Heritage Impact Assessment (prepared as part of an EIA) of a proposed Wind Energy Facility to be situated at Olifants River Settlement 617, 620 and Grave Water Kop 158/5 situated on the Namaqualand Coast in the Vredendal District, South Western Cape.

Prepared for

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SECOND DRAFT

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Executive summary

The Archaeology Contracts Office of the University of Cape Town was appointed by Savannah Environmental (Pty) Ltd on behalf of the proponent Eskom Generation, to undertake a heritage assessment (as part of an EIA process) of portions of the farms Olifants River Settlement 617 and 620 and Grave Water Kop 158/5 situated on the Namaqualand Coast in the Vredendal District, South Western Cape. The proposed activity is the development of a Wind Energy Facility which will involve 100 wind turbines distributed over a 25 sq km area. The study area in question is located 2 km inland of the shoreline above the coastal escarpment.

Research has shown that while the shoreline of Namaqualand is rich in archaeological sites, historical sites and other forms of generally protected heritage are relatively scarce. The area is characterised by rocky shorelines, beaches and dune fields, while the inland coastal plain is arid and flat occasionally punctuated by vegetated dunes and deflation bays. The area is remote being used mostly by local farmers (grazing of small stock), while the coastline has been subject to *ad hoc* alluvial diamond mining resulting in significant environmental damage in places.

A detailed field inspection has revealed that the dominant cultural resources that will be impacted are Late Stone Age (LSA) archaeological sites and the landscape itself. The distribution of archaeological sites on the landscape is very much as predicted in the heritage scoping report, but with some interesting exceptions.

The results of the study show that there are large expanses of the landscape that contain very few archaeological sites, however there are two clusters of archaeological sites (LSA middens) which are associated with what used to be two waterholes. While the most of the individual middens that form these clusters warrant a low conservation status (no more than grade 3b-c), they have high group value and are academically significant. Micro-adjustment of wind turbine locations combined with a program of sampling of the middens is expected to result in satisfactory mitigation.

Indications are:

- Historical sites and buildings do not exist in the study area and therefore will not be impacted.

- The wilderness qualities of the landscape will be significantly impacted by the proposed activity

- An estimated 13 Late Stone Age shell middens on the farm Skaapvlei (Grave Water Kop 158/5) will be directly impacted by the proposed activity.

- In heritage terms, no fatal flaws have been identified for the proposed turbine site, access roads, substation or power line corridor alternatives.

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GLOSSARY

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

Calcrete *A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.*

Doorbank horizon *A cemented crusty hard surface from an ancient landscape that underlies Aeolian sands in many areas on the west coast.*

Early Stone Age *A very early period of human development dating between 300 000 and 2.6 million 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 of 2000).*

HWC (Heritage Western Cape) *The provincial compliance agency responsible for the conservation of heritage.*

Late Stone Age (LSA) *In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).*

Middle Stone Age (MSA) *An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.*

Midden *A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.*

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

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

Pliocene A geological time period (of 5 million – 3 million years ago).

Miocene A geological time period (of 23 million - 5 million years ago).

SAHRA *South African Heritage Resources Agency.*

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

National Heritage Resources Act (25) 1999 relevant definitions

"Archaeological'' means - *material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.* This means that an archaeological site is any area where there are artefacts (objects made by human hand) and ruins that are over 100 years of age. An archaeological find is therefore any object or collection of objects or structures in disuse made by human hand that is over 100 years old. This can range from ancient stone tools, ruins to the contents of historic rubbish dumps containing ceramic shards and bottles.

''Palaeontological'' means - *any fossilised remain 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.* The term 'fossil' means mineralised bones of animals, shellfish, plants, marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

"Graves and human remains" are protected by primarily by the NHRA but also provincial ordinances, local authorities and provincial health departments.

''Structure'' means - any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old. Such structures may only be altered or demolished under a Section 42 permit issued by the heritage authority.

"Cultural landscapes" are protected by the Act as they are defined as being cultural heritage. Under certain circumstances the compliance authority may intervene and comment on the design and aesthetic qualities of any development that forms part of or is within sight of a heritage place or site or protected area.

"Shipwrecks and aircraft wrecks" on land and in the sea greater than 60 years of age are protected and defined as heritage in terms of the Act.

1. INTRODUCTION

The Archaeology Contracts Office (ACO) of the University of Cape Town was appointed by Savannah Environmental (Pty) Ltd on behalf of the proponent Eskom Generation, to undertake a heritage assessment of portion of the farms Olifants River Settlement 617, 620 and Grave Water Kop 158/5 situated on the Namaqualand Coast in the Vredendal District, South Western Cape. The proposed activity is the development of a Wind Energy Facility which will consist of 100 wind turbines distributed over a 25 sq km area, along with access roads, substation, visitors centre and a 132 kV transmission line to the Juno substation near Vredendal.

