of material associated with limestone ridges. As an example, a known palaeontological/archaeological wetland surface with bones and occasional artefacts has been described by Avery (Avery and Klein 2009) at the site of Spreeuwal on the edge of the bay adjacent to Club Mykonos.

The presence of limestone deposits on the site will require monitoring of the both construction phases of the factory. The initial phase will be quite limited while the second phase will be it will become a much larger facility.

We understand that the Port of Saldanha are investigating expanding the ore loading capacity of the terminal and propose a deep water basin extending into the southern half of the AFRISAM property. Any re-use of the buildings would therefore be only of a temporary nature.

[1] SG Dgm 156/1831, Erf pag C.Q. 5-30, 20 January 1831



Overstaande figuur A.B.C.D.E.F.G.H. stelt voor de leenings plaats genaamd de Yzervarkensrug groot 3912 Morgen en 50 Qt. Roeden gelegen Noordoostwaarts van de Hoetjesbaay waarvan egter afgetrokken moet worden 100 Morgen eedigdurende erfpagtland aan Jacobus Retief behorende dus resteen 3812 Morgen & 50 Qu. Roedan.

Strekkende Oostwds. aan de plaats Eenzaamheid
Zuyd-Oost ten Oosten aan Gouwts. Land en naar de plaats Teekoes klip
Zuyd Westwds. naar de Zee en
Noord Westwds. aan het land de plaatsen. Klipvlei en Witteklip en
Noord ten Oosten aan de plaats Ongegund.

Gemeeten voor D^l Retief & Co.
door my,
(Get) L. Ruysch,
gew. Landmeter.

Figure 6: The original Yzervarkenrug Farm with later sub-divisions was granted as a loan farm in 1831 (SG Dgm 156/1831)

Figure 7: 1938 aerial photograph ref

Figure 8: The farm werf as it appears today. Red polygons highlight features/areas that were present on the 1938 aerial photograph. The labourer's cottages within the upper red polygon appear to be of later manufacture, with cement breeze blocks used in their manufacture. They probably replaced an earlier structure/structures. Kraals and pens seem to be consistent with earlier structures. The dwelling at upper left is not present in the 1938 aerial photo.

Mitigation: Due to the age of some buildings/structures on the werf, permits from Heritage Western Cape will be required for demolition. An application can be made in due course. The sub-surface limestone may contain archaeological and palaeontological resources, and monitoring of construction activities will be required.

4.2 Southern and northern limestone quarries, and Holvlei clay quarry areas

4.2.1 Heritage Indicators

Limestone/calcrete deposits with alternating hard and soft strata;
Cavities in the limestone deposits formed by erosion or animal/human agents (and often covered over and preserved by mantle deposits such as aeolian sand);
Granite outcrops;
Land adjacent to rocky ridges;
Old farm buildings and associated structures.

4.2.2 Observations

As we have observed elsewhere on the Vredenburg peninsula, LSA people tended to favour localities close to the edges of limestone ridges, rather than directly on them. In other words, sites tend to be found in the adjacent areas that are today under agriculture (eg sites 001-003, 005, 008, 015-016, 036, 063-068). Further north on the Vredenburg Peninsula, the focus of Late Stone Age occupation has been well demonstrated to focus heavily on granite outcrops, eg Kasteelberg, but also at the numerous other smaller occurrences in the vicinity. In the project area we have found a noticeable

spike in LSA residues on the small hill to the east of the southern limestone quarry, where surface granite outcropping occurs in greater abundance than in other parts the project area (sites 053, 054, 056, 064). Most of these sites are recognised by the presence of the associated marine shell at the surface. Few stone artefacts were observed though they are present. Perhaps the most stone artefacts of any sites seen, were observed on the disturbed LSA archaeological site (037) in the ploughed field at the proposed Holvlei quarry area. In addition to an extensive shell scatter, a number of stone artefacts were present, in particular, a number of upper and lower grindstones, usually associated with encampments (Plates 13 - 15). Kaplan speculated that this might be associated with the Khoi Khoi and he may be correct. It is not unusual to find traces of occupation in open fields away from rock outcrops. Many of them are ephemeral and may not represent encampments such as the one at 037, but rather itinerant stock posts or short stopovers. Though disturbed by ploughing, more intact occupation horizons may lie at greater depth and such localities may require some form of testing to determine if that is the case, if mining is to take place there.

Some traces of LSA occupation are however found on the limestone ridges, particularly in small flat sediment-filled gullies where the ground surface is more conducive (eg 020, 032) but tend to be few.

Though rarely found at the surface due to the mantling of later deposits, a small cavity/cave was found at the edge of the proposed northern limestone quarry (site 031) (Plate 16). At present it is used by porcupines (evidence of scattered quills and gnawed bone), but these localities could contain archaeological and palaeontological debris if they formed and were exposed in the distant past. This was the only “in situ” cavity that could be pin pointed during the survey, but there will undoubtedly be others discovered during mining.

Scavenging animals (such as the brown hyena and/or jackals) will often carry back food to their dens, particularly if young are to be fed. These residues can contain human remains as scavengers make no distinction when foraging for food. Such was the case at the old hyena den site at the Hoedjiespunt and Sea Harvest sites (Berger & Parkington 2005a, Berger & Parkington 2005b, Grine & Klein 1993, Stynder et al 2001). The alternating bands of hard and soft strata can be seen in Plate 17, which shows the sections of an old prospecting trench in the vicinity of the proposed middle quarry.

Features made by using calcrete blocks/chunks have been noted in various locations. “Cairns” (eg 006), lies close to an area where other historical building ruins have been observed. Although it cannot unequivocally be identified as a grave, it should be treated as such until it can be tested, and if it going to be disturbed. Graves are most often found near settlements and are easily identified by mounds of limestone/calcrete chunks, or by informal calcrete head and/or foot stones. A good many calcrete piles that are scattered throughout the project area are more likely to have resulted from clearing of fields during ploughing. Piles such as these are therefore often found adjacent to fields, outside the ploughing zone. Similarly, some that occur close tracks or roads are probably the result of localised track preparation and maintenance.

At least 4 circular features demarcated by limestone chunks and blocks have been tentatively identified as kraals or hut surrounds (021, 022, 063, 068) (Plates 18 -20). These may or may not date to the LSA, but could equally be quite recent. Little by way of artefactual material was identified in association to make any age determination.

Only a few isolated MSA artefacts were found. Kaplan recorded a site with shellfish and a few patinated MSA artefacts (ASCP 3) in association. This site could not be relocated, but it is likely to date to the LSA as an ostrich eggshell bead was observed. The MSA material may have predated the LSA, or have been brought there to perhaps recycle the stone into other artefacts. The scattered isolated MSA finds point to a presence on the limestone hills, although there has not yet been any observation of a clearly identifiable site however. There is a strong likelihood that buried MSA material will be found during the course of mining.

Some more recent historical remains in the form of a ruined dwelling (007) can be found ~80m south east of a larger abandoned standing shed at the northern end of the mining area. Made from calcrete

chunks held in place with mud mortar it is likely to date to the latter half of the 19th C. The structure lies within the southern mining footprint to the east of the existing road (Plates 21, 22). Similarly, a small structure closer to the haul road and conveyor route is built with the same fabric (051) (Plate 23, 24).

Mitigation: Some surface sites will be affected by the quarrying and will require mitigation as indicated in Table 1. An ongoing program of monitoring will be required to identify possible buried MSA and palaeontological resources.

4.3 Haul road and conveyor

4.3.1 Heritage Indicators

There are no clear heritage indicators for the greater part of the route east of the limestone ridge. Where the road extends over the limestone ridge to the west, the same heritage indicators identified for the mining footprints come into play.

4.3.2 Observations

The proposed haul road alignment comes close to, or has a direct impact on LSA sites within the proposed mining area. Of particular concern is the fact that the road apparently passes over the small hill with granite outcrops where a number of LSA sites have been identified (in particular 069). Ephemeral LSA shell scatters have also been observed in the existing farm track along the boundary fence on the ridge. These too need to be tested but we believe would not impede the use of the route for haulage purposes. Elsewhere, along the route we did not identify any heritage resources (Plates 25, 26).

Mitigation: Although the route of the road is still to be confirmed, we would propose that due to the number of sites on the hill with the granite outcrops, that the haul road be relocated off the hill and to the east. An old track already exists along the eastern edge of the koppie, or it can be located across the old ploughed land close by. There are some minor LSA sites in the area which we have proposed but these can be easily mitigated or avoided if possible, as indicated in Table 1.

4.4 Sensitivity mapping

Sensitivity maps for the components of the project are presented in Appendix 3, Figures 6 - 8. These indicate broadly the areas of concern via colour shading. They indicate the broad area where we believe buried archaeological resources (and palaeontological resources for that matter) may be found (but prediction of location is not possible) that must be subject to ongoing monitoring and mitigation. Identified surface archaeological sites that require mitigation or avoidance prior to impact are shown. The hill that we believe should be avoided is also highlighted.

5. IMPACT ASSESSMENT

5.1 Mining

The greatest impact on archaeological resources is likely to result from the physical mining of resources necessary for the manufacture of cement. A number of heritage sites and features have been identified at the surface within all of the affected mining areas, all of which fit within the broadly established regional LSA and colonial period resources pattern (for example Bateman1946, Dewar 2010, Fauvelle-Aymar et al 2006, Halkett 2011, Hart 2003, Hart & Pether 2008, Kaplan 1996, Malan et al, in prep, Orton 2007, Orton 2008, 2009, Orton 2010, Orton & Smuts 2007, Sadr 2009, Sadr et al1 992, Sadr et al 2003, Smith 2006, Smith et al 1991). These can for the most part can be mitigated or avoided. Based on our knowledge of heritage sites associated with limestone bodies within the local area, and beyond, there is a more than likely chance that buried heritage resources will be found. In particular, old cavities and hollows that may have formed in the past within the limestone

formations (where the softer deposits eroded from between the harder strata) are known to have been used on occasion by early modern humans and scavenging and carnivorous animals alike (for example, Brink 1997, Berger & Parkington 2005a, Berger & Parkington 2005b, Grine & Klein 1993, Stynder et al 2001). Occupation sites with residues predating 20 ka are rare on the west coast, and known stratified MSA localities are few in number, compared to sites from the LSA, which derive from more recent times when population densities had risen dramatically. The MSA period is of great interest both locally and internationally for what can be deduced about the development of modern humans at that time. Bone residues remain very well preserved in the calcareous sediments that make up the southern and northern ore bodies, and consequently are much sought after by the scientific community.

Both Palaeontological and archaeological residues may be affected by mining. Mitigation of known heritage resources is required prior to site preparation and mining, and ongoing inspection of quarries during operation and mitigation is required Ongoing mitigation resulting from monitoring would be in the form of collection and or controlled archaeological excavation.

Table 2: Impact table - Mining (Limestone Quarries - operation)

Site preparation and operation	Northern		Southern	
	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	Local/regional	Local/regional	Local/regional	Local/regional
Magnitude	High	Medium	High	Medium
Duration	Long	Long	Long	Long
SIGNIFICANCE	**HIGH (-)**	**MED- HI (- /+)**	**HIGH (-)**	**MED- HI (- /+)**
Probability	Definite	Probable	Definite	Probable
Confidence	Certain	Sure	Certain	Sure
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible

An LSA site has been identified within the area proposed for clay mining at Holvlei. Mitigation of the site is required prior to mining and will be in the form of surface mapping, collection and test excavations.

Table 3: Impact table - Mining (Holvlei Clay Quarry - operation)

Site preparation and operation	Holvlei Clay Quarry	
	Without mitigation	With mitigation
Extent	Local/regional	Local/regional
Magnitude	High	Medium
Duration	Long	Long
SIGNIFICANCE	**HIGH (-)**	**MEDIUM (- /+)**
Probability	Definite	Probable
Confidence	Certain	Unsure
Reversibility	Irreversible	Irreversible

5.2 Transport corridor

Both of the components are expected to have limited impact on surface (largely predictable) heritage resources. The western sector of the proposed road alignment as it stands (the western edge of the southern limestone area) will impact LSA sites unless mitigation occurs, and we have proposed shifting the haul road away from the hill with the granite outcrops to preserve the sites. The risks of encountering heritage resources diminish dramatically the further one goes to the east. Mitigation optimally would consist of avoidance, and where this is not possible, physical mitigation.

Table 4: Impact table - Transport corridors (Quarries to factory - construction)

Construction only	Conveyor		Road	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local	Local	Local	Local
Magnitude	Low	Very low	High	Low
Duration	Long	Long	Long	Long
SIGNIFICANCE	**LOW (-)**	**VERY LOW (+)**	**MEDIUM (-)**	**LOW (+)**
Probability	Probable	Probable	Definite	Unlikely
Confidence	Sure	Sure	Certain	Certain
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible

5.3 Cement factory

The proposed factory will be located in the ne part of the site. While no impact on pre-colonial archaeological resources is anticipated, some buried MSA material may occur within the calcrete strata. A small farm werf consisting of a number of dwellings, sheds and kraals can be found towards the centre of the site. Some of the buildings/structures can be seen on a 1938 aerial photograph. The land itself was originally a small part of the loan farm known as Yzervarkensrug (127), first surveyed in 1831. The buildings that now stand on the site date from a later time probably no earlier than c1900, after Yzervarkensrug was subdivided. The buildings are not identified by Fransen in any survey, and may at best have some moderate local significance but would be ungraded. A permit from Heritage Western Cape would be required for modification or demolition.

Ongoing inspection of the construction phase of the factory is required. Ongoing mitigation resulting from monitoring would be in the form of collection and or controlled archaeological excavation.

Table 5: Impact table - Factory (Construction)

Construction only	Cement Factory	
	Without mitigation	**With mitigation**
Extent	Local/regional	Local/regional
Magnitude	Medium	Low
Duration	Long	Long
SIGNIFICANCE	**HIGH (-)**	**MEDIUM (+)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

5.4 Conservation areas

Land owned by Afrisam to the west of the Holvlei clay quarry will not be mined but will be placed under conservation if the project is approved. As such, only some minor use may occur along a small section in the south where a transport corridor may be required. Roads do already exist here however. No impact is therefore expected as the status quo will be maintained. It is possible that Holvlei quarry may not be used if suitable clay can be sourced from within the limestone quarries themselves.

Table 6: Impact table - Conservation Areas

Status Quo	Conservation Areas
	Without mitigation
Extent	Site specific
Magnitude	Very low
Duration	n/a
SIGNIFICANCE	**NEUTRAL**
Probability	Definite
Confidence	Certain
Reversibility	n/a

6. MITIGATION

Mitigation of identified surface sites has been indicated in Appendix 1, Table 1.

Mitigation of all mining and related activities on buried heritage resources (in particular of yet to be identified Middle Stone Age sites and Palaeontological sites) will require a consistent and long term monitoring program to be implemented as part of the Environmental Management Plan.

7. ENVIRONMENTAL MANAGEMENT PLAN

7.1 Appointment of heritage specialists

This project cannot proceed without the appointment of appropriate specialists to implement the recommendations of the specialist EIA/HIA reports.

7.2 Initial planning

At some point after issuing of the authorisation for the project, and prior to building of any infrastructure and/or proceeding with mining, the appointed heritage specialists must consult with AFRISAM to determine the implementation program of the cement project, and to develop a strategy for the mitigation and ongoing monitoring of the activities as part of the mining program. Heritage specialists must identify additional approved persons who may act on their behalf in the event of the principal being unable to respond at any time to the heritage program requirements. All such persons must complete the necessary health and safety inductions and be accredited to enter the mining area.

Costs for the heritage program will be borne by AFRISAM and must include specialist fees and disbursements. In addition, some contingency budget must be available to implement specialised mitigation of finds of high significance. It may only be possible to determine “ball park” figures for those eventualities.

The appointed specialist/s must be in possession of the necessary permits from the Provincial Heritage Authority in order to swiftly implement mitigation. Additional nominated persons who will assist with the monitoring and mitigation program must be listed on the permits.

7.3 Mining/Construction areas including Holvlei

- Initial identification of heritage sites to be impacted;
- Heritage specialists to apply for the necessary permits;
- Implement the necessary initial mitigation of surface heritage sites (as recommended) (purple shading on the sensitivity maps);

- Implement the agreed ongoing monitoring program for buried archaeological (palaeontological) sites (light orange shading on the sensitivity maps). This stage may include some training of mining and/or environmental personnel for day to day monitoring;
- If buried archaeological (palaeontological) sites are identified during monitoring that require mitigation, they may need to be cordoned off until they can be mitigated. Mining must relocate to another part of the ore body until mitigation is complete;
- Implement the agreed mitigation on a case by case basis as required in consultation with AFRISAM personnel. Some covered facilities may be required for storage of and initial processing of finds. Material will ultimately reside at the IZIKO South African Museum in Cape Town. Once off storage costs may be incurred;
- Refine the monitoring and mitigation program on an ongoing basis as knowledge of local conditions and heritage resources develops;

8. CONCLUSIONS

No surface heritage resources of very high significance have been identified within the project area. There are however a number of ephemeral archaeological sites that mirror the pattern of LSA use of the northern part of the Vredenburg Peninsula. As few of these have ever been investigated in this area, we have suggested that they be subjected to some basic testing if they are to be impacted. The remains of vernacular structures should be mapped and recorded before they are impacted.

Of greatest interest (and concern) are the buried heritage resources such as MSA occupation/palaeontological sites that may/will be exposed by mining. Similar resources have been found elsewhere in Saldanha and the region is well known for its fossil material. Provided the heritage monitoring and mitigation program is properly implemented, mining may have a positive benefit for the broader scientific community by making buried finds accessible.

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10. PHOTOGRAPHS



Plate 1: Looking sw across the factory site. **Plate 2:** Looking east across the factory site towards the Saldanha Steel plant. **Plate 3:** Old concrete slabs probably represent the remains of prefabricated buildings. The Duferco plant can be seen behind in a nw direction.



Plate 4: Looking from the southern end of the farm toward the Duferco plant. **Plate 5:** Looking towards the Oil storage terminal across the Sishen Saldanha railway line **Plate 6:** A modest farm cottage is one of the buildings on the werf. It was built after 1938 (see also Plates 7and 8).



Plates 7 & 8: The post-1938 building from the rear and front showing the relatively modern shed/garage. **Plate 9:** An earlier building towards the centre of the werf possibly dating from late 19th to early 20th c.


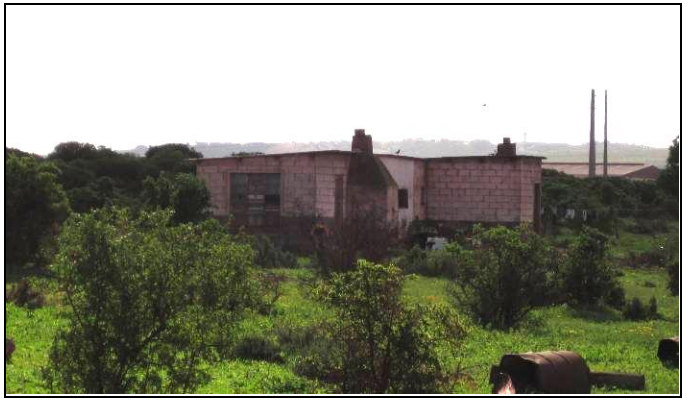


Plate 10: Looking to the se towards the road bridge crossing the railway lines showing the mix of older and more recent structures at the centre of the werf. **Plate 11:** Labourer's cottages are built with breeze blocks and stand on the site of an earlier structure. **Plate 12:** Several kraals and sty's are located at the centre of the werf. The internal construction fabric of some walls suggests that they may be part of the original kraal seen on the 1938 aerial photograph. Abundant calcrete chunks are held in place by mud mortar in what seems to be the traditional fabric and building technique of the broader region. More recent plaster has been applied to the outside of most walls. All structures which were originally white, have now taken on a pink hue due to the iron ore dust carried over the area by the prevailing south east winds from the ore loading facility at the harbour.



Plate 13 - 15: An extensive disturbed Late Stone Age site is present in the proposed clay mine area (037- 050). Although pottery was no longer visible at the site, numerous marine shells and stone artefacts including a number of distinctive upper grindstones were present. The site was originally located by Kaplan in the 1997 survey and he indicated that it was likely to be a camp site.


Plate 16: A small cavity in the limestone has been used by porcupines as a den. These cavities are of great interest to archaeologists and palaeontologists alike, as they may have been used in the past by humans and bone accumulating animals. While this was the only cavity observed, there are bound to be others. **Plate 17:** An old prospecting trench in the middle quarry area shows the nature of the alternating hard limestone and intervening soft, soily strata.



Plate 18 - 20: The abundant surface limestone chunks have been used to create what are believed to be kraals or "hut" surrounds (l -021, m - 022, r - 063). No obvious artefactual material was associated making it difficult to assess age. While some may be associated with the historical structures in the area, we cannot exclude the possibility at this time that they are of pre-colonial age.



Plate 21 & 22: Historic structures use the abundant limestone chunks as building material with mud used as a binder. More recently, a cement skim was applied to the outer surfaces to prevent rain damage. This building (007) is not directly threatened by the activities. It is of moderate interest only. **Plate 23:** A small cottage (051) is built in much the same manner as (007). Both 007 and 051 may have been old farmhouses.

Plate 24: Looking south across the old structure 051. **Plate 25:** Looking east along the Haul road/ conveyor route towards the factory site in the distance (along the fence). **Plate 26:** Looking west across the Saldanha - Vredenburg road back along the conveyor/haul road route showing the nature of the prevailing landscape

Plate 27: Looking west across the existing upper quarry that will be extended in the initial mining phase. **Plate 28:** Looking north across the same quarry. The section at right exposes the Prospect Hill Formation.

APPENDIX 1: Table1 identified sites in the project area

LABEL	LATITUDE S (dec deg)	LONGITUDE E (dec deg)	PROJECT COMPONENT	DESCRIPTION	GRADING[1]	SUGGESTED MITIGATION
001	32.98886300	17.91276100	West of south 2 quarry	Marine shell fragments in mole hills LSA	Generally protected B	Test/excavate prior to impact (if any)
002	32.98752300	17.91153800	West of south 2 quarry	Marine shell fragments in mole hills LSA	Generally protected B	Outside mining footprint - Test/excavate if mining area changes
003	32.98751300	17.91241400	West of south 2 quarry	Marine shell fragments in mole hills LSA	Generally protected B	Outside mining footprint - Test/excavate if mining area changes
004	32.98709100	17.91780600	West of south 2 quarry	Mound of limestone/calcrete chunks - possible grave. Modern broken bottles nearby	Generally protected B	Outside mining footprint - Test/excavate if mining area changes
005	32.98986900	17.91712900	West of south 2 quarry	Marine shell fragments in mole hills - low density, no stone artefacts observed LSA	Generally protected B	Test/excavate prior to impact (if any)
006	32.99129200	17.91874800	West of south 2 quarry	Small cairn-like arrangement of limestone/calcrete chunks but in ploughed field so unlikely to be a grave but should be checked. Limestone piles very common on areas adjacent to farmland resulting from clearing of ploughed fields	Generally protected B	Test prior to impact (if any)
007	32.96104900	17.91638100	North of north quarry	Ruinous building made from calcrete chunks held in place with mud mortar (early 19th c) - ~80m south east of a larger abandoned standing shed	Generally protected B	Avoid if possible. If not, document the structure and apply for demolition permit
008	32.96474400	17.91777900	North of north quarry	Marine shell fragments LSA	Generally protected C	No action required
009	32.96461300	17.91695600	North of north quarry	Isolated silcrete flake - MSA	Generally protected C	No action required
010	32.96673700	17.91869800	Immediately east of north quarry	Trigonephrous globulis specimens embedded in limestone (fossil snails)	Generally protected C	No action required
011	32.96769700	17.91878800	Immediately east of north quarry	Trigonephrous globulis specimens embedded in limestone (fossil snails)	Generally protected C	No action required
012	32.96788100	17.91873700	Immediately east of north quarry	Trigonephrous globulis specimens embedded in limestone (fossil snails)	Generally protected C	No action required
013	32.97286500	17.92070800	Between north and central quarries	Isolated stone flake - MSA	Generally protected C	No action required
014	32.97260000	17.92149000	Between north and central quarries	Isolated stone flake - MSA	Generally protected C	No action required
015	32.95903900	17.91648000	Between north quarry and conservation areas	Marine shell fragments LSA - no stone artefacts observed	Generally protected B	Test/excavate prior to impact (if any)
016	32.95918400	17.91604600	Between north quarry and conservation areas	Marine shell fragments LSA - no stone artefacts observed	Generally protected B	Test/excavate prior to impact (if any)
017	32.97677500	18.00423300	Factory	Several concrete slabs (old farm sheds) 20thC	Ungraded	No action required
018	32.97939700	18.00481100	Factory	Small pile of calcrete (formal?) possible grave or beacon?	Generally protected B	Test prior to impact (if any)
019	32.98703500	18.00182600	Factory	Few concrete slabs - floors of corrugated iron farm sheds 20th C	Generally protected C	No action required
075	32.98381400	17.99970100	Factory	Farm complex	ungraded	Apply for demolition permit
020	32.97310100	17.91690600	Between north and central quarries	(Extension of Kaplan's ASCP 2?) Ephemeral surface shell traces - limpet and black mussel. Mostly highly fragmented but with a few "whole" shells. There are some faint shell traces at Kaplan's site position so difficult to know where exactly his plot was?	Generally protected B	Test/excavate prior to impact (if any)
021	32.97181200	17.91788100	Between north and central quarries	(definitely Kaplan's ASCP 10) Small circular arrangement of calcrete chunks with an inner diameter of approx 2 meters. This appears to be a deliberate	Generally protected B	Test/excavate interior prior to impact (if any)

				arrangement resembling a small kraal. There are no immediately identifiable artefacts associated and it is impossible to assess the age.		
022	32.97425400	17.91766100	Between north and central quarries	Small circular arrangement of calcrete chunks with an inner diameter of approx 2 meters. Crudely packed. A small exotic cobble found nearby is the only associated artefact. It is impossible to assess the age but it resembles a kraal.	Generally protected B	Test/excavate interior prior to impact (if any)
023	32.97455200	17.91754700	Between north and central quarries	Two overgrown calcrete "cairns" (piles?). Close to old road so may be material that was cleared from the track rather than anything significant.	Generally protected C	No action required
024	32.97496500	17.91493200	Between north and central quarries	Similar pile of calcrete that is almost certainly related to track clearing	Generally protected C	No action required
025	32.98100900	17.91814900	Central quarry	Many signs of activity relating to old quarrying activities such as piles of large calcrete boulders/chunks, roads, litter, prospecting trench.	Generally protected C	No action required
026	32.98322600	17.91809000	Central quarry	Trigonepherous globulis shells in section of the old lime quarry	Generally protected C	No action required
027	32.98382100	17.92093800	Central quarry	Isolated MSA flake on sandstone	Generally protected C	No action required
028	32.97956400	17.92135900	Immediately east of central quarry	(Kaplan's ASCP 7 F1) While it cannot be entirely ruled out that a structure stood here at some point as per Kaplan's assessment, the calcrete and granite rock pile is more likely to be material that was removed from the adjacent fields during ploughing and dumped in this location. A concrete lintel is however present with the calcrete. This is not significant heritage however.	Generally protected C	No action required
029	32.97927900	17.92125900	Immediately east of central quarry	(Kaplan's ASCP 7 F2) Kaplan refers to this pile of calcrete rubble as a possible grave. I would not like to entirely contradict his assessment but again I think this pile might simply be material removed from the ploughed fields. An upper grindstone reported by Kaplan nearby could not be relocated.	Generally protected B	Test/excavate prior to impact (if any)
030	32.96737500	17.91729500	North quarry	Isolated MSA flake on silcrete	Generally protected C	No action required
031	32.96372400	17.91835500	North of north quarry	Partly exposed solution cavity in the calcrete. Clear signs of it use by porcupines though no apparent archaeological material was visible on the surface. Cavities such as this will be of great interest if exposed by mining as they may contain either palaeontological or archaeological deposits.	Generally protected B	Test/excavate interior prior to impact (if any). Monitoring of mining if and when it occurs) at this point will be required regardless of outcome of test excavation
032	32.96406100	17.91778300	North of north quarry	(Likely to be Kaplan's ASCP 4?) Fairly dense scatter of LSA shell with a number of stone artefacts in quartz, with 1 piece of hornfels present. Whelk, limpet and black mussel seen, some of which was whole. Probably 10 - 15 meters diameter and unlikely to be too deep due to the underlying calcrete.	Generally protected B	Test/excavate prior to impact (if any)
033	32.96402900	17.91769500	North of north quarry	"	"	"
034	32.96418300	17.91779600	North of north quarry	"	"	"
035	32.96412600	17.91796000	North of north quarry	"	"	"
036	32.96147800	17.91643200	North of north quarry	(Kaplan's ASCP 5) is a very low density scatter of fragmented LSA shellfish including limpet and black mussel. Kaplan included the ruins of an old building as part of this site, but I have previously recorded that as 007 earlier in this table.	Generally protected B	Test/excavate prior to impact (if any)
037	32.93688000	17.91912400	Holvlei Clay Quarry	(Kaplan's ASCP 1) An extensive, low density, LSA shell and stone artefact scatter in a ploughed field. The site was probably more focussed but surface traces are dispersed by ploughing. I observed both shell and stone artefact including lower and upper grindstones, but was unable to locate pottery, ostrich eggshell, and MSA/ESA implements as reported by Kaplan. The shell appears patchy at the surface and may indicate separate shell dumps below surface.	Generally protected B	Test/excavate prior to impact (if any)
038	32.93684000	17.91895200	Holvlei Clay Quarry	"	"	"

039	32.93678400	17.91891600	Holvlei Clay Quarry	"	"	"
040	32.93677800	17.91900200	Holvlei Clay Quarry	"	"	"
041	32.93680900	17.91869100	Holvlei Clay Quarry	"	"	"
042	32.93687600	17.91842500	Holvlei Clay Quarry	"	"	"
043	32.93688900	17.91840300	Holvlei Clay Quarry	"	"	"
044	32.93698600	17.91822400	Holvlei Clay Quarry	"	"	"
045	32.93704000	17.91810200	Holvlei Clay Quarry	"	"	"
046	32.93710800	17.91821100	Holvlei Clay Quarry	"	"	"
047	32.93714800	17.91841400	Holvlei Clay Quarry	"	"	"
048	32.93701700	17.91871800	Holvlei Clay Quarry	"	"	"
049	32.93701600	17.91898900	Holvlei Clay Quarry	"	"	"
050	32.93666900	17.91949200	Holvlei Clay Quarry	"	"	"
051	32.98675600	17.92258500	Conveyor	Ruin of a small vernacular 3 room cottage constructed from calcrete held in place with mud mortar. Some other structural elements surrounding the ruin. Very overgrown but refuse dumps are likely to be present.	Generally protected B	Record and map structure, test excavation of any dumps if located. Apply for demolition permit
052	32.98662000	17.92208600	Conveyor	Circular calcrete feature of unknown use (possible well or threshing floor).	Generally protected B	Testing/excavation prior to impact
053	32.98915700	17.92405100	Granite koppie	Prominent granite outcrop around which were found a number of quartz flakes (possibly LSA) and several sherds of refined earthenware (transfer print) and stoneware. No marine shell was observed.	Generally protected B	Koppie as outlined on sensitivity map should be a no go area. Hence mitigation not required. Should it not be a no-go area, mitigation will be required.
054	32.98967900	17.92421200	Granite koppie	Small shell scatter of approximately 10-15 meters diameter in amongst bush. Of reasonable density and containing limpet, black mussel and oyster shells with a number in whole and mostly whole state. One quartz flake was observed. This is probably not Kaplan's site ASCP 8 despite similarity of locations?	Generally protected B	Koppie as outlined on sensitivity map should be a no go area. Hence mitigation not required. Should it not be a no-go area, mitigation will be required.
055	32.99065100	17.92447700	Granite koppie	Isolated MSA flake on silcrete	Generally protected C	No action required
056	32.99051800	17.92352400	Granite koppie	(Likely to be Kaplan's ASCP 8?) "extensive" shell scatter on track. Only shell observed. Was not able to confirm Kaplan's observations of associated stone artefacts and oriental ceramics in situ shell, bone and stone in two small excavations on the slope but these may no longer be visible due to erosion?	Generally protected B	Koppie as outlined on sensitivity map should be a no go area. Hence mitigation not required. Should it not be a no-go area, mitigation will be required.
057	32.99042100	17.92351000	Granite koppie	"	"	"
058	32.99034400	17.92353200	Granite koppie	"	"	"
059	32.99031100	17.92354400	Granite koppie	"	"	"
060	32.99028800	17.92357300	Granite koppie	"	"	"
061	32.99012300	17.92354700	Granite koppie	"	"	"
062	32.98999500	17.92357400	Granite koppie	"	"	"
063	32.98872600	17.92088300	Southern quarry	Possible circular calcrete kraal of approximately 2 meters diameter. Age cannot be determined as there are no associated artefacts.	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
064	32.99756200	17.92418000	Haul road	Ephemeral traces of marine shell in mole hills suggesting buried shell midden/s	Generally protected B	Test/excavate prior to impact (if any)
065	32.99781400	17.92406900	Haul road	"	"	"
066	32.99784400	17.92416500	Haul road	"	"	"
067	32.99786000	17.92427200	Haul road	"	"	"
068	32.99811900	17.92446400	Haul road	Some apparent calcrete arrangements coincidental with the shell observations at 064-067. Possible kraal but could also be rubble piles resulting from ploughing??	Generally protected B	Inspect in more detail prior to impact (if any)
069	32.98892700	17.92535000	Haul road	Fairly dense surface scatter of fragmented marine shell including limpet and black mussel and associated with granite outcrops. Some whole shells were observed and one quartz flake was noted.	Generally protected B	Koppie as outlined on sensitivity map should be a no go area. Hence mitigation not required. Should it not be a no-go

						area, mitigation will be required.
070	32.98876300	17.92536000	Haul road	Various "arrangements" of calcrete, one linear and wall-like? Others are piles. Some ephemeral shellfish remains (black mussel) associated. Age indeterminate (LSA or colonial??)	Generally protected B	Koppie as outlined on sensitivity map should be a no go area. Hence mitigation not required. Should it not be a no-go area, mitigation will be required.
071	32.98809000	17.92517600	Haul road	Calcrete pile?	Generally protected C	No action required
072	32.98304600	17.93127500	Haul road	Ephemeral surface limpet shell traces in ploughed field	Generally protected C	No action required
073	32.98594500	17.93091000	Conveyor	Ephemeral surface limpet and black mussel shell traces in farm track	Generally protected C	No action required
074	32.98621000	17.92730100	Conveyor	Ephemeral surface limpet and black mussel shell traces in farm track	Generally protected B	Test/excavate prior to impact (if any)
075	32.99120600	17.92651900	Haul road	Ephemeral surface limpet shell traces next to old farm track. Generally fragmented but some large chunks noted.	Generally protected B	Test/excavate prior to impact (if any)
076	32.99116900	17.92621100	Haul road	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
077	32.98689100	17.92599300	Haul road	Surface shell scatter brought up by moles containing a variety of limpets, and black mussel shell. Several whole shells noted.	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
078	32.98798800	17.92495100	Haul road	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
079	32.98844500	17.92529400	Haul road	Isolated MSA flake	Generally protected C	No action required
080	32.98838900	17.92529000	Haul road	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
081	32.98832900	17.92537400	Haul road	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
082	32.98770000	17.92439200	Haul road	Multiple calcrete chunk piles - from clearing fields for ploughing	Generally protected C	No action required
083	32.98735500	17.92289600	Haul road	Remains of demolished structures - calcrete with cement attached - old troughs?	Generally protected C	No action required
085	32.99215700	17.92727400	Haul road/southern mining	Multiple calcrete chunk piles - from clearing fields for ploughing	Generally protected C	No action required
086	32.99209900	17.92719700	Haul road/southern mining	Localised surface limpet shell scatter with some biggish chunks - not too dense	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
087	32.99282000	17.92737400	Haul road/southern mining	Ephemeral surface shell scatter next to granite boulders	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
088	32.99827200	17.92336500	South 1 quarry	Ephemeral surface limpet shell traces in molehills. Several whole shells.	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
089	32.99612500	17.92101300	South 1 quarry	Ephemeral surface limpet shell traces in molehills.	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
090	32.99774400	17.92302900	South 1 quarry	Localised, fairly dense limpet shell scatter in molehills. Some whole shell noted	Generally protected B	Test/excavate interior and/or exterior prior to impact (if any)
091	32.99927500	17.92425000	South 1 quarry	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
092	n/a	n/a	n/a	duplicated site reading	n/a	n/a
093	32.99560600	17.92490700	South 1 quarry	Calcrete chunk pile - from clearing fields for ploughing	Generally protected C	No action required
Data from 1997 Kaplan	**LATITUDE S (dec deg)**	**LONGITUDE E (dec deg)**	**PROJECT COMPONENT**	**Description**	**Significance**	**Mitigation**

survey						
ascp1	32.93916700	17.92450000	Conveyor	A possible Khoikhoi herder camp, with marine shell, bone, ostrich eggshell, stone artefacts (incl grindstones).	high	Controlled collection of the camp material
ascp2	32.97233300	17.91700000	Between north and central quarries	LSA Stone flakes, fragmented marine shell, pottery, bone exposed by burrowing animals	med - high	Controlled sampling
ascp3	32.96550000	17.91916700	North of north quarry	Scatter of fragmented shell, bone, stone, lgs, msa artefacts, fossil bone (not re-located by Halkett)	high	Controlled sampling
ascp4	32.96400000	17.91683300	North of north quarry	Small scatter of fragmented shell, 1 stone, 1 oes	med - low	A small controlled testing of the site
ascp5	32.96133300	17.91650000	North of north quarry	Old farm buildings	low	None required
ascp6	32.97616700	17.91650000	Between north and central quarries	A few fragments of marine shell exposed by burrowing animals	low	None required
ascp7 f1& f2	32.97966700	17.92066700	Immediately east of central quarry	stone (calcrete) features. F1 - collapsed remains of shepherds hut? F2 - line of limestone rocks (burial?)	high	Site should be mapped and "burial" investigated".
ascp8	32.98966700	17.92400000	granite koppie	Extensive scatter of marine shell. Also stone flakes and chunks and blue and white oriental porcelain	high	Controlled sampling of the site
ascp9	32.99100000	17.92463300	granite koppie	Small scatter of fragmented shell (not re-located by Halkett)	med - low	None required
ascp10	32.97133300	17.91766700	Between north and central quarries	Remains of a stone circle, probably a kraal with no artefactual material	medium	Should the gravel road be upgraded, or future quarrying activities be planned, the ruins should be mapped.