1.1 The need for the project

Studies completed by Eskom have forecast that the company's electricity generating capacity will be under pressure to meet the needs of the Nation, considering the current rate of growth of the economy. This is particularly so in the Western Cape Province, where local growth rates exceed the national average. Eskom is responding to this situation by taking measures to expand the organisation's generating, transmission and distribution capacity in a number of ways. Besides increasing the extent of other energy sources, Eskom is trying to raise the contribution of clean renewable energy such as wind and solar energy to the national transmission and grid. To this end, an experimental wind farm has been established near Klipheuwel in the Western Cape where three different kinds of wind turbines have been undergoing testing to establish what best suits local conditions. In order to optimise the use of the wind resource, Eskom has identified areas of the country that experience consistently high wind speeds for optimum daily power generation. An area on the Namaqualand coast just north of the Olifants River mouth has been identified as being suitable. Site selection has been a lengthy process involving work-shopping various options to make sure that the process is in line with the DEA&DP Strategic Initiative report.

1.2 The receiving environment

The study area lies on the arid coast of Namaqualand, Western Cape Province, 10 km to the north of the Olifants River mouth. The application that is now for consideration in the EIA process is a Wind Energy Facility of up to 100 turbines. Initially 50 turbines will be built and commissioned as phase 1, with a further 50 being constructed as a second phase. The area identified for the study is large, incorporating parts of farms Olifants River Settlement 617 and 620 and 158/5 Grave Water Kop. Eskom is investigating possible procurement and lease options of the above portions of land which will amount to ~37km^2, although only a 25km^2 area within this site is required for the facility. Initial planning has indicated that only the western half of the study area will be used for the construction of the 4 rows of wind turbines.

The land in question is entirely undeveloped and somewhat remote (Figure 1) being accessible via a gravel road from Koingnaas (some 50 km inland). The built environment is limited to a gravel provincial road, casual off-road tracks and the Skaapvlei Farm/Mining houses immediately to the north of the study area. On Skaapvlei previous attempts have been made to farm wheat. Currently wheat farming has been abandoned and the land is largely overgrown at present. In the

immediate coastal zone to the west, concession diamond mining has significantly damaged an otherwise scenic coastline (characterised by cliffs, beaches and sheltered bays).

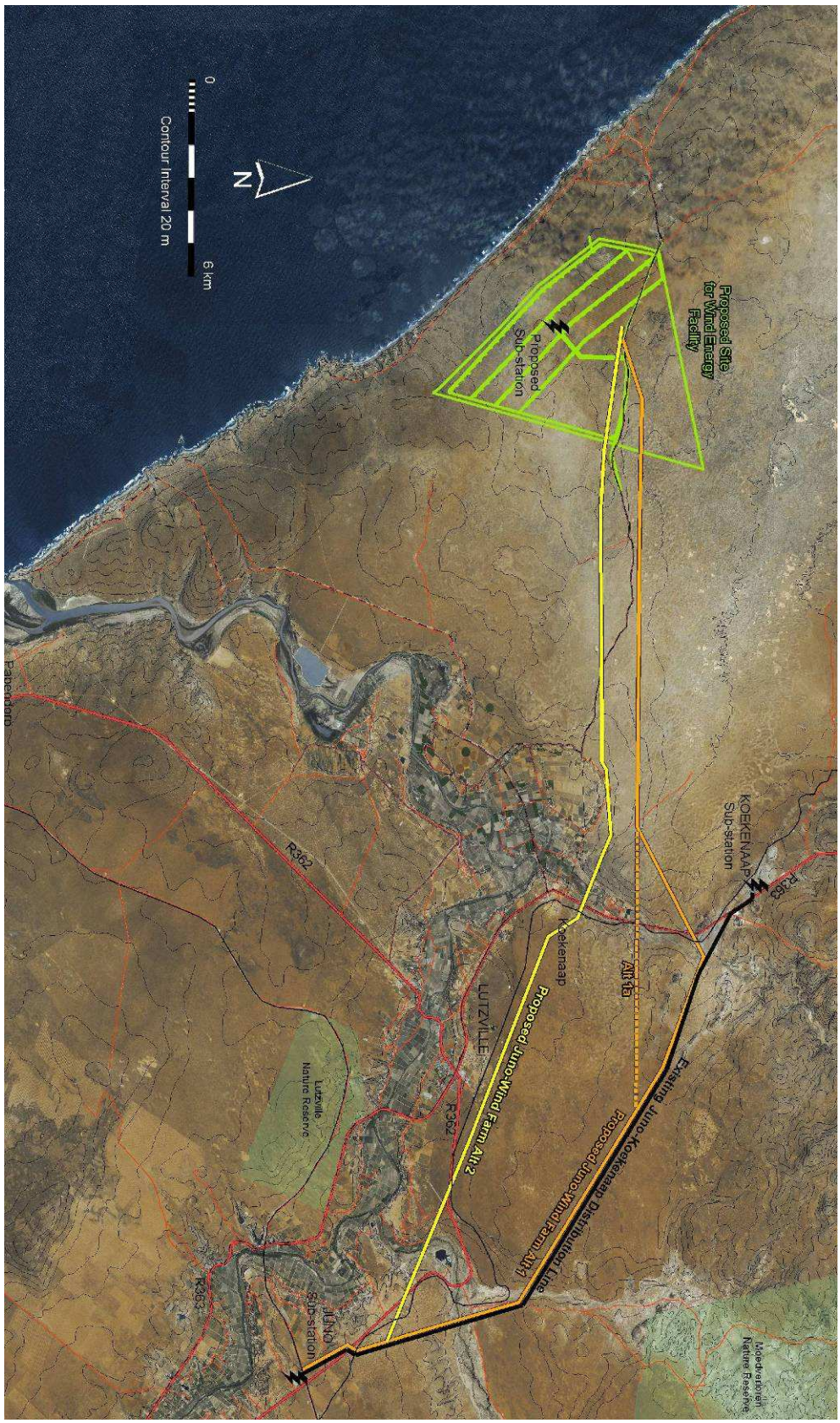

Figure 1. Satelite image showing the location of the study area along with power line alternatives. (image supplied by Savannah Environmental)

Within the study area, the landscape is characterised by low vegetated dunes, occasional deflation bays and fossil *Termiteria* mounds (*Heuweltjies*). The Strandveld vegetation is low and scrubby – there are no significant trees. Rocky outcrops are limited to a number of low ferricrete rafts which are mostly confined to the eastern side (inland) of the study area. The landscape is sandy throughout, however there is evidence of dried out wetlands and pans (many evidently highly saline), in particular on the farm Skilpadvlei, of which a portion lies within the study area. Two waterholes (which in the recent past contained potable water) were identified on the farm Skaapvlei.

Figure 2 The study area - typical view

The study area, which is some 2 km from the immediate coastline, does not lie on any commonly used tourism route (although in recent years a local farmer has commenced an eco-tourism initiative) however the shoreline is frequented by people who regularly use the coast for recreational camping over the holiday season. Generally, apart from Transhex Diamond Mining staff and local farmers, the local area is scarcely populated.

Human-made environment is limited to occasional wind pumps, fenced stock camps and off-road tracks which are only accessible with a four wheel drive vehicle. Much of the landscape, even within the study area is untouched, being devoid of paths or tracks and is only accessible on foot. Wildlife is common, but species diversity is low – small and medium bovids (springbok, steenbok

and duiker), small carnivores (meerkat and aardwolf) along with numerous rodents, birds and reptiles were observed during the course of this study.

Natural landscape and archaeological sites have been identified as the main heritage resource that requires assessment in this specialist study. The proposed activity does not involve deep excavation and is therefore unlikely to impact Cenozoic palaeontology which is likely to exist in deeply buried contexts.

1.3 The proposed activity

Eskom proposes to erect up to 100 wind turbines on a site of approximately 25 km^2. The turbines will be positioned so that each unit can make optimum use of the wind resource. They will be arranged in a series of 4 rows (a-d) across the western side of the study area roughly parallel to the coast. Each turbine will be approximately 300 m apart from the next while rows will be approximately 700 m apart. Each turbine consists of a steel tower 80 m high supporting a swivelling generator nacelle (containing the gearbox and generator) weighing 60 tons. Each blade will be 45 m long. The wind energy facility will be fenced. Associated infrastructure will consist of an access road, sub-station and visitors centre.

Figure 3 Vesta type wind turbine similar to those envisioned for the study area (Eskom).

Initially 50 wind turbines will be built, with expansion to 100 turbines envisaged in later years.

The wind energy facility will be linked to the national power grid by a 132 KV transmission line. Three alternatives routes are under investigation for the transmission line;

- Alternative 1 runs mostly north of the Koekenaap-Skaapvlei road and joins the Koekenaap – Juno transmission line at Koekenaap.
- Alternative 1a is a variation on alternative 1 avoiding botanically sensitive areas.
- Alternative 2 runs south of Koekenaap-Skaapvlei the along the northern edge of the Olifants River Valley and links directly with Juno substation.

The comparative impacts of each alternative are assessed in this study.

2. METHODOLOGY

2.1 Information base

The information that has informed this study is derived from two main sources. The first of which is experience derived from a number of significant studies that have taken place close to the study area as well as the general body of information that has been derived from researchers mostly based at the University of Cape Town who have worked in the Elands Bay area since the

1960s. Major studies on Namakwa Sands property, Transhex, Namaqualand Diamond Mining Corporation and De Beers owned properties have provided a solid background of observations.

The second major source of information is derived from the detailed field survey of the study area itself which took place prior to the compilation of this report.