[1] **Grading:**

(a) National: Grade I significance and should be nominated as such. (b) Provincial: Grade II significance and should be nominated as such. (c) Local: Grade IIIA significance. Mitigation as part of the development process is not advised. The site should be retained as a heritage site (High significance). (d) Local: Grade IIIB significance. It should be mitigated and (part) should be retained as a heritage site (High significance). (e) Local: Grade IIIC significance. The building contributes to character and significance of the local environs (f) **Generally Protected A**: the site should be mitigated before destruction (generally High/Medium significance). (g) **Generally Protected B**: the site should be recorded before destruction (generally Medium significance). (h) **Generally Protected C:** the site has been sufficiently recorded. It requires no further recording before destruction (generally Low significance).

APPENDIX 2: Figures showing locations of heritage sites

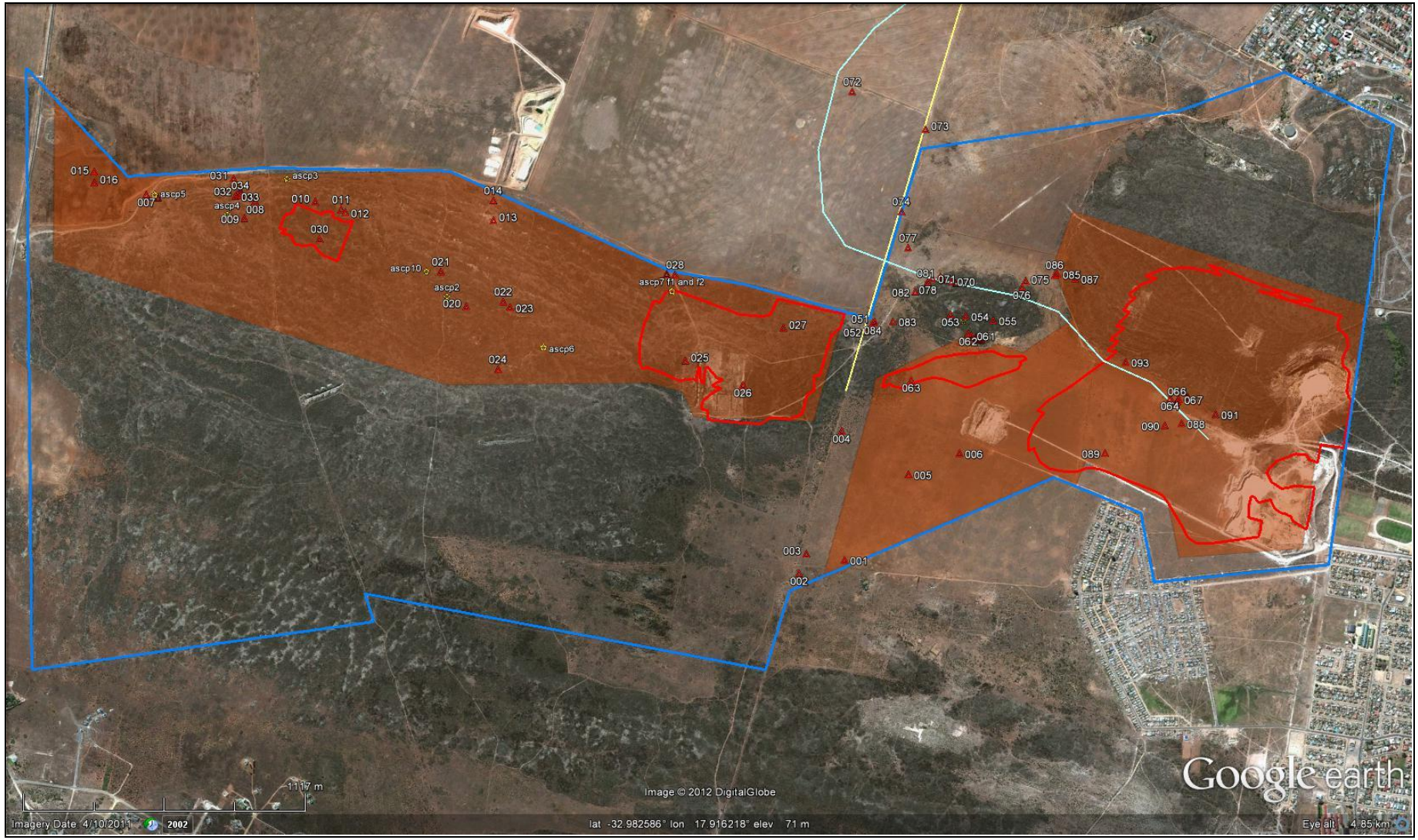

Figure 2: Sites located in the proposed mining areas and haul/conveyor route

Figure 3: Sites located in the proposed clay quarry area

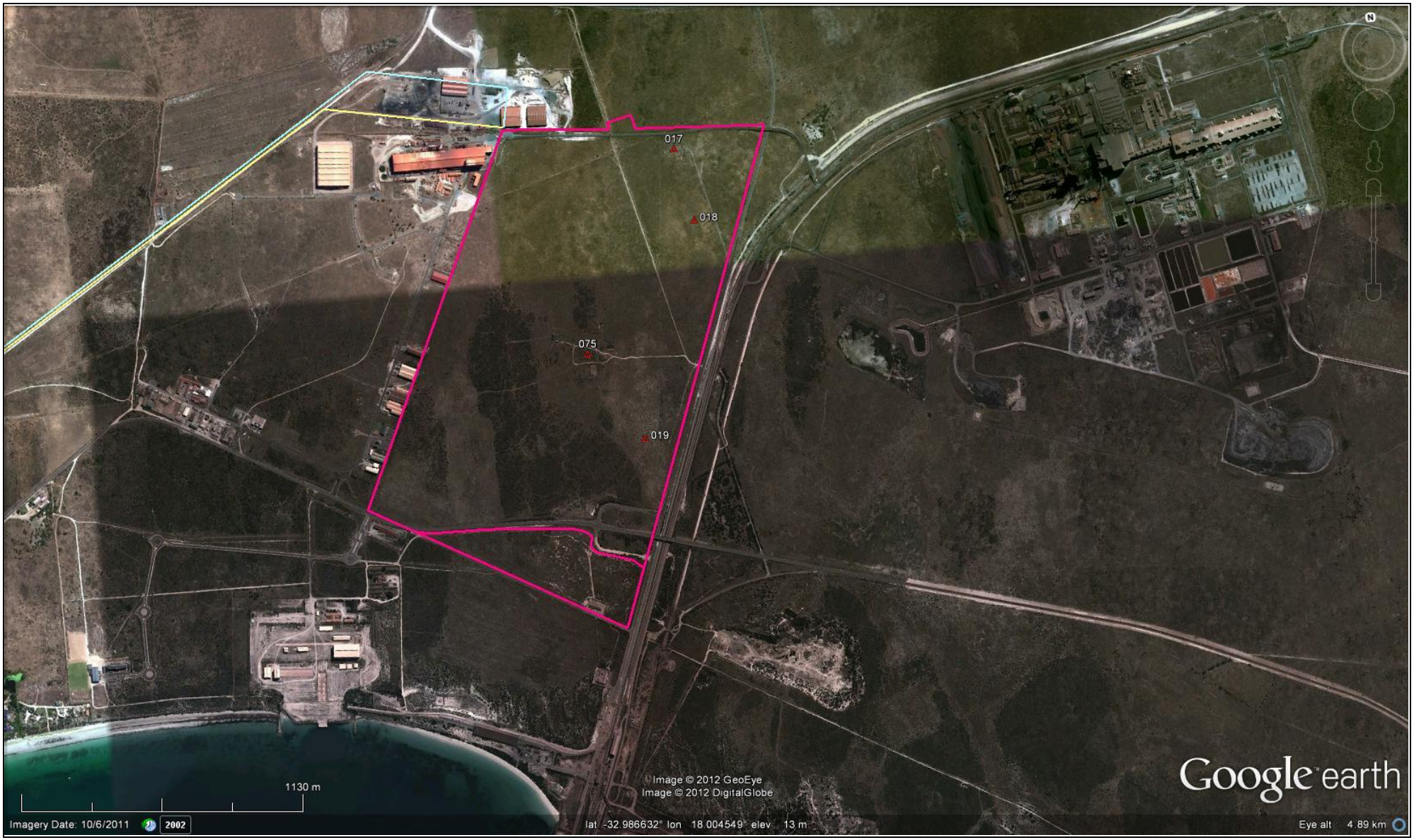

Figure 4: Sites located in the proposed cement plant area

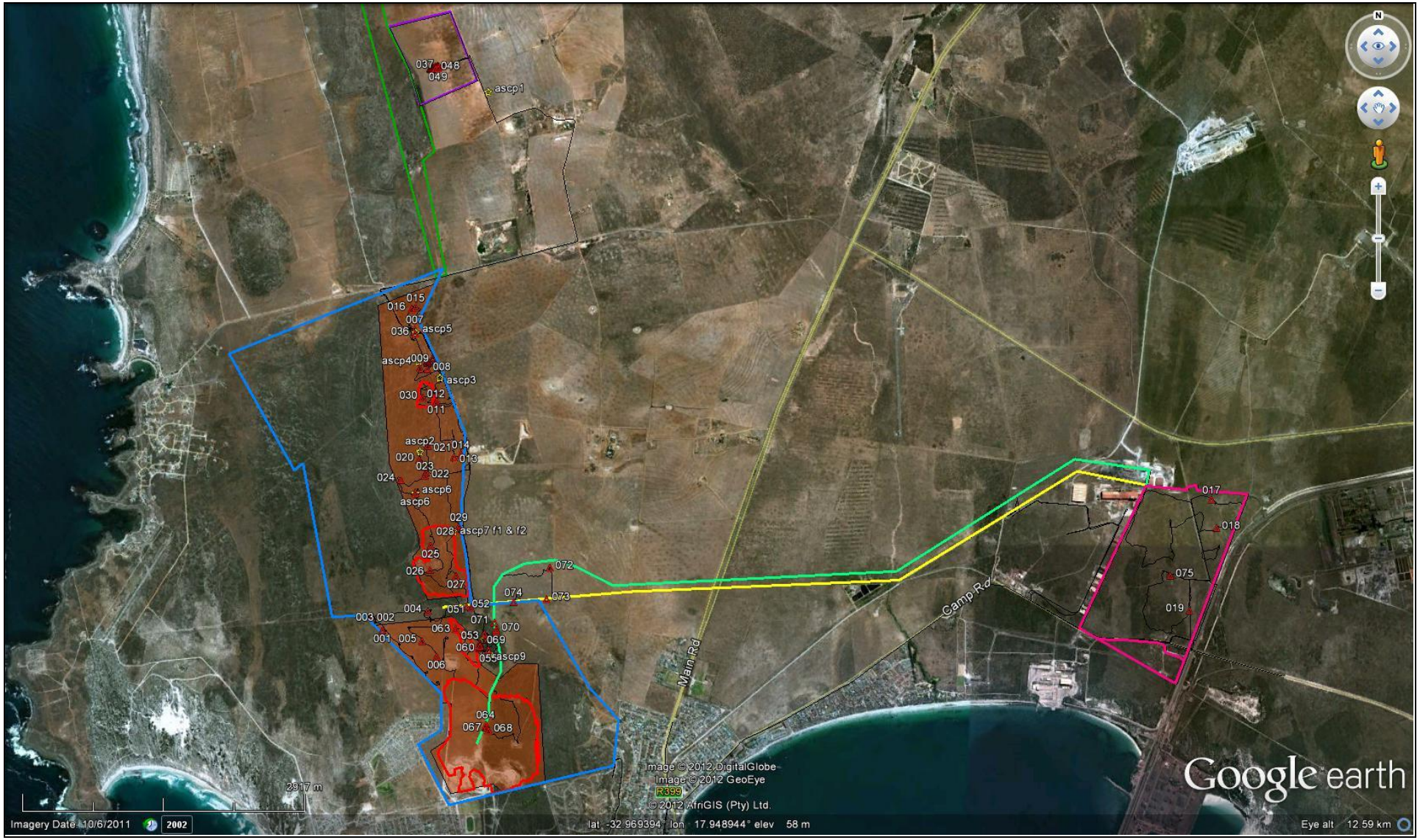

Figure 5: Trackpaths (black) in relation to project components

APPENDIX 3: Archaeological/heritage sensitivity maps

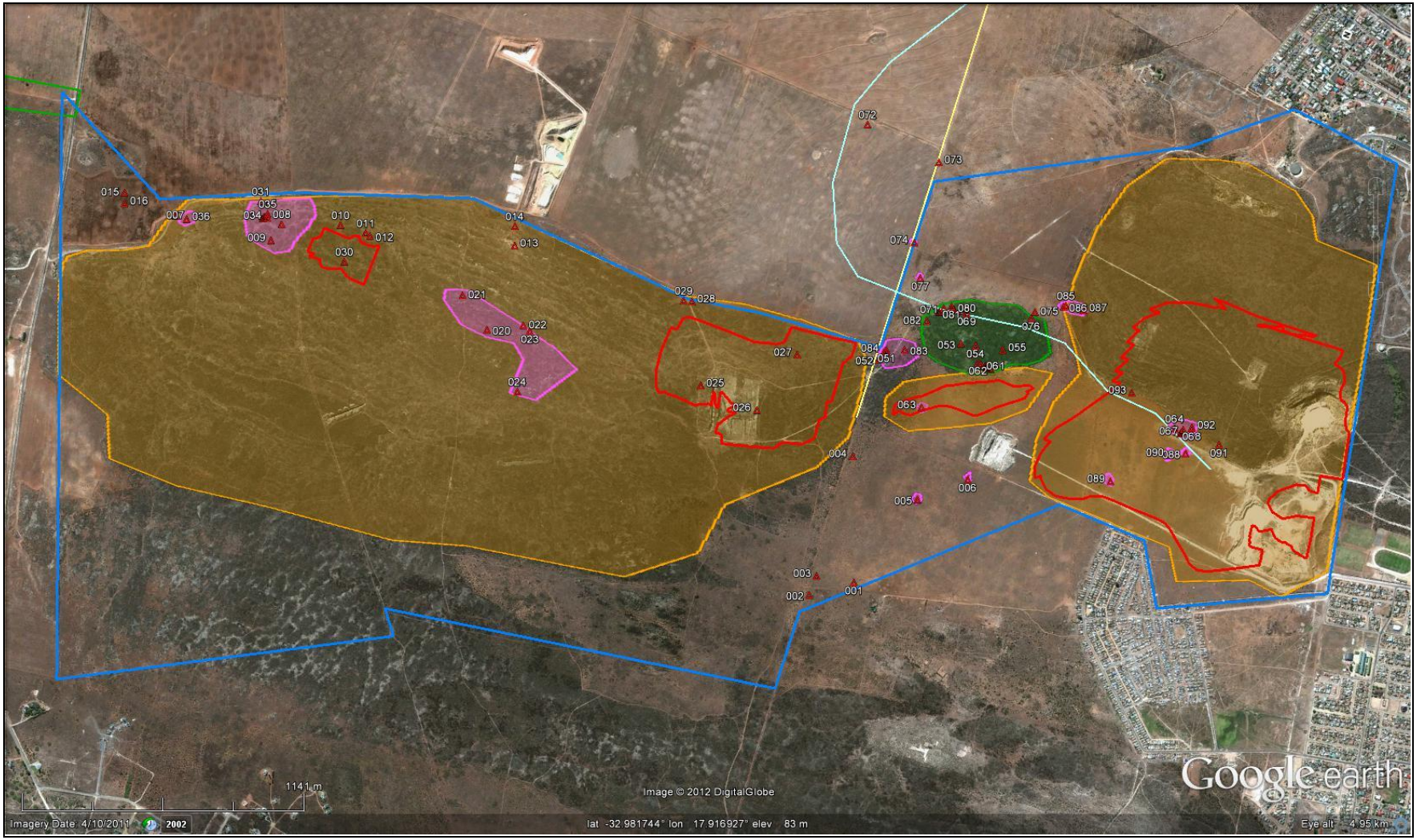

Figure 6: Archaeological/heritage sensitivity of the mining areas (red polygons - proposed initial quarries, blue - property boundaries) (Light orange shading - areas where all new mining/infrastructure should be monitored, and any sites found are assessed and mitigated if necessary); (Purple shading - identified surface archaeological sites requiring mitigation before impact. Mitigation could involve excavation or avoidance); (Green shading - no go area. Move haul road to the east)

Figure 7: Archaeological/heritage sensitivity of the Holvlei clay quarry (dark purple polygon - proposed clay quarry, green - property boundaries - conservation) (Light orange shading - areas where all new mining/infrastructure should be monitored, and any sites found are assessed and mitigated if necessary); (Purple shading - identified surface archaeological sites requiring mitigation before impact. Mitigation could involve excavation or avoidance);

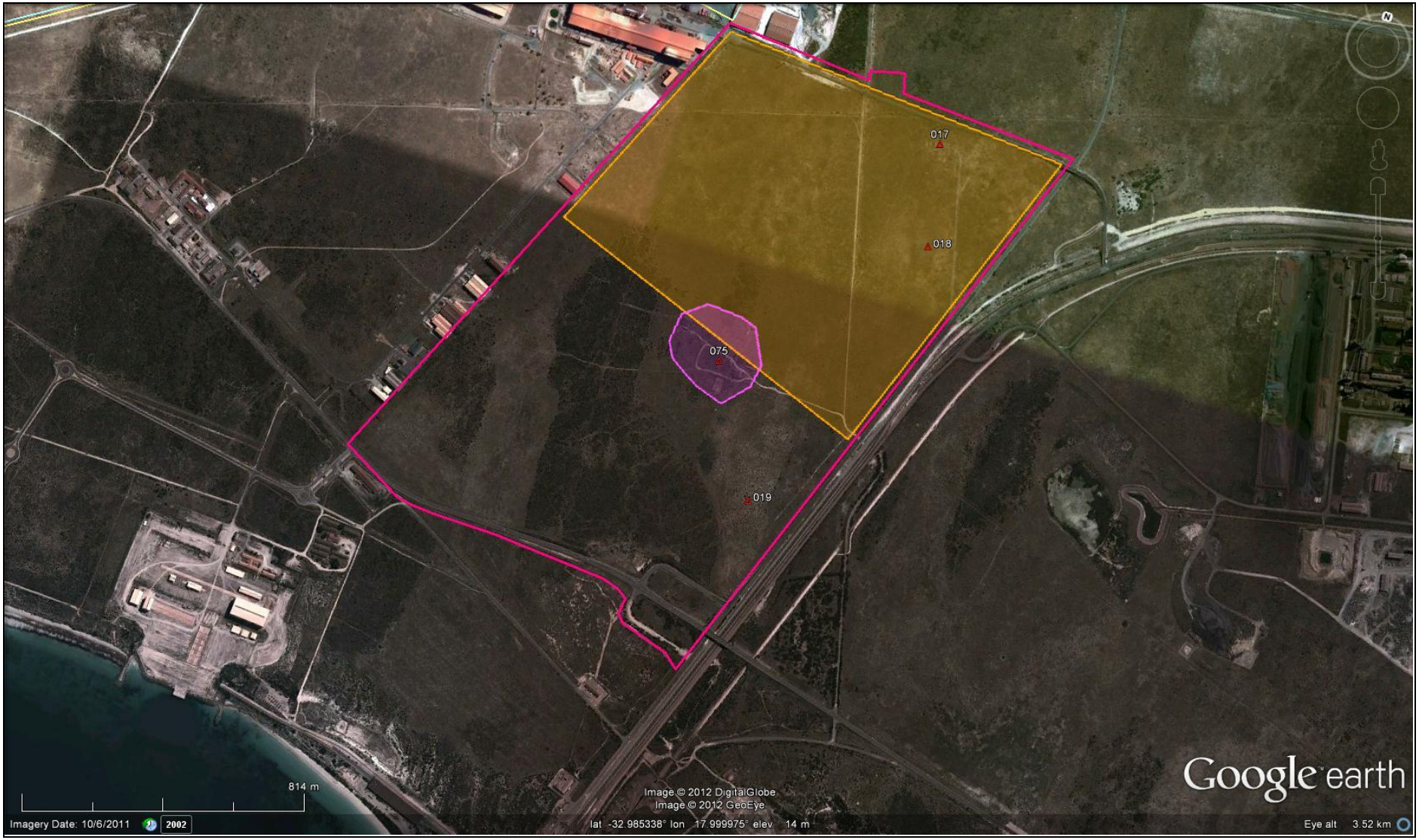

Figure 7: Archaeological/heritage sensitivity of the cement plant site (pink polygon)
(Light orange shading - areas where all new mining/infrastructure should be monitored, and any sites found are assessed and mitigated if necessary);
(Purple shading - identified surface archaeological/heritage sites requiring mitigation before impact. A permit is required in order to demolish/re-use structures);

APPENDIX 4: Draft Visual Impact Assessment

DRAFT VISUAL
IMPACT ASSESSMENT

PROPOSED AFRISAM CEMENT PLANT, QUARRIES AND ASSOCIATED INFRASTRUCTURE, SALDANHA BAY

September 2012

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This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, Western Cape. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate the VIA.

Stephen Stead has 12 years experience in the field of GIS mapping and 3D modelling through his work as a GIS consultant and visual impact practitioner. He is accredited by the Association of Professional Heritage Practitioners (APHP) as a Visual Impact Assessment Specialist. Mitha Cilliers is a landscape architect with nine years experience in the fields of landscape architecture and environmental planning. For the last four years she has focused on Visual Impact Assessments. Mitha is registered with the South African Council for Landscape Architectural Profession (SACLAP).

I, Stephen Stead, principle author of the Visual Impact specialist report, hereby declare that I am an independent consultant appointed to provide specialist input on the proposed project. I hereby confirm that I have no business, financial, personal or other, interest in the activity, application or appeal in respect of which I have been appointed, other than fair remuneration for work performed in connection with the activity and application. All opinions expressed in this specialist report are my own.

Stephen Stead
Association of Professional Heritage Practitioners (APHP) accredited VIA Specialist

ACRONYMS

ACEC	Areas of Critical Environmental Concern
APHP	Association of Professional Heritage Practitioners
BLM	Bureau of Land Management (United States)
BPEO	Best Practicable Environmental Option
CALP	Collaborative for Advanced Landscape Planning
CBA	Critical Biodiversity Areas
DEA&DP	Department of Environmental Affairs and Development Planning
DEM	Digital Elevation Model
DoC	Degree of Contrast
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographic Information System
IAIAsa	International Association of Impact Assessment, South African Affiliate
I&APs	Interested and Affected Parties
IEMA	Institute of Environmental Management and Assessment (United Kingdom)
IFC	International Finance Corporation
KOP	Key Observation Point
MAMSL	Metres above mean sea level
PSPF	Provincial Spatial Planning Framework
ROD	Record of Decision
SBSDF	Saldanha Bay Spatial Development Framework
SDF	Spatial Development Framework
TPA	Tons per annum
VAC	Visual Absorption Capacity
VE	Visual Envelope
VIA	Visual Impact Assessment
VRM	Visual Resource Management
WCPSDF	Western Cape Provincial Spatial Development Framework
ZVI	Zone of Visual Influence

GLOSSARY

Best Practicable Environmental Option (BPEO)
This is the option that provides the most benefit, or causes the least damage, to the environment as a whole, at a cost acceptable to society, in the long, as well as the short term.

Cumulative Impact
The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.'

Impact (visual)
Visual impact describes the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.

Issue (visual)
Issues are concerns related to the proposed development, generally phrased as questions, taking the form of "what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?"

Key Observation Points (KOPs)
Receptors refer to the people located in the most critical locations, or key observation points, surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.

Management Actions
Actions that enhance benefits of a proposed development, or avoid, mitigate, restore or compensate for, negative impacts.

Receptors
Individuals, groups or communities who would be subject to the visual influence of a particular project.

Sense of Place
The unique quality or character of a place, whether natural, rural or urban.

Scenic Corridor
A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.

Scoping
The process of determining the key issues, and the space and time boundaries, to be addressed in an environmental assessment.

Viewshed
The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area in which, or the extent to which, the landscape modification is likely to be seen.

Zone of Visual Influence (ZVI)
The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'

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1. EXECUTIVE SUMMARY

Saldahna Bay is a town created by both tourism and industrial development. The *high* scenic quality of the critical biodiversity and west coast landscapes combined with the *lower* scenic quality of the well established industrial and mining areas make the overall scenic quality *moderate*. Saldahna has been identified as an industrial growth node and the existing Saldahna SDF has incorporated the proposed mining areas into the regional planning. However, the Saldahna Municipality SDF planning has yet to be recognised by the Western Cape Province. The proposed mining areas also include fynbos vegetation, which have been defined as Critical Biodiversity Areas by the C.A.P.E. Fine-scale Biodiversity Planning Project (WCPSDF). This document recommends that the project sites be managed in a manner compatible with biodiversity conservation and be restored to a natural state and that the loss of CBA areas are adequately offset in terms of DEA&DP guidelines and best practice. The certainty of decision is reduced as the proposed life of mine is 100 years. The long time frame of the project (2012 – 2112) limits the confidence levels. It must be recognized that the surrounding landscape character (and sense of place) is likely to change during this time period. Detailed 3D modelling of the proposed landscape modifications was provided which has assisted in understanding the impacts.

The proposed cement plant will be developed in two phases and is located on an industrial site adjacent to existing large factory structures. The surrounding sense of place is strongly associated with the Saldanha Steel plant and harbour. The proposed plant landscape modification would not significantly change the established industrial landscape character even though it is a large size, height and scale. It is also recommended that lighting mitigations be implemented to reduce further light pollution in the area, avoiding the use of pole-top security lighting and installing fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. The area shown in Point 1 on the Mitigations Map in Figure 2 should be retained as undeveloped for screening and biodiversity purposes. Structures should be matt cement grey or painted dark reddish brown based colours that would blend in with the colours of the surrounding landscape *(See Figure 2: Mitigation Map point 1 and 2).*

The plant would be linked to the quarry via an access road and possibly a conveyor system. It is recommended that the R45 road is crossed via an underpass for both transport options. Due to the conveyor system requiring a crusher on top of the hill, visual preference is for the road option. Mitigation is required which would include that the haul road is tarred, re-aligned around the steep slope area to the west of the R399 road which should be cut in if possible and a low screening wall created on the valley side. The cut face will have to be rehabilitated to veld grass. *(See Mitigation Map point 3 and 4).*

Three quarry sites were assessed: the southern, northern limestone quarries and the proposed Holvlei Clay Quarry to the north of the Jacobsbaai Road. The southern quarry is an expansion of the existing Prospect Hill quarry. Hence, visual character will be strongly associated with the existing quarry landscape, as well as the Saldanha west residential areas and Middelpos informal settlement area. To reduce the visual intrusion to proximate residential receptors, it is recommended that a 3 m undulating screening berm is built to the west of the quarry site. The upper eastern extent the quarry should curve on the edges to align more naturally with the hill topography. A maximum 30 degree slope is recommended to allow for effective rehabilitation *(See Mitigation Map point 5).* As the upper extent of the quarry is visually prominent, it is recommended that mined areas are effectively rehabilitated to fynbos as per the botanical specialist's recommendations.

A large portion of the proposed northern limestone quarry is located on the skyline. Should the No-go option be exercised to meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, (DEA&DP. 2002) it is likely that the project would be threatened. Given the current inclusion of the mine in the Saldanha SDF and the recognition of Saldahna as a development zone, the VIA has not recommended this area as a No-go area. However, due to this skyline area potentially generating higher levels of permanent visual intrusion which will not meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, it is recommended that the proposed mine plan for this area be amended. The plan needs to depict the final post-mine skyline as a smooth and

continuous line that mirrors the existing skyline, but must be lowered by approximately 4 m on the ridgeline (Skyline Comparison Map below). Should this not be provided, the No-go option for skyline mining is recommended. The proposed northern section of the quarry is adjacent to the Jacobsbaai Road which is an important tourist route. It is recommended that the mine is set back from the north-east corner where an existing low mound will afford some natural visual screening *(See Figure 3: North Quarry Mitigation Map).* To control the dust and reduce visual intrusion, the mining must be undertaken in such a way that concurrent rehabilitation can take place with quarrying working in a 200 m cut face, and restored with face rip benches and rehabilitated concurrently (as per the botanical specialist's specifications).

A low berm needs to be created to the west of the low mound parallel to the road to connect to the hill area. The berm needs to be formed by topsoil removed from the limestone fynbos in the southern quarries which will not be rehabilitated back to limestone fynbos. The screening berm needs to appear natural and it is recommended that an accredited landscape architect be utilised for the design and construction. The existing quarry at S5 can be included into quarry areas and be rehabilitated afterwards. Visual buffer on the Jacobs Bay road should be curved to align with the topography and to allow a more effective north south critical biodiversity corridor. The road must be realigned along the edge of the quarry area and not cut through the buffer area. *(See Mitigation Map point 6 and 7).*

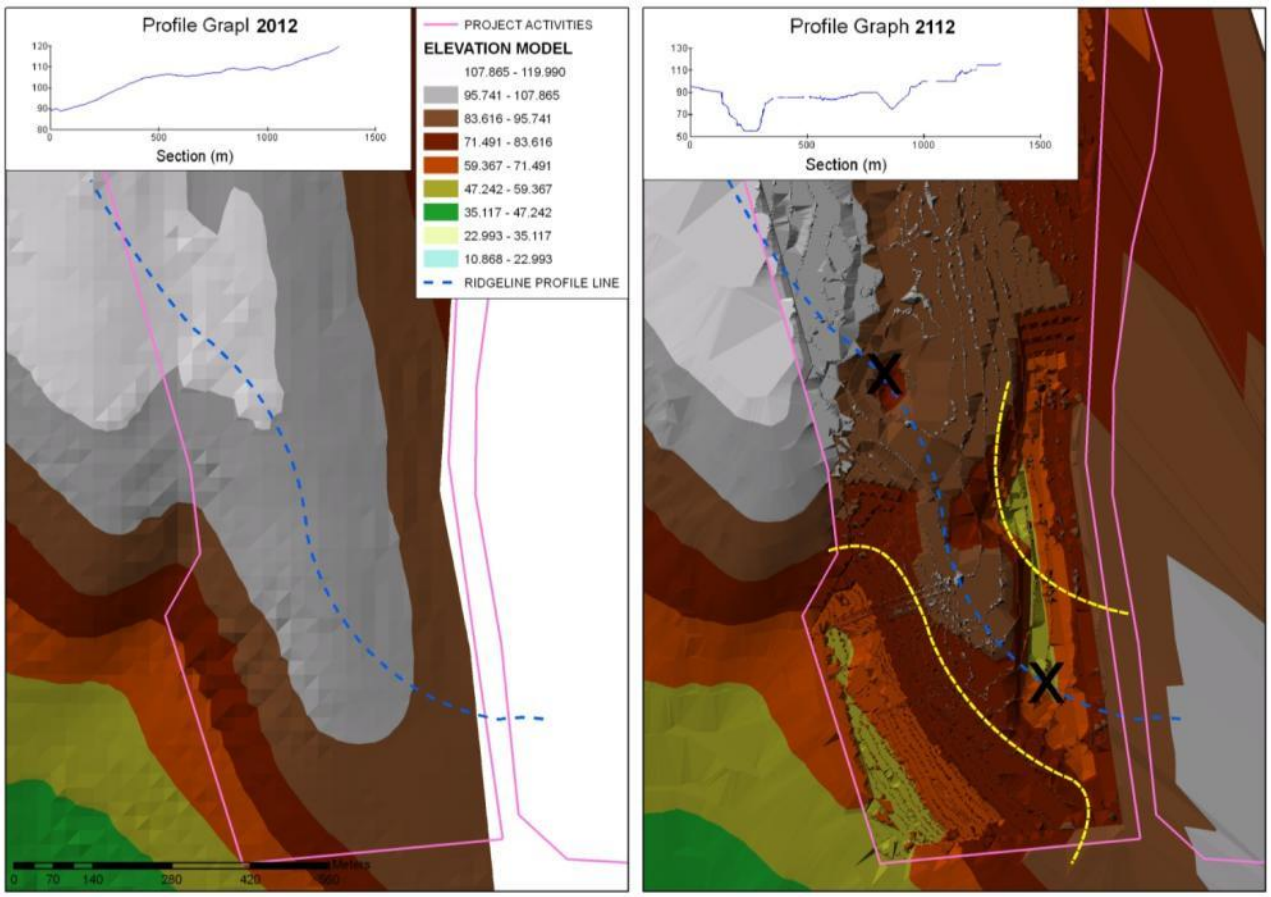


Figure 4: Skyline comparison Map

The proposed Holvlei clay quarry is located on top of a hill. Visual intrusion to surrounding low lying receptors could be limited reducing the southern extent of the quarry areas so that the bulk of the cutting of the quarry is located on the top of the hill. Quarry edges to be curved to align with the topography *(See Mitigation Map point 8).*

Due to the close proximity of the proposed mine to the town of Saldanha, the post mine landscape is important and can result in landscape sterilization if not adequately managed. It is recommended that areas closer to Saldanha Bay residential areas (south quarry) should not be rehabilitated to limestone fynbos but rather to public open space or sport facilities in the post mine land use that can

be incorporated into the town. Areas away from the urban edge (on top of the hill) need to be rehabilitated to limestone fynbos and be formally protected within a proclaimed conservation areas, in conjunction with the other surrounding critical biodiversity areas that remain. The proposed thin strip of the northern conservation area does not have any visual value in terms of defining CBA landscape character value as it is too narrow. It is recommended that adjacent areas to the west of the proposed thin strip is also incorporated into the critical biodiversity corridor as part of the biodiversity offset and total area provided with formal conservation status *(See Mitigation Map point 9).*

Even though the proposed mining does conform to the Saldanha SDF, the potential visual impacts are defined as having a ***high significance***. This is due to the size, scale and long time period associated with the proposed mining landscape modifications, as well as the loss of CBA vegetation. Should permissions for the mining be granted, it must be recognised that the area will be strongly associated with mining for a period of 100 years which would entrench the currently degraded landscape of the Western Saldanha areas. The mining could influence the 'west-coast' landscape character and sense of place of the Jacobsbaai area. The loss of the CBA limestone fynbos vegetation needs to be adequately offset in terms of DEA&DP guidelines. Due to the large areas which will be lost, this decision needs to be carefully considered as it could set a precedent for CBA offsets in the future. It is recommended that the mine plan be reviewed every twenty years.