2.2 Assessment method

The study area was surveyed over a five day period by two accredited archaeologists. Co-ordinates of the boundary of the study area and turbine alignments were programmed into a Garmin GPSmap 60csx global positioning system which was carried into the field. Where parts of the study area were accessible to an off-road vehicle as many sandy tracks as possible were driven as this is the fastest way possible to cover large tracts of landscape. At intervals "forays" of between 1 and 12 km were made on foot into the *veld* so as much of the landscape as possible could be checked and assessed. However the remoteness of certain parts of the study area necessitated a great deal of walking. All heritage features were assigned co-ordinates using global positioning systems. After each field day, co-ordinates and walk paths were downloaded onto a computer so that adequacy of coverage could be checked. Borrow pits along the access road were inspected to understand the subsurface conditions of the study area as well as verify the presence of any buried archaeological material.

It is important to note that archaeological site co-ordinates presented in this report represent a single fix roughly in the middle of each site, and not the area of the site itself. For planning purposes and the variable accuracy of hand-held GPS, a radius of at least 30 m from each fix should be considered to be the boundary of any archaeological site.

Assessment of the significance of the archaeological material is based on draft grading guidelines used by both SAHRA and Heritage Western Cape (unpublished discussion material).

2.3 Assumptions and limitations

This survey conducted during the 5-day field assessment cannot claim to be a complete survey of the entire site – the work tended to be concentrated in those areas that revealed themselves to be archaeologically sensitive or/and were going to be directly affected by the proposed activity. However, every kind of landscape within the study area was visited and inspected so that an overall sense of the distribution patterns of archaeological sites could be obtained.

No trial excavations were carried out which means that there is a possibility that Late Stone Age archaeological sites (especially ephemeral ones) may lie under aeolian sands.

It is assumed that subsurface conditions within the study area are similar to those observed in 3 nearby borrow pits and in the mining operation at Namakwa sands to the north.

3. THE HERITAGE CONTEXT

The history and pre-history of Namaqualand, despite its obvious rich cultural resources, has been until recently one of the most neglected areas of study in the country. The first serious academic

archaeological and anthropological studies of the area did not take place until the 1980s (Webley 1984, 1992). These focussed on the Nama reserves of the Kamiesberg mountains and the edge of Bushman land while a few initial archaeological studies have been conducted in the Richtersveld and southern Namibia (Robertshaw 1975).

The coastal archaeological wealth of the Namaqualand coast was only demonstrated circa 1988 when Eskom commissioned a series of preliminary studies to identify potential power station sites along the Namaqualand coast. Hundreds of Late Stone Age archaeological sites were located in the apparently waterless landscape (Parkington and Hart 1991). This observation was further illustrated in 1991 when Halkett and Hart (1997) of the ACO sample-surveyed the coastline of De Beers owned properties between Mitchell's Bay and Port Nolloth recording details of almost 1 000 archaeological sites. Archaeological work in the mining areas has been ongoing since 1991 with the result that a great deal of information is now available with respect to the coastal areas and the Gariep River. Recent research in the Kleinzee area (Halkett and Orton pers comm., Dewar 2007) has revealed that parts of Namaqualand were occupied by people almost a million years ago as is evident by massive scatters of Early Stone Age artefacts on high ground overlooking the coastal plain, however the greatest amount of archaeological sites are those which relate to the ancestors of the San and Khoekhoen which have been radiocarbon dated to within the last 5 000 years (mid-late Holocene). These sites are densest along the immediate coastline but may be found further inland close to water sources or natural foci (dunefields, rock outcrops) on the landscape. Colonial period sites, apart from those related to the relatively recent heritage of copper (in the north) and diamond mining, are uncommon.

3.1 The Vredendal Coastal Area

The Namaqualand coast north of the Olifants River was archaeologically unknown until 1987 when John Parkington of the ACO was appointed by the Environmental Evaluation Unit (EEU) on behalf of Namakwa Sands to assess the impacts of proposed heavy mineral sands mining. It became clear at that time that the dry areas of the West Coast were surprisingly archaeologically rich. Parkington and Poggenpoel (1991), after several preliminary assessments in the Brand Se Baai area near Vredendal, suggested that occupation of the coast during the Late Stone Age had taken place as a single burst of prehistoric occupation, probably within the last 2000 years. However, subsequent research (Parkington 2006) including archaeological excavation at several localities between Brand Se Baai and the Orange River Mouth has shown that people have been exploiting coastal resources since the Eemian interglacial period about 120 000 years ago with the discovery of rare Middle Stone Age shell middens, at Brand Se Baai, Liebenbergsbaai and Boegoeberg.

Historically the primary inhabitants of Namaqualand were San (bushmen) and Khoekhoen herders – the ancestors of the Nama speaking South Africans of the present day. Occupation of the area by San during the last 10 000 years (Holocene) was probably continuous but pulsed according to environmental patterns with events such as the "little ice age" circa 1400 AD playing a significant role (Dewar 2007). Although there is still much to be learned about the archaeology of the region, some interesting patterns in the distribution of archaeological sites are beginning to emerge. There are numerous archaeological sites on the immediate coast, mostly associated with rocky shoreline areas where marine resources were easy to obtain. Many of these sites contain ceramics and appear to be less than 2000 years old judging by the types of artefacts that are

found on them. In contrast, the few sites that have been located further inland on the coastal plains tend to be much older, dating to over 3000 years ago. This hints at changes in the way that people used the landscape over time, which may reflect a combination of environmental and social factors combined with population pressure. Coastal occupation and pressure on coastal resources may have increased after 2000 years ago when Khoekhoen arrived in the Cape bringing with them herds of sheep, ceramic technology and a new economic order.

3.2 The inland areas

To date very little is known about the inland areas (from 10 km inland of the coast), with the few archaeological surveys that have been completed limited to the Nama reserves and the western edge of Bushman Land (Webley 1984, 1992). There are vast tracks of land in the mountains and between the escarpment and the coast for which absolutely no information is available.

3.3 Colonial period occupation

Compared with other parts of South Africa, colonial period occupation of the un-hospitable region of the Namaqualand is very late having taken place during the mid-late 19th century. Farmers clashed with "wild" Bushmen, who after years of attrition were finally wiped out by the commando operations launched from regional centres in the Northern Cape (Penn 1995). Rumour has it that the last "wild bushman" died in about the 1890s (Steenkamp 1977).

Built environment heritage tends to be restricted to towns and mines. Farms tend to be very large so farm houses are very sparse. Nevertheless many of these are greater than 60 years old and have unique vernacular characteristics. Formal building conservation studies in the region are in their infancy.

The industrial archaeology of Namaqualand is significant, and among some of the earliest mining, railway and transport heritage in South Africa. Like so much of Namaqualand heritage, it has never been subject to any form of academic assessment (Worth pers comm.).

3.4 Conservation status of heritage

In more than any other area of the Cape, impact assessments and heritage management studies commissioned by Namakwa Sands (Pty) Ltd, De Beers Namaqualand Mines Division, Trans Hex Mining Ltd and Namaqualand Diamond Corporation have provided the bulk of what is known about the archaeology of the Namaqualand coast. Not only has this work contributed to research, but also importantly it has allowed us to gauge the condition of the "National Estate" of archaeological sites on the west coast.

During the early 20th century large-scale diamond mining began and it was only in the 1990s that mining companies began to implement policies for the conservation and assessment of heritage sites. This means that in certain areas massive destruction of coastal archaeological sites has

occurred without any mitigatory provisions. The worst hit areas are between Alexander Bay and Port Nolloth, the coastal areas of the Buffels Marine Complex at Kleinzee, parts of the Koingnaas mining area. However, the fact that many of these areas are off-limits to the public has resulted in the excellent preservation of archaeological sites in those parts of these high security areas that have not been developed. Unfortunately the area between the Spoeg and the Olifants River mouths have been impacted very seriously by years of small *ad hoc* diamond operations which has resulted in a plethora of informal off-road tracks to the coastal zone. Furthermore, there is hardly an area of the coastal fore-dunes that has not been subject to some form of disturbance. This means that virtually the entire material heritage of the immediate coastline (i.e. the Admiralty Zone – the coastal fore dunes) has already been lost. Fortunately, many sites have survived in the areas immediately inland of the coast. These are threatened by not only continued mining of these areas but especially by undisciplined use of off-road vehicles and the mass of informal roads/tracks that result.

The loss of heritage sites on the west coast is destined to continue as long as the coast and near coastal areas are subject to diamond mining, and in some instances, uncontrolled access by off-road vehicles. In the light of the substantial collective impacts that have already occurred to the population of archaeological sites, it is imperative that all effort is made to conserve the remaining sites, and where impacts will inevitably occur, sample them to ensure that loss of historical/cultural/scientific information resulting from their destruction is minimised.

The conservation status of colonial period archaeology, industrial archaeology and built environment has never been audited.

4. FINDINGS

4.1 Cultural landscape, built environment and historical sites

Colonial period heritage is extremely scarce in the study area and vicinity. There are no built structures close to, or within the study area apart from the provincial road, off-road tracks, stock drinking troughs, grazing camps and wind pump reservoirs. The nearest built settlement is the Skaapvlei farm (just to the north of the site) and the Transhex mining camp a number of kilometers to the south of the site. Neither of these places can be considered to be significant heritage resources, although buildings and family graves at Skaapvlei located outside of the study area may be more than 60 years old. Most of the Skaapvlei structures show evidence of *ad hoc* modernisation and are not worthy of high conservation status. The buildings have little aesthetic or historical value so the nearby presence of the wind energy facility will not compromise their cultural landscape qualities.

In essence, the landscape is ancient – the recent human presence being limited to ephemeral traces of agriculture and various impacts resulting from alluvial diamond mining activities, which are mostly restricted to the immediate coast. The cultural landscape qualities of the place are that of a relatively undisturbed landscape imprinted over by the archaeological sites of late Stone Age hunter gatherers then within the last 2 000 years, transhumant Koekhoen pastoralists. Colonial occupation up to now is ephemeral and of very recent duration.