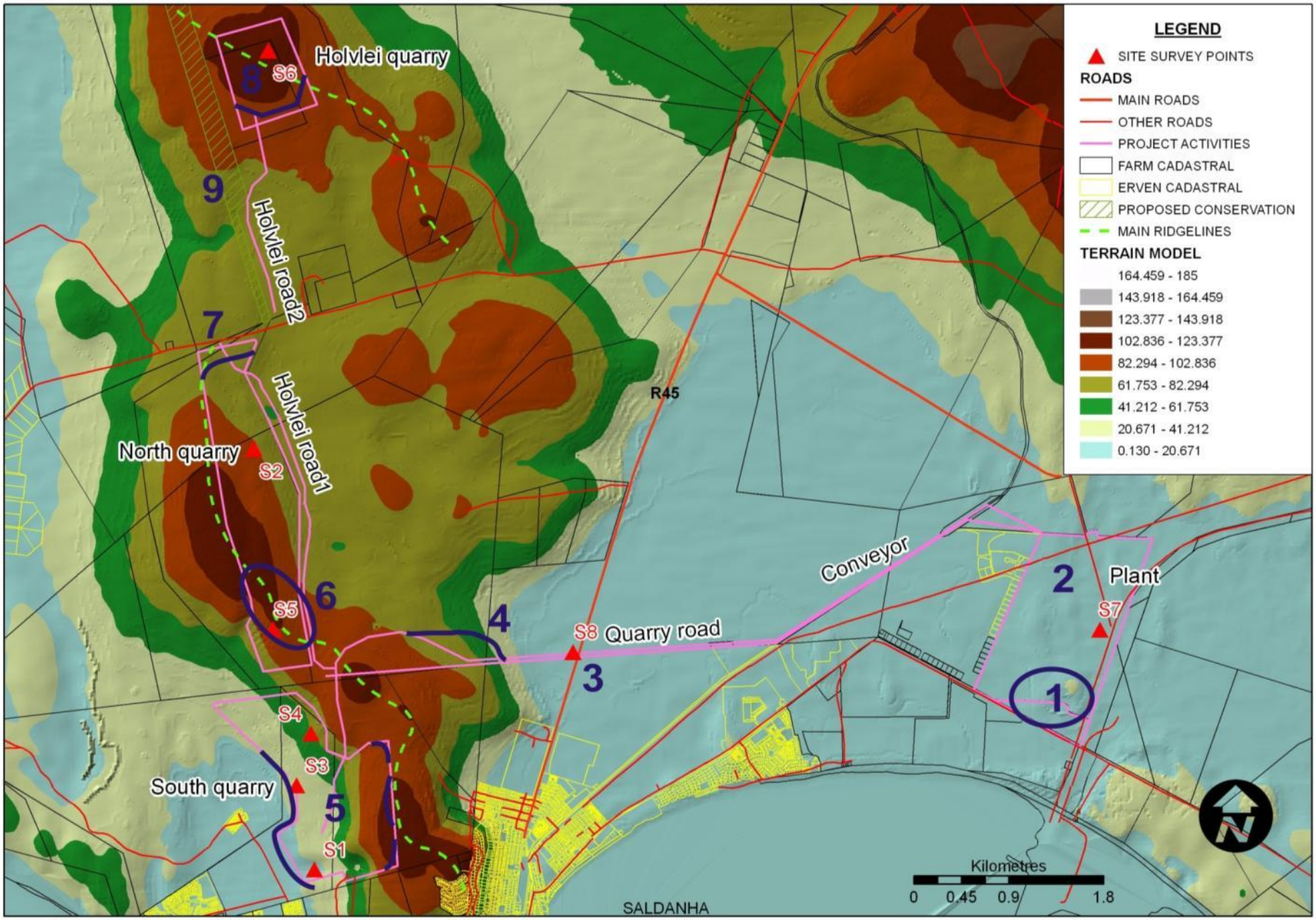


Figure 5: Mitigation Map

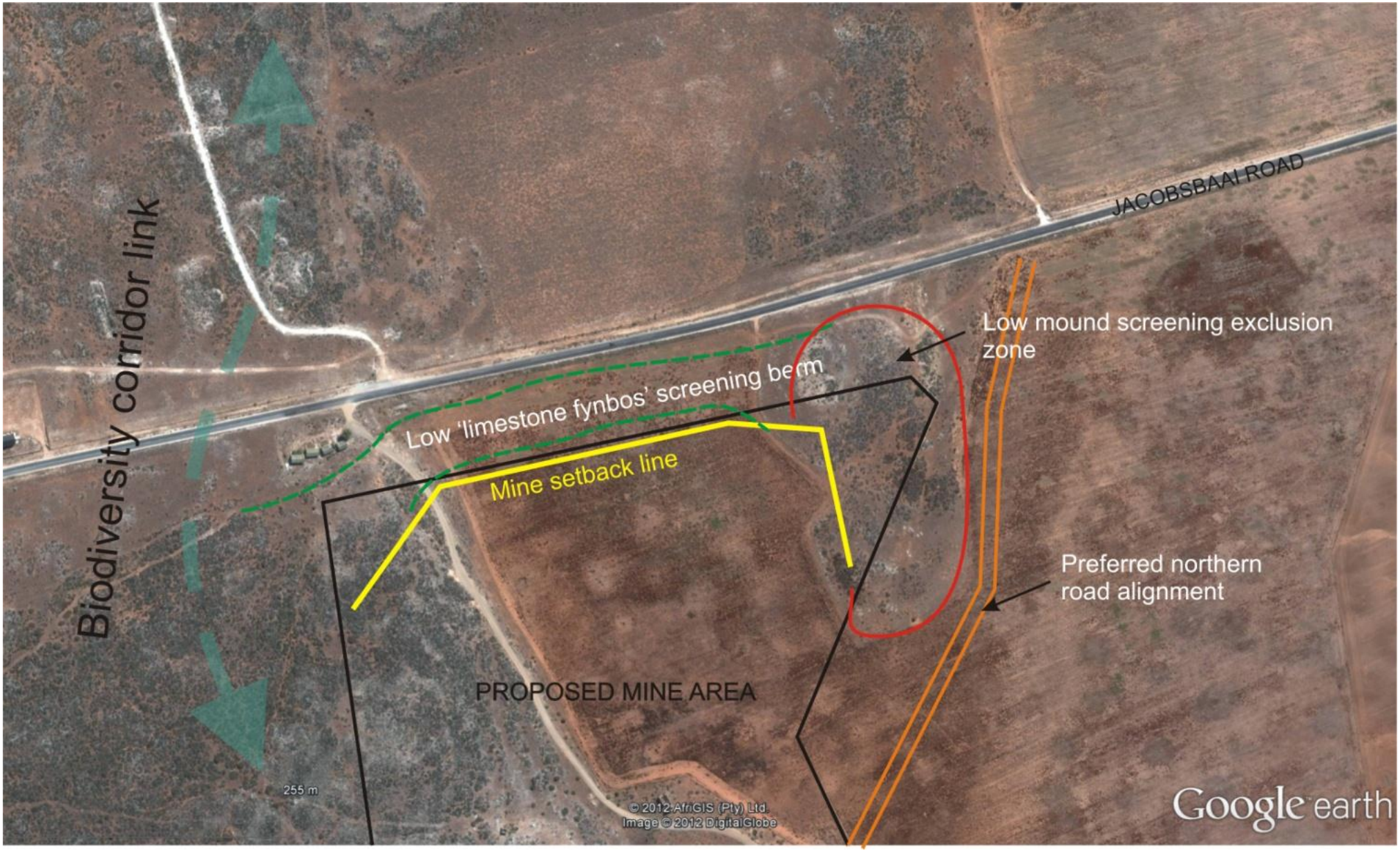


Figure 6: North Quarry Mitigation Map

DEA&DP VISUAL IMPACT CRITERIA

Regional Scenic Quality	**The inherent sensitivity of the landscape, which is usually determined by a combination of topography, land form, vegetation cover and settlement pattern** **High (H)** : highly visible and potentially sensitive areas in the landscape. **Moderate (M)** : moderately visible areas in the landscape. **Low (L)** : minimally visible areas in the landscape.
Moderate	The study area is typical of the West Coast terrain, with undulating plains which rise up to 114 m above sea level. These are within 3 to 5 km from the coast which creates an interesting landscape. The vegetation within the proposed project area does include Limestone Fynbos, which is defined as a Critical Biodiversity Area (CBA), and is a key feature in the landscape. The region is an important tourist destination, with the Langebaan estuary, the coastal belt and its related natural environment serving as the primary tourist attractions in the area. Saldanha town is strongly associated with existing limestone quarry activity, industry and harbour facilities, which generate lower scenic quality levels, higher levels of visual contrast and increase the visual absorption capacity of the study area to accommodate the proposed mining activities. As described above it is clear that the study area and region has a mixed tourist – industrial character. The existing Saldahna Bay SDF has allowed for mining in the proposed area, however, this is yet to be recognised by Province. Even though the surrounding areas have a *moderate* scenic quality due to existing industry, the critical biodiversity areas, which increase the overall scenic quality of the area, have to be recognised.

Extent	**Geographical area of influence** **Site Related (S)** : extending only as far as the activity **Local (L)** : limited to immediate surroundings **Regional (R)** : affecting a larger metropolitan or regional area **National (N)** : affecting large parts of the country **International (I)** : affecting areas across international boundaries
Regional	Due to the combined extent of the proposed activities, the viewshed is extensive. Except for the plant, the viewshed would mainly be contained within the foreground / mid ground distance zone. The viewshed of the more southern activities are more associated with the built environment of Saldanha which has a higher VAC level.

Visual Exposure	**Degree of exposure to receptors** **High (H)** : Dominant or clearly noticeable (<2 km) **Moderate (M)** : Recognisable to the viewer (2 – 6 km) **Low (L)** : Minimally visible areas in the landscape (>6 km)
High	Within the viewshed of the quarry activities are communities located in the 2 km high exposure area and, as such, the views of the proposed landscape modification will be dominant and clearly noticeable to the surrounding areas and communities.

Site Visual Absorption Capacity	**Potential of landscape to conceal** **High (H)** : effective screening **Moderate (M)** : partial screening **Low (L)** : little screening
Moderate to Low (Quarries) **Moderate to High** (Plant/ Southern 1 Quarry)	For all quarry sites surveyed, the ability of the landscape to absorb the visual contrast that would be generated by the proposed landscape modifications is low or moderate to low, with the exception of the Southern 1 quarry due to its close proximity to the existing Prospect Hill quarry site. The industrial nature of the area and zoning of the cement plant's proposed location, has moderate to high visual absorption capacity due to the adjacent factory and the Saldanha Steel Mill which generate high levels of visual contrast during the day and night.

Site Scenic Quality	**The inherent sensitivity of the landscape, which is usually determined by a combination of topography, land form, vegetation cover and settlement pattern** **High (H)** : highly visible and potentially sensitive areas in the landscape. **Moderate (M)** : moderately visible areas in the landscape. **Low (L)** : minimally visible areas in the landscape.
High (Northern Quarry) **Moderate to High** (Southern Quarries) **Low** (Plant)	Located in Limestone Fynbos which is valued as critical biodiversity vegetation and surrounded by agricultural landscapes, the site for the northern quarries has the highest scenic quality as the context is not associated with the urban settlement of Saldanha. The other quarries are all to some extent associated with existing (historic) limestone quarry modification which does detract from their scenic value to some degree, resulting in moderate to high levels of scenic quality. The southern quarry is in close proximity to the developed context of Saldanha, as well as the existing Prospect Hill quarry where the scenic quality is low. The scenic quality of the area where the cement plant is proposed is also low due to the industrial landscape character of the site and surrounds.

Visual Sensitivity of Receptors	**The level of visual impact considered acceptable by the visual receptors is dependent on the type of receptor** **High (H)** : e.g. residential areas, nature reserves and scenic routes or trails **Moderate (M)** : e.g. sporting or recreational areas, or places of work **Low (L)** : e.g. industrial, mining or degraded areas
High (Northern Quarry) **Moderate** (Southern Quarry) **Low** (Plant)	The visual sensitivity of receptors to the landscape modifications relates to the scenic quality except for the proposed northern quarry, which is located on the skyline and will be partially visible from Jacobs Bay which increases the receptor sensitivity to this landscape modification. The northern quarry, located in CBA fynbos, is also clearly visible from the Jacobs Bay access road which is associated with tourism related to the Jacobs Bay coastal area, and is rated as high. The southern quarries are strongly associated with the developed nature of Saldanha but would have moderate receptor sensitivities due to high levels of exposure, which could impact the sense of place should dust mitigation not be effectively implemented. The industrial zoning for the area where the plant is proposed, as well as the existing strong industrial context generated by the Saldanha Steel Mill and harbour, would reduce the visual sensitivity of receptors to a similar landscape modification in this area.

Visual Intrusion	**Congruence of the project with the particular qualities of the area, or its 'sense of place'** **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
Moderate to High (Quarry) **Moderate** (Plant)	Overall visual intrusion would be moderate to high for the quarries and transportation options, and moderate for the plant.

Visual Significance	**A synthesis of nature, duration, intensity, extent and probability** **Low (L)** : will not have an influence on the decision. **Moderate (M)** : should have an influence on the decision unless it is mitigated. **High (H)** : would influence the decision regardless of any possible mitigation.
High	When taking the severity and significance of all impacts from the elements of the proposed intervention into consideration the anticipated visual impact should influence on decision regardless of the proposed mitigation measures. Even though the proposed mining does align with the Saldanha SDF, the visual impacts were defined as having a high significance. This is due to the size, scale and long time period associated with the proposed mining landscape modifications as well as the loss in CBA vegetation. Should permissions for the mining be granted, it must be recognised that the area will be strongly associated with mining which would entrench the currently degraded landscape of the Western Saldanha areas, and could influence the 'west-coast' landscape character and sense of place of the Jacobsbaai area. The loss of the CBA limestone fynbos vegetation needs to be adequately offset in terms of DEA&DP guidelines. Due to the large areas which will be lost, this needs to be carefully considered as it could set a precedent for

	offsets in the future.

2. SUMMARY OF VISUAL IMPACT ASSESSMENT METHODOLOGY

The process that VRM Africa follows when undertaking a Visual Impact Assessment (VIA), is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method in that the study compares the contrast of the proposed project modifications to the landscape, measured in the form, line, texture and colour, against the same elements found in the existing natural landscape. The International Finance Corporation (IFC) prescribes eight performance standards (PS) for environmental and social sustainability. The first is to identify and evaluate environmental and social risks and impacts of a project, as well as to avoid, minimise or compensate for any such impacts. This is the essence of all visual impact assessment fields.

Even though VRMA uses a documented methodology, it is important to remember that a VIA differs from most other fields of impact assessment in that, besides the unavoidable subjective human element innate to the assessment practitioner, common to all fields, the assessment subject in VIA is in itself a result of human perception. The visual experience is not limited to the visual senses, but is a multisensory emotional involvement experienced by people when they perceive a specific scene, landmark, landscape, etc. However, objectivity and consistency is greatly increased by using standard assessment criteria such as that utilised by VRMA.

This emotional enrichment that people experience is a non-material benefit that people obtain from cultural ecosystems services, as described by The Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis report: *"Cultural ecosystems services: the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences."*

The above includes the following, amongst others:

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising;
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations;
- Sense of place: Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem;
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

One of the objectives of IFC Performance Standard 6 is to maintain the benefits from ecosystem services. Ecosystem services are organised into four types, with visual/aesthetic benefits falling into the category of cultural services, the nonmaterial benefits people obtain from ecosystems. The VIA method used by VRMA aims to protect the integrity of the landscape character that a proposed project will impact on, in order to sustain visual resources for future benefit to, and utilisation by, people. This resonates with IFC Performance Standard 8 that recognises the importance of cultural heritage for current and future generations. Its objective is to protect cultural heritage from adverse impacts of project activities and promote equitable sharing of benefits gained from the use thereof.

VRM Africa's methodology of assessing potential impacts on the visual resources of an area earmarked for a proposed development, and recommending avoidance/mitigation/compensation measures, meets the three IFC Performance Standards applicable to the field of visual assessment, i.e. PS 1, PS 6 and PS8. Below follows a brief summary of this assessment method.

The first step in the VIA process is determining the existing landscape context. A regional landscape survey is undertaken, which identifies defining landscape features that surround the site of a proposed development, and sets the scene for the VIA process to follow. These features, also referred to as visual issues, are assessed for their scenic quality/worth. This report also assesses to

what degree people who make use of these locations (e.g. a nearby holiday resort, residential area) would be sensitive to change(s) in their views, brought about by a proposed project (e.g. a mine).

These people are referred to as receptors and are identified early on in the VIA process. Only those sensitive receptors who qualify as Key Observation Points (KOPs) by applying certain criteria, are used to measure the amount of contrast that would be generated by the changes caused by the project activities, against the existing landscape (the visual impact).

The landscape character of the proposed project site is then surveyed to identify areas of similar land use and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape's integrity. This can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be "absorbed" or "disappear", into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method, which is then represented in a visual sensitivity map.

Proximity to surrounding receptors is evaluated in terms of distance buffers (foreground up to 6 km, background from 6 to 24 km, and seldom seen due to no receptors) and viewshed maps are generated that indicate the overall areas where the project activities would be visible, and shows in which distance buffers receptors fall.

The proposed project activities are then finally assessed from the KOPs around the site to see whether the visual objectives (VRM Classes) defined for the site are met. This is measured in terms of the potential change to the site's visual elements of form, line, colour and texture, as a result of the proposed project (i.e., are the expected changes within acceptable parameters to ensure that the visual character of the landscape is kept intact and, if not, what can be done by the project to ensure that it is). Photo montages are generated to represent the expected change in the views, as seen from each KOP and, if Class objectives are not met, to also show how proposed mitigation measures could improve the same views.

Using the impact assessment method provided by the environmental consultant, each project activity is assessed for its visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors on whether the proposed activities meet the recommended visual objectives defined to protect the landscape character of the area. Recommendations are made and mitigations are provided.

For this report VRM Africa used the Specialist Impact Methodology supplied by Aurecon South Africa. This Risk Assessment system assesses the significance of the potential environmental impacts of the proposed development, outlined as follows: For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) are described. These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place.

Refer to Annexure 2 for a detailed description of the applied Visual Impact Assessment and Aurecon Specialist Impact Assessment methodology.

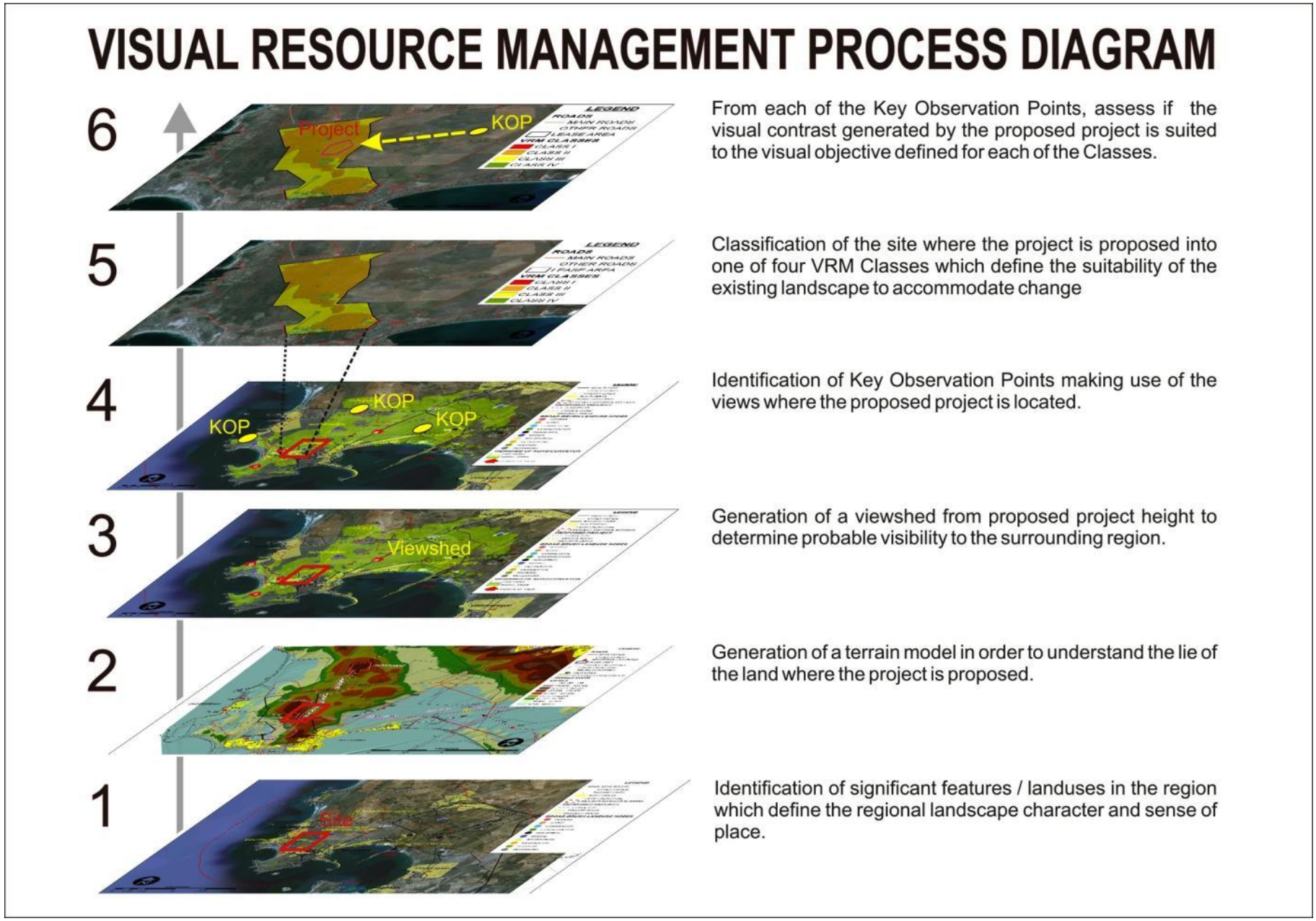


Figure 7: VRM Process Diagram

3. INTRODUCTION

VRM Africa was appointed by Aurecon South Africa (Pty) Ltd to undertake a Visual Impact Assessment for the proposed AfriSam cement plant, mine and associated infrastructure in Saldanha Bay. The Saldanha Bay Municipality is located approximately 140 km from Cape Town on the western coastline of the West Coast District Municipality in the Western Cape Province. The locality map below depicts the proposed project in relation to Cape Town and the towns of Saldanha Bay and Vredenburg.

Figure 8: Regional Locality Map

TERMS OF REFERENCE

- The scope of the study is to cover the entire affected project area: This includes the full site extent, and where potential impacts may occur beyond the site boundaries, such as cumulative impacts.
- Secondary Data Collection and Review: Collate and analyse all available secondary data relevant to the affected project area.
- Prepare and undertake a site visit and compile a brief field report.
- Environmental Impact Assessment (EIA) Specialist Report: Prepare and submit an electronic draft report that describes the baseline of the affected project area, includes a sensitivity analysis which describes any risks posed by the project, as well as an impact assessment for the proposed project with possible mitigation measures. This report should include viewsheds for initial and final layouts, and photomontages for the final layout, if necessary. Prepare and submit an electronic final report, following comments from the client on the draft report.
- Cumulative Effects: These must be considered in all reports.
- Specific attention will be given to the following:
    - Quantifying and assessing the existing scenic resources/visual characteristics on, and around, the proposed site.
    - Evaluating and classifying the landscape in terms of its sensitivity to a changing land use.
    - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.

- Determining visual issues, including those identified in the public participation process.
- Reviewing the legal framework that may have implications for visual/scenic resources.
- Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project.
- Identifying possible mitigation measures to reduce negative visual impacts, for inclusion into the project design, including input into the Environmental Management Plan (EMP).

Limitations and Assumptions

- This report is limited to the assessment of the visual impact of the proposed AfriSamCement Plant, Limestone and Clay Quarries and associated infrastructure only.
- Assessment based on information provided for the time period 2012 – 2042 has a high confidence level. Certainty is reduced as time periods increase and the existing time frame until 2112 limits the predictability for assumptions and therefore has a decreased confidence level.
- The landscape characterisation findings from the Alpha Saldanha Cement Project Aesthetics Assessment (August 1997) by Newtown Landscape Architects were studied for this document. (Young 1997)
- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of Google Earth Pro for mapping is licensed for use in this document.
- The visibility analysis and 3D computer model is based on terrain information from:
  - Two metre contours data provided by the client
  - South African Provincial Survey General data.
- Reference has been made to the Western Cape Department of Environmental Affairs and Development Planning's "*Guideline for involving visual and aesthetic specialists in EIA processes"*. (Oberholzer, B., 2005).
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure (Lange 1994). The project deliverables, including electronic copies of reports, maps, data, shape files and photographs are based on the author's professional knowledge, as well as available information. The study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if, and when, new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

In terms of best practice, the following guidelines were used to measure adherence to best practice:

- Internationally, the U.K Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Landscape and Visual Impact Assessment'; and
- from a Southern African perspective, the 'Guideline for Involving Visual and Aesthetic Specialists in EIA Processes generated by South Africa's Provincial Government of the Western Cape Department of Environmental Affairs and Development Planning'.

'Principles that influences (development) within a receiving environment include the following:

- The need to maintain the overall integrity (or intactness) of the particular landscape or townscape;
- The need to preserve the special character or 'sense of place' of a particular area; and
- The need to minimize visual intrusion or obstruction of views within a particular area.' (Oberholzer, B., 2005).

4. REGIONAL LANDSCAPE CONTEXT

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, land form, soils, vegetation, land use and human settlement.' It creates the specific sense of place or essential character and 'spirit of the place'. (Spon Press, 2002). The first step in the VIA process is determining the existing landscape context of the region and the sites where the project is proposed.

AfriSam began acquiring limestone mining rights together with a suitable factory site in the Saldanha area in the early 1970s, through its subsidiary company, National Portland Cement. Legislation on mining rights is currently such that AfriSam will forfeit these rights within the next few years if the limestone is not utilised once all the timing extension possibilities have been exhausted. AfriSam has indicated that the 'South African Cement market landscape is changing significantly over the next couple of years and it is therefore becoming imperative to ensure that current market share is maintained and not lost to new competitors. By installing the mill at Saldanha, and later a kiln, the company will be able to make use of the current limestone deposits located at Saldanha. If this is not done, a competitor could apply to make use of these rights and this could result in a loss in the market share of the company.' (Afrisam Feasibility Study 2010)

The site of the proposed project is located approximately 140 km north of Cape Town in the town of Saldanha Bay. Saldanha is a multi-functional town, comprising of fishing and related industrial activities, tourism, the port, the military base and the steel industry. (Saldanha SDF 2011)

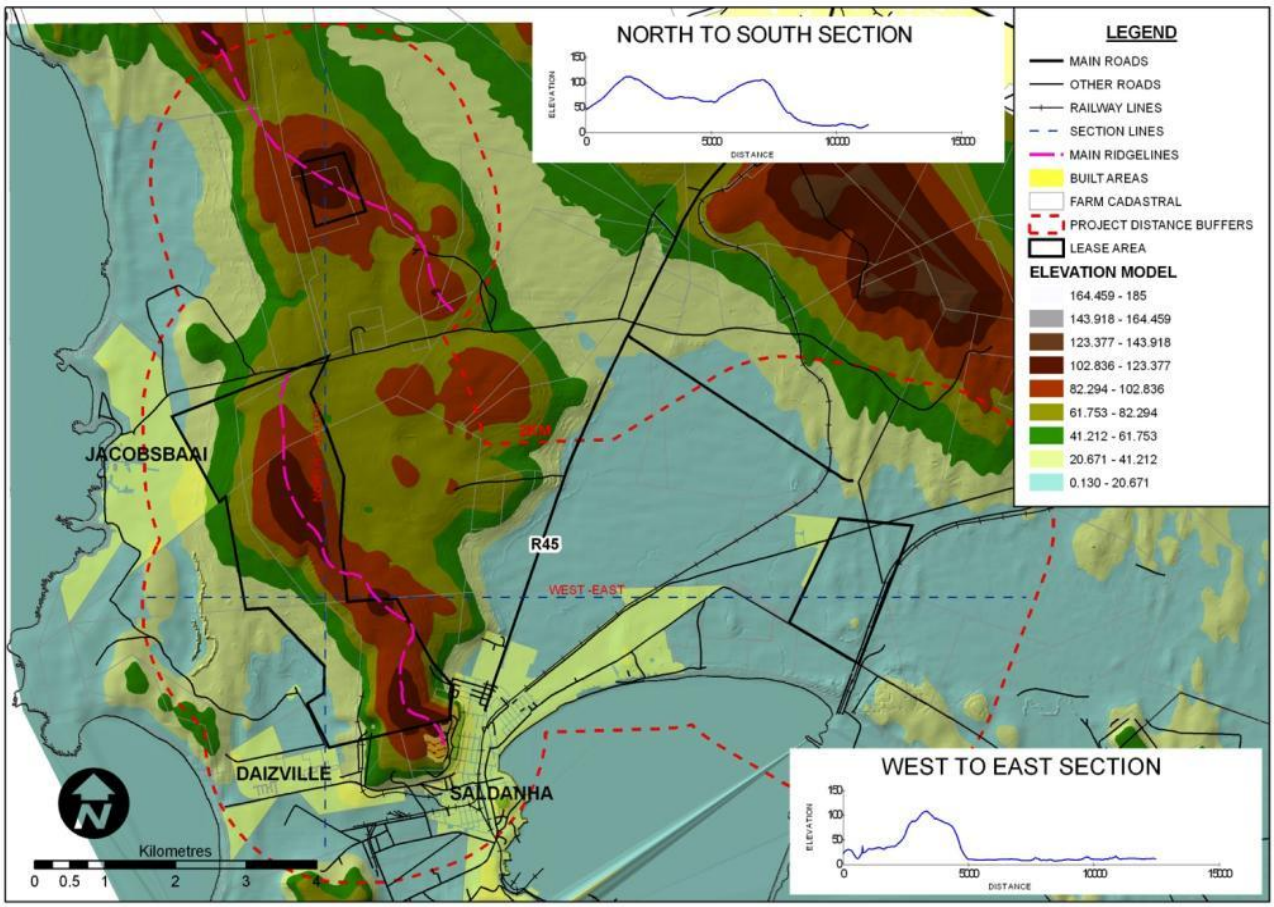


Figure 9: Preliminary Site ***Broad Brush*** Elevation Model Map (pending detailed contour survey)

The topography of the greater area around the site is characteristically a West Coast rolling landscape and is comprised of the following topographical features:

- The western parts of the Saldanha Bay Municipal area is characterised by granite outcrops and koppies.

- The geology is divided into Sandveld and Cape granite groups. Within the Sandveld group are a Witzand formation made up of unconsolidated white sand with shells and pebbles, locally along the beach and Langebaan formation made up of limestone and calcrete, partially cross-bedded, calcified dune sand. The Cape Granite group includes the Langebaan formation which is made up of mainly coarse-grained porphyritic granite with quartz porphyry. (Source: AfriSam Saldanha: Groundwater Study SRK Consulting Engineers and Scientists)
- Regionally there are small rolling hills aligned north-south, ranging between 3 and 5 km from the coast.
- Most residential areas are lower-lying, with an exception of a few areas in Saldanha.
- J acobs Bay faces predominantly west, away from the site.
- T he town of Saldanha faces predominantly south-east, away from the site.
- D iazville lies in a shallow valley and faces towards the southern limestone quarry.

Three field studies were undertaken on 24 March2011, 18 March 2012 and 11 July 2012 to identify important visual features, or issues, in the greater area surrounding the site, as well as on the site itself.

A broad brush regional landscape survey was undertaken, which identified core features in the surrounding area that define the landscape context and sets the scene for the VIA process to follow. During the field study, eight significant landscapes issues were defined in the context of both the site and the surrounding areas. The significant surrounding landscape issues associated with the proposed site were identified during the field survey and are listed and mapped below:

- Access Routes
- Nature and Conservation
- Agriculture
- Commercial
- Industrial
- Mining
- Recreation and Tourism
- Residential

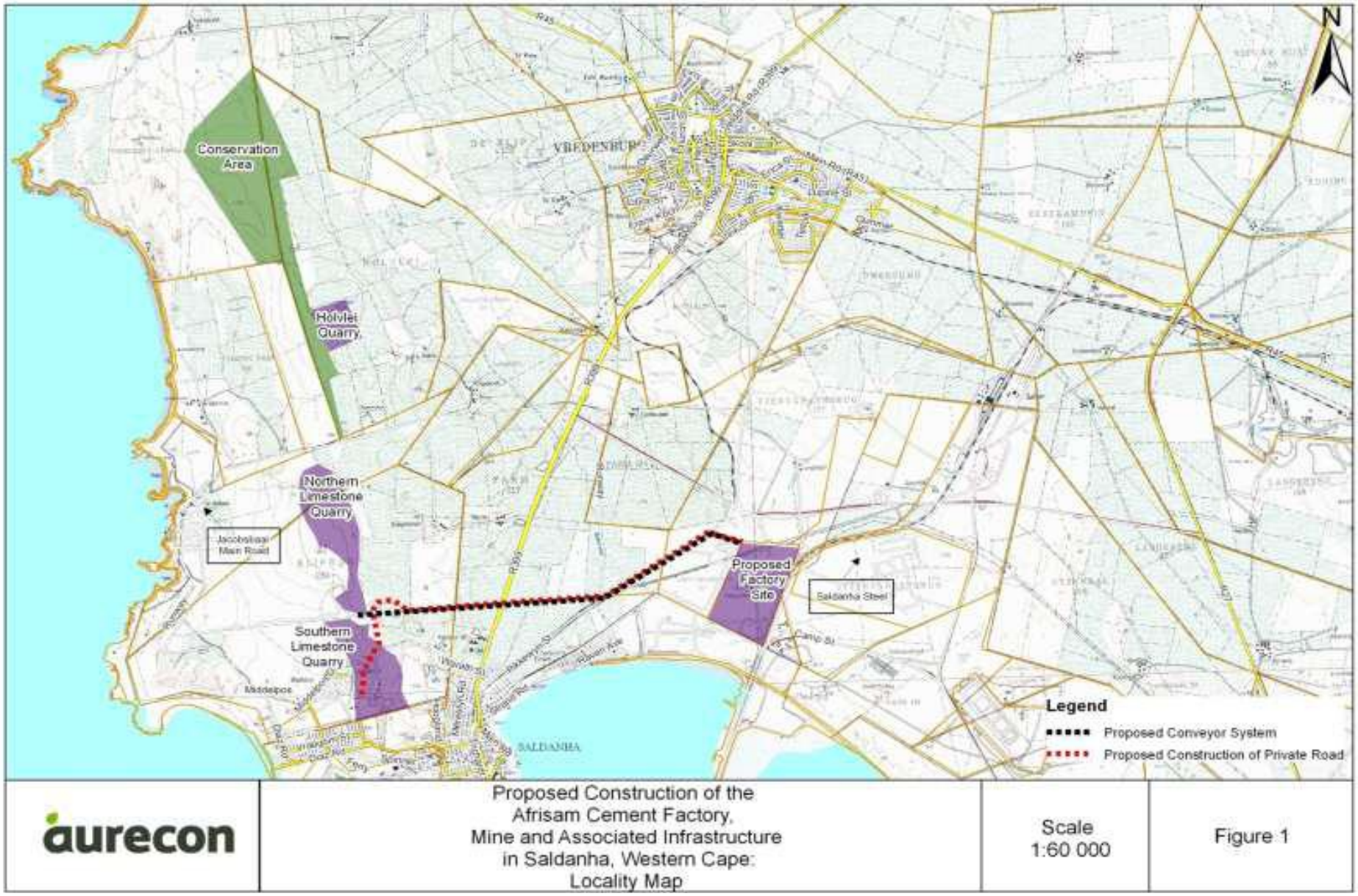


Figure 10: Aurecon map of proposed project areas overlaid onto topographical Map

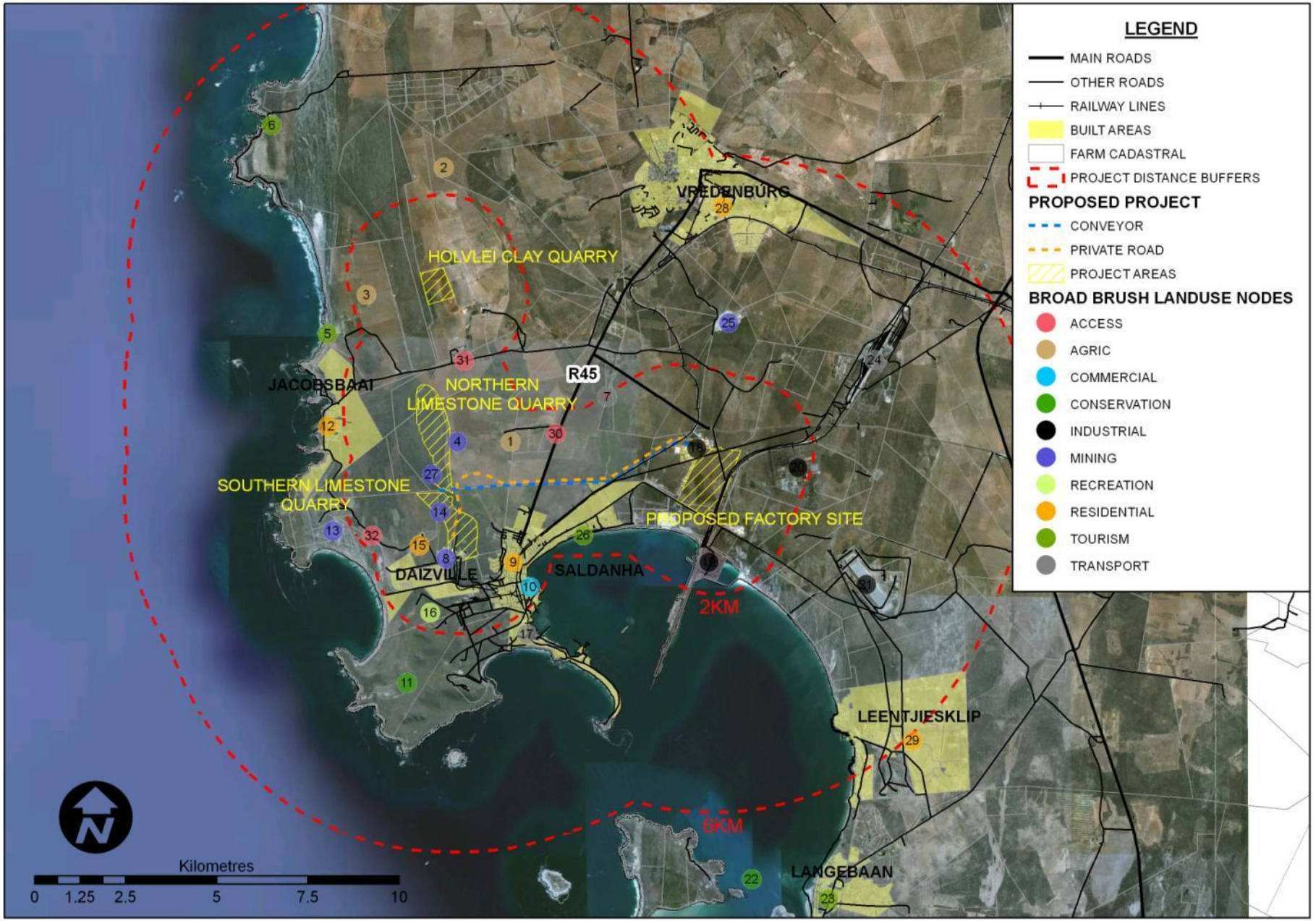


Figure 11: Significant landscape context survey points overlaid onto Google Earth Terrain Map

Access Routes and Tourist View Corridors

Photograph 1: Photograph of view corridor, access road to Jacobs Bay

Photograph 2: Photograph of R399 view corridor, access to Saldahna Bay

The R27 road runs north-south through the Municipal Area and divides the study area into an eastern and western portion. The R45 road that runs from Paternoster to Hopefield divides the study area into a northern and southern portion. These two roads are the most significant roads in the area, while other roads in the area distribute movement throughout the study area. (AfriSam South Africa Saldanha Project Feasibility Study. December 2010)

Nature and Conservation

Photograph 3: Photograph of Limestone Fynbos

The study area is typical of the West Coast terrain with undulating plains which rise from sea level to form low hills within 3 to 5 km from the coast. The natural vegetation is mostly Strandveld. The Langebaan Lagoon to the south of the sites is a Ramsar site. (Young, G. 1997)

The data used in the vegetation map, as seen in Figure 24, originates from the C.A.P.E. Fine-scale Biodiversity Planning Project (Pence, G. 2008).This data highlights Critical Biodiversity Areas (CBAs),

which are environmental assets and need to be protected. They are also a tourism attraction for the area. In areas designated as CBAs, further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of special biodiversity features. (Saldahna Bay SDF. 2011)

Sites are identified as Critical Biodiversity Areas through the systematic assessment conducted by the C.A.P.E. Fine-Scale Biodiversity Planning (FSP) project. Taken as a whole, these represent the sites required to meet biodiversity pattern targets and ecological process objectives. Thus it is recommended that the sites be managed in a manner compatible with biodiversity conservation, and ultimately remain in, or be restored to, a natural state. (Pence, G. 2008)

Photograph 4: Example of Saldanha Limestone Strandveld (Maree, K.S. and Vromans, D.C. 2010)

Agriculture:

Photograph 5: Photograph of cultivated agricultural fields

Photograph 6: View of Saldanha olive tree orchard (Source: www.panoramio.com/Oompie/55691344)

The dominant land use is agricultural, primarily pastures and cultivated wheat fields. Most of the land use within the viewsheds of the proposed project is agricultural. Agriculture consists mainly of wheat, sheep and wine farming, which are important in terms of both the geographic product, as well as employment. Approximately 16% of employment in the Saldanha Bay district is in agriculture.