4.2 Pre-colonial archaeology

Previous research has revealed that the bulk of archaeological sites (mainly Late Stone Age middens) lie within half a kilometer of the coast. Their frequency drops off rapidly with distance away from the coast. This spatial patterning reflects that people (typically in an arid environment) tended to focus their settlements, which were mostly of short seasonal duration, close to resource rich areas. Inland of the coast above the coastal escarpment archaeological sites are quite scarce being limited to ephemeral scatters situated in occasional deflation hollows. Where there is a rocky outcrop with shelters or overhangs, or any place that has the potential for providing a water source evidence of occupation is prolific. Within the study area, the general patterning of pre-colonial occupation is very much in keeping with what would be expected in an arid area. Some 65 observations of archaeological material (Appendix A) were recorded during the course of the study. Many of these are ephemeral scatters which will not be impacted by the proposed activity. The inland areas of the landscape are almost devoid of surface archaeological material, however ephemeral occurrences of mostly MSA material were noted associated with low ferricrete rafts, particularly in the central eastern part of the area. Almost every blowout/deflation that was inspected showed evidence of pre-colonial Late Stone Age occupation. These sites are generally ephemeral typically consisting of no more than 20-60 fragments of flaked quartz or silcrete with very little shell or bone.

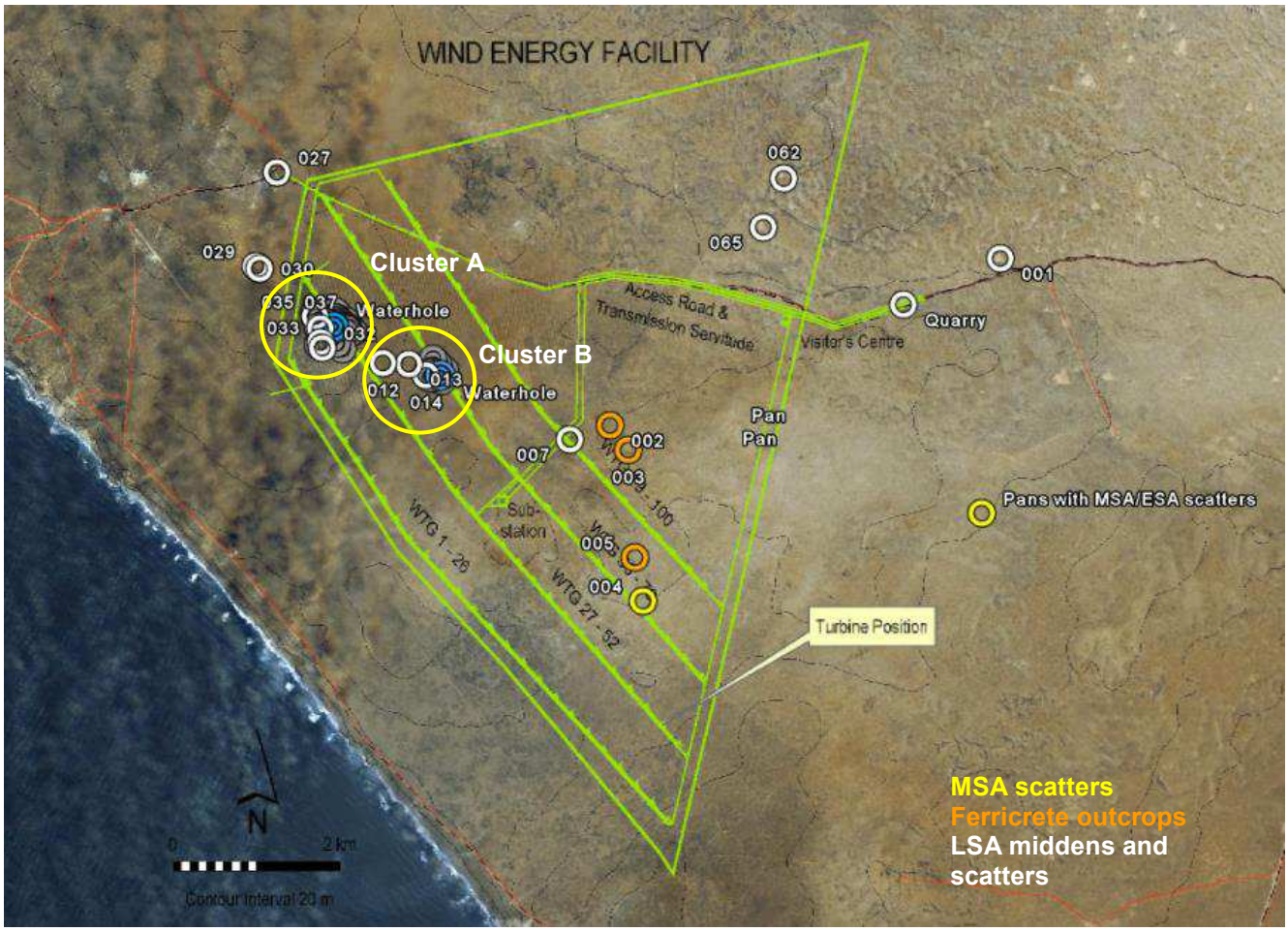

Figure 4. Satellite photograph of study area showing distribution of archaeological sites (photo supplied by Savannah Environmental (Pty) Ltd)

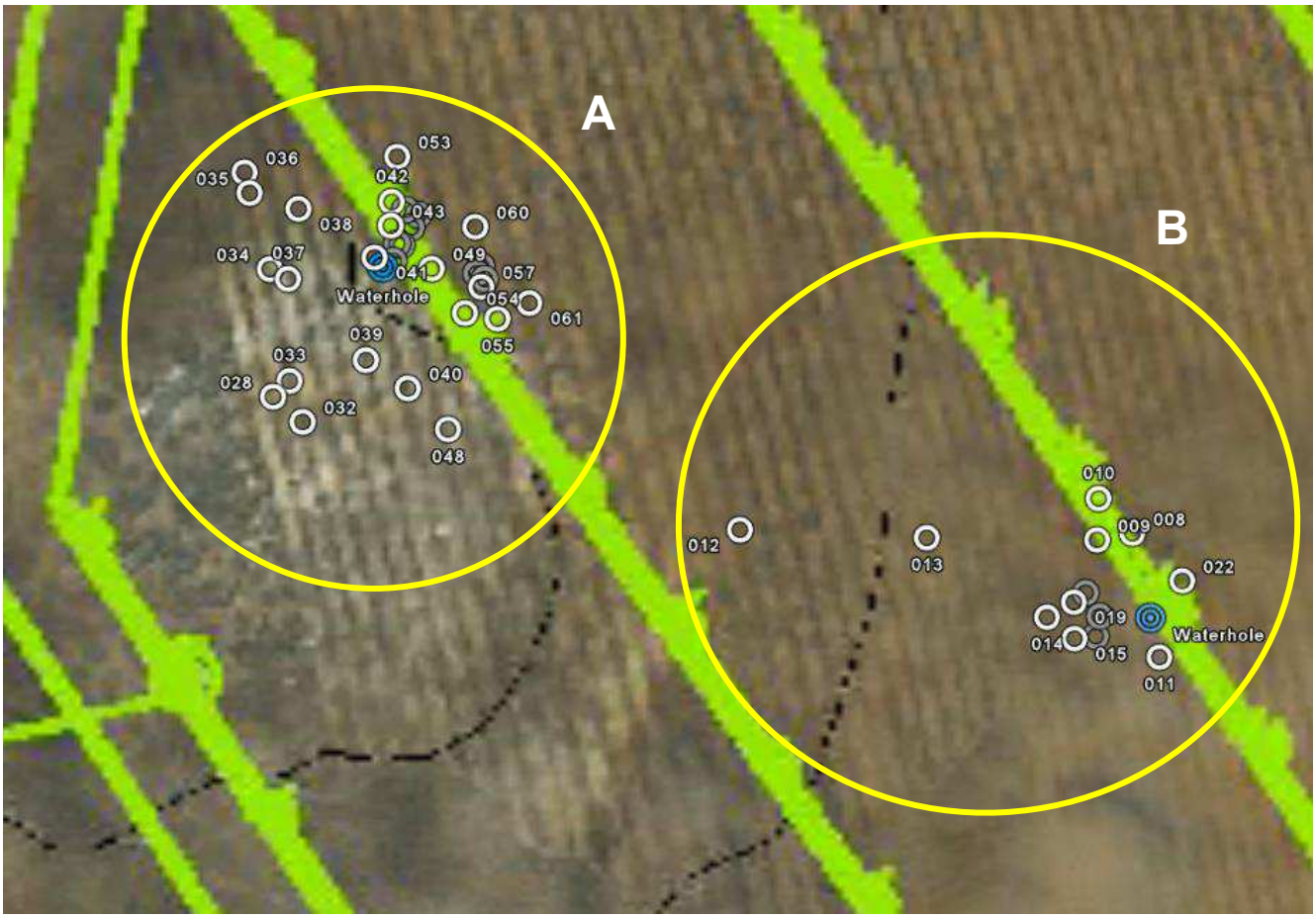

Figure 5 Two clusters of LSA middens, each one associated with a water source. (photo supplied by Savannah Environmental (Pty) Ltd)