Commercial / Harbour

Photograph 7: Photograph of Saldahna Bay harbour

'Saldanha Bay is the largest contributor to the West Coast District Municipality's economic output, relying mainly on secondary activities such as processing and transport. Major commercial sectors include manufacturing, transport and communications, wholesale, retail and tourism, and finance and business service.'(Source: www.tradeinvestsa.co.za)

Industrial

Photograph 8: Photograph of Saldahna Steel factory showing industrial sense of place

Surrounding the proposed plant site are existing heavy industries such as Saldanha Steel and Kumba Iron Ore.The most significant and unique comparative economic advantage of the Saldanha Bay Municipality is its deep water port facility and related industrial complex. The Saldanha port has a number of intensive development initiatives such as the development of Saldanha Port for 'bulk exports', the Saldanha-Sishen railway connection and the development of Saldanha Steel as a world-class "green" steel mill. (Saldanha Bay SDF. 2011)

Mining

Photograph 9: Photograph of existing mining activities located at the south of the proposed site

The area has existing limestone, sand and clay quarries. Not all potential mineral resources have been identified in the area and this could lead to ad hoc applications for mining permits in the area. The adverse impacts of these mining activities on environmentally sensitive and urban areas should be mitigated. (Saldanha Bay SDF. 2011) Planning for the area has allowed for mining in the area however this is yet to be recognised by Province.

Recreation and Tourism

Photograph 10: Photograph of Mykonos Resort

Photograph 11: Photograph of Langebaan (www.panoramio.com/ Chris974/ 12166868)

Although tourism is currently secondary to the role of Saldanha as a growing industrial port, it should not be overlooked considering that the town of Saldanha has a unique waterfront, as well as a working harbour area which have the potential, if correctly developed, to drive the growth of the town's tourism industry. The coastal belt and its related natural environment is the primary tourist attraction in the area. Protecting the natural beauty and resources of the study area should be a priority to the local community and is essential in ensuring the sustained growth of the local tourism industry. It is anticipated that the tourism industry in the study area may grow by more than 50% over the next 10 years (Saldanha Bay SDF. 2011).

Residential

Photograph 12: View of Saldahna residential area

Photograph 13: Photograph from Saldahna showing residential areas and rolling hills

The Saldanha Bay Municipal area offers a range of residential options for high and middle income households. Some of the local towns, such as Langebaan, St. Helena Bay and Paternoster, are becoming increasingly popular as retirement towns, where it can be expected that more middle and higher income residential opportunities may have to be provided in these areas. There is also the need for subsidised housing, such as the area north of Diazville which will be directly adjacent to the southern limestone quarry.

4.1 Regional landscape context findings

Regional Scenic Quality	The inherent sensitivity of the landscape, which is usually determined by a combination of topography, land form, vegetation cover and settlement pattern **High (H)** : highly visible and potentially sensitive areas in the landscape. **Moderate (M)** : moderately visible areas in the landscape. **Low (L)** : minimally visible areas in the landscape.
Moderate	The study area is typical of the West Coast terrain, with undulating plains which rise up to 114 m above sea level. These are within 3 to 5 km from the coast which creates an interesting landscape. The vegetation within the proposed project area does include Limestone Fynbos, which is defined as a Critical Biodiversity Area (CBA), and is a key feature in the landscape. The region is an important tourist destination, with the Langebaan estuary, the coastal belt and its related natural environment serving as the primary tourist attractions in the area. Saldanha town is strongly associated with existing limestone quarry activity, industry and harbour facilities, which generate lower scenic quality levels, higher levels of visual contrast and increase the visual absorption capacity of the study area to accommodate the proposed mining activities. As described above it is clear that the study area and region has a mixed tourist – industrial character. The existing Saldahna Bay SDF has allowed for mining in the proposed area, however, this is yet to be recognised by Province. Even though the surrounding areas have a *moderate* scenic quality due to existing industry, the critical biodiversity areas, which increase the overall scenic quality of the area, have to be recognised.

5. PROJECT DESCRIPTION

AfriSam (South Africa) (Pty) Ltd (hereafter referred to as AfriSam) proposes to construct a cement plant and associated infrastructure in the Saldanha region, with the purpose of re-entering the cement market in the Western Cape. The proposed project includes the mining of limestone and clay, which would then be transported to the cement plant by road or conveyor. The rationale for Afrisam's proposal to construct a cement plant at Saldanha is based on three principal considerations:

- Lack of market penetration in the Western Cape;
- The location of suitable limestone reserves at Saldanha; and
- The proximity to an export port.

5.1 Planning Policy Saldahna Bay Spatial Development Framework (Feb 2010) Key Findings

- Some mining activities impact negatively on the pristine natural environment of the municipal area, or are in close proximity to urban areas. 'Several extractive industrial activities are established in the municipal area. These activities include, amongst others, mining of construction materials such as lime scales and sand mining. Many of the mining operations are currently located in relative close proximity to the Saldanha and Langebaan areas. The adverse impacts of these mining activities on environmentally sensitive and urban areas should be mitigated. Not all potential mineral resources have been identified in the area and this can lead to ad hoc applications for mining permits in the area.'
- **'Critical biodiversity areas** (CBA) are environmental assets and need to be protected. They are also a tourism attraction for the area. In areas designated as CBA, further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of special biodiversity features.
- Place-specific character should not be neglected as the tourism industry is expected to grow, which re-emphasises the need for the specific character of the tourism areas to be retained.'
- The Saldanha SDF notes that the series of hills north of Saldanha define edges within the Municipal area. The initial limestone quarry areas are located on the said ridgeline. The DEA&DP Guideline for the Management of Development on Mountains, Hills and Ridgelines states that 'Development on the crest of a mountain, hill or ridge will be strongly discouraged.'
- The main tourism areas identified on the Saldanha SDF tourism plan need to be incorporated into the land use and receptor sensitivity assessment.'
- These proposed quarries are located in designated **critical biodiversity areas** (CBA). However, these areas have also been identified in the Saldanha SDF as being suitable for extraction of limestone. Provincial planning clarity needs to be established in order to provide a point of departure for the development of the Northern and Southern limestone quarries.
  See Appendix for further details on Planning Policies.

The objective of this section of the VIA is to describe the character of the project activities and to define the extent to which it will be visible to the surrounding areas. The extent of the visibility of the project can be seen in the viewshed maps on the following pages.

The proposed project comprises of the following activities, as identified in the following maps:

- Southern Limestone Quarry
- Northern Limestone Quarry
- Holvlei Clay Quarry
- The construction of a cement plant located at Saldanha (near the ore loading terminal, adjacent to Saldanha Steel) which consists of:
  - Grinding and packing facility, and
  - Clinker manufacturing plant.
- Transport corridor linking the quarries to the plant, with private road or conveyor system with conveyor bridge or underground pass options to cross roads.
- Lights at night
- Cumulative impacts

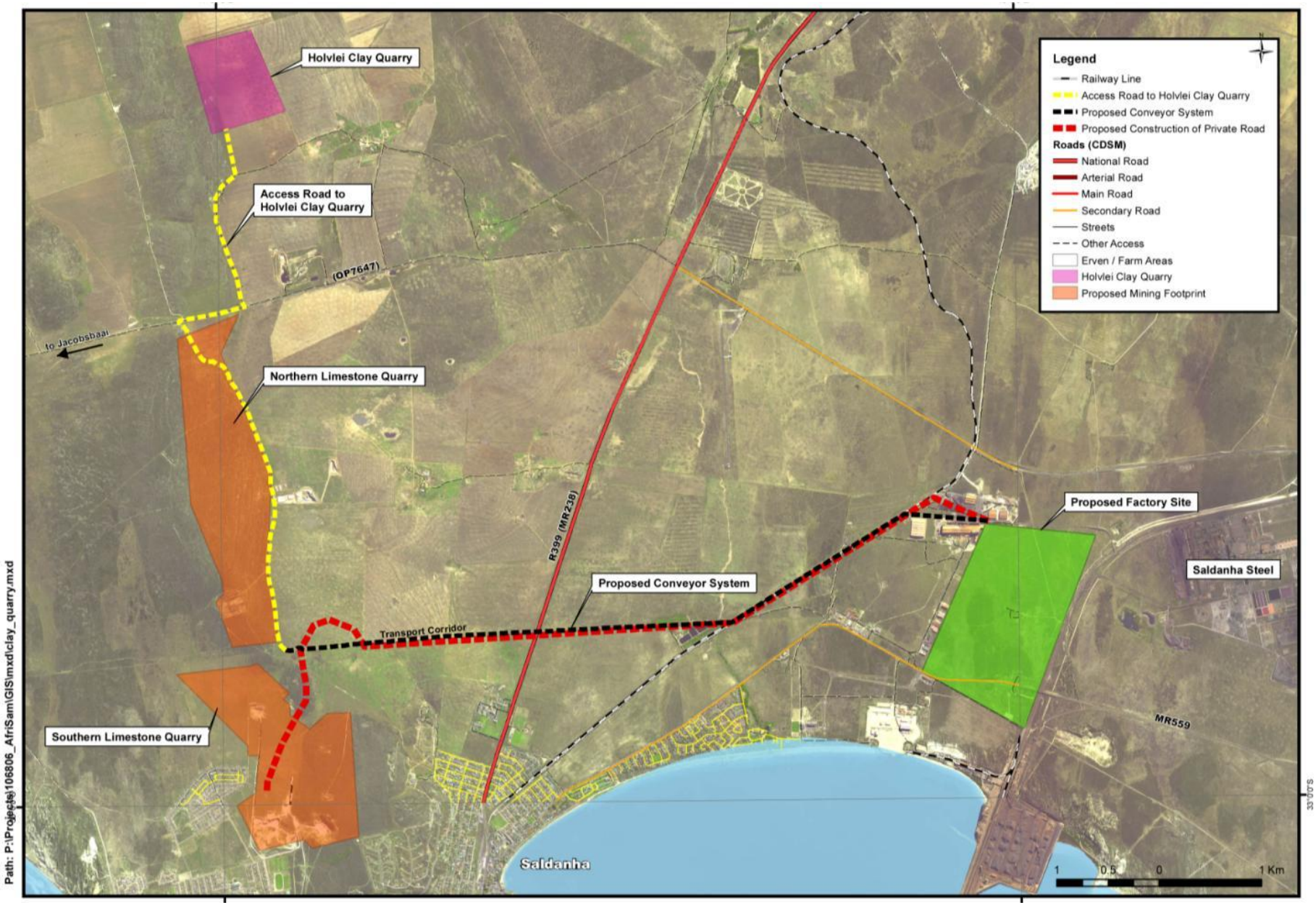


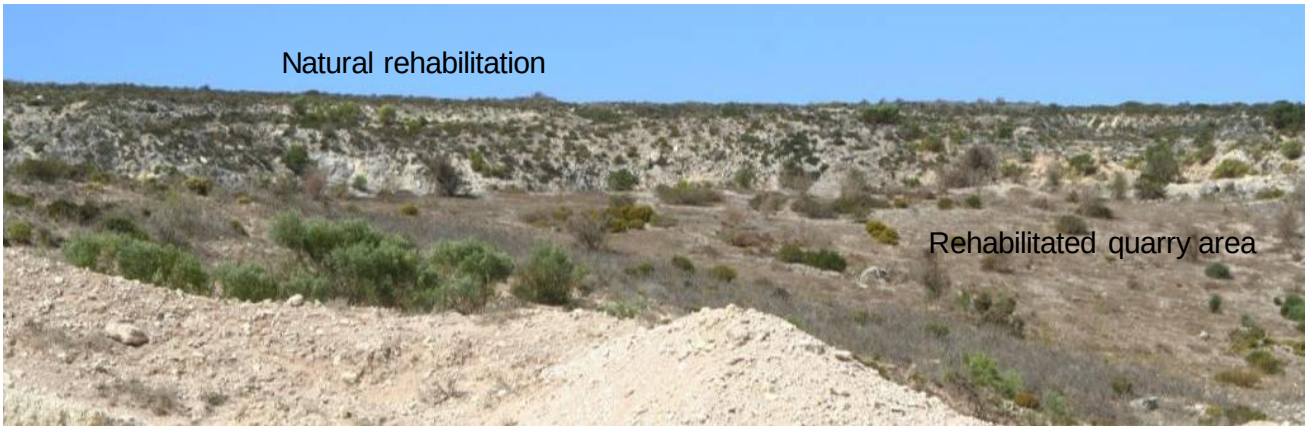
Figure 12: Location map of proposed Afrisam project

Figure 13: Proposed Saldanha Cement Plant Plan

5.2 Limestone Quarries

The AfriSam South Africa Saldanha Project Feasibility Study states that limestone at Saldanha is to a large extent, loosely consolidated and free-digging, by means of excavators or front-end loaders will be used. Where the limestone formation becomes too hard, conventional drilling and blasting will be resorted to. Both single and multi-bench mining will be employed in various sections of the south quarry (AfriSam Saldanha Project Feasibility Study. 2010).The excavated limestone is light in colour, ranging in tone from very light to dark, mostly in horizontal bands, creating horizontal, linear elements. Matt surfaces range from smooth to finely textured. The photographs below show an example of existing mining activities, depicting typical scenes associated with the extraction of limestone.

Photograph 14: Existing Prospect Hill limestone quarry



Photograph 15: Photograph of the Prospect Hill Quarry workings with natural rehabilitation (Source: Afrisam)

Photograph 16: Photograph of existing benching in Ulco limestone quarry (Source: Afrisam)

5.3 Phases of Construction and 3D Drawings

The proposed project would be undertaken in two phases. The approximate timing of the proposed operational phases is as follows:

- Phase 1: 2014 - 2021
- Phase 2: 2022 - 2112

Please note that the timeframe for the proposed mining activities would vary, based on market demand. The suggested timing is a guideline, based on the approximate volumes of limestone present in the area. (Aurecon South Africa (Pty) Ltd. 2011).

Assessment based on information provided for the time period 2012 – 2042 has a high confidence level. Certainty is reduced as time periods increase and the existing time frame until 2112 limits the predictability for assumptions and therefore has a decreased confidence level.

PHASE 1: (approximately 2014 – 2021)

Phase1 of the proposed project would include the following activities/ components:

- The erection and commissioning of a grinding plant (to mill clinker), and a storage and packing facility to market cement to the Western Cape market, including:
  - The construction of enclosed storage facilities, covering a total area of 11 000 m^2 for the storage of clinker, limestone and gypsum at the proposed cement plant;
  - The installation of a vertical roller mill, with a total height of approximately 50 m; and
  - The construction of cement storage facilities as well as packing and dispatch facilities.

AfriSam currently mines up to 40 000 tpa of limestone, for use as agricultural lime, under its mining right, with a limited footprint, at the existing Tabakbaai quarry area. Phase 1 will undertake the mining of an additional 170 000 tpa (approximate maximum) of limestone from the quarry footprint. Clinker would be sourced from an associate foreign company via the Saldanha Port facility, or from Afrisam's Ulco cement plant near Kimberley. The proposed construction of the grinding plant facility would take approximately 24 months.

PHASE 2: (Approximately 2022 – 2112)

Phase 2 of the proposed project would include the following activities/ components:

- The erection of a clinker manufacturing facility with an annual production capacity of 600 000 tpa, including:
  - The construction of a precalciner kiln system. The pre-heater tower is expected to have a total height of approximately 80 m and cover a total area of 400 m^2.
  - Construction of additional storage and handling facilities for limestone, clay, gypsum and clinker, to accommodate the increased production levels.
  - The installation of a second vertical roller mill, with a total height of 50 m.
  - The construction of a second packing and palletizing line.
  - Mining within the quarry footprint, with the existing limestone production increasing to a total of 1.2 million tpa, delivered to the proposed cement plant site.
  - Mining of approximately 120 000 tpa of clay from the proposed Holvlei clay quarry, including transport to the proposed cement plant via the transport corridor.
  - The construction of a transport corridor.

Due to the expected production during Phase 2, a maximum of 1.2 million tons of limestone would need to be transported from the limestone quarries to the proposed cement plant site per annum. In order to transport the suggested volumes (expected in Phase 2), two transportation alternatives are being considered:

- *Conveyor system*: The proposed enclosed conveyor system would extend along the proposed transportation corridor for approximately 9 km, from the eastern border of the quarry footprint in an easterly direction into the proposed cement plant site. To ensure that all material is efficiently transported, the proposed crusher would need to be located at the quarry site, at the start of the conveyor.
- *Proposed private road*: Based on surrounding topography, the proposed private road would begin at the eastern quarry border, in a similar position as proposed for the conveyor, but may require following topographical contours for a short distance prior to re-aligning itself with the transportation corridor. Internal quarry haul roads would be constructed to the point where the transportation corridor meets the

quarry. Under this alternative, the crusher would be located at the plant site. (Aurecon South Africa (Pty) Ltd. 2011)

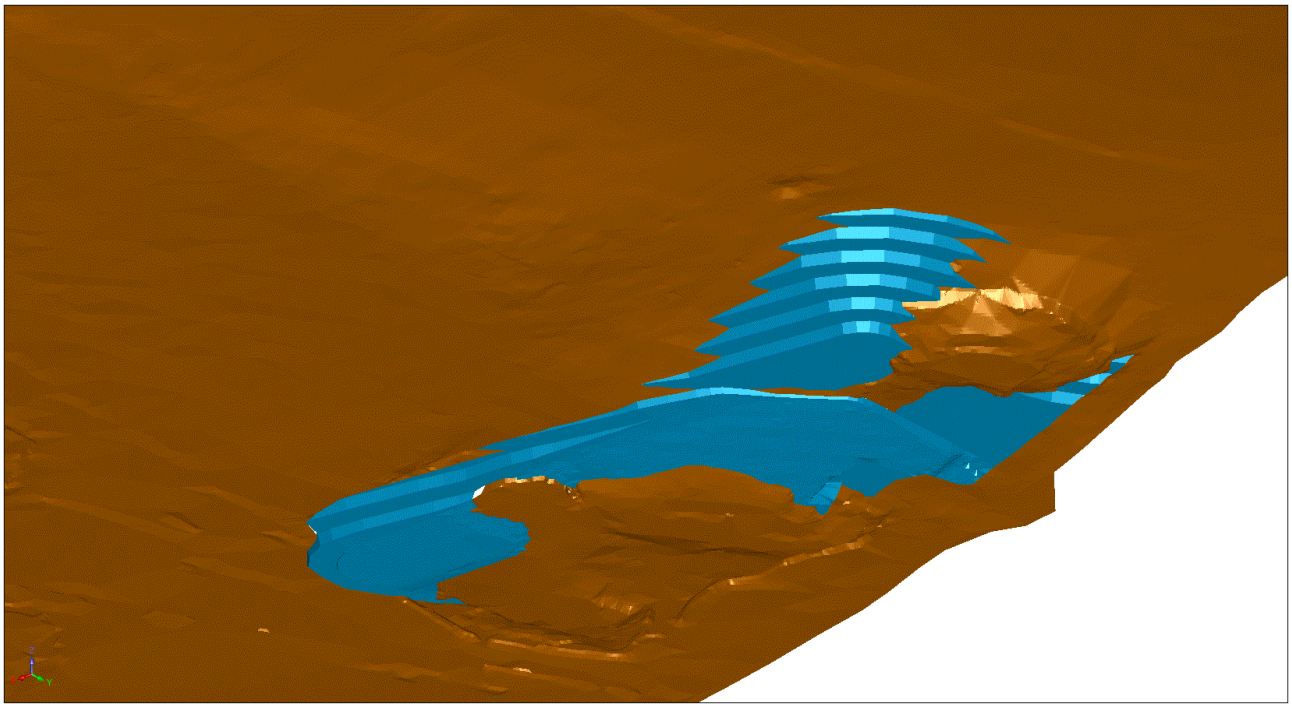


Figure 14: Saldanha mine Southern quarry, end 2020

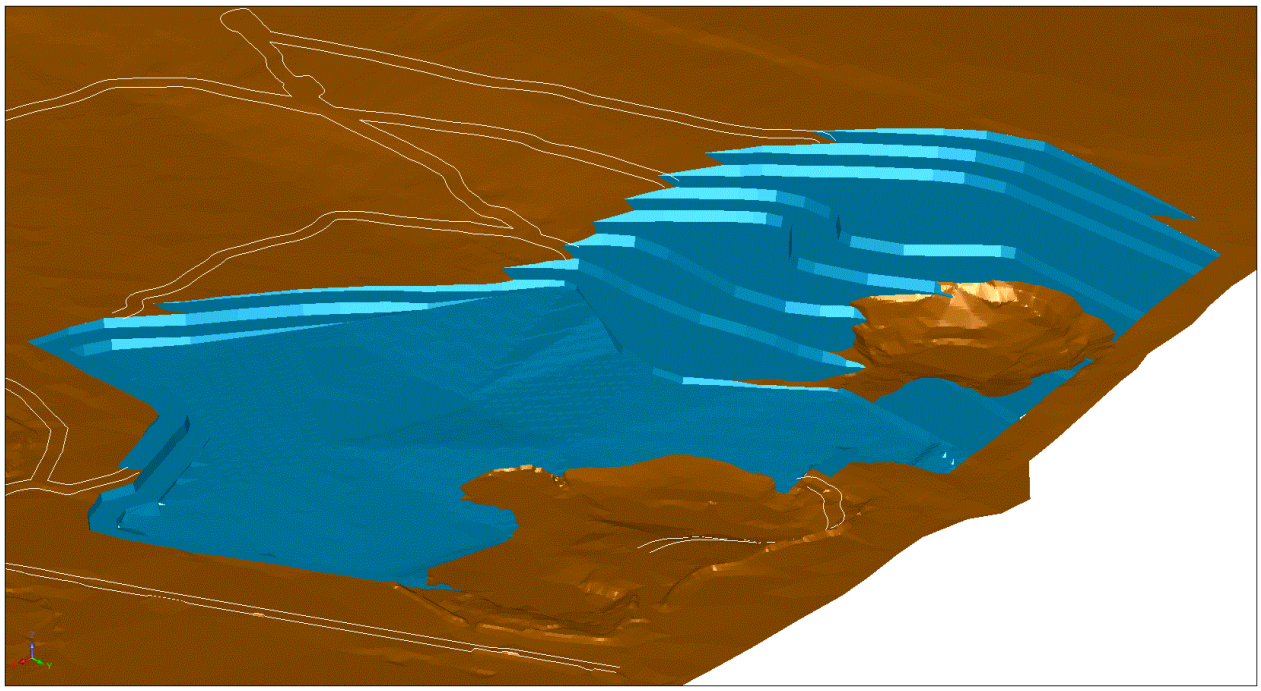


Figure 15: Saldanha mine Southern quarry, end 2031

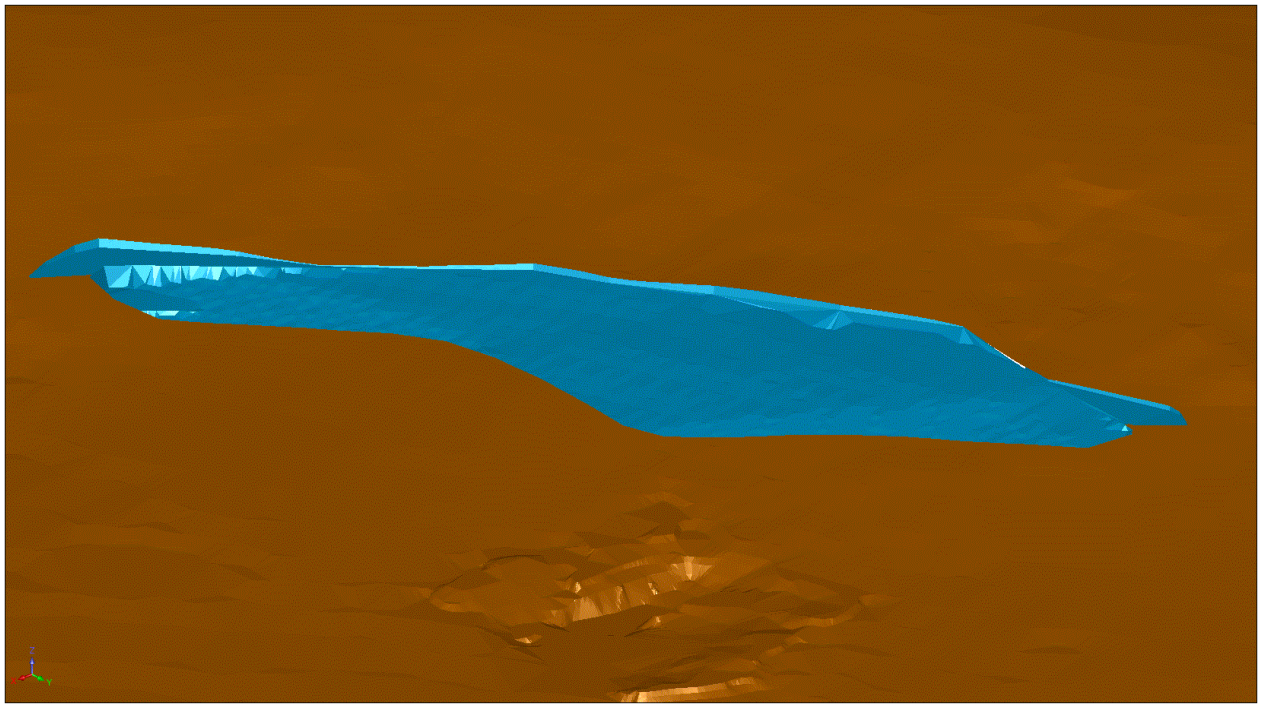


Figure 16: Saldanha mine Southern quarry (elevated), end 2031

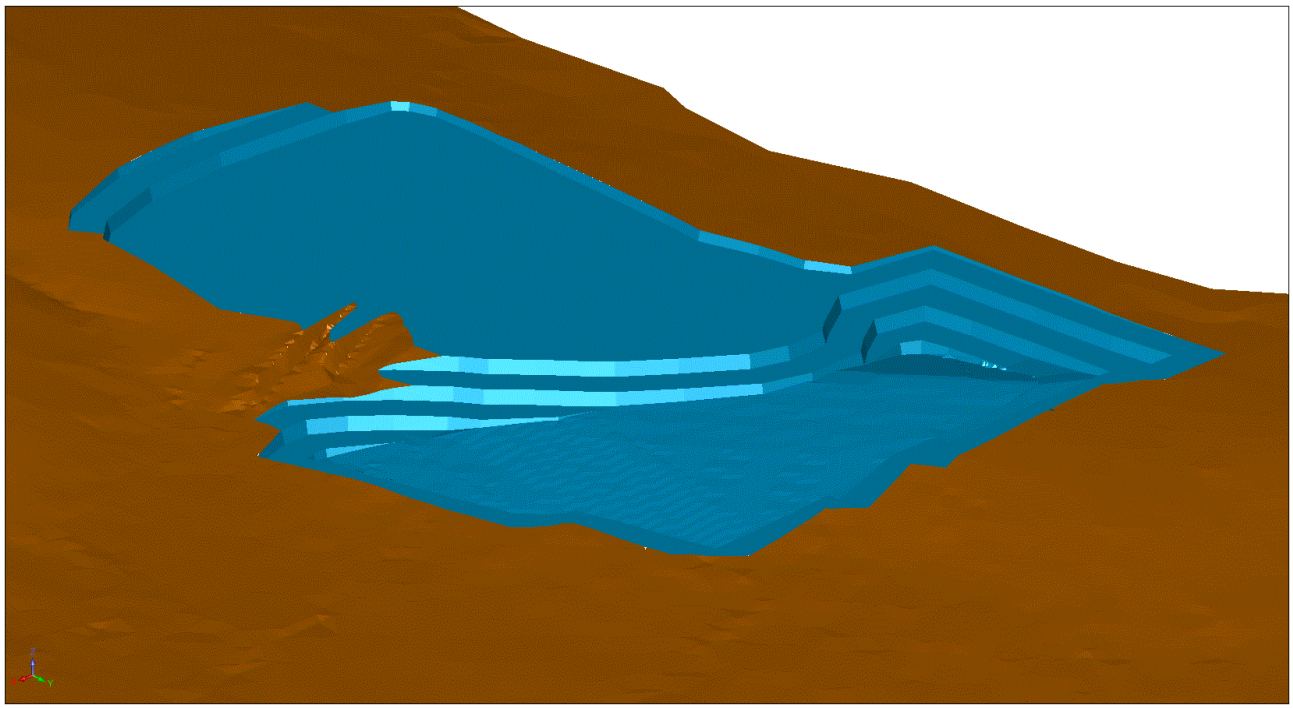


Figure 17: Saldanha mine northern quarry (skyline), end 2031

5.4 Holvlei Clay Quarry

The AfriSam South Africa Saldanha Project Feasibility Study states that the clay quarried at the Holvlei site is soft and easy to dig. Preliminary evaluations indicate a life of approximately 20 years of acceptable quality clay mining. This will be a free-digging operation by means of excavators or front-end loaders taking place over a number of benches. Hauling will be effected by means of road-legal haul trucks, either to the central tipping station, or directly to the factory site. Dumps are relatively low to the ground and have mostly horizontal tops. This horizontal line reflects the long, straight horizon line in the distance. Dumps are mid to light toned, becoming darker over time. Fresh earth/clay is yellower than the surrounding pale-red ochre ground. Texture is fine and even.

The site of the proposed Holvlei clay quarry site is on Portion 4 of Holvlei 120, north of Portion 9 of Kliprug 282 and Portion 7 of Jacobs Bay 109, approximately 3 km inland of the western coastline, 2

km north of the Jacobs Bay Road, and approximately 9 km north-west of the proposed cement factory site. (DEA&DP EIA Application for Afrisam (South Africa) (Pty) Ltd Cement Plant)

Photograph 17: Photograph of existing Purbeck Ball Clay Quarry, UK
(Source: http://www.enotes.com)

5.5 Cement Factory and Associated Infrastructure

Photograph 18: Example of a cement plant (Source: www.roadequipments.com)

The photograph above depicts a typical view of a cement factory which would include pre-heater, kiln, silos and associated infrastructure. The proposed Afrisam factory layout plan can be seen in Figure 10. The proposed factory would be constructed in phases as outlined below:

- Phase 1 of the Saldanha Project consists of a material receiving facility, a cement grinding plant with a bag packing and palletizing plant, bulk truck loading facilities and all associated infrastructure. 5000 ton capacity inverted cone type silos are to be built.
- Phase 1 of the proposed mining operation would be completed and rehabilitated before the commencement of Phase 2.

- Phase 2 of the Saldanha Project includes the full development of the clay and limestone quarries, coal stockpiling and coal milling facility, 5-stage heater and kiln plant and a second cement mill and cement packing line.

Forms of the cement plant, seen in the example photograph above, are regular, manmade prisms, both circular and rectilinear. Smaller forms create linear elements running vertically, horizontally and diagonally over the smooth surfaces and light tones of the larger forms. All forms read as a single mass at a distance. Colour is mostly a light grey.

Photograph 19: Example oflights at night at Saldanha Steel plant
(Source: www. wideblue. co. za/ wkf_saldanhasteel1)

The photograph above shows the existing lights at night of the Saldanha Steel plant adjacent to the proposed plant site. Solid forms are created by the visual massing of the many lights over all surfaces of the plant. Light dissipation and reflection off dust and/or water in the air enlarges the shapes of the plant and hence the visual impact.

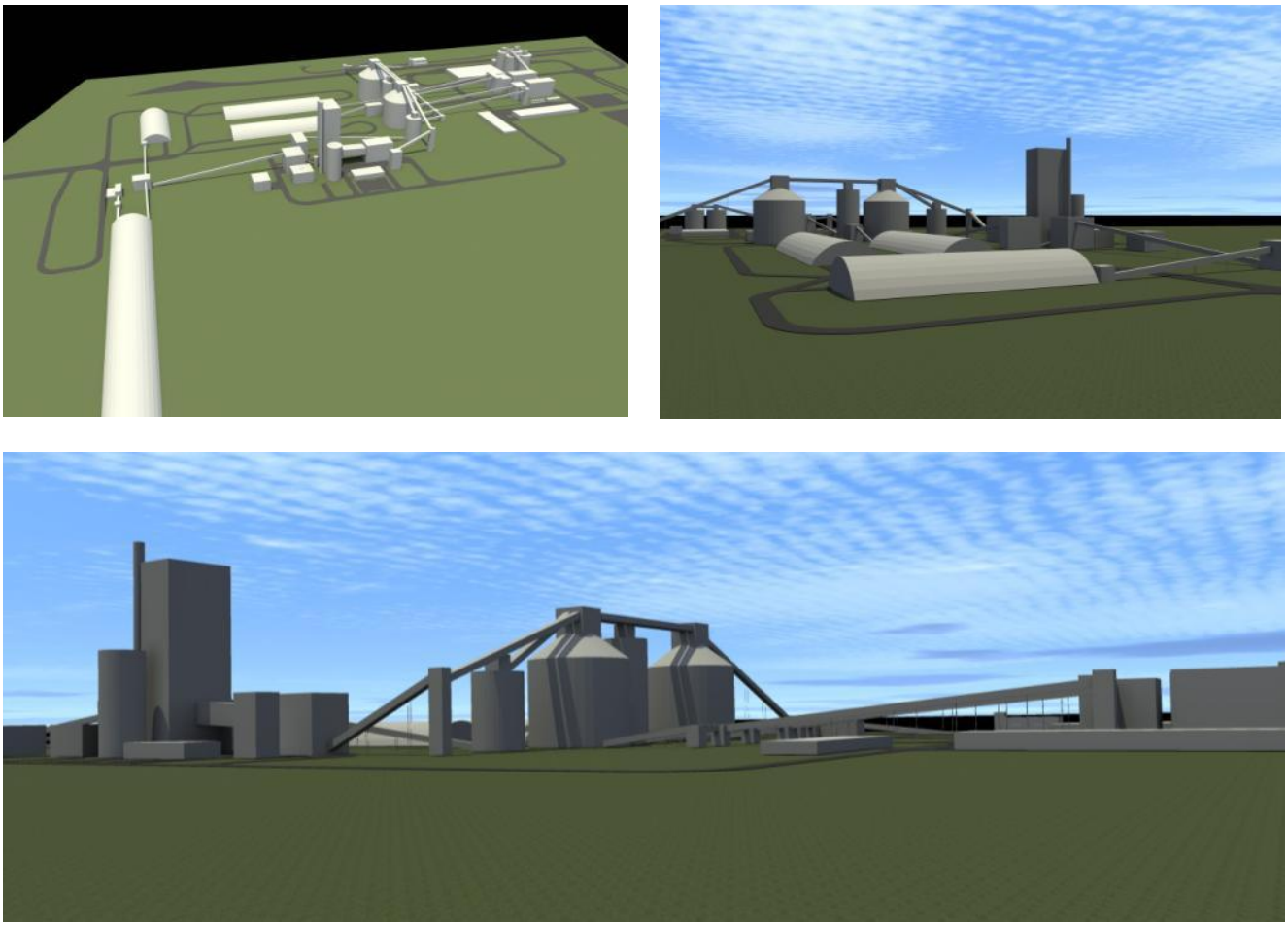


Figure 18: 3D view of proposed plant

5.6 Transport Corridor

Alternative 1: Private road

The proposed conveyor and private road alternatives would follow similar routes, extending for approximately 9 km in an easterly direction from the limestone quarry to the proposed cement factory. The mined limestone and clay will be transported to the plant site by means of suitably sized, side-tipping dump trucks used 9 hours per day, 5 days a week. Flatbed trucks will be loaded with two ton pallets of cement. Airshed Planning Professionals (Pty) Ltd have indicated in their Air Quality Impact Assessment that the project will 'most likely increase ambient PM10 concentrations and dustfall rates and the most significant sources of particulates are paved plant roads and unpaved haul roads.' **To combat the issue of dust impacts, all private roads to be constructed or used would need to be tarred.**

Photograph 20: Example of private road to Nilkanth Quarry, India
(Source: www.geolocation.com)

Alternative 2: Conveyor system

The proposed conveyor alternatives for the transportation of raw materials would follow a similar route to the road. Different design examples for a conveyor system include systems that stand 2.5 m high and are partially sunken and/or elevated in places. An enclosed ground-level example can be seen in the photographs below. Two options are proposed for the intersection of the conveyor and the main road: either underground tunnels or via a conveyor bridge. (See photograph on the following page).

IBR covered conveyor belt system
(Source: Alpha Saldanha Cement Project Aesthetics Assessment 1997)

Temple Quarry conveyor
(www.geolocation.com)

Troughed belt conveyor
(www.directindustry.com)

Photograph 21: Photographs of different types of conveyor systems

Cox Quarry, Canada
(www.mainlandsd.com)

Conveyor Bridge at South Ferriby Marina
(www. geograph.org.uk)

Photograph 22: Photographs of different types of conveyor bridges

6. PROJECT VISIBILITY AND EXPOSURE

Making use of ASTGTM elevation data, a terrain model was generated for the area around the proposed project area. This makes use of the offset values indicated below, measured as metres above point ground level.

Name	Description	Area / Lengths (approximate)	OFFSET A (m)
Holvlei Clay Quarry	Located on Portion 4 of Holvlei 120, north of the northern limestone quarry site. It is approximately 3 km inland of the western coastline, 2 km north of the Jacobs Bay Road and approximately 9 km north-west of the proposed cement plant site.		2
Limestone Quarry	The quarry footprint is located on Portions 8, 9, 15 and 23 of Farm Kliprug, and Portions 7 and 9 of Jacobs Bay. It is approximately 1 km to the north-west of the town of Saldanha, and directly north of Diazville, extending north to the Jacobs Bay Road, and approximately 6.8 km south-west of the proposed cement plant site. The western quarry boundary is approximately 3 km east of Jacobs Bay and approximately 7.8 km west of the proposed cement plant site.	Southern: 160 ha Northern: 172 ha	0
Road/ Conveyor System	The proposed conveyor and / or private road alternatives would follow a similar route, extending for approximately 9 km in an easterly direction from the eastern boundary of the limestone quarry to the proposed cement plant.	9 km	2
Processing Plant	The highest structure will be the kiln stacks (approximately 100 m) and the pre-heater tower, which will be approximately 80 m high and operate 24 hours a day.	97 ha within a total site area of 190ha	100

6.1 Holvlei Quarry Visibility

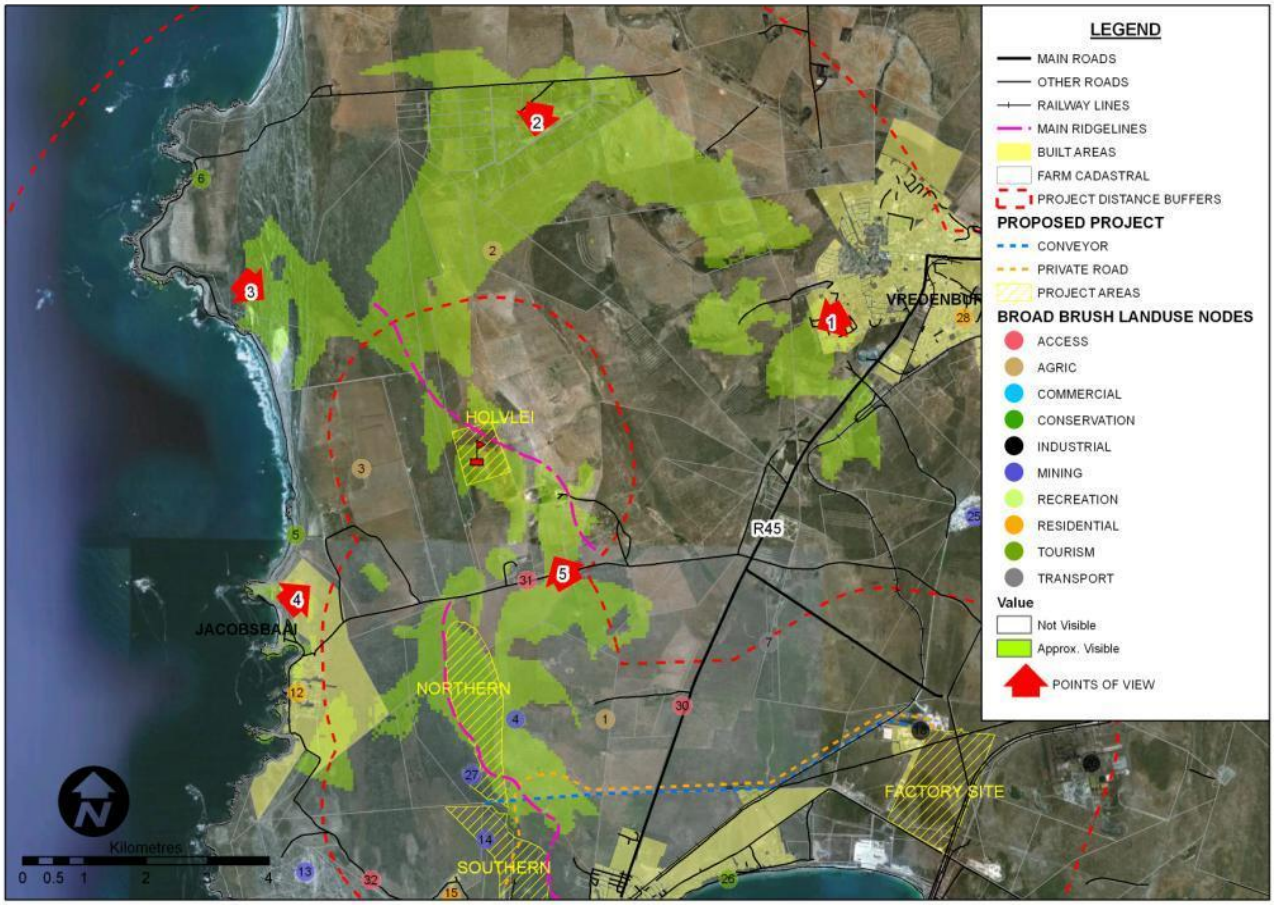


Figure 19: Viewshed generated for the Holvlei Quarry

The viewshed generated for the Holvlei Quarry has a local zone of visual influence as the area is fragmented and linear. The 2 km distance buffer from the site offers few receptor views. However, receptor exposure would be high as it includes the Jacobs Bay access road and, on a more moderate level, some Jacobs Bay receptors. Receptors for the area include western Vredenburg, the small holdings to the north, Jacobs Bay and the access road. The receptors from Saldahna would not have views of the site.

6.2 Northern Limestone Quarry Visibility

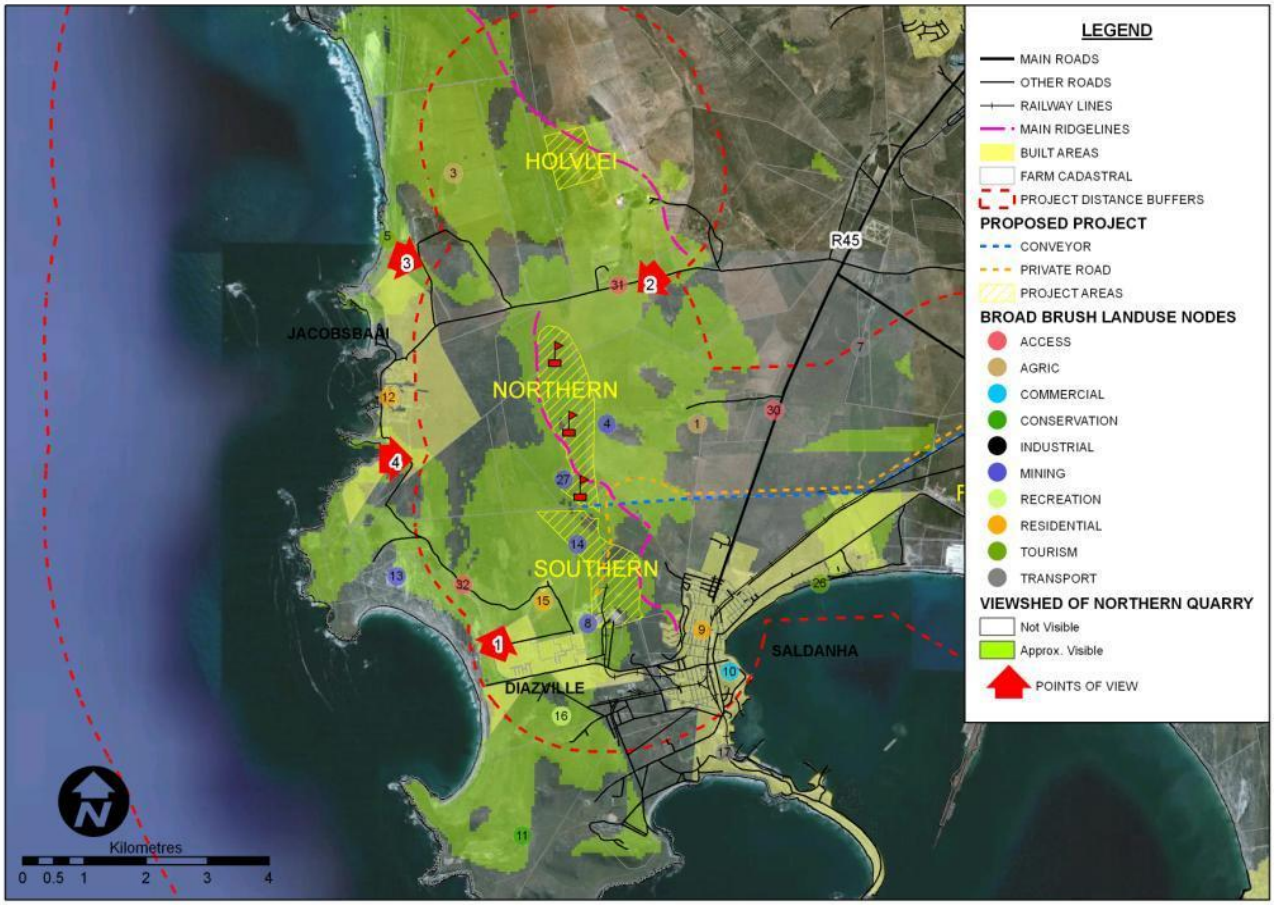


Figure 20: Viewshed generated for the Northern Limestone Quarry sites

The viewshed generated for the northern limestone quarry is extensive and covers a regional zone of visual influence. This would extend beyond the 2 km high exposure area. The pattern is mostly north-south linear, with certain areas to the east and west having no visibility due to topographic screening associated with the low hill where the quarries are proposed, as well as adjacent low hills to the east. Receptors would be located in the high exposure foreground area and would include Jacobs Bay residential and access road, as well as Diazville receptors. Receptors from Saldahna would be excluded due to topographical screening.

6.3 Southern Limestone Quarry Visibility

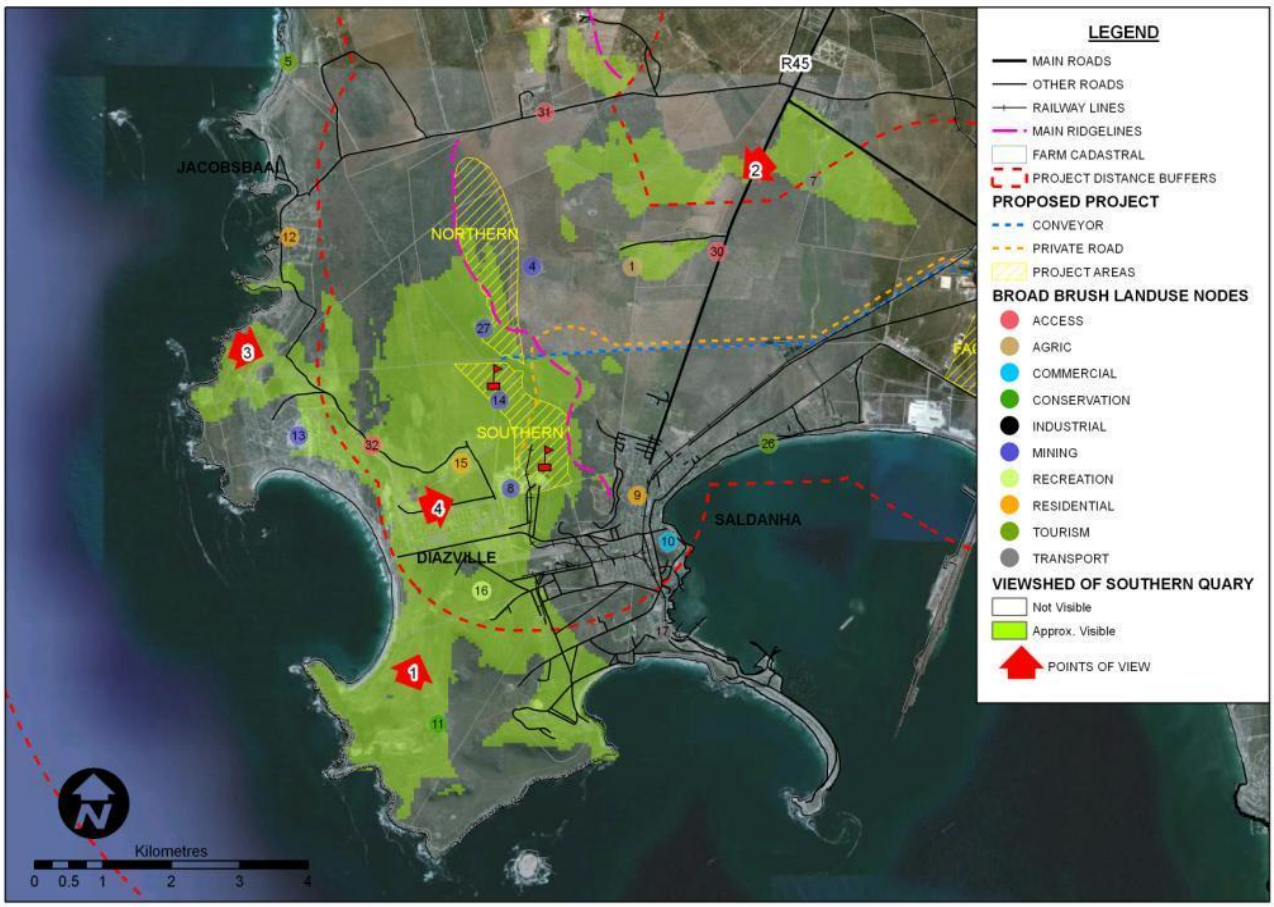


Figure 21: Viewshed generated for the Southern Limestone Quarry

The viewshed generated for the two southern proposed limestone quarry sites, was defined as localised. It would be constrained to the south-west of the site due to the low hill which forms a visual barrier for the eastern receptors. The areas exposed to the proposed quarries is contained and mainly located within the 2 km high exposure area and includes the Diazville and Saldahna West areas. It may include some of the southern extents of the Jacobs Bay area which is proposed for future residential development.

6.4 Road or Conveyor System Visibility

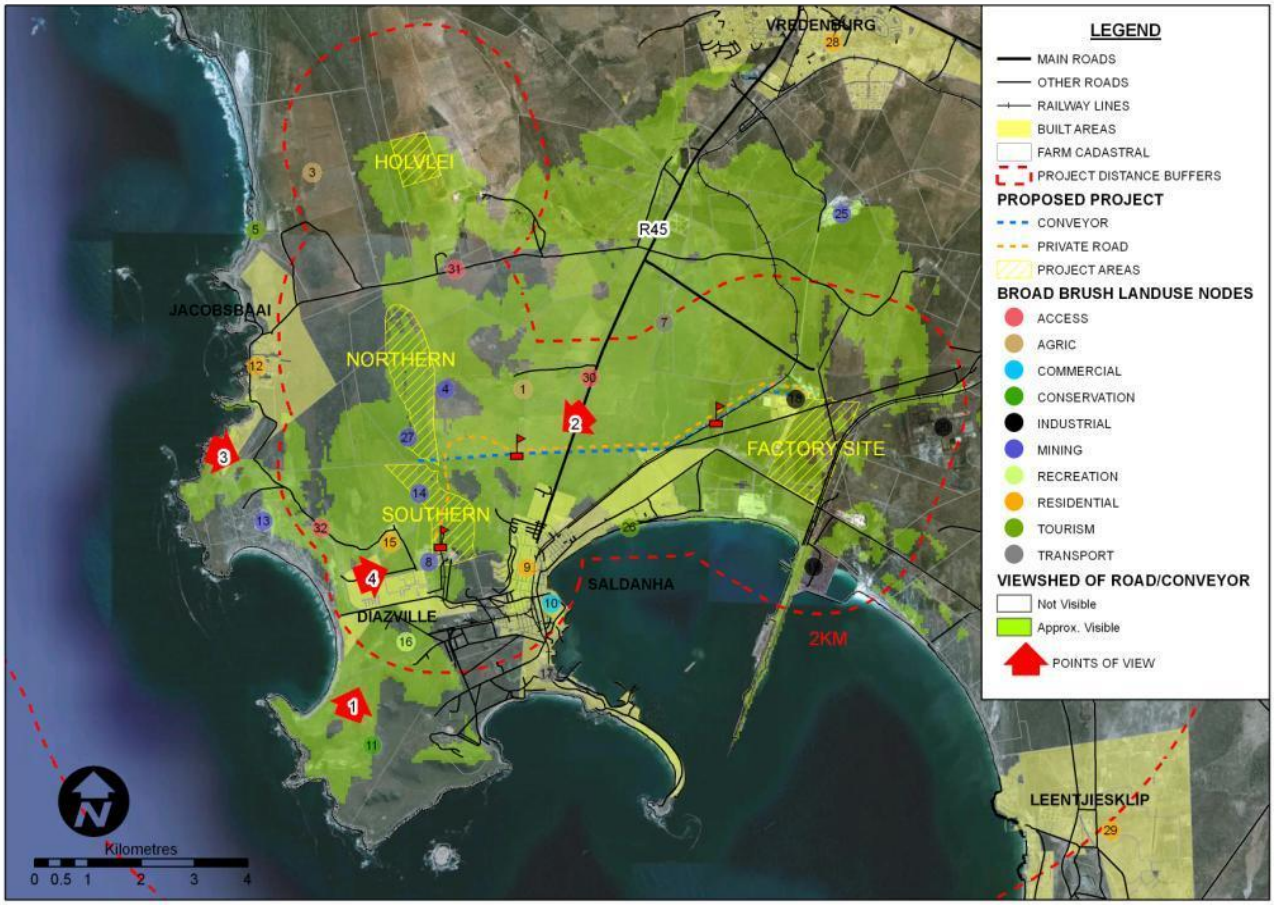


Figure 22: Viewshed generated for the road/ conveyor system

The viewshed generated for the road or conveyor system at a 2m offset was defined as regional. This would cover most of the flat areas associated with the Saldahna industrial area, as well as the flat areas to the north of Saldahna Bay. The viewshed would mainly be located in the 2 km high exposure area, which includes the R45 as well as the Diazville residential receptors who would see the road activity at the top of the hill.

6.5 Processing Plant

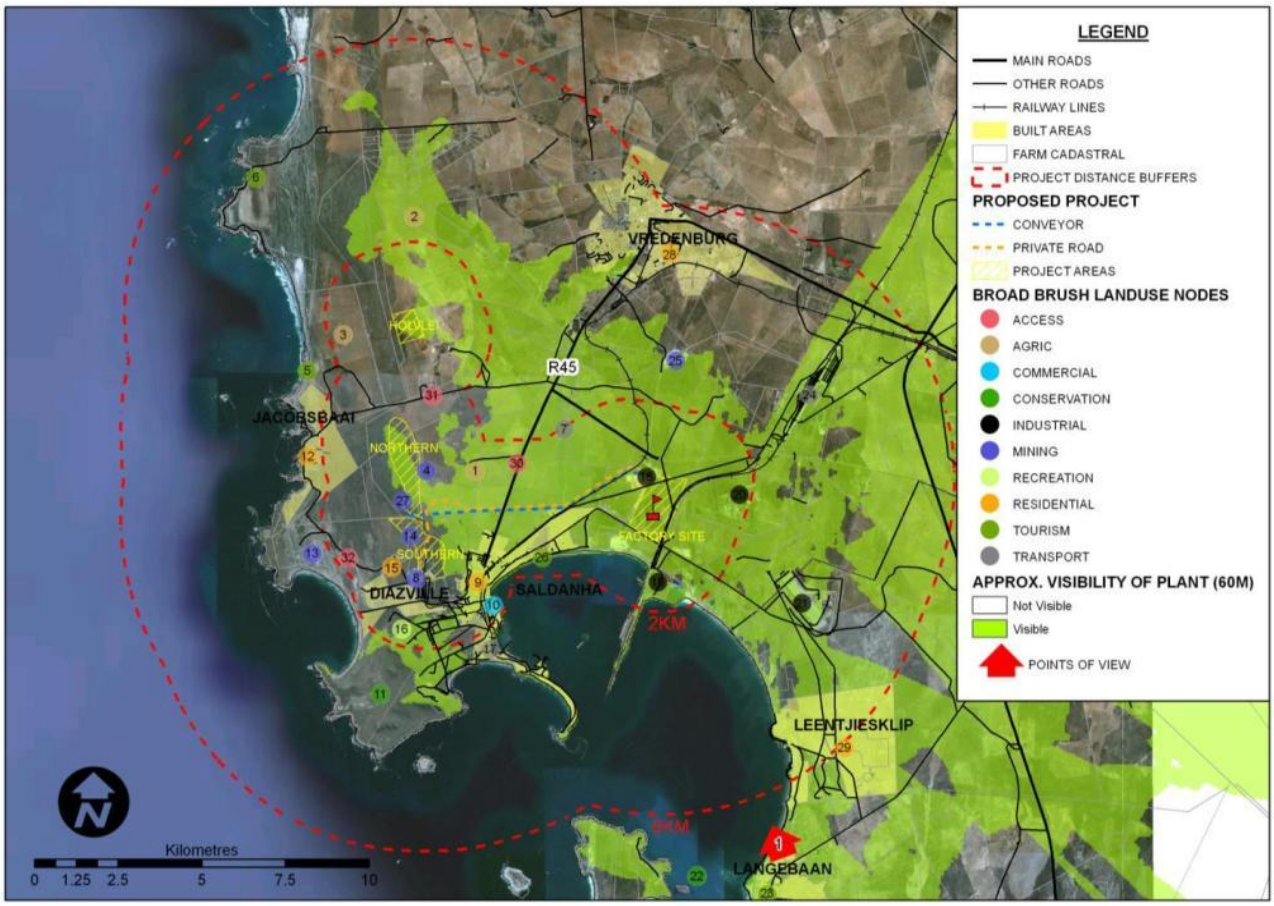


Figure 23: Viewshed generated for the plant with 100m offset above ground on location

The viewshed for the proposed plant, generated from an offset of 100 m above ground level, is regional and would extend over most of the low-lying ground adjacent to the site. The viewshed would extend beyond the 2 km high exposure area and beyond the 6 km foreground distance zone. Receptors located in the area include those in the Langebaan area and residents in areas of Saldahna, who would have clear views of the proposed plant.

6.6 Visibility Findings

Visibility						
Activities	Cement Factory	Private Road and Conveyor System	Southern Limestone Quarry	Northern Limestone Quarry	Holvlei Clay Quarry	Lights at Night
Height (m)	100 m	2 m	0 m	0 m	0 m	100 m
Extent	Regional	Local	Regional	Regional	Local	Regional
Exposure	High	High	High	High	Moderate	Moderate

*Key: H =High, M= Moderate, L = Low, * = Low confidence*

Extent	**Geographical area of influence** **Site Related (S)** : extending only as far as the activity **Local (L)** : limited to immediate surroundings **Regional (R)** : affecting a larger metropolitan or regional area **National (N)** : affecting large parts of the country **International (I)** : affecting areas across international boundaries
Regional	Due to the combined extent of the proposed activities, the viewshed is extensive. Except for the plant, the viewshed would mainly be contained within the foreground / mid ground distance zone. The viewshed of the more southern activities are more associated with the built environment of Saldanha which has a higher VAC level.

Visual Exposure	**Degree of exposure to receptors** **High (H)** : Dominant or clearly noticeable (<2 km) **Moderate (M)** : Recognisable to the viewer (2 – 6 km) **Low (L)** : Minimally visible areas in the landscape (>6 km)
High	Within the viewshed of the quarry activities are communities located in the 2 km high exposure area and, as such, the views of the proposed landscape modification will be dominant and clearly noticeable to the surrounding areas and communities.

The following receptors were identified during the field survey as having views of the area where the developments are proposed:

- Langebaan
- Leentjiesklip
- Saldanha
- South Jacobs Bay community
- North Jacobs Bay and tourism node
- Vredenburg south west
- Diazville communities
- Road: R45 entrance into Saldanha and R45 southbound from Vredenburg
- Minor Road 238: Access route along district road between R45 and Jacobs Bay
- Minor Road 238: Access route from Diazville to Jacobs Bay
- Smallholdings to the north
- CBI / nature / tourism area to the north-west, just outside high exposure area
- Cape Nature SAS Saldanha Contractual Natural Reserve

7. PROJECT SITE LANDSCAPE SURVEY

The landscape character of the proposed project site is surveyed to identify areas of similar land use and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to the proposed landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be "absorbed" or "disappear", into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method, which is then represented in a visual sensitivity map. (*Refer to Methodology in Annexure for further details.)*

The proposed factory site does not fall within the CBA area but to the north, south and east there are small sites identified as CBA areas which will need to be taken into consideration in terms of cumulative impacts. The main impact to the CBA areas is from the Northern and Southern limestone quarries which, excepting the previously mined area, fall in their entirety into the CBA zones. The western portion of the Holvlei clay quarry also impacts the CBA area. For the most part, the proposed corridor and private road routing are aligned along existing infrastructure corridors and mainly impact the CBA areas where mining is proposed. As part of the study, the cumulative impacts of the proposed mining activities to the CBA areas will need to be assessed, as these CBA areas are a vital component of the West Coast sense of place.

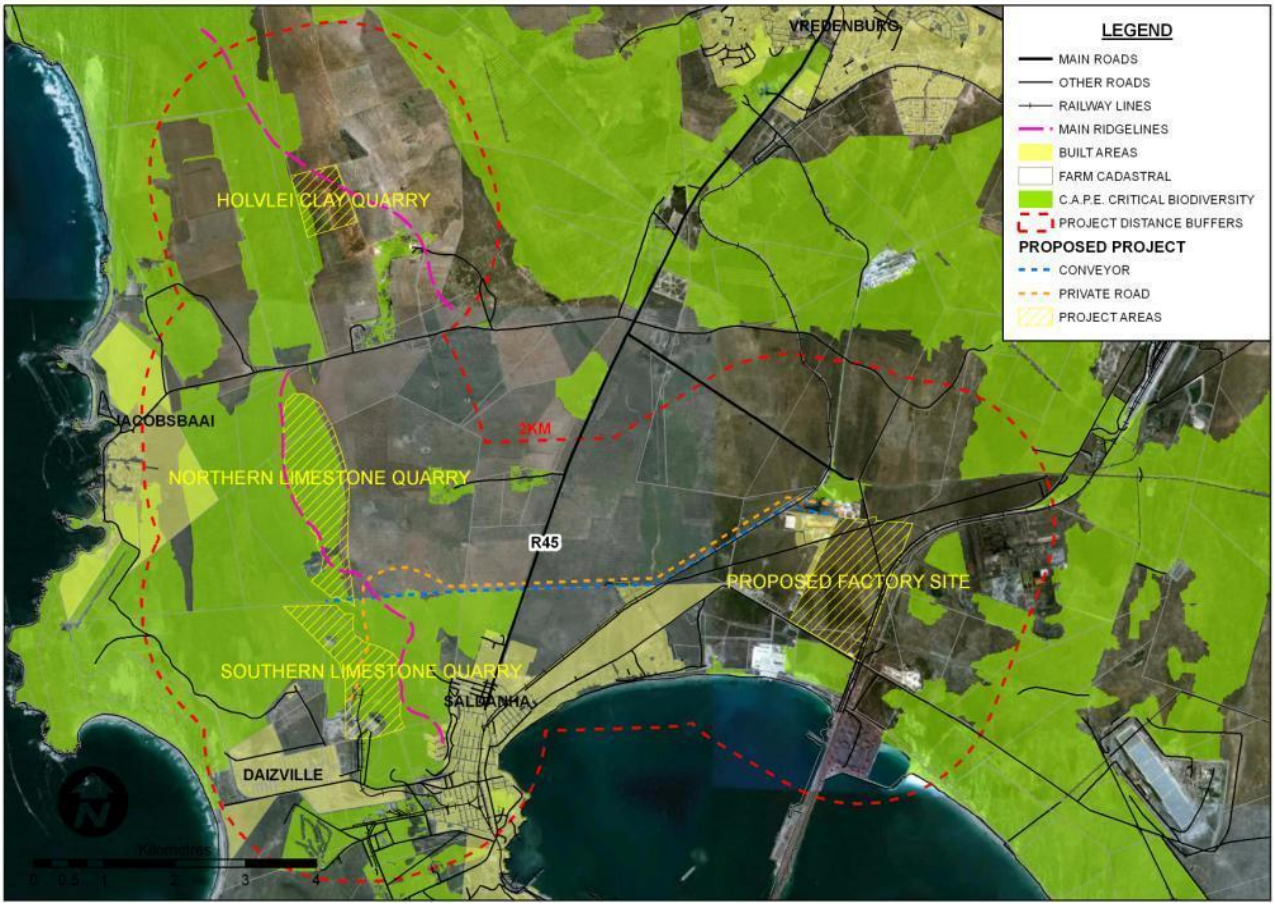


Figure 24: Vegetation Map from CAPE Fine scale Biodiversity Planning project

Making use of a 2 m digital terrain model surveyed by the client, a detailed terrain model was generated in order to understand the topography of the site.

- A
  s indicated on Figure 6, the north to south elevation cross-section shows an undulating terrain within

the 50 m height range, except to the south which increases in height. The southern hill (to the north of the town of Saldanha) is 100 m in height and is an important visual feature.

- The west to east elevation cross-section shows a 100 m range between the western hills and the eastern flats where the factory site is proposed. The height of the area increases the visual importance of the area.
- Holvlei Clay Quarry is mainly south facing, the Northern limestone quarry is predominantly east facing and the Southern limestone quarry is west facing. The different orientation of the landscape modifications would reduce the overall visibility of the project as they are associated with different viewsheds.
- Part of the northern quarry is located on a ridgeline which would increase skyline intrusion impact as seen from the lower-lying receptors of Jacobs Bay and Saldanha West.

The following locations, which are associated with various proposed project activities, were surveyed during the field study to determine scenic quality, receptor sensitivity to landscape change and distance from nearest receptors:

- S1: Prospect Hill Limestone Quarry
- S2: Northern Limestone Quarry
- S3: Southern 1 Limestone Quarry
- S4: Southern 2 Limestone Quarry
- S5: Northern Limestone Quarry
- S6: Holvlei Clay Quarry
- S7: Cement Factory and Associated Infrastructure
- S8: Private road / Conveyor System and Bridge

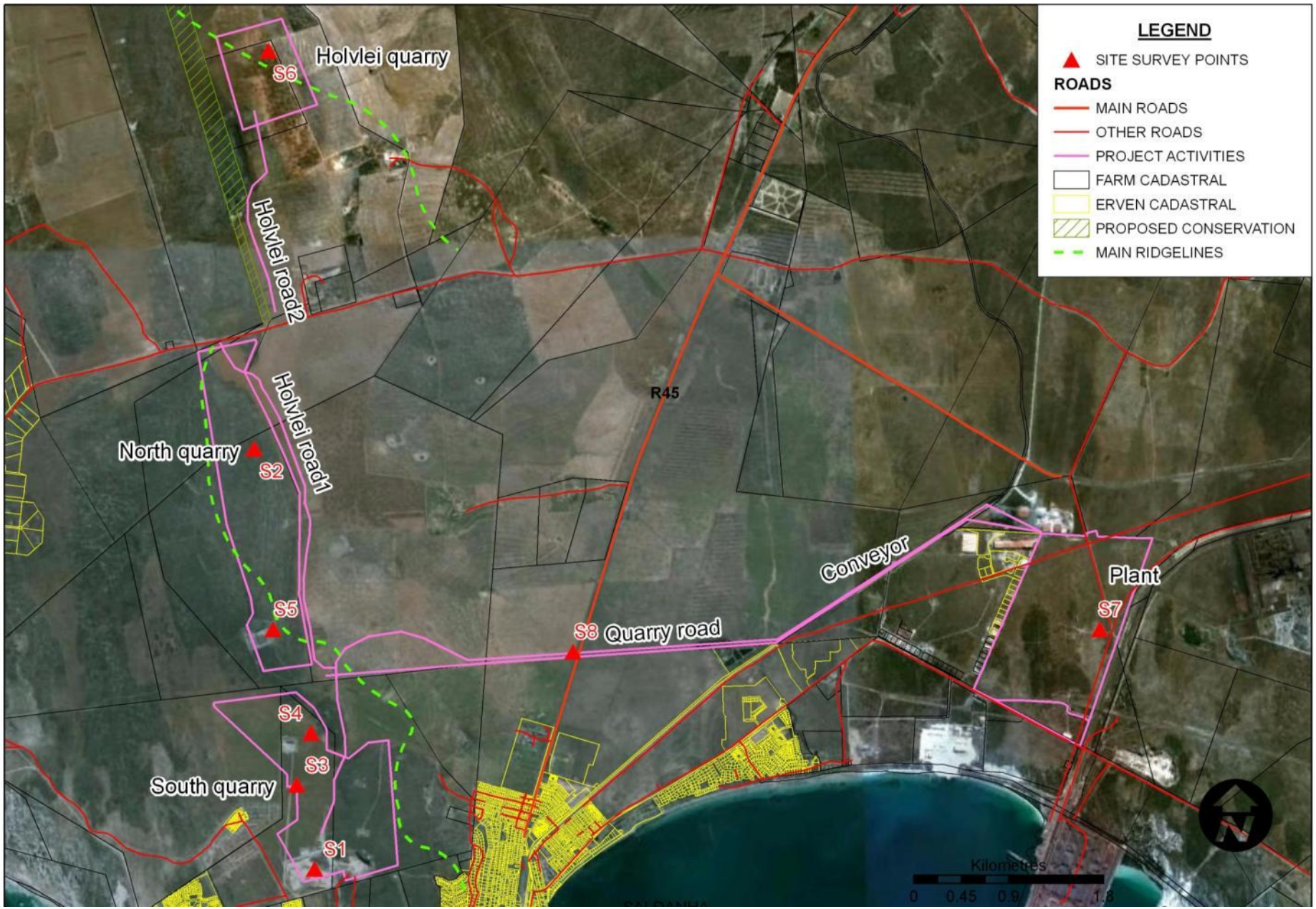


Figure 25: Site survey reference points (S1 – S8) overlaid onto aerial survey

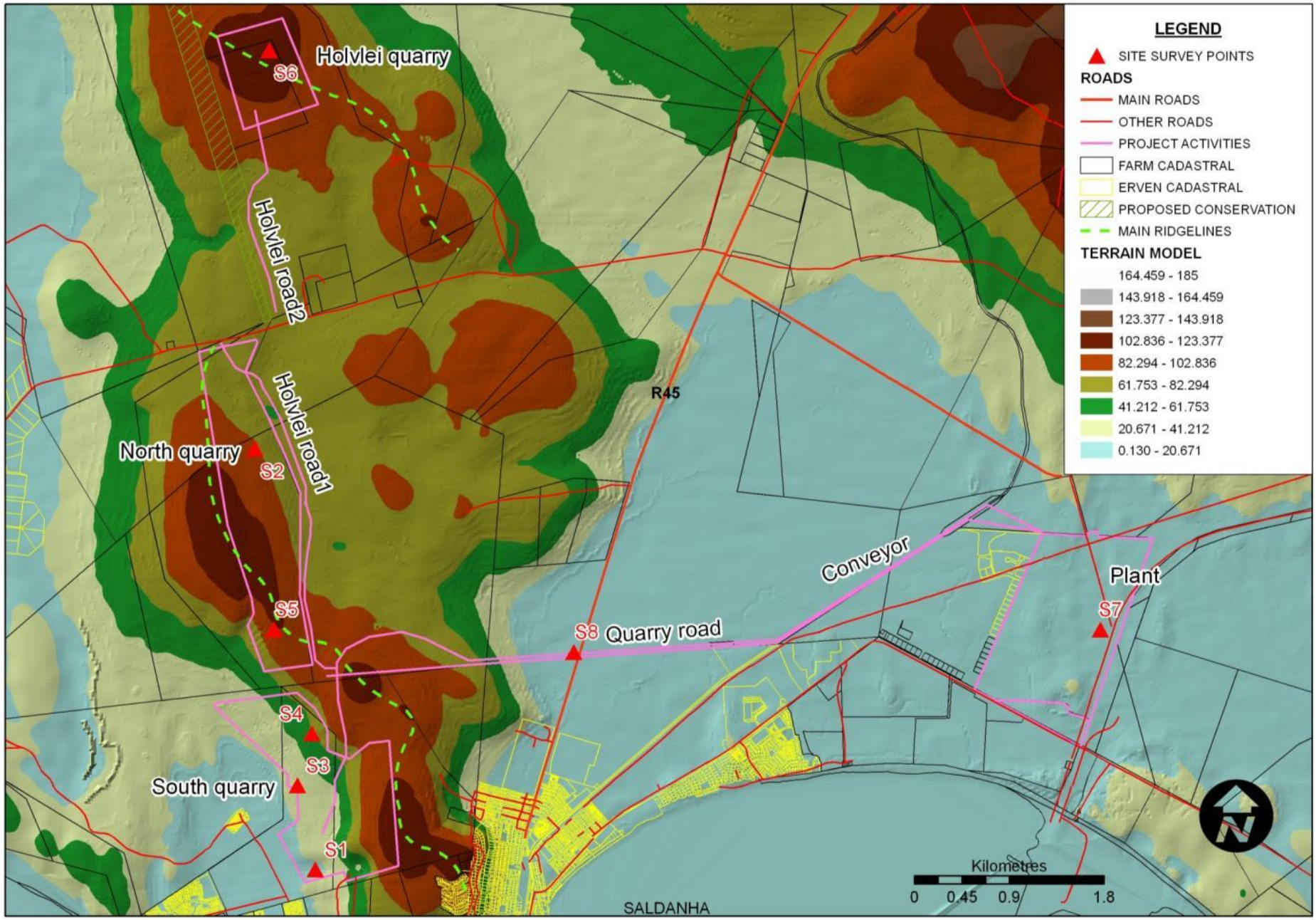


Figure 26: Site survey reference points (S1 – S8) overlaid onto elevation map

7.1 S1: Prospect Hill Limestone Quarry

Photograph 23: Photograph taken of the existing Prospect Hill cut face

Photograph 24: Photograph of the old Prospect Hill Quarry workings with natural rehabilitation

This is the location of the existing Prospect Hill Limestone Quarry, as well as that of the naturally rehabilitated old vacant quarry. The VAC is *moderate* to *high* due to the existing landscape modifications associated with the quarry. These have generated *high* levels of colour and form contrasts as seen from the surrounding areas. The scenic quality of the landform is rated *moderate to low*, as the landform consists of low rolling hills. In the context, these offer some interesting shapes and sizes although they are not dominant or exceptional. Vegetation at the site is rated *low* as it was highly modified from the mining modifications. There was no visible water at the site. Colour is rated as *moderate to low* as there is some intensity or variety of colour, but does not read as a harmonious entity with the bright white of the limestone cuttings. Adjacent scenery is rated *low*. This includes the residential developments of Saldahna West, as well as the informal settlement located adjacent to the site. Scarcity is rated as *very low,* as the characteristics of the area are not particularly uncommon and offers limited visual resources. Cultural modifications are predominantly the mining landscape. This is rated as a *negative* as the modifications are very visually discordant and promote strong disharmony. The overall scenic quality is therefore *low*.

Receptor users are mainly middle to low income residential. The preferences of the more proximate receptors of the informal settlement would be more for the economic benefit of the proposed development, as opposed to the visual sense of place. Also influencing this rating is the fact that the site is very strongly modified by the existing mining landscape modifications. The amount of use of the site is rated *high,* due to the close proximity to the residential areas. The site is highly modified and maintaining the visual quality for the general public would be of *moderate to low* concern. Maintaining the visual quality of adjacent land use is rated *high*, specifically the critical biodiversity areas of Limestone Fynbos, situated above the limestone quarry area. Visually significant or special areas are rated *low*, as there are no special management objectives defined for the current mining site. Residential receptors are in close proximity and fall into the foreground zone. The overall class rating is Class IV due to the low levels of scenic quality and moderate to low receptor sensitivities. These objectives allow for major landscape modifications to the existing character of the landscape.

7.2 S2: Limestone Quarry: Northern (CBA)

Photograph 25: View north of open agricultural landscapes and Jacobs Bay Road in middle ground

Photograph 26: View of Limestone Fynbos on site with adjacent clay workings in the background

This site is located on Limestone Fynbos, which offers limited screening potential. This, in addition to the site being on the side of a hill, leads to a *low* VAC. This low rounded hill is visually interesting but not exceptional hence landform is rated as *moderate to low.* Vegetation is rated as *high* as the Limestone Fynbos has a variety of vegetation types which creates interesting textures and patterns. There is no visible presence of water. Colour is rated as *moderate to high*. There is an interesting variety of colours and contrasts mostly from the vegetation. Adjacent scenery is rated as *moderate.* These adjacent areas include the dryland agriculture landscapes which define the greater sense of place. As the area is a Critical Biodiversity Area (CBA), the scarcity factor is defined as *high*. Cultural modifications are rated as *moderate to high* and the general lack of development adds to the landscape character of the site. The overall scenic quality of the site is rated *high*.

Users of this site would be tourist-related, as well as residential receptors accessing the Jacobs Bay area. The concern for visual maintenance is therefore important to most users. The amount of use is *moderate* as the Jacobs Bay Road is a district road. Due to the CBA rating of the area, public interest would be very high. The importance of maintaining the visual sense of place for adjacent land users is *moderate to low* as these are predominantly farmers or related to clay mining. This is a special site due to its critical biodiversity; hence the need for management is *high*. However, the planning for the area could be influenced by the Saldahna SDF preliminarily zoning for mining. Receptors fall within the foreground zone, within 2 km of the site, and a VRM Class II is defined for the area. The class rating is a result of the *high* scenic quality and receptor sensitivity. The Class II visual objective is to retain the existing landscape character and level of change should be low. Management activities can be seen, but should not attract the attention of the casual observer and should repeat the basic elements of form, line, colour and texture found in the natural features of the characteristic landscape.

7.3 S3: Limestone Quarry: Southern (Close proximity to residential)


Photograph 27: View south towards existing Prospect Hill quarry


Photograph 28: View west towards adjacent Middelpos informal settlement

The Limestone Quarries, Southern 1 and 2, are situated fairly high on the low hill, increasing their prominence and visibility, with little or no screening from the proposed site. The existing mining activity has increased the colour and form contrasts within the area, hence the VAC is *moderate to low*. Landform is rated *low* as the small hills have interesting, although not exceptional, scenic value. The vegetation has been highly modified by previous mining and agricultural activities and is therefore mainly grasslands with very little variety. There is no visible presence of water and colour is rated as *moderate*. There is some variety of colours provided by the vegetation, but this is not a dominant scenic element. Adjacent scenery is rated *high* due to the close proximity to the Limestone Fynbos CBAs. The scarcity rating is *moderate.* These areas are distinct, although somewhat similar, as they have been modified by mining and agriculture. Cultural modifications are rated *low* and scenic quality for both sites is *low*.

The amount of use of the site is rated as *high* as it is fairly prominently placed on the side of the hill, in clear view of the Middelpos and Saldahna West residential receptors. This, in addition to the site's proximity to CBAs, increases the likelihood that the general public would be interested in maintaining the visual landscape. However, receptors from the informal settlement in the foreground are more likely to be concerned with any potential employment opportunities offered by the proposed mine than with the visual maintenance of the landscape. Overall receptors' sensitivity is *moderate* and the amount of use of the site is rated *high*. The importance of maintaining adjacent land use is rated as high due to the Limestone Fynbos. The overall significance of the landscape is *moderate* due to the existing mining landscape modifications detracting from the landscape visual character. As the scenic quality is *low* with *moderate* receptor sensitivity, a Class IV rating was defined for the area where the objectives allow major landscape modifications to the existing character of the landscape.

7.4 S4: Limestone Quarry: Southern (Elevated)

Photograph 29: Photograph west from site towards the coast line

Photograph 30: View south towards Middelpos informal settlement and Saldanha Bay West

As for Southern Quarry 1.

7.5 S5: Limestone Quarry: Northern (Skyline and old quarry)

Photograph 31: View west from site towards Jacobs Bay

Photograph 32: Photographs depicting existing previous mining activities undertaken on site

The VAC of the site is *moderate to low* as it is located on a low hill on a ridgeline and the surrounding fynbos offers some screening. The site is strongly associated with an historic mining landscape which is still visible from the surrounding areas, including Jacobs Bay. This has the effect of increasing the VAC. The scenic quality of the landform is *moderate to high*. The site is located on a ridgeline which forms a skyline as seen from the lower-lying receptors, including Jacobs Bay. Vegetation is rated as *moderate,* as most of the area has been strongly modified by the mining activities which has naturally rehabilitated over time. There is no visible presence of water. Colours are rated *moderate*. Predominant colours are those of the vegetation and of the existing white limestone quarry. This offers some discordant colouring. The adjacent scenery is rated *high* due to the close proximity of the site to the Critical Biodiversity Limestone Fynbos area. This would also increase the scarcity value to *moderate to high*. Cultural modifications are rated as *very low* due to existing mining landscape modifications. Overall scenic quality is rated as *moderate*.

Receptors will have a *high* sensitivity to landscape modifications. Modifications on the site can be seen from Jacobs Bay, which includes both residential and tourist receptors. The amount of use is *moderate* as the views of the main receptors at Jacobs Bay are directed mostly to the sea, in the opposite direction. As Jacobs Bay is a tourist destination, it is likely that public interest in maintaining the existing landscape character would be *high*. Adjacent land use and special significant areas are also rated as *high* due to their association with tourism and the region being a CBA.

Due to the foreground distance zone, the moderate scenic quality and high receptor sensitivity, the site was rated Class II. The visual objective is to retain the existing landscape character and level of change should be low. Management activities can be seen, but should not attract the attention of the casual observer and should repeat the basic elements of form, line, colour and texture found in the natural features of the characteristic landscape.

7.6 S6: Holvlei Clay Quarry

Photograph 33: View south from site depicting industrial landscapes of Saldahna Bay

Photograph 34: View east depicting foreground dryland farming and Vredenburg in background

The VAC is rated as *moderate to low*. Although the area is located on the top of a low hill, the area has been modified by agricultural activities and includes a reservoir, fencing and road infrastructure. The scenic quality landform is rated as *moderate to low* as it is made up of low rolling hills which are interesting, but not exceptional, visual features. Vegetation is rated *low* as it has been highly modified by agricultural activities and on the site no vegetation is evident on the open ground. There is also no visible presence of water. Due to the uniform colours of the earth with limited variety, the colour is rated as *low*. Adjacent scenery is also related to agriculture, with a *moderate* rating, as the cultural landscape is a core element in defining the area's sense of place. The scarcity of the visual resources is rated as *moderate to low* as this type of landscape is similar to others in the region. Cultural modification related to agriculture adds little or no variety or discordant elements to the landscape. The overall scenic quality is rated *moderate*.

Receptors include residential and tourism-related traffic on the Jacobs Bay road. It is a district road with moderate amounts of traffic. Public interest in maintaining the existing landscape character is *moderate to high* as the area is strongly associated with tourism which would influence public opinion. Hence, receptor sensitivity to landscape modification is rated *moderate*. Much of the tourism in the area is associated with visual resources of the landscape. Adjacent land use is therefore also rated as *moderate*. The site has a *low* rating as a special or significant visual resource as it has no visual significance other than being fairly prominent.

Due to the foreground zoning, and *moderate* receptor sensitivity to the agricultural site which has *moderate* scenic quality, the VRM rating is Class III. The visual objective is to partially retain the landscape character where the level of change to the character should be low. Management activities may attract the attention of the casual observer but should not dominate the view, and changes should repeat the basic element of form, line, colour and texture found in the natural features of the existing landscape.

7.7 S7: Cement Factory and Associated Infrastructure


Photograph 35: View east from site towards Saldanha Steel factory


Photograph 36: View west from site showing low topographic rise and fynbos vegetation


Photograph 37: View east from site that depicts the Saldanha industrial and residential areas

The VAC of the site is *moderate to high*. It is located adjacent to a large factory which dominates the landscape character. The landform is rated as *low* as it is fairly flat with few interesting landscape features. Vegetation on the site is rated *low* as it has been highly modified by previous agricultural activities and there is no visible presence of water. Colours are predominantly associated with grasses and small bushes, as well as those of the existing adjacent factory site. There is little colour harmony and hence colour is rated *low*. The adjacent scenery is also rated *low* due to the industrial nature of the adjacent land use. The area as a scare resource is rated *low* due to the close proximity to the existing industrial activities. Cultural activities are *very low* due to the discordant nature of most of the industrial activity.

Receptor sensitivity to landscape modification is rated *low* due to the existing *low* visual quality of the industrial nature of the site. Amount of use is *high* as the site is on an open plain and is fairly exposed to surrounding receptors. As the area is an industrial zone with existing industrial activities, public interest in maintaining existing visual quality would be *moderate*. This is due to the fact that the site is already degraded but it is also strongly associated with tourism. There are no visually significant areas associated within the site. Overall receptor sensitivity to landscape modification is moderate to low. A Class IV visual objective was defined as receptors are within the foreground area and have a *moderate to low* receptor sensitivity and *low* scenic quality. A Class IV objective provides for major

modifications to the existing landscape. The level of change can be high and may dominate the view and attract receptor attention.

7.8 S8: Private road / Conveyor System and Bridge

Photograph 38: View west depicting proposed conveyer route in agricultural landscape context

Photograph 39: View east depicting old access servitude and industry in the background

The VAC of the site is *moderate*. There is existing major infrastructure which includes the main road into Saldahna, as well as telephone and powerline infrastructure. This would assist in absorbing the proposed landscape modification. Landform is rated as *moderate to low* as it consists of low rolling hills with interesting, but not exceptional, visual character. Vegetation is highly modified with mainly veldt grasses, with no variety or contrast, and there is no visible presence of water. Colours are primarily associated with vegetation, as well as the black colour of the double-lane tarred road, and are discordant, with limited variation. Adjacent scenery is rated *low* and includes industrial vistas to the south as well as existing infrastructure. Scarcity of the visual resource is *low* as the landscape is fairly common within the region. Cultural modifications are *low* as they add little or no variety to the area, and are discordant.

The amount of use is *high* and, as it is an entrance to Saldahna, public interest would be *moderate to high*. The visual quality of adjacent land is *low*, as these areas are mainly industrial or degraded agricultural vistas. Special areas are rated *high* as it is a gateway into Saldahna and, as such, landscape modifications would need to be carefully considered. The overall receptor sensitivity to landscape modification on site is *moderate to high*.

As the site is in the foreground zone, receptor sensitivity is *moderate to high*, and scenic quality is *low,* a Class III visual objective is defined for the site. The visual objective is to partially retain the landscape character where the level of change should be low. Management activities may attract the attention of the casual observer but should not dominate the view and changes should repeat the basic element of form, line, colour and texture found in the natural features of the characteristic landscape.

7.9 Site Landscape Significance Findings

Site Scenic Quality Summary Table

Site Survey information								
ID	S1	S2	S3	S4	S5	S6	S7	S8
Name	Prospect Hill Limestone Quarry	Northern Limestone Quarry 1	Southern 1 Limestone Quarry	Southern 2 Limestone Quarry	Northern Limestone Quarry 2	Holvlei Clay Quarry	Cement Factory and Infrastructure	Private Road / Conveyor system
Visual Absorption Capacity	MH	L	ML	ML	ML	M	MH	M

Scenic Quality								
Land Form	2	2	2	2	4	2	1	2
Vegetation	1	5	2	2	3	1	1	1
Water	0	0	0	0	0	0	0	0
Colour	2	4	3	3	3	2	1	2
Adjacent Scenery	1	3	5	5	5	3	1	1
Scarcity	2	5	3	3	3	2	1	1
Cultural Modifications	-4	2	-4	-4	-2	2	-4	-2
Score	4	21	11	11	16	12	1	6
Category	C	A	C	C	B	B	C	C

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

Sensitivity								
Type of User	L	H	L	L	H	H	L	H
Amount of Use	H	M	H	H	M	M	H	H
Public Interest	M	H	M	M	H	M	M	M
Adjacent Land Users	H	L	H	H	H	M	L	L
Special Areas	L	H	M	M	H	L	L	H
Score	M	H	M	M	H	M	ML	H

(H = High, M = Moderate, L = Low sensitivity)

Distance Zone								
Zone	FG	FG	FG	FG	FG	FG	FG	FG

(FG = Foreground, BG = Background, SS = Seldom Seen)

VRM Class								
Class	IV	II	IV	IV	III	III	IV	III

7.10 Site Landscape Significance Findings

Site Scenic Quality	**The inherent sensitivity of the landscape, which is usually determined by a combination of topography, land form, vegetation cover and settlement pattern** **High (H)** : highly visible and potentially sensitive areas in the landscape. **Moderate (M)** : moderately visible areas in the landscape. **Low (L)** : minimally visible areas in the landscape.
High (Northern Quarry) **Moderate to High** (Southern Quarries) **Low** (Plant)	Located in Limestone Fynbos which is valued as critical biodiversity vegetation and surrounded by agricultural landscapes, the site for the northern quarries has the highest scenic quality as the context is not associated with the urban settlement of Saldanha. The other quarries are all to some extent associated with existing (historic) limestone quarry modification which does detract from their scenic value to some degree, resulting in moderate to high levels of scenic quality. The southern quarry is in close proximity to the developed context of Saldanha, as well as the existing Prospect Hill quarry where the scenic quality is *low*. The scenic quality of the area where the cement plant is proposed is also *low* due to the industrial landscape character of the site and surrounds.

Visual Sensitivity of Receptors	**The level of visual impact considered acceptable by the visual receptors is dependent on the type of receptor** **High (H)** : e.g. residential areas, nature reserves and scenic routes or trails **Moderate (M)** : e.g. sporting or recreational areas, or places of work **Low (L)** : e.g. industrial, mining or degraded areas
High (Northern Quarry) **Moderate** (Southern Quarry) **Low** (Plant)	The visual sensitivity of receptors to the landscape modifications relates to the scenic quality except for the proposed northern quarry, which is located on the skyline and will be partially visible from Jacobs Bay which increases the receptor sensitivity to this landscape modification. The northern quarry, located in CBA fynbos, is also clearly visible from the Jacobs Bay access road which is associated with tourism related to the Jacobs Bay coastal area, and is rated as *high*. The southern quarries are strongly associated with the developed nature of Saldanha but would have moderate receptor sensitivities due to *high* levels of exposure, which could impact the sense of place should dust mitigation not be effectively implemented. The industrial zoning for the area where the plant is proposed, as well as the existing strong industrial context generated by the Saldanha Steel Mill and harbour, would reduce the visual sensitivity of receptors to a similar landscape modification in this area.

8. VRM SENSITIVITY MAPPING

Sensitivity levels are a measure of public concern for scenic quality. Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The USA Bureau of Land Affairs has defined four Classes that represent the relative value of the visual resources of an area:

i. **Classes I and II** are the most valued;
ii. **Class III** represent a moderate value; and
iii. **Class IV** is of least value.

The VRM process divides the proposed property into Physiographic Rating Units (PRUs) with like characteristics based on the following characteristics provided by specialists and GIS data:

- Similar visual patterns, texture, colour, variety (Vegetation)
- Like geographic character (KOP Viewsheds)
- Similar impacts from manmade modifications (Land Use)
- Steeper slopes due to excessive scarring of the landscape
- The land use map based on the Vegetation Report
- Areas of high prominence
- Topography

Based on the site survey and Google Earth satellite imagery, the following PRUs were identified within the project boundary as depicted spatially on the map below:

- Agricultural area, which refers to those areas currently being utilised extensively for agricultural activities such as the Holvlei area, or those areas that have previously been modified by agricultural activities and have resulted in the fynbos areas being cleared for grazing or cultivation.
- Critical Biodiversity Areas (CBAs),which are areas defined by the C.A.P.E. Fine-Scale Biodiversity Planning (FSP) project as environmental assets where further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of these special biodiversity features.
- Mine transformed area, where extensive and intensive excavation is currently underway (as in the Prospect Hill quarry) or the smaller areas scattered around the project areas which have previously been excavated for limestone and partial, natural rehabilitation has taken place.
- Mine transformed areas on the skyline only refers to the area of the proposed northern limestone quarry, which has previously been mined and excavations are currently visible from Jacobs Bay.
- Road refers to the section of the property which overlaps with the Jacobs Bay access road.
- Water tower and access refers to the area to the east of Prospect Hill where the existing water tower for Saldahna is located, which includes a modified apron around the site and an access road.
- The industrial zoned area refers only to the site where the cement plant is proposed, which has already be zoned as industrial and where the industrial landscape context is strongly associated with other industrial type structures.

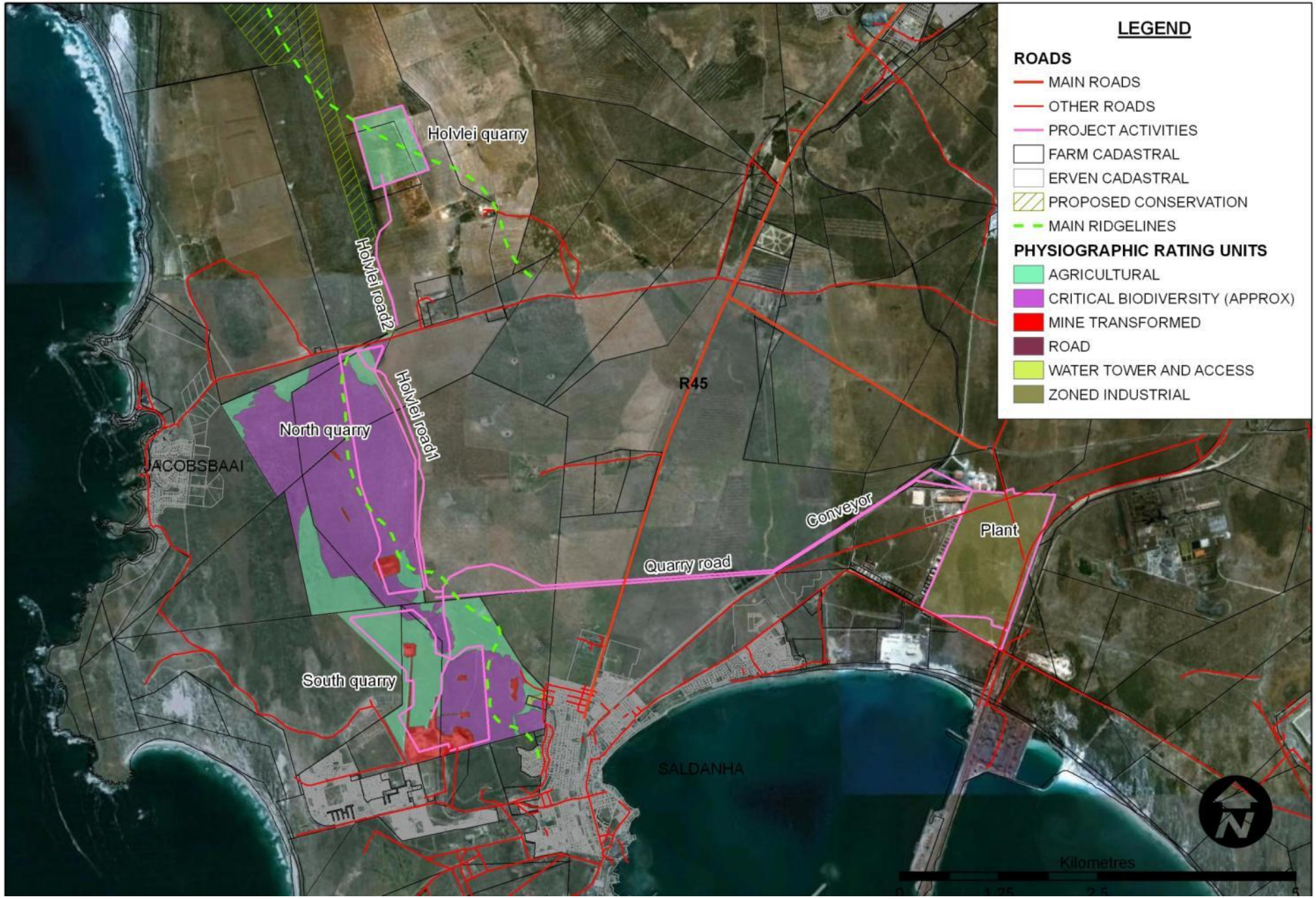


Figure 27: Physiographic Rating Units Map

The above land use areas were extrapolated from the survey point scenic quality and receptor sensitivity findings to generate scenic quality and receptor sensitivity layers. These were then incorporated into a VRM Class map making use of the VRM matrix (Refer to Figure 25). The following visual objectives were defined for the four VRM Classes:

Class I

- No Class I areas were defined within the project boundary as the area is not formally protected.

Class II

- A Class II visual objective, which allows for low levels of landscape modifications, was assigned to the Critical Biodiversity Areas. Many of the Critical Biodiversity vegetation types occur only along the West Coast and are thus endemic to these municipalities. In effect, the endemic percentages see below indicate the degree to which a vegetation type is endemic to a particular municipality. For Saldanha Bay area:
  - The endemic Saldanha Limestone Strandveld (86% endemic) is restricted to the exposed limestones (calcrete) of the Saldanha Peninsula. Prominent limestone ridges adjacent to the coast are a familiar feature of this area, such as at Saldanha, Jacobs Bay and Paternoster.(Maree, K.S. and Vromans, D.C. 2010)

Class III

- A Class III visual objective was assigned to the areas which have been modified previously or are currently being modified by agricultural areas and which have medium scenic qualities and receptor sensitivities. A moderate degree of landscape modification can be undertaken in order to protect the regional sense of place.

Class IV

- A Class IV visual objective was assigned to the areas located within the project boundary that had previously, or are currently, associated with limestone quarry activities. These areas generate high levels of visual contrast due to the white limestone colours in contrast to the grey–greens of the fynbos, and the modified landform. Class IV was also assigned to the industrial zone where the proposed cement plant is located.

9. KEY OBSERVATION POINT CONTRAST RATING

The assessment of the Degree of Contrast (DoC) is a systematic process undertaken from Key Observation Points (KOPs) surrounding the project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications. Key Observation Points (KOPs) are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the degree of contrast that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations, or receptors, surrounding the property. The degree of contrast generated by the proposed landscape modifications are measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible (USA Bureau of Land Management, 2004).

To define the KOPs, potential receptor locations are identified in the viewshed analysis, which are screened, based on the following criteria:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size
- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

As indicated in the map on the following page, eight receptor locations were identified as Key Observation Points. These locations were used to assess the suitability of the proposed landscape modifications.

Map ID	Name	Activity	Description
R1	Main Road	Plant	Significant view, as entrance to Saldanha Bay is via Main road which also represents the main views as seen from Langebaan residential areas.
R7	R399	Conveyor & Road	The R399 is a main road to Saldanha as well as a tourist route.
R10	Middelpos	Southern Quarries	Road between Middelpos and Diazville informal settlement.
R12	Jacobs Bay	Northern Quarry	Residential/tourist
R14	Rd to Jacobs Bay	North Quarry	Access road to Jacobs Bay
R15	Rd to Jacobs Bay	Holvlei Quarry	Access road to Jacobs Bay
R17	Saldanha	Plant	Residential/ tourist area in Merestyn Street
R20	Agricultural	Holvlei Quarry	Agricultural north east of Vredenburg

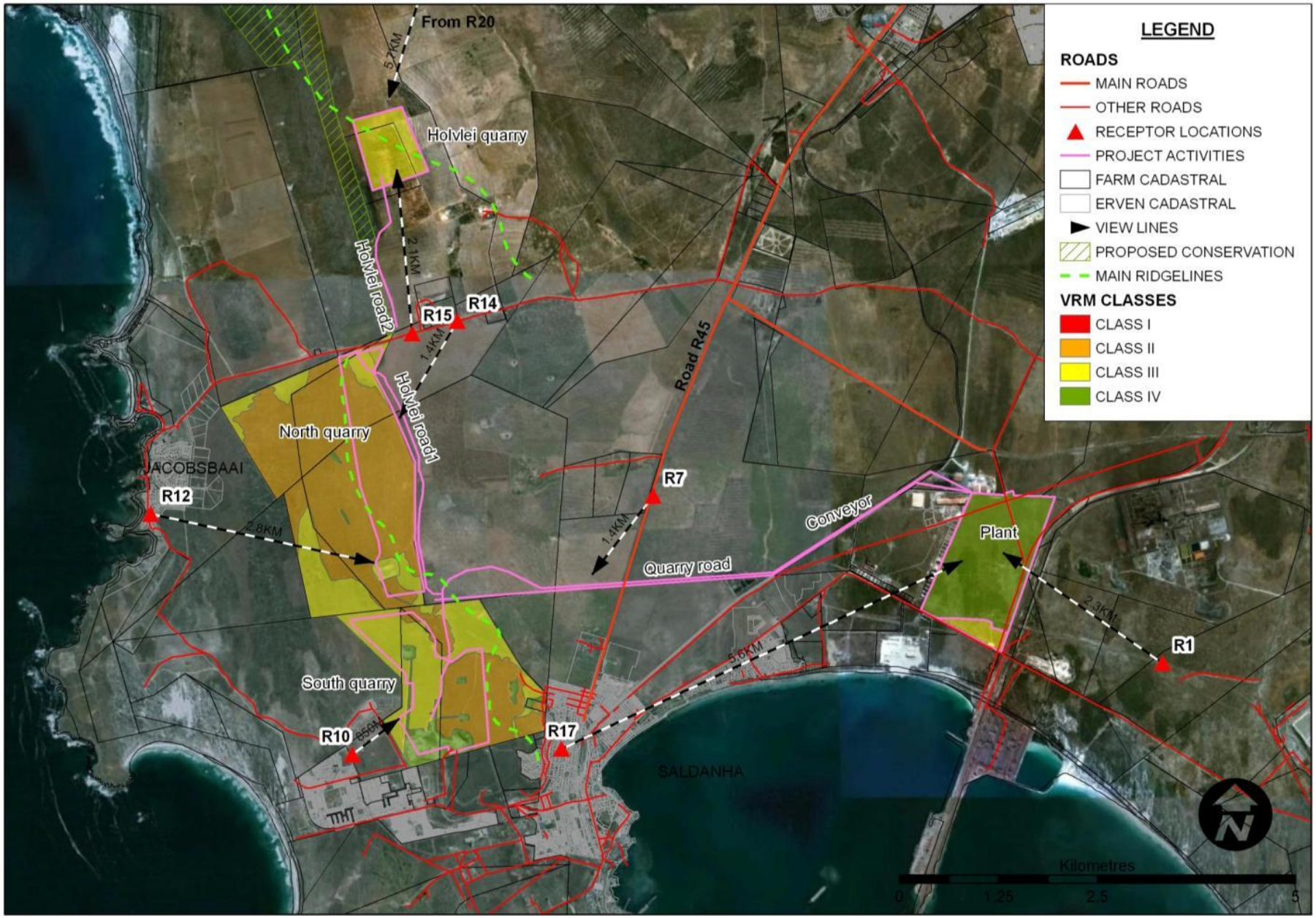


Figure 28: Receptor (KOP) points overlaid onto VRM Classes and Google Earth aerial photograph

9.1 R1: Photomontage from Camp Road

Existing View

Proposed view

For illustrative purposes only

The receptor is located 2.3 km from the plant site and would fall into the foreground/middle ground buffer zone where the area would be sensitive to landscape modification. Camp Road is one of the main access routes from Langebaan into Saldanha. This receptor was identified as a Key Observation Point (KOP) as, although the scenic quality is low, the sensitivity is moderate as receptors would have clear views of the site, as well as very clear views of the existing industrial plants. There is a high visual absorption capacity created by the very large industrial plants adjacent to the site. The topography is fairly flat with low rolling hills in background which give some variation to the topography. Receptor location is within visible distance of Langebaan lagoon but the context is strongly associated with the industrial landscape.

In terms of 'form' the existing landscape includes strong, structured forms of the existing industrial structures dominating the scene. Existing industrial structures also generate strong vertical and horizontal lines, mostly distinct and solid. Wavy, horizontal lines are characteristic of the topography and vegetation typical in this area. Vegetation and soil characteristics portray medium to dark colours in the fore- / middle ground, with dappled spots of colour brought on by manmade structures. The effect of moisture and dust particles in the air reduces the intensity of colour in the background to medium to light. The proposed structures would be of similar nature in form, line, colour and texture thus blending in with the elements of the receiving landscape.

In terms of mitigation, it would be advisable to use matt, cement grey or dark reddish brown based colours that would quickly fade away with distance. Even though the area is already an industrial area, lights at night should be kept to a minimum, and lighting should be directional rather than flooding the whole area, in order to avoid light spillage onto adjacent properties. Security lighting could also be connected to sensors that are activated only upon illegal entry to the site. The visual objectives for this area could thus be met with correct and efficient implementation of mitigation measures.

9.2 R7: Photomontage from R399 Road

Existing view

Proposed view of conveyor bridge option

For illustrative purposes only

Photograph 40: Photograph showin cadastral line of proposed road alignment

The R399 is a main commuter road to Saldanha, as well as a tourist route which runs in close proximity to the proposed conveyor, trucks, road and bridge option. The sense of place is mainly agricultural to the west, where the road and conveyor are proposed. This receptor was identified as a KOP mainly due to the tourism influence and the location of the site at the entrance, or gateway, into Saldanha.

The receptor lies within the foreground distance zone (1.2 km away from the site) and is directly adjacent to the proposed landscape modification with high levels of exposure to the proposed project activities. Receptors would be tourists, as the road is an entrance/gateway into Saldanha. It is probable that maintaining visual quality would be a major concern for most users. The R45 is a main entrance into Saldanha and the main link between Saldanha and Vredenburg. It carries a large amount of traffic. The industrial context of the areas directly to the east of the site would impact the sense of place.

Vertical lines, from the power and communications structures, are prominant but not dominant in the landscape. Horizontal lines, mostly a result of the topography, are in general straight, with some large curves as a result of the koppies and ridge. Colours are mostly grey-greens and darker specks of vegetation, as well as a cluster of mostly mixed lighter colours and whites from buildings of the town.

The preferred option for the conveyor at the intersection with the R399 is to cross underneath the road, reducing the negative visual effect in term of visibility. In terms of the conveyor bridge option, the proposed structure would contrast significantly with the landscape setting. However, while prominent, it would not dominate the scene, as it would mostly follow the existing contours. At the road crossing, the conveyor should be covered in a structure painted in colours that would blend with the natural colour of the area. At night time it is proposed that minimal lights are used and light with a yellow colour is used instead of brighter, white lights.

The visual impact from the road option would be more intrusive since it would involve the constant movement of a large number of bulky trucks between the plant and pits. Should the roads not be tarred, dust clouds would frequently arise causing visual disturbance. Should mining activities continue through the night, the lights from the trucks would be visually annoying.

Visual objectives for this area would be met with the correct and effective implementation of mitigation measures since management activities may attract attention, but should not dominate the view of the casual observer.

9.3 R10: Photomontage from Middelpos

Existing View

Proposed view in 2040 with red lines indicating 2112 expansion

For illustrative purposes only

Proposed view with rehabilitation

For illustrative purposes only

3D View from R10: 2015

3D View from R10: 2025

3D View from R10: 2036

3D View from R10: 2042

Figure 29: 3D model of proposed phases from R10

Photograph 41: Photograph showing sense of place

Receptors are situated less than 1 km from the proposed quarry and it would be defined as a high exposure area. The area is located in an informal settlement where issues would be more related to socio-economic concerns as opposed to the proposed landscape modification. There is a potential that the very close proximity of the receptors in relation to potential dust impacts and potential disruption of daily movement patterns could affect the public interest. Adjacent land use is industrial and residential. Special areas are the Limestone Fynbos vegetation patches in the area, which has very high critical biodiversity value. This receptor was identified as a Key Observation Point (KOP) due to its very close proximity to the proposed quarry.

The topography of the area is very flat, with a ridge that creates a backdrop for the activities and proposed open cast pits. The main colours are monotones of finely textured greens, with a moderately rough textured block of various, mainly pastel colours created by the informal housing structures. Horizontal lines of the topography and the housing block are the most prominent in the scene. Light and telecommunication poles create fine vertical lines, softening the upper edge of the housing block. The access road to the residential area forms a strong directional line towards the proposed activity. The eye would naturally follow this line and the contrast of the white pits against the green backdrop would be quite prominent. Dust clouds from the blasting and hauling activities would be plainly in sight against the blue sky backdrop. Lights at night would also be highly visible and intrusive during hours of darkness.

Due to the existence of the current mining activities, the area is no longer pristine. This would result in a cumulative negative impact from the additionally proposed open cast pits which would degrade elements in the landscape. Due to the location of the pits in the topography, not much can be done in terms of mitigating measures, except to minimise the intrusive nature of dust and light pollution. Dust suppression techniques could be implemented. In terms of light, similar mitigation measures as with R1 and R7 above could be applied. The creation of a low berm, on the community's side of the proposed activities, to act as a visual screen, could also be implemented as a mitigation measure.

Taking into consideration the conservation status of the biodiversity, the visual objective would be to retain the existing character of the landscape. However, it has been classified by the local Saldanha Municipality as an industrial area, which would result in a different class of visual objective. This would allow for the level of change to be high, as long as the management activities do not dominate the view or become the major focus of the viewers' attention. In both cases the visual objective would not be met, either with or without effective and correctly applied mitigation measures.

9.4 R12: Photomontage from Jacobs Bay

Existing View

Proposed view during mining

For illustrative purposes only

Proposed view with rehabilitation

For illustrative purposes only

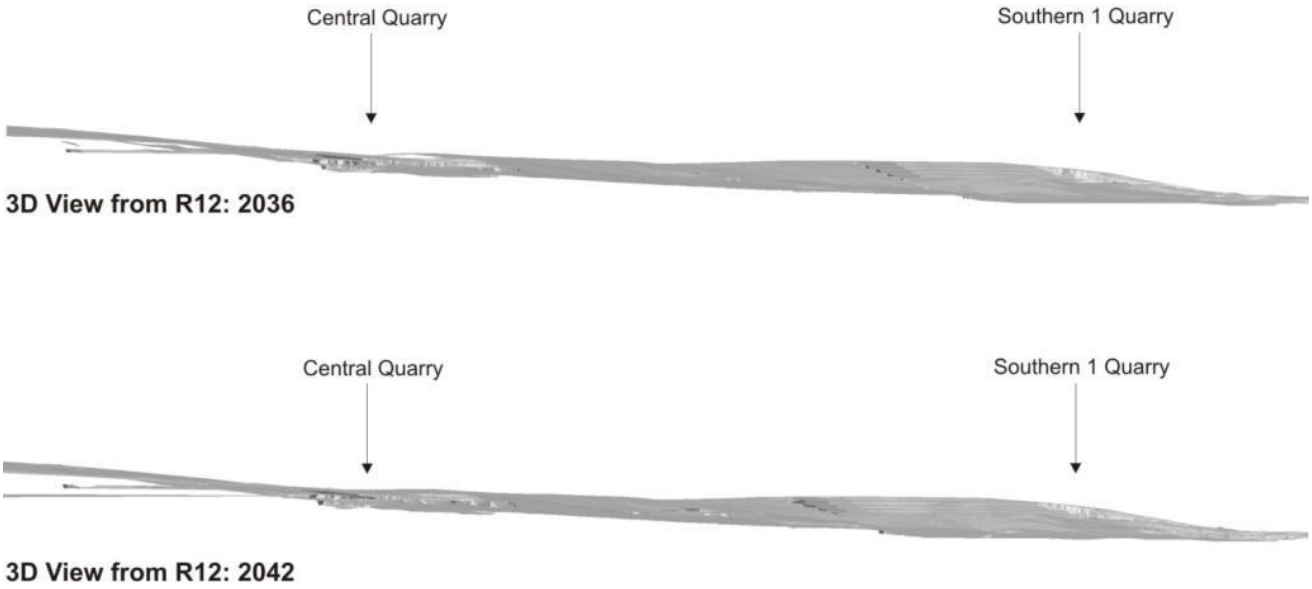


Figure 30: 3D model of proposed phases from R12

Photograph 42: Photograph showing Jacobs Baysense of place

Jacobs Bay is a very tranquil retirement / tourist hideaway located around a small private bay and surrounded by a ridge which creates a cosy sense of place. Residents and / or visitors would be drawn to this retreat to relax and revive in the pleasant and comfortable sense of place. A ridge forms the eastern edge of the landscape, followed by a relatively even slope towards the private bay. Being located less than 4 km from the proposed activity; Jacobs Bay would fall within the *high* visual exposure zone, with the activity being present in the fore- / middle ground view of the receptors, mostly on the outside eastern edge of the residential area. This area also forms part of the special areas, containing very high value critical biodiversity Limestone Fynbos. Taking these factors into consideration, it can be assumed that, in general, public concern would be very high and the public may also be opposed to the proposed development. However, evidence exists that current mining activities are degrading the serenity of the landscape. It should also be noted that this area has been earmarked for industrial use by the Saldanha Bay SDF (Feb 2010) in opposition to the conservation status as derived from the Western Cape PSPF (2005), as well as Western Cape DEA&DP Guidelines (2005) (Refer to Annexure 2: Relevant Planning Policy).

This receptor was identified as a Key Observation Point (KOP) due to the interest of the public and the near distance, 2.8 km, from the proposed activity. Colours in the landscape are monotones, varying with seasonal changes between moderately to finely textured greens and greys. The white soil stands out prominently where the landscape is scarred by manmade interventions, such as the current mining activities and existing dirt roads in the area. A very prominent horizon dominates the scene. The residential character comprises of charming, white rural Cape-style houses, fairly densely spaced to contain encroachment on the landscape.

9.5 R14 and R15: Photomontage from Jacobs Bay Road

Existing View

Proposed view of total mining area

Proposed view in process showing stages of mining

For illustrative purposes only

Photograph 43: View from R15 in the direction of Holvlei Clay Quarry

Photograph 44: Photograph showing R15 sense of place

This road is the main access route to the residential area of Jacobs Bay, a retirement and tourist destination, as described above. As a result, public concern for the protection of the sense of place would be high. For the receptors along this road, both the North and Holvlei quarries would be in the fore- / middle ground of receptors' views. The landscape is characterised by the typical flat topography of the sub-region. This area is located near the ridgeline, on a sloping plateau. Vegetation is typical of the study area and the Limestone Fynbos has not been disturbed by crop growing and grazing activities. This results in open views and a high visual exposure to the mining activities. Exposure would, however, be of a short duration, as the viewer would be travelling through the landscape.

The receptor was identified as a KOP mainly due to tourism and the concerned nature of residential travellers along this road. Colours are mainly finely textured, medium greens and grey-browns of the vegetation, and would vary with the season. Due to the farming activities and levelness of the topography, there is an absence of form, except that of the topography, which would be translated as strong, slightly undulating with horizontal lines. The road forms a strong line, drawing the eye forwards to the horizon and is accentuated by the repetitive vertical lines of the adjacent telecommunication poles. The mining activities would expose the light colour of the soil in this area, which would result in a sharp contrast with the surrounding landscape character. Dust from blasting and hauling activities would cause visual disturbance during daylight hours.

Looking towards Holvlei quarry when driving along the road to Jacobs Bay, the proposed mining activities would be visible, slightly cutting into the ridgeline. Dust from blasting activities and transport activities along haul roads would be clearly visible against the blue sky and landscape backdrop. Lights during hours of darkness would also be clearly visible. These could be mitigated as described in previous sections. The road option would result in visual disturbance due to constantly moving trucks and their associated dust trails. Should the activities continue during dark hours, the lights of the trucks would add to the visual disturbance of the lights at the pits. The effect of dust can be mitigated by the construction of a hard road surface or the implementation of effective dust control measures.

Visual objectives for views towards Holvlei quarry provide for management activities that should repeat the basic elements found in the predominant natural features of the characteristic landscape. Visual objectives can be met with mitigation measures.

For the R15, looking towards the North quarry, both the conveyor and the road options would add a distinctive line to the scene. The visibility of the conveyor could be mitigated by painting it in a colour to blend in with the colours of the landscape. During hours of darkness the lights would, however, be visible from quite a distance, as the alignment of the conveyor would be from the upper section of the ridge, crossing the uniformly sloped topography all the way to the plant. Mitigation measures would be similar as those proposed for R14 above.

Visual objectives for the views towards North quarry could be met with mitigation if the level of change is kept to a minimum, and management activities may be seen by, but should not attract the attention of, the casual observer.

9.6 R17: Photomontage of Saldanha Residential

Existing View

Proposed view

For illustrative purposes only

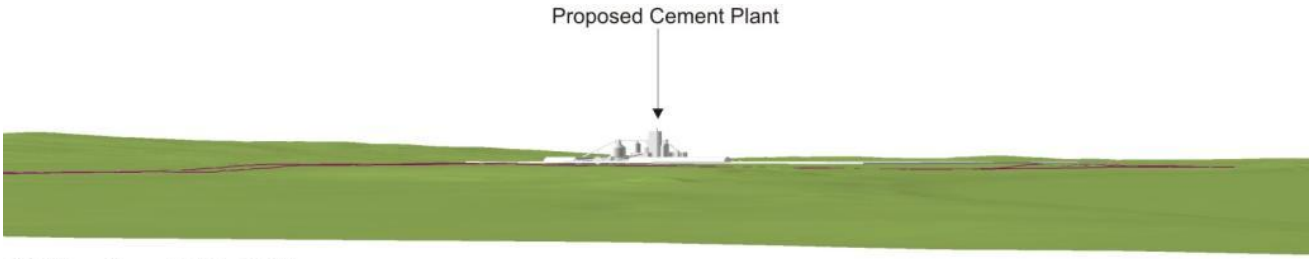


Figure 31: 3D model of proposed plant from R17

Photograph 45: R17 Receptor sense of place

This receptor viewpoint is in Merestyn Road in Saldanha. The proposed plant is situated 5.7 km from this residential receptor and is within the 6 km buffer, which therefore has the potential to impose change. The area is residential but is also related to tourism due to the open views of the bay and harbour. Adjacent land use includes industrial and commercial sectors. The lower-lying areas would have limited views of the proposed landscape modification and industrial /commercial areas would be focused on the local context and not the regional context. In its urban context, the sense of place is one of an industrial harbour which creates a unique sense of place and does add value.

Prominent lines in the scene are the strong horizon line, the lines of the dirt road and major road into town, as well as the curve of the harbour. Smaller angular lines are portrayed by the residential structures in the scene. These are clustered together and read as a moderately rough texture with various colours, rather than as separate lines. The lines from the industrial structures add a vertical linear element to the scene, prominent but not dominant. Vegetation adds finely textured, lighter grey-brown-greens, as well as dark patches of exotic and garden plants. Another prominent colour in the scene is the blue from the ocean.

The forms, lines and colours of the proposed plant structures would be similar to those of the existing industrial structures, enhancing the capacity of the scene to visually absorb the proposed structures. The structures would, however, be nearer to the receptors, increasing visibility and the visual intrusion on the scene and the associated viewers. During hours of darkness this would be even more evident as the contrast between the lights and the dark sky is more prominent than the forms, lines, colours and textures during daylight hours.

As mitigation measures, the structures could be painted as explained above and lights should be managed as explained in previous sections. Visual objectives for this receptor would be met with and without mitigation measures.

9.7 R20: Agriculture North West of Vredenburg

Figure 32: View towards Holvlei quarry where no visual change will be noticeable

FOR ILLUSTRATIVE PURPOSES ONLY

Photograph 46: Photograph showing sense of place

R20 is located north-east of the Holvlei quarry, less than 6 km away, and the proposed activities would thus be in the farm middle ground of the receptors' views. The receptors are farmsteads and, as private entities, their concern for negative visual intrusion would be high, especially since the current land use of the proposed Holvlei quarry is agriculture. The current sense of place is rural-pastoral. The topography is flat and open with prominent, weakly undulating horizontal lines that are accentuated by the clear ridgeline. The main colours and textures are a result of agricultural activities. The fine, smooth ochre-browns of the soil are visible when lands are not cultivated. This monotone mass is broken by clusters of dark greens of exotic vegetation and specked with whites, pastels, reds and other colours of farmsteads and outbuildings.

Views towards the proposed activities are blocked by the topography and for this receptor, visual objectives during daylight hours, would thus be met without mitigation measures. Should mining activities continue during hours of darkness, mitigating measures for lights should be implemented as stated in previous sections. Visual objectives would also be met during dark hours with the correct and effective implementation of mitigation measures.

9.8 Contrast Rating Summary Table

Receptor information								
Receptors	R1	R7	R10	R12	R14	R15	R17	R20
Name	Camp Road	R399	Middelpos	Jacobs Bay	Road to Jacobs Bay	Road to Jacobs Bay	Saldanha Residents	Agriculture
Main Activity Visible	Plant	Access road / bridge and conveyor	Southern quarries	Northern quarry (skyline)	Northern quarry (CBA)	Holvlei quarry	Plant	Holvlei quarry
VRM Class	IV	III	III / IV	II / III / IV	II	III	IV	III

Contrast								
Form	M	M	M-S	S	W	W	W	W
Lines	M	M	M	S	M-W	M-W	W	W
Colour	M	M-S	S	S	M-S	M-S	W	W
Texture	M	M-S	M-S	S	M	M	W	W
DoC	M	M-S	M-S	S	M	M	W	W

Key: N = Neutral, S = Strong, M = Moderate, W = Weak

Visual Objectives Met								
Southern quarry (close proximity)	X	X	Y(M)	Y(M)	X	X	X	X
Southern quarry (elevated)	X	X	Y(M)	X	X	X	X	X
Northern quarry (CBA)	X	X	X	X	**N**	X	X	X
Northern quarry (Skyline)	X	X	Y(M)	**N**	X	X	X	X
Holvlei quarry	X	X	X	X	Y(M)	Y(M)	X	Y(M)
Access road and conveyor	X	Y(M)	X	X	**N**	Y	Y	X
Plant	Y(M)	X	X	X	X	X	Y	X
Lights at night	Y(M)	Y(M)	Y(M)	**N**	**N**	Y(M)	Y	Y(M)

Key: Y = Yes, N = No, Y (M) = Yes with mitigation, x = Not visible,

9.9 Visual Intrusion and Contrast Rating Findings

Southern quarry (Close proximity)

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
High	Although this quarry would be situated near the existing quarry, visual contrast would still be high. The proposed pit would be visible from the Middelpos community, as well as from the Jacobs Bay residential area. The pit is also located in an area with sensitive biodiversity. Mitigation measures could address the negative effects of dust and light nuisance and pollution.

Southern quarry (Elevated)

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
High	Southern quarry 2 is also situated in an area that displays evidence of existing mining activities but would also, however, contrast quite strongly with the proposed activity and would be in full view of residential areas. Mitigation measures could, at best, address dust and light nuisance and pollution.

Northern quarry

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
High	(CBA region) This quarry would be located in the fore- / middle ground of the receptors' views and would be situated in a landscape that does not contain other prominent negative visual elements. Mitigation measures would be similar to the other quarries. Mitigation measures for the road and conveyor options would also address dust and light issues. (Skyline region) Of the five proposed quarries, the skyline area of the northern quarry would be the nearest to the sensitive receptor, Jacobs Bay residential area. The proposed mining activities would be prominent in the landscape as it would be located on a ridgeline. Again, mitigation measures could address dust and light nuisance and pollution.

Holvlei quarry

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
High	Holvlei quarry would have similar issues and mitigation potential as the northern quarry.

Access road and bridge and conveyor system

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
High	These two options would traverse the landscape from an area where it would strongly contrast with the surrounding landscape features, to an industrial area where change would be evident but not necessarily uncharacteristic with the surrounding landscape features. Dust and light nuisance and pollution issues could be addressed with mitigation measures for the road option. With regards the conveyor option, the structure could be painted and light pollution could be addressed.

Cement plant and pre-heater

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
Moderate	The proposed plant site is situated in an industrial area and it would thus fit with the surrounding land use. As mitigation measures, the effect of lights at night could be addressed, as well as contrast created by the colour of structures.

Lights at night

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
Moderate Plant **High** Quarries and conveyor / road	Lights during hours of darkness would have a more severe impact at the quarries and associated transport routes than at the plant. Mitigation measures could typically entail the following: • Avoid pole-top security lighting; • Use motion sensors to activate lights on illegal entry; and • Use directional lighting to reduce light spillage onto neighbouring land.

Project Overall Visual Intrusion

Rating	Congruence of the project with the particular qualities of the area, or its 'sense of place' **High (H)** : noticeable change **Moderate (M)** : partially fits into the surroundings, but clearly noticeable **Low (L)** : blends in well with the surroundings
Moderate to High	Overall visual intrusion would be moderate to high for the quarries and transportation options, and moderate to low for the plant with the overall visual intrusion as moderate to high due to the significance of the critical biodiversity areas which will be lost.

10. IMPACTS PER PROPOSED ACTIVITY PER AURECON IMPACT CRITERIA

Impact, as defined by the DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA processes (2005) is: 'A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space' (Oberholzer. 2005).

Based on the contrast rating, which was undertaken from each of the surrounding receptors, an assessment was made on whether the proposed activities met the recommended visual objectives defined in order to protect the landscape character of the area. The following proposed activities were identified as requiring visual assessment:

- Southern Limestone Quarry
- Northern Limestone Quarry
- HolMei Clay Quarry
- Access road, bridge and conveyor
- Cement Factory and associated infrastructure
- Lights at night
- Private road / Conveyor system

10.1 Southern Limestone Quarry

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Medium - Low	Even with effective mitigation measures, the landscape would still be notably altered.
Duration	Medium	Medium	Impact would occur for up to 10 years.
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact.
Probability	Definite	Definite	The probability of the occurrence is definite.
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Irreversible	Irreversible	The activity will lead to an impact that is permanent.
Cumulative	Yes	Yes	Proposed activity will add cumulatively to the existing open cast mining activities in the near vicinity.

10.1.1 Mitigations

Construction

- A shallow angled screening berm needs to be created to the east of Middlepos and fully rehabilitated to fynbos type vegetation / veld grass (indigenous / endemic)
- It is assumed that a security gate, chain link fence, possibly with associated administrative and refreshment facilities, would be constructed at the quarry, as well as the access / haul road and conveyor.
- Mitigation measures would include dust suppression techniques and refraining from construction activities outside of business hours.
- Southern Quarry: generate a 3 m high undulating screening berm to the west. On the eastern extent the quarry should curve on the edges to align more naturally with the topography. Maximum 30 degree slope to allow for effective rehabilitation. (See Figure 2: Mitigation Map point 5)

Operation

- Implementing dust suppression techniques inside the quarry, e.g. scheduling of blasting sequences and regular wetting of the roads inside the quarry.
- If operational during hours of darkness, use directional lighting to avoid light spillage onto neighbouring and nearby areas.
- Implement a system whereby security lighting is kept to a minimum and is linked to motion sensors that are activated upon illegal entry only.
- Rehabilitation of Prospect Hill Quarry after mining complete.
- Netting covers over areas of cutting slopes that are not being directly mined to reduce the visual intrusion.

Decommissioning / Closure

- Rehabilitate vertical slopes to create natural contours and texture to aid in vegetation establishment. Vegetate slopes with indigenous, preferably endemic, vegetation.
- Examples of the successful rehabilitation to grassland can be seen in Photograph 47 and 48 of the rehabilitated north east face of Tabakbaai quarry. Although this face will in future be mined it was rehabilitated in the 90's without any special attention to see what the long term effect would be. The rehabilitated face is the face in the foreground below the old workings of the Prospect Hill Quarry. (Source: Afrisam)

Photograph 47: Photograph of successful rehabilitation of north east face of Tabakbaai quarry

Photograph 48: Close up photograph of natural rehabilitated north east face of Tabakbaai quarry

10.2 Northern Limestone Quarry

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Medium - Low	Even with effective mitigation measures, the landscape would still be notably altered.
Duration	Medium	Medium	Impact would occur for up to 10 years.
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact.
Probability	Definite	Definite	The probability of the occurrence is definite.
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Irreversible	Irreversible	The activity will lead to an impact that is permanent.
Cumulative	Yes	Yes	Proposed activity will add cumulatively to the existing open cast mining activities in the near vicinity.

10.2.1 Mitigations

A large portion of the mine is located on the skyline and should the No-go option be exercised to meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, (DEA&DP. 2002) it is likely that the project would be threatened. Given the current inclusion of the mine in the Saldanha SDF and the recognition of Saldahna as a development zone, the VIA has not recommended this area as a No-go area. However, it must be noted that DEA&DP are yet to formally recognise the Saldanha SDF.

However, due to this skyline area potentially generating high levels of permanent visual intrusion which would not meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, it is recommended that the proposed mine plan for this area be amended for the proposed skyline mine zone (Figure 1). The plan needs to depict the final post-mine skyline which needs to reflect a smooth and continuous line that mirrors the existing skyline, but would be lowered by approximately 4 m on the ridgeline. Should this not be provided, the No-go option for skyline mining is recommended.

The northern section of the quarry is adjacent the Jacobsbaai Road which is an important tourist route. It is recommended that the mine is set back from the north-east corner where an existing low mound will afford some natural visual screening (Figure 3). A low berm needs to be created to the west of the low mound parallel to the road to connect to the hill area. The berms needs to be formed by topsoil removed from the limestone fynbos in the southern quarries which will not be rehabilitated back to limestone fynbos.

Construction

- Incorporate Jacobsbaai setback area
- A low berm needs to be created to the west of the low mound parallel to the road to connect to the hill area (Figure 3), created from topsoil which will not be rehabilitated back to limestone fynbos. The screening berm needs to appear natural and it is recommended that an accredited landscape architect be utilised for the design and construction.
- Chain link security fence
- Mitigation measures would include dust suppression techniques and refraining from construction activities outside of business hours.

- Implement a system whereby security lighting is kept to a minimum and is linked to motion sensors that are activated upon illegal entry only.
- It is assumed that a security gate, possibly with associated administrative and refreshment facilities, would be constructed at the quarry, as well as the access / haul road and conveyor.

Operation

- From a visual impact mitigating perspective, it is recommended that the mine plan for the skyline area is amended. This will ensure that the post-mine skyline, which needs to reflect a smooth and continuous line that mirrors the existing skyline, would be lowered by approximately 4 m on the ridgeline (Figure 1).
- Implement dust suppression techniques inside the quarry, e.g. scheduling of blasting sequences and regular wetting of the roads inside the quarry.
- If operational during hours of darkness, use directional lighting to avoid light spillage onto neighbouring and nearby areas. Implement a system whereby security lighting is kept to a minimum and is linked to motion sensors that are activated upon illegal entry only.
- Search and rescue for red data species for all quarries.
- Rehabilitation concurrently as soon as possible after disturbance.
- Remove and replace at least 30 cm of topsoil.
- Stockpiles to be maximum 1.5 to 2.0 m in height and not to be driven on.
- Work in 200 m cut face, as cut and restore.
- Face rip benches and rehabilitate.
- Earthworks during construction activities can focus on berming the west face in order to hide some of the mining activities near the top.

Decommissioning

- Rehabilitate vertical slopes to create natural contours and texture to aid in vegetation establishment. Vegetate slopes with indigenous, preferably endemic, vegetation.

10.3 Holvlei Clay Quarry

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Medium - Low	Even with effective mitigation measures, the landscape would still be notably altered,
Duration	Medium	Medium	Impact would occur for up to 10 years,
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact,
Probability	Definite	Definite	The probability of the occurrence is definite,
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact,
Reversibility	Irreversible	Irreversible	The activity will lead to an impact that is permanent,
Cumulative	Yes	Yes	Proposed activity will add cumulatively to the existing open cast mining activities in the near vicinity,

10.3.1 Mitigations

Construction

- Chain link security fence
- Mitigation measures would include dust suppression techniques and refraining from construction activities outside of business hours.

Operation

- Implement dust suppression techniques inside the quarry, e.g. scheduling of blasting sequences and regular wetting of the roads inside the quarry.
- Implement a system whereby security lighting is kept to a minimum and is linked to motion sensors that are activated upon illegal entry only. It is also strongly recommended that this quarry be mined from the top downwards, limited expansion down the slopes and utilising the surrounding cut to screen the exposed faces.
- Reduce the southern extent of the quarry areas so that the bulk of the cutting of the quarry is located on the top of the hill. Quarry edges to be curved to align with the topography. (see Mitigation Map point 9)
- Visual buffer on Jacobs Bay road should be curved to align with the topography and to allow a more effective north south critical biodiversity corridor. The road must be realigned along the edge of the quarry area and not cut through the buffer area. (See Mitigation Map point 8)

Decommissioning

- Rehabilitate cut face area to create natural contours and texture to aid in vegetation establishment. Vegetate cut-face with indigenous, preferably endemic, vegetation.

10.4 Access road or conveyor system

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Low	Even with effective mitigation measures, the landscape would still be notably altered.
Duration	Medium	Medium	Impact would occur for up to 10 years.
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact.
Probability	Definite	Definite	The probability of the occurrence is definite.
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Irreversible	Irreversible	The activity will lead to an impact that is permanent.
Cumulative	Yes	Yes	Proposed activities will add cumulatively to the existing open cast mining activities in the near vicinity.

10.4.1 Mitigations

Construction and Planning

- Visual preference for an underpass for R45 for road/conveyor. (See Mitigation Map point 3).
- Visual preference is for road option over conveyor as conveyor would require a crusher activity to be located on top of the hill which could be visually intrusive.
- Haul road has the potential to generate high levels of dust and it is recommended that the haul road be tarred.
- During *Planning Phase*, consider re-alignment of the road option in order to avoid going straight op the slope.
- Should the conveyor option be utilised, consider constructing the conveyor as close to ground surface as possible or cutting into the ground surface if possible.
- Mitigation measures would include dust suppression techniques and refraining from construction activities outside of business hours.
- Align road through areas which are not rating high vegetation sensitivity.
- Realign the road around the steep slope area. (See Mitigation Map point 4).
- To reduce the visual intrusion of the haul trucks, the road should be cut in if possible and a low screening wall created on the valley side. The cut face will have to be rehabilitated to veld grass.

Operation

- If the road is not covered in a hard surface (e.g. paving blocks, concrete, tar etc.), dust suppression techniques should be implemented.
- Should the conveyor option be implemented, lights should be kept to a minimum and the structure should be painted in colours to blend in.

Decommissioning

- The road surface could be removed and rehabilitated.
- The structures of the conveyor should be removed and the vegetation rehabilitated to its pre-impact status.

10.5 Cement Factory and Associated infrastructure

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Medium	Even with effective mitigation measures, the landscape would still be notably altered.
Duration	Long Term	Long Term	Impact would occur for more than 10 years after construction.
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact.
Probability	Definite	Definite	The probability of the occurrence is definite.
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Reversible	Reversible	As soon as the structures are removed during decommissioning phase and the site rehabilitated with natural vegetation, the impact could be reversed.
Cumulative	Yes	Yes	Proposed activity will add cumulatively to the existing industrial activities in the near vicinity.

10.5.1 Mitigations

Construction

- Implement dust suppression techniques during construction phase.
- Ensure that as much existing vegetation (other than exotic invaders) is retained wherever possible during the construction phase to act as dust collectors and to break the monotony of vast expanses of exposed earth.
- The absolute minimum amount of vegetation and topsoil should be removed from the project area.
- Ensure that all existing natural vegetation is retained wherever possible and incorporated into the site design, especially on the periphery of the project area.
- To reduce the amount of glare, external surfaces of buildings and other structures should be articulated or textured to increase the interplay of light and shade.
- Structures should be painted in matt, cement grey or dark reddish brown based colours that would blend in with the colours of the surrounding landscape.

Operation

- Avoid the use of pole-top security lighting.
- Implement a system whereby security lighting is only activated upon illegal entry onto site.
- Implement directional lighting to avoid light spillage onto neighbouring land.
- Use as few lights as possible. (See Mitigation Map point 2)

Decommissioning

- The structures of the plant and all hard surfaces should be removed and the vegetation rehabilitated to its pre-impact status.

10.6 Lights at Night

Impacts per phase table

Criteria	Mitigation		Motivation
	Without	*With*	
Extent	Regional	Regional	Even with correctly implemented mitigation measures, the extent of the impact would still be on a regional scale.
Magnitude	Medium	Medium	Even with effective mitigation measures, the landscape would still be notably altered.
Duration	Long Term	Long Term	Impact would occur for more than 10 years after construction.
SIGNIFICANCE	High	High	Medium magnitude with regional extent and medium duration impact.
Probability	Definite	Definite	The probability of the occurrence is definite.
Confidence	Sure	Sure	The report findings were based on a relatively sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Reversible	Reversible	As soon as the structures are removed during decommissioning phase, the impact could be reversed.
Cumulative	Yes	Yes	Proposed activity will add cumulatively to existing lights within the study area.

10.6.1 Mitigations

Construction

- Refrain from construction activities during hours of darkness.

Operation

- Aim lights down. Choose “full-cutoff shielded” fixtures that keep light from going up or sideways. Full-cut off fixtures produce minimum glare.
- Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high.
- Choose energy- efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact fluorescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.
- Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put security lights on a motion-detector switch, which turns them on only when someone enters the area. (See appendix: Good Neighbour – Outdoor Lighting’ by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp.)

Decommissioning

- Refrain from construction activities during hours of darkness.

10.7 Visual Impact Summary Table

Criteria	Southern Limestone Quarry		Northern Limestone Quarry		Holvlei Clay Quarry	
With/without Mitigation	*Without Mitigation*	*With Mitigation*	*Without Mitigation*	*With Mitigation*	*Without Mitigation*	*With Mitigation*
Extent	Regional	Regional	Regional	Regional	Regional	Regional
Magnitude	Medium	Medium - Low	Medium	Medium - Low	Medium	Medium - Low
Duration	Medium	Medium	Medium	Medium	Medium	Medium
SIGNIFICANCE	High	High	High	High	High	High
Probability	Definite	Definite	Definite	Definite	Definite	Definite
Confidence	Sure	Sure	Sure	Sure	Sure	Sure
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Cumulative	Yes	Yes	Yes	Yes	Yes	Yes

Criteria	Access road, bridge and conveyor		Cement Factory and associated infrastructure		Lights at night	
With/without Mitigation	*Without Mitigation*	*With Mitigation*	*Without Mitigation*	*With Mitigation*	*Without Mitigation*	*With Mitigation*
Extent	Regional	Regional	Regional	Regional	Regional	Regional
Magnitude	Medium	low	Medium	Medium	Medium	Medium
Duration	Medium	Medium	Long Term	Long Term	Long Term	Long Term
SIGNIFICANCE	High	High	High	High	High	High
Probability	Definite	Definite	Definite	Definite	Definite	Definite
Confidence	Sure	Sure	Sure	Sure	Sure	Sure
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Cumulative	Yes	Yes	Yes	Yes	Yes	Yes

11. CONCLUSION

Saldahna Bay is a town created by both tourism and industrial development. The *high* scenic quality of the critical biodiversity and west coast landscapes combined with the *lower* scenic quality of the well established industrial and mining areas make the overall scenic quality *moderate*. Saldahna has been identified as an industrial growth node and the existing Saldahna SDF has incorporated the proposed mining areas into the regional planning. However, the Saldahna Municipality SDF planning has yet to be recognised by the Western Cape Province. The proposed mining areas also include fynbos vegetation, which have been defined as Critical Biodiversity Areas by the C.A.P.E. Fine-scale Biodiversity Planning Project (WCPSDF). This document recommends that the project sites be managed in a manner compatible with biodiversity conservation and be restored to a natural state and that the loss of CBA areas are adequately offset in terms of DEA&DP guidelines and best practice. The certainty of decision is reduced as the proposed life of mine is 100 years. The long time frame of the project (2012 – 2112) limits the confidence levels. It must be recognized that the surrounding landscape character (and sense of place) is likely to change during this time period. Detailed 3D modelling of the proposed landscape modifications was provided which has assisted in understanding the impacts.

The proposed cement plant will be developed in two phases and is located on an industrial site adjacent to existing large factory structures. The surrounding sense of place is strongly associated with the Saldanha Steel plant and harbour. The proposed plant landscape modification would not significantly change the established industrial landscape character even though it is a large size, height and scale. It is also recommended that lighting mitigations be implemented to reduce further light pollution in the area, avoiding the use of pole-top security lighting and installing fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. The area shown in Point 1 on the Mitigations Map in Figure 2 should be retained as undeveloped for screening and biodiversity purposes. Structures should be matt cement grey or painted dark reddish brown based colours that would blend in with the colours of the surrounding landscape *(See Figure 2: Mitigation Map point 1 and 2).*

The plant would be linked to the quarry via an access road and possibly a conveyor system. It is recommended that the R45 road is crossed via an underpass for both transport options. Due to the conveyor system requiring a crusher on top of the hill, visual preference is for the road option. Mitigation is required which would include that the haul road is tarred, re-aligned around the steep slope area to the west of the R399 road which should be cut in if possible and a low screening wall created on the valley side. The cut face will have to be rehabilitated to veld grass. *(See Mitigation Map point 3 and 4).*

Three quarry sites were assessed: the southern, northern limestone quarries and the proposed Holvlei Clay Quarry to the north of the Jacobsbaai Road. The southern quarry is an expansion of the existing Prospect Hill quarry. Hence, visual character will be strongly associated with the existing quarry landscape, as well as the Saldanha west residential areas and Middelpos informal settlement area. To reduce the visual intrusion to proximate residential receptors, it is recommended that a 3 m undulating screening berm is built to the west of the quarry site. The upper eastern extent the quarry should curve on the edges to align more naturally with the hill topography. A maximum 30 degree slope is recommended to allow for effective rehabilitation *(See Mitigation Map point 5).* As the upper extent of the quarry is visually prominent, it is recommended that mined areas are effectively rehabilitated to fynbos as per the botanical specialist's recommendations. To control the dust and reduce visual intrusion, it is advised that all limestone mining is undertaken in such as way that concurrent rehabilitation can take place with quarrying working in a 200 m cut face, and restored with face rip benches and rehabilitated concurrently.

A large portion of the proposed northern limestone quarry is located on the skyline. Should the No-go option be exercised to meet the DEA&DP Guideline for the Management of Mountains, Hills and Ridges, (DEA&DP. 2002) it is likely that the project would be threatened. Given the current inclusion of the mine in the Saldanha SDF and the recognition of Saldahna as a development zone, the VIA has not recommended this area as a No-go area. However, due to this skyline area potentially generating higher levels of permanent visual intrusion which will not meet the DEA&DP Guideline for

the Management of Mountains, Hills and Ridges, it is recommended that the proposed mine plan for this area be amended. The plan needs to depict the final post-mine skyline as a smooth and continuous line that mirrors the existing skyline, but must be lowered by approximately 4 m on the ridgeline (Skyline Comparison Map below). Should this not be provided, the No-go option for skyline mining is recommended. The proposed northern section of the quarry is adjacent to the Jacobsbaai Road which is an important tourist route. It is recommended that the mine is set back from the north-east corner where an existing low mound will afford some natural visual screening *(See Figure 3: North Quarry Mitigation Map).*

A low berm needs to be created to the west of the low mound parallel to the road to connect to the hill area. The berm needs to be formed by topsoil removed from the limestone fynbos in the southern quarries which will not be rehabilitated back to limestone fynbos. The screening berm needs to appear natural and it is recommended that an accredited landscape architect be utilised for the design and construction. The existing quarry at S5 can be included into quarry areas and be rehabilitated afterwards. Visual buffer on the Jacobs Bay road should be curved to align with the topography and to allow a more effective north south critical biodiversity corridor. The road must be realigned along the edge of the quarry area and not cut through the buffer area. *(See Mitigation Map point 6 and 7).*

The proposed Holvlei clay quarry is located on top of a hill. Visual intrusion to surrounding low lying receptors could be limited reducing the southern extent of the quarry areas so that the bulk of the cutting of the quarry is located on the top of the hill. Quarry edges to be curved to align with the topography *(See Mitigation Map point 8)*.

Due to the close proximity of the proposed mine to the town of Saldanha, the post mine landscape is important and can result in landscape sterilization if not adequately managed. It is recommended that areas closer to Saldanha Bay residential areas (south quarry) should not be rehabilitated to limestone fynbos but rather to public open space or sport facilities in the post mine land use that can be incorporated into the town. Areas away from the urban edge (on top of the hill) need to be rehabilitated to limestone fynbos and be formally protected within a proclaimed conservation areas, in conjunction with the other surrounding critical biodiversity areas that remain. The proposed thin strip of the northern conservation area does not have any visual value in terms of defining CBA landscape character value as it is too narrow. It is recommended that adjacent areas to the west of the proposed thin strip is also incorporated into the critical biodiversity corridor as part of the biodiversity offset and total area provided with formal conservation status *(See Mitigation Map point 9).*

Even though the proposed mining does conform to the Saldanha SDF, the potential visual impacts are defined as having a ***high significance***. This is due to the size, scale and long time period associated with the proposed mining landscape modifications, as well as the loss of CBA vegetation. Should permissions for the mining be granted, it must be recognised that the area will be strongly associated with mining for a period of 100 years which would entrench the currently degraded landscape of the Western Saldanha areas. The mining could influence the 'west-coast' landscape character and sense of place of the Jacobsbaai area. The loss of the CBA limestone fynbos vegetation needs to be adequately offset in terms of DEA&DP guidelines. Due to the large areas which will be lost, this decision needs to be carefully considered as it could set a precedent for CBA offsets in the future. It is recommended that the mine plan be reviewed every twenty years.

12. ANNEXURE 1: MODEL PROOF

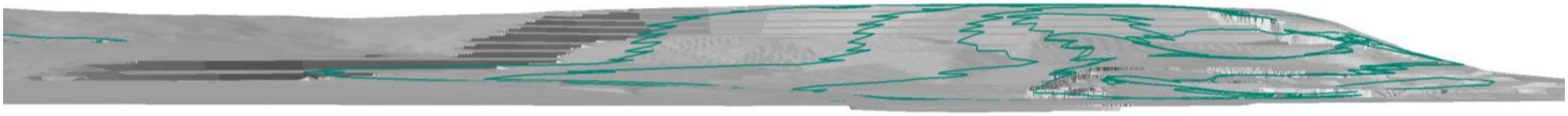


Figure 33: Quarry one: phases of excavation: 3D model view 2042

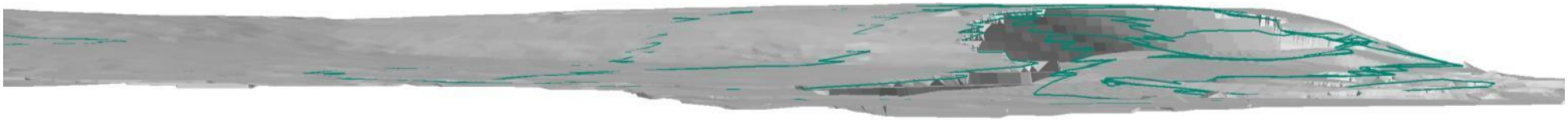


Figure 34: Quarry one: phases of excavation: 3D model view 2025

Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages, are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003) (Sheppard, S.R.J., 2005). This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

For details of Code of Ethical Conduct, see Methodology in Annexure 2.

13. ANNEXURE 2: METHODOLOGY

Visual impact is defined as 'the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.' (Oberholzer, B., 2005). As identified in this definition, 'landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, as they embody the history, land use, human culture, wildlife and seasonal changes to an area.' (U.K IEMA, 2002). These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

VRM Africa's objective is to provide Interested and Affected Parties (I&APs) and decision-makers with sufficient information to take "early opportunities for avoidance of negative visual effects." This is based on the U.K. Institute of Environmental Management and Assessment's (IEMA), and South Africa's Western Cape Department of Environmental Affairs and Development Planning's (DEA&DP), guidelines:

- "The ideal strategy for each identifiable, negative effect is one of avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation may be explored. If the consideration of mitigation measures is left to the later stages of scheme design, this can result in increased mitigation costs because early opportunities for avoidance of negative visual effects are missed." (U.K IEMA, 2002).
- "In order to retain the visual quality and landscape character, management actions must become an essential part of the guidelines throughout construction and operation...Proper management actions ensure that the lowest possible impact is created by the project...
- Ongoing monitoring programmes, with regard to the control of aesthetic aspects, for all stages of the project, are a vital component, ensuring that the long-term visual management objectives are met."(Oberholzer, B., 2005).

The impact assessment methodology that VRM Africa uses is based on the VRM methodology developed by the United States Bureau of Land Management (BLM) which measures the contrast the proposed landscape modification, by comparing the form, line, texture and colour of the project against the same elements found in the natural landscape. The contrast rating is a systematic process undertaken from KOPs surrounding the project site, and the assessment of the degree of contrast (DoC) is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The method is based on the premise that the degree to which a proposed landscape modification affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape (USA Bureau of Land Management, 2004).

Landscape Significance

Landscape significance is assessed in order to highlight the nature and degree of significance of the landscape context by differentiating between those landscapes of recognised or potential significance or sensitivity to modification to those landscape contexts that have low sensitivity and scenic value. 'Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.' (USA Bureau of Land Management, 2004).

Viewshed Analysis

A viewshed is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' (Oberholzer, B., 2005). This reflects the area within which, or the extent to which, the landscape modification is likely to be seen. It is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape, as a point of departure for defining the shared landscape context, and to identify the receptors making use of the common views. Viewshed analyses are not absolute indicators of the level of significance, but an indication of

potential visibility (Centre for Advanced Spatial Analysis, 2002). Once the sites and heights of the proposed activities have been finalised, the viewshed analysis will be undertaken.

Key Observation Points (KOPs)

KOPs are defined by the BLM Visual Resource Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are used to assess the suitability of the proposed landscape modifications by means of assessing the degree of contrast of the proposed landscape modifications to the existing landscape, taking into consideration the visual management objectives defined for the area. The following selection criteria were utilised in defining the KOPs:

- Angle of observation
- Number of viewers
- Length of time the project is in view
- Relative project size
- Season of use
- Critical viewpoints, e.g. views from communities, road crossings
- Distance from property

Visual Sensitivity of Receptors Criteria

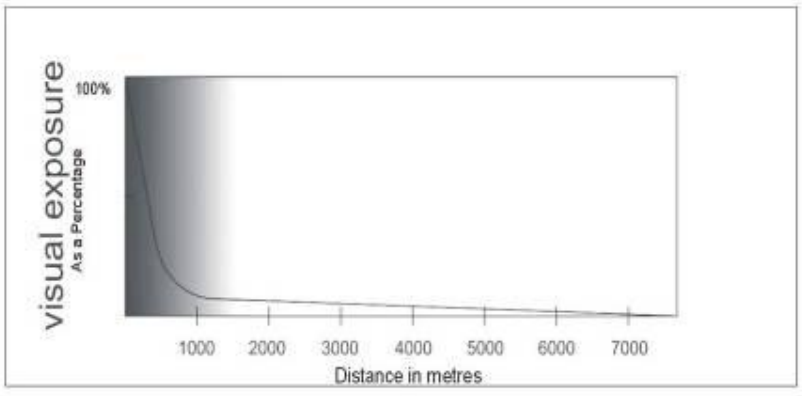
The level of visual impact considered acceptable is dependent on the types of receptors.

- *High sensitivity* : e.g. residential areas, nature reserves and scenic routes or trails
- *Moderate sensitivity* : e.g. sporting or recreational areas, or places of work
- *Low sensitivity* : e.g. industrial, mining or degraded areas

Receptor Exposure

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. Institute of Environmental Management and Assessment's (IEMA) *'Guidelines for Landscape and Visual Impact Assessment'* as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature (Hull, R.B. and Bishop, I.E., 1988). According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2 km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.



The VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management (United States Department of Interior): (USA Bureau of Land Management, 2004). The distance zones are:

1. Foreground / Middle ground, up to approximately 6 km, which is where there is potential for the sense of place to change;
2. Background areas, from 6 km to 24 km, where there is some potential for change in the sense of place, but where change would only occur in the case of very large landscape modifications; and
3. Seldom seen areas, which fall within the Foreground / Middle ground area but, as a result of no receptors, are not viewed or are seldom viewed.

In order to determine the level of exposure to receptors, the following criteria were utilised, and the receptors located within each distance zone were identified:

Visual Exposure Criteria (Oberholzer, B., 2005)

- *High* :Dominant or clearly noticeable (<2 km)
- *Moderate* :Recognisable to the viewer (2 – 6 km)
- *Low* : Minimally visible areas in the landscape (>6 km)

Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium or low sensitivity levels by analysing the various indicators of public concern. The following criteria were used to assess the sensitivity of each of the communities:

- **Public Interest:** The visual quality of an area may be of concern to local, state, or national groups. Indicators of this concern are usually expressed in public meetings, letters, newspaper or magazine articles, newsletters, land use plans, etc. Public controversy, created in response to proposed activities that would change the landscape character, should also be considered.
- **Special Areas:** Management objectives for special areas such as natural areas, wilderness areas or wilderness study areas, wild and scenic rivers, scenic areas, scenic roads or trails, and Areas of Critical Environmental Concern (ACEC), frequently require special consideration for the protection of visual values. This does not necessarily mean that these areas are scenic, but rather that one of the management objectives may be to preserve the natural landscape setting. The management objectives for these areas may be used as a basis for assigning sensitivity levels.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent land can affect the visual sensitivity of an area. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be visually sensitive.
- **Type of User:** Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen and used by large numbers of people are potentially more sensitive. Protection of visual values usually becomes more important as the number of viewers increase (USA Bureau of Land Management, 2004).

Scenic Quality

In the VRM methodology, scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors. During the rating process, each of these factors is ranked on a comparative basis with similar features in the region (USA Bureau of Land Management, 2004). These seven elements are:

1. **Landform:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
2. **Vegetation:** Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Also consider smaller-scale vegetation features which add striking and intriguing detail elements to the land.
3. **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.

4. **Colour:** Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast and harmony.
5. **Scarcity:** This factor provides an opportunity to give added importance to one, or all, of the scenic features that appear to be relatively unique or rare within one physiographic region.
6. **Adjacent Land Use:** Degree to which scenery, outside the scenery unit being rated, enhances the overall impression of the scenery within the rating unit. The distance, at which adjacent scenery will start to influence scenery within the rating unit ranges, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
7. **Cultural Modifications:** Cultural modifications in the landform, water, and vegetation, and addition of structures, should be considered, and may detract from the scenery in the form of a negative intrusion, or complement or improve the scenic quality of a unit.

Visual Sensitivity Rating Criteria

This is the inherent sensitivity of the landscape, which is usually determined by a combination of topography, landform, vegetation cover and settlement pattern.

- *High visual sensitivity* : highly visible and potentially sensitive areas in the landscape;
- *Moderate visual sensitivity* : moderately visible areas in the landscape; and
- *Low visual sensitivity* : minimally visible areas in the landscape.

Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003) (Sheppard, S.R.J., 2005). This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.

- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, 'sales' techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken (Sheppard, S.R.J., 2005).

VRM Classes

The landscape character of the proposed project site is surveyed to identify areas of common land use and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the project would be "absorbed" or "disappear" into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method as seen below, which is then represented in a visual sensitivity map

The BLM has defined four Classes that represent the relative value of the visual resources of an area:

i. **Classes I and II** are the most valued
ii. **Class III** represent a moderate value
iii. **Class IV** is of least value

		VISUAL SENSITIVITY LEVELS								
		High			Medium			Low		
SCENIC QUALITY	A (High)	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		fore/middle ground	Background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The VRM class objectives are defined as follows:

1. The **Class I** objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. **Class I** is assigned to those areas where a ***specialist decision*** has been made to maintain a natural landscape.
2. The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
3. The **Class III** objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes

should repeat the basic elements found in the predominant natural features of the characteristic landscape.

4. The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's attention.

Contrast Rating Stage

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the Degree of Contrast (DoC) of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- **None** : The element contrast is not visible or perceived.
- **Weak** : The element contrast can be seen but does not attract attention.
- **Moderate** : The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** : The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

13.1 Specialist Impact Methodology (Aurecon)

A standardised and internationally recognised methodology *(South African Department of Environmental Affairs and Tourism's Integrated Environmental Management Information Series (Gov of SA, 2002)* has been applied to assess the significance of the potential environmental impacts of the proposed development, outlined as follows:

For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) are described. These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place.

Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**National**	Within the country
	Regional	Within the province/recognised region
	Local	On site or within 1000 m of the impact site
Magnitude of impact (at the indicated spatial scale)	**High**	Social and/or natural functions and/ or processes are *severely* altered
	Medium	Social and/or natural functions and/ or processes are *notably* altered
	Low	Social and/or natural functions and/ or processes are *slightly* altered
	Very Low	Social and/or natural functions and/ or processes are *negligibly* altered
	Zero	Social and/or natural functions and/ or processes remain *unaltered*
Duration of impact	**Short term**	Up to 7 years
	Medium Term	Up to 10 years after construction
	Long Term	More than 10 years after construction

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and magnitude. Such significance is also informed by the context of the impact, i.e. the character and identity of the receptor of the impact. The means of arriving at the different significance ratings is explained in the following table, developed by Ninham Shand in 1995 as a means of minimising subjectivity in such evaluations, i.e. to allow for reliability in the determination of significance.

Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact has been determined using the rating

systems outlined in the following two tables. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95% chance of the impact occurring.
Probable	Estimated 5 to 95% chance of the impact occurring.
Unlikely	Estimated less than 5% chance of the impact occurring.

Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Lastly, the REVERSIBILITY of the impact has been estimated using the rating system outlined in the following table:

Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is permanent.
Reversible	The impact is reversible, within a period of 10 years.

Subjectivity in assigning significance

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, environmental assessment processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can

Consideration of cumulative impacts

The following questions must be considered when addressing the cumulative impacts for each specialist study.

1. Are there key valued ecosystem vectors (VEC) of importance in the region (e.g. air quality, water quality, aquatic resources, agricultural areas, important biodiversity areas, visual resources etc)? Each specialist to identify as relevant to his/her field of expertise; and
2. How will the project impact on this VEC when considered in conjunction with other activities currently occurring in the area, and those known to be imminent? Assess significance thereof.

13.2 DEA&DP Nature of the visual impacts for the total project with mitigation

EXTENT	**Geographical area of influence.** **Site Related (S):***extending only as far as the activity* **Local (L):** limited to i*mmediate surroundings.* **Regional (R):** *affecting a larger metropolitan or regional area* **National (N):** *affecting large parts of the country* **International (I):** *affecting areas across international boundaries*
DURATION	**Predicted lifespan** **Short term (S):** *duration of the construction phase.* **Medium term (M):** *duration for screening vegetation to mature.* **Long term (L):** *lifespan of the project.* **Permanent (P):** *where time will not mitigate the visual impact.*
INTENSITY	**Magnitude of impact on views, scenic or cultural resources** **Low (L):** *where visual and scenic resources are not affected.* **Moderate (M)**: *where visual and scenic resources are affected* **High (H)**: *where scenic and cultural resources are significantly affected.*
PROBABILITY	**Degree of possible visual impact:** **Improbable (I):** *possibility of the impact occurring is very low.* **Probable (P):** *distinct possibility that the impact will occur.* **Highly probable (HP):** *most likely that the impact will occur.* **Definite (D):** *impact will occur regardless of any prevention measures.*
SIGNIFICANCE	**A synthesis of nature, duration, intensity, extent and probability** **Low (L):** will not have an influence on the decision. **Moderate (M):** should have an influence on the decision unless it is mitigated. **High (H):** would influence the decision regardless of any possible mitigation.
CONFIDENCE LEVELS	Key uncertainties and risks in the VIA process, which may influence the accuracy of, and confidence in, the VIA process.

Source: DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes, page 29

13.3 Visual Resource Management Criteria

1. Scenic Quality Rating Questionnaire

KEY FACTORS	RATING CRITERIA AND SCORE		
SCORE	**5**	**3**	**1**
Land Form	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including dune systems: or detail features that are dominating and exceptionally striking and intriguing.	Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
SCORE	**2**	**0**	**-4**
Cultural Modification	Modifications add favourably to visual variety, while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

2. Sensitivity Level Rating Questionnaire

The following VRM questionnaire was completed for general receptors in the area:

FACTORS	QUESTIONS	
Type of Users	**Maintenance of visual quality is:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Amount of use	**Maintenance of visual quality becomes more important as the level of use increases:**	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low
Public interest	**Maintenance of visual quality:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Adjacent land Users	**Maintenance of visual quality to sustain adjacent land use objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
Special Areas	**Maintenance of visual quality to sustain Special Area management objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

3. Distance Zones

Landscapes are subdivided into four distance zones, based on relative visibility from travel routes or observation points. The four zones are:

DISTANCE ZONES	DISTANCE ZONES DEFINITION
Foreground	The foreground (fig) zone includes areas seen from highways, rivers, or other viewing locations that are less than 1 kilometres away.
Middle ground	The middle ground (mg) zone includes areas seen from highways, rivers, or other viewing locations that are greater than 1 kilometre but less than 2 kilometres away.
Background	Seen areas beyond the foreground-middle ground zone greater than 2 kilometres away are in the background (big) zone.
Seldom seen	Areas not seen as foreground-middle ground or background (i.e. hidden from view) are in the seldom-seen (ss) zone

4. VRM Terminology

The following terms were used in the Contrast Rating Tables to help define Form, Line, Colour, and Texture. The definitions were a combination of Microsoft Word Dictionary and simple description.

FORM	LINE	COLOUR	TEXTURE
Simple	Horizontal		Smooth
Weak	Vertical		Rough
Strong	Geometric		Fine
Dominant	Angular		Coarse
Flat	Acute		Patchy
Rolling	Parallel		Even
Undulating	Curved	Dark	Uneven
Complex	Wavy	Light	Complex
Plateau	Strong	Mottled	Simple
Ridge	Weak		Stark
Valley	Crisp		Clustered
Plain	Feathered		Diffuse
Steep	Indistinct		Dense
Shallow	Clean		Scattered
Organic	Prominent		Sporadic
Structured	Solid		Consistent

Simple	Basic, composed of few elements	**Organic**	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	**Structure**	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	**Regular**	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	**Horizontal**	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	**Vertical**	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	**Geometric**	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	**Angular**	Sharply defined; used to describe an object identified by angles
Undulating	Moving sinuously like waves; wavy in appearance	**Acute**	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	**Parallel**	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	**Curved**	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	**Wavy**	Repeatedly curving forming a series of smooth curves that go in one direction and then another
Plain	A flat expanse of land; fairly flat dry land, usually with few trees	**Feathered**	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	**Indistinct**	Vague; lacking clarity or form
Prominent	Noticeable; distinguished, eminent, or well-known	**Patchy**	Irregular and inconsistent;
Solid	Unadulterated or unmixed; made of the same material throughout; uninterrupted	**Even**	Consistent and equal; lacking slope, roughness, and irregularity
Broken	Lacking continuity; having an uneven surface	**Uneven**	Inconsistent and unequal in measurement irregular
Smooth	Consistent in line and form; even textured	**Stark**	Bare and plain; lacking ornament or relieving features
Rough	Bumpy; knobbly; or uneven, coarse in texture	**Clustered**	Densely grouped
Fine	Intricate and refined in nature	**Diffuse**	Spread through; scattered over an area

Coarse	Harsh or rough to the touch; lacking detail	**Diffuse**	To make something less bright or intense

14. ANNEXURE 3: RELEVANT PLANNING POLICY

In order to comply with the VRM requirements, it is necessary to clarify which planning policies govern the property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be viewed in the context of the planning policies from the following:

- National Environmental Management Act (No. 107 of 1998) as amended by Act 56 of 2002 and Act 8 (NEMA, 2004)
- Western Cape PSDF (2005)
- Western Cape DEA&DP Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1 (2005)
- W estern Cape DEA&DP Guideline for the Management of Development on Mountains, Hills and Ridges. (2002)
- Saldahna Bay Spatial Development Framework (Feb 2010)

14.1 Western Cape Provincial Spatial Development Framework (PSDF)

Visual Impact:

- Topography: The impact of human activity has had a pronounced impact on the natural landscape and the need to manage and control such impacts is key to protecting the scenic qualities and visual resources of the Province.*(Ch 4, pg 25)*

Heritage and Indigenous Vegetation:

- For all new development proposals, evidence must be provided that no valuable indigenous habitat will be negatively impacted on.*(Pg 40)*
- All changes proposed to landscapes and urban settlements whether they be for agricultural or urban and rural development purposes shall consider any heritage resource policy that may be relevant including those which might be proposed. *(WCPSDF, Ch 8, pg 26)*(DEA&DP, 2005)

14.2 DEA&DP Guideline for Involving Visual and Aesthetic Specialist in EIA

Principles that influence (development)…. within a receiving environment include the following:

- the need to maintain the overall integrity (or intactness) of the particular landscape or townscape;
- the need to preserve the special character or 'sense of place' of a particular area; and
- The need to minimize visual intrusion or obstruction of views within a particular area. (Oberholzer, 2005).

14.3 DEA&DP Guideline for the Management of Mountains, Hills and Ridges

Definitions of mountain hill or ridge are described as a physical landscape feature, elevated above the surrounding landscape. This includes the foot/base, slopes and crest of the mountain, hill or ridge.

Key reasons for controlling development in these areas are:

- a high scenic and aesthetic value, and
- they are often characterised by unique and sensitive ecosystems.*(Page 2, 3)*

Key decision making criteria:

- In Natural/Wilderness zones (areas in reasonably pristine conditions) only non-consumptive developments may be considered.
- Development on steep slopes (i.e. steeper than 1:4) will be strongly discouraged as such areas are subject to erosion and instability.
- Development on the crest of a mountain, hill or ridge will be strongly discouraged. (*Page 7,8, 9,11, Appendix B)* (DEA&DP, 2002)

14.4 Saldahna Bay Spatial Development Framework (Feb 2010)

Conservation (SDF Document: Part 1-4)

Planning sensitively for the future of the Saldahna Bay Municipal Area will involve achieving a balance between the level and extent of human-related development and activities, and the ability of the natural environment to accommodate these. This balanced approach will ensure that the future growth of the Saldanha Bay Municipal Area is sustainable. In addition to being sustainable, it is important that future growth and change be accommodated in a manner that does not jeopardize the character and the elements that make the Saldanha Bay Municipal Area unique. *(Page 8)*

- There are RAMSAR sites located in the area. These sites, registered under the RAMSAR Convention, are for the conservation of wetlands of international importance. These sites are administrated by the National Department of Environmental Affairs and Tourismand comprise the following sites in the area:*(Page 54)*
    - Langebaan lagoon
    - Jutten island
    - Malgas island
    - Marcus island
- The identified importance for biodiversity conservation, and the ecosystem status, from a global biodiversity perspective, of much of the vegetation in the study area. Further loss of relatively undisturbed areas of these ecosystems would severely compromise realisation of conservation targets. *(Page 65)*
- In areas designated as **critical** biodiversity areas, further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of special biodiversity features.*(Page 65)*
- In **critically endangered** ecosystems, further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of special biodiversity features. *(Page 65)*
- In **endangered** ecosystems, further loss of natural habitat should be avoided. Where loss of natural habitat is inevitable, every attempt should be made to minimise further fragmentation of the remaining natural habitat. It is important to keep tracts of natural habitat intact, to assist the maintenance of ecosystem functioning. Every attempt should be made to avoid loss or disturbance of special biodiversity features.*(Page 65)*
- In **vulnerable** ecosystems, loss of natural habitat should be carefully weighed up. The rate of habitat loss in these ecosystems should be monitored, and the cumulative impacts of different projects or developments that result in loss of natural habitat should be borne in mind. It is important to consult ecological process layers and special habitat layers where these are available. Every attempt should be made to avoid loss or disturbance of special biodiversity features. *(Page 66)*
- In **least threatened** ecosystems, there are usually lower levels of pressure on biodiversity. Nevertheless, every attempt should be made to avoid loss or disturbance of special biodiversity features. There are many broader environmental and aesthetic considerations that need to be taken into account in decision-making on land use in these ecosystems.*(Page 66)*

Sense of Place (SDF Document: Part 7 – 9)

- A cultural landscape, as found in the Saldanha Bay Municipal Area, is comprised of the layers of adaptation and transformation of the various human and natural components that have over time contributed to an area's particular character. It encompasses visual landscapes, historic places, sites and built environments, as well as natural fauna and flora and the remnants of cultural practices. It is this character that influences how people perceive a particular area. Although each person identifies with a place differently, there is always a commonality in their perception and understanding of the broader space-defining elements of a landscape. *(Page 102)*
- There are a number of defining edges in the Saldanha Bay Municipal Area. Visual definition is created by the Atlantic Ocean to the north, west and south, the Langebaan Lagoon, the Berg River which is the northern boundary of the study area, and the series of hills in the northern study area and the hills to the south of the study area at Langebaan. *(Page 103)*
- A cultural landscape can also be understood at a more local scale, thereby revealing characteristics particular to a district that forms part of the broader sub-region. From the analysis, it is clear that the application of a place-specific approach to the spatial planning, design and management of the Saldanha Bay Municipal area is of critical importance. Its application at the various levels of planning (sub-regional to site specific) will ensure the retention of "place specific character" and that the meanings that people attach to their places and the values that underpin such meanings are not neglected.*(Page 106)*
- The fishing industry and the agricultural industry were the industries on which the Saldanha Bay Municipal Area's economy historically relied. Economic conditions have changed over the years and now the manufacturing industry and the tourism industry are emphasised with regard to economic growth. It is

anticipated that the tourism industry in the study area may grow with more that 50% over the next 10 years. The economy of the scenic coastal towns of Saldanha Bay, Paternoster, St. Helena Bay, and Langebaan already rely heavily on what should be a year round flow of tourists. Generally, tourism in the West Coast still has vast untapped potential.*(Page 107)*

Tourism (SDF Document: Part 12)

- **Development:**
  - Industrial activity in the proximity of the town should be restricted to industries that do not negatively impact on the proposed tourist-related developments along the waterfront. *(Pg 224)*
  - The Saldanha Waterfront area is currently underutilized, yet its potential as a tourist destination is evident. However, there are properties along the water's edge which are neglected and the area requires appropriate planning measures to ensure that neglected properties are developed according to the area's tourism potential. *(Pg 226)*
- **Environmental Assets:**
  - There are a number of attractions drawing visitors to the area. These are all primarily orientated towards the environmental assets in the area; seasonal wild flowers, the Berg River, sea, whales, mountains, protected fauna and flora species, proximity to the West Coast Nature Reserve, fossil sites, fossil museum etc.
  - There are also a number of historical monuments and cultural features in the study area, which offer additional attractions. *(Page109)*

Extractive Industry (SDF document Part 12)

- Several extractive industrial activities are established in the municipal area. These activities include, amongst others, mining of construction materials such as lime scales and sand mining. Many of the mining operations are currently located in relative close proximity to the Saldanha and Langebaan areas. The adverse impacts of these mining activities on environmentally sensitive and urban areas should be mitigated.
- Not all potential mineral resources have been identified in the area and this can lead to ad hoc applications for mining permits in the area.
- Extractive industrial activities should be in harmony with the ecological systems, respecting the processes that control the functioning of these elements.
- Any negative impacts associated with extractive industrial activities must be effectively mitigated.
- Buffer areas should surround extractive industrial areas that are located in close proximity of core urban areas in order to mitigate visual and environmental impacts.
- Mining areas should be fully rehabilitated, as per minimum statutory requirements, once the extraction of mining resources ceases.
- Mining areas should, wherever possible, be located close to core urban areas/ transport routes and existing infrastructure to ensure maximum economic sustainability. *(Pg 168)*

14.5 Planning and Policy Key Findings

- Some mining activities impact negatively on the pristine natural environment of the municipal area, or are in close proximity to urban areas. "Several extractive industrial activities are established in the municipal area. These activities include, amongst others, mining of construction materials such as lime scales and sand mining. Many of the mining operations are currently located in relative close proximity to the Saldanha and Langebaan areas. The adverse impacts of these mining activities on environmentally sensitive and urban areas should be mitigated. Not all potential mineral resources have been identified in the area and this can lead to ad hoc applications for mining permits in the area."
- **Critical biodiversity areas** (CBA) are environmental assets and need to be protected. They are also a tourism attraction for the area. In areas designated as CBA, further loss of natural habitat should be avoided. The remaining fragments of natural habitat in these ecosystems are of national importance. Every attempt should be made to avoid loss or disturbance of special biodiversity features.
- Place-specific character should not be neglected as the tourism industry is expected to grow, which re-emphasises the need for the specific character of the tourism areas to be retained.
- The Saldanha SDF notes that the series of hills north of Saldanha define edges within the Municipal area. The initial limestone quarry areas are located on the said ridgeline. The DEA&DP Guideline for the Management of Development on Mountains, Hills and Ridgelines states that 'Development on the crest of a mountain, hill or ridge will be strongly discouraged.'
- The main tourism areas identified on the SaldanhaSDF tourism plan need to be incorporated into the land use and receptor sensitivity assessment.
- These proposed quarries are located in designated **critical biodiversity areas** (CBA). However, these areas have also been identified in the Saldanha SDF as being suitable for extraction of limestone. Provincial planning clarity needs to be established in order to provide a point of departure for the development of the Northern and Southern limestone quarries.

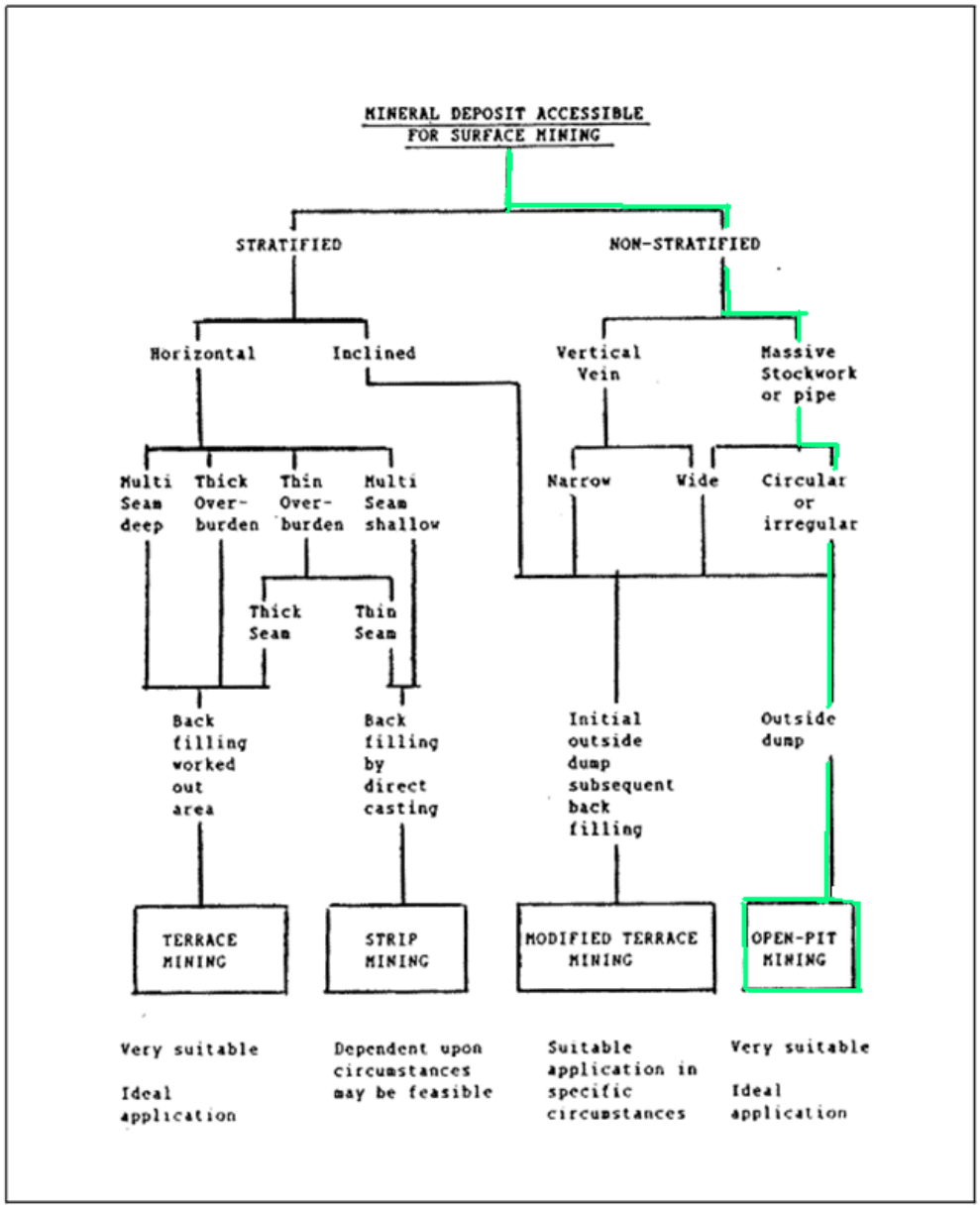
15. ANNEXURE 4: REPORTS

15.1
15.2 Saldanha Mining Method Report

Geology and Mining Method

Saldanha Mine is situated in a sandy beach. Fine, unconsolidated quartzite sand covers most of the area. The three major substrata minerals are limestone, granite and clay. These are of natural origin and underlie the majority of the sand. The following factors are taken into consideration when selecting an applicable mining method for Saldanha Mine:

- Surface and underground water features
- Surface topography
- The surrounding environment
- Ore mineral grades and scatter
- Ore body depth and proximity to surface
- Ore body utilisation
- Mining Method Economics (e.g. transport costs)

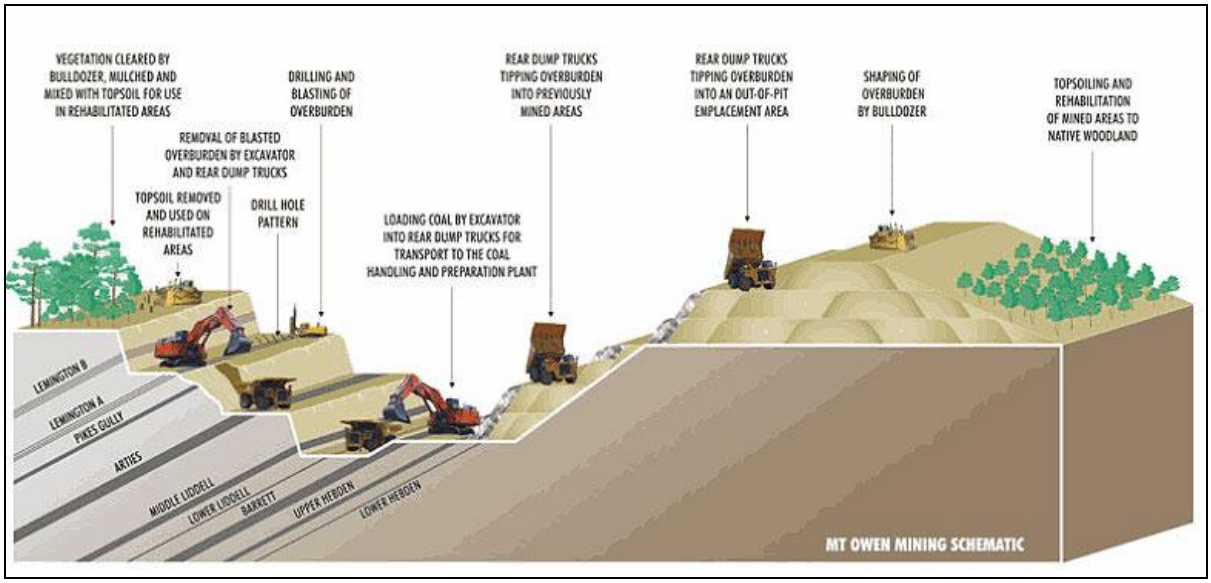


Classification of Surface Mining Methods

The open pit mining method is utilized when an ore body is in close proximity to the earth's surface. The ore body is usually a pipe or vein type, steeply dipping, stratified or irregular shaped. Saldanha ore body is irregularly shaped and relatively flat. Thus the open pit mining method is suitable to extract the deposit.

The excavation is normally by rope or hydraulic shovels with trucks carrying both ore and waste. Free-digging is carried out at the initial stages. Drill and blast will also be employed, which makes the process cyclic. Waste material will be dumped or backfilled inside the mined-out area.

Prior to mining in a particular area, all vegetation cover and useable soil is removed and placed on a separate soil stockpile. Waste rock and ore are blasted at irregular intervals as required and removed to backfill areas or the primary crusher, respectively. Material is loaded onto haul trucks using hydraulic shovels and front-end loaders. The graphic below illustrates the general open cast mining method principles that will be applied at Saldanha. The backfill into the pit area will be minimal due to the large portion of rock to be mined which consists of limestone and very little waste.



Generalized Schematic of a typical Open Cast Mining Method

Mining will be done by utilizing bench heights of 10m. The average depth of the limestone seldom exceeds 30m, which implies three benches of 10m. The topography and the floor contact of the limestone are, however, undulating. This has the effect that a number of benches are mined according to elevation, although topographically the depth is only 30m.

16. ANNEXURE 5: GENERAL MITIGATIONS

'Good Neighbour – Outdoor Lighting' by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp. has been included below.

Good Neighbor OUTDOOR LIGHTING

PRESENTED BY THE NEW ENGLAND LIGHT POLLUTION ADVISORY GROUP (NELPAG) AND *SKY & TELESCOPE*

What is good lighting? Good outdoor lights improve visibility, safety, and a sense of security, while minimizing energy use, operating costs, and ugly, dazzling glare.

Why should we be concerned? Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the night-time environment and neighbors' property values. Light directed uselessly above the horizon creates murky skyglow — the "light pollution" that washes out our view of the stars.

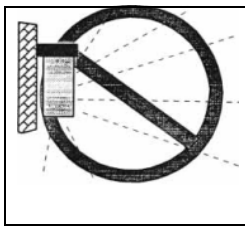
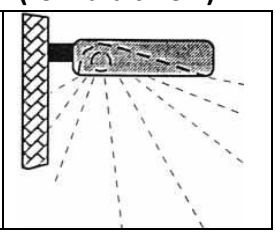
Glare Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

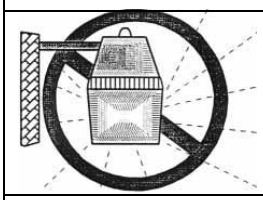
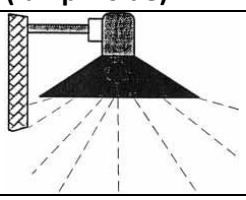
Light Trespass Poor outdoor lighting shines onto neighbors' properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

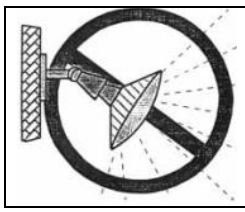
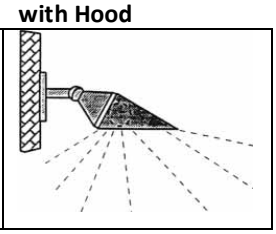
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

Excess Lighting Some homes and businesses are flooded with much stronger light than is necessary for safety or security.

Good and Bad Light Fixtures

Typical "Wall Pack"	Typical "Shoe Box" (forward throw)
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down

Typical "Yard Light"	Opaque Reflector (lamp inside)
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down

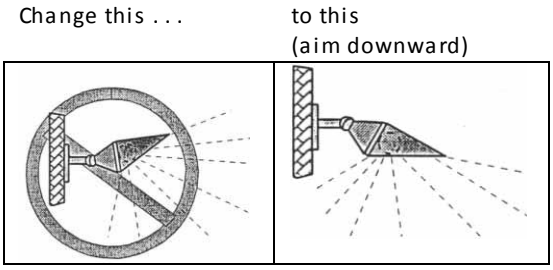
Area Flood Light	Area Flood Light with Hood
	
BAD Waste light goes up and sideways	**GOOD** Directs all light down

How do I switch to good lighting?

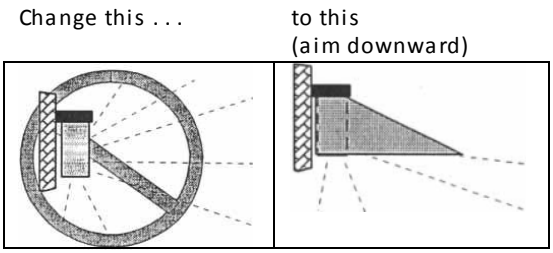
Provide only enough light for the task at hand; don't over-light, and don't spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbors or polluting the sky.

1. Aim lights down. Choose "full-cutoff shielded" fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.
3. If color discrimination is not important, choose energy- efficient fixtures utilizing yellowish high-pressure sodium (HPS) bulbs. If "white" light is needed, fixtures using compact flourescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapor bulbs.
4. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

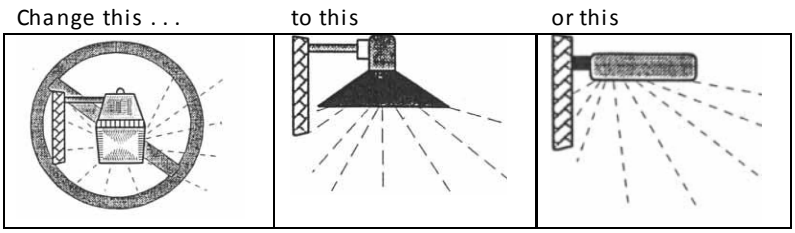
What You Can Do To Modify Existing Fixtures



Floodlight:



Wall Pack



Replace bad lights with good lights.

You'll save energy and money. You'll be a good neighbor. And you'll help preserve our view of the stars

Presented by the New England Light Pollution Advisory Group (NELPAG) http://cfa/ www.harvard .edu /cfa/ps/nelpag.html) and Sky & Telescope http://SkyandTelescope.com/). NELPAG and Sky & Telescope support the International Dark-Sky Association (IDA) (http://www.darksky.org/).

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