4.2.1 Late Stone Age sites at Skaapvlei (Grave Water Kop 185/5)

The most interesting archaeological occurrences occurred on the Farm Skaapvlei (Grave Water Kop 185/5). The study revealed the presence of two dried springs that were once waterholes (Figure 7) with potable water. Each one of these (see Figure 5) had attracted a concentration of small shell middens (sites clusters A and B, Figures 8, 9). The contents of the sites are varied – many are ephemeral limpet dominated shell scatters (Figure 6) that are visible in what was once ploughed land. Agriculture has affected some of these sites and compromised their "within-site" stratigraphy, however since the sites appear to be single occupation events, stratigraphic integrity is of only moderate importance. The sites retain scientific significance. *C. argenvillei* is the visually dominant shellfish species on most middens, however confirmation of this will require archaeological sampling. In contrast at least 3 of the sites are dense middens (even though they are some 3 kms from the present coastline. Stone artefacts are present on all sites. The raw materials used are wide ranging – notably quartz, crystal quartz, very high quality silcrete, hornfels, quartzite as well as cryptocrystalline silicates. Fragments of animal bone have been noted on the denser sites. The assemblages tend to be informal despite the high grades of raw material available. Ceramics are present on many of the waterhole associated sites indicating that part of the occupation span took place within the last 2 000 years. The value of the waterhole related sites is that they represent two complete systems of occupation (site clusters A

and B) which are of scientific value in terms of their potential to provide information about the cultural affinities of the people who lived there, and the time depth of their occupancy of the area. Sites of both clusters A and B will be impacted by the disturbance corridors for the wind turbines.

Figure 6. One of the denser LSA middens found in site cluster A

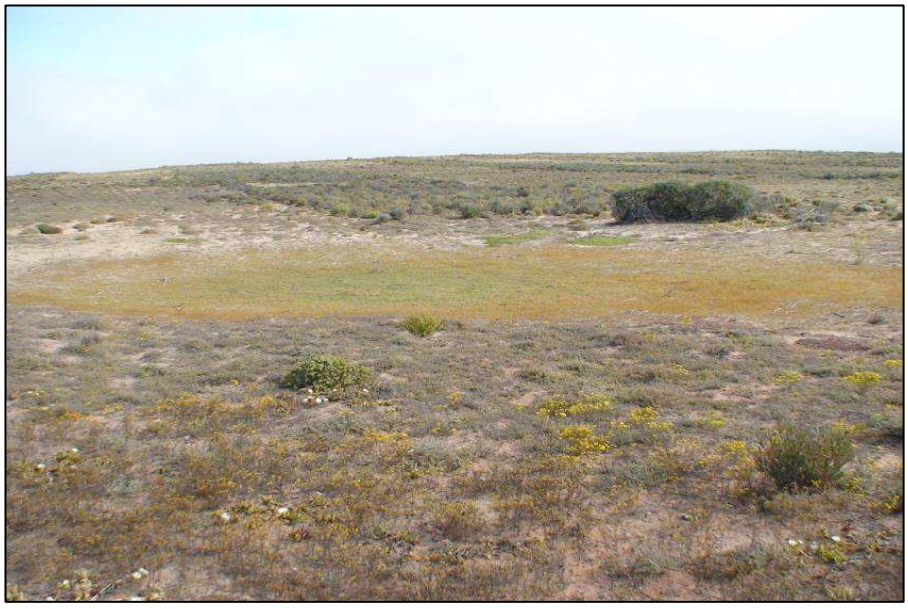

Figure 7 The water hole which was the focus of settlement at site cluster A

4.2.2 Early and Middle Stone Age

Older archaeological material dating from the Middle and Early Stone Ages has been found in areas where sand mining or overburden excavation/removal has resulted in the exposure of previous land surfaces. However due to the large amounts of aeolian sands that cover the study area none of this material is visible. Ephemeral occurrences of Middle Stone Age artefacts were noted within the study area associated with low outcrops of ferricrete, however none of these are considered significant. Many of these artefacts are probably in secondary context as it was noted that the outcrops had attracted burrow digging animals. The material was probably unearthed

from the hardpan crust (Pleistocene Doorbank horizon) that underlies the surface sands throughout the region.

The inspection of local borrow pits has revealed that the stratigraphy of surface sediments throughout the study area is similar. Typically the surface consists of red-yellow aeolian sands deposited over compacted and cemented sand, in places enriched by the presence of heavy minerals. The interface is commonly known as the Doorbank horizon – a hard crust of cemented material that is quite resistant to mechanical intrusion. Middle Stone Age material was noted eroding out of the interface between the recent sands and the underlying harder layers. The implication of this is that (as has been noted throughout the region) there is a generalised scatter of Early and Middle Stone age material dispersed throughout the study area on the Doorbank horizon where it has become conflated and concentrated by natural processes over thousands of years.

The depth of the Doorbank Horizon is variable. Since this would probably be a good founding material for the erection of structures, it will be impacted by the foundation slabs for the proposed wind turbines.

4.2.3 Pleistocene palaeontology and fossil rich archaeological sites

Fossil bone-rich archaeological sites have been noted close to the shoreline near Cliff Point and at Brand Se Baai. Sites such as these are rare and considered to be extremely valuable heritage resources. There is a possibility that fossil-rich Pleistocene deposits do exist in the study area in the aeolian sand body lying above the Doorbank horizon, especially under the first row of turbines which are situated back from the summit of the coastal ridge. Unfortunately, there is no possible way of predicting where or if an impact could occur. However there are precautionary measures that can be put in place (see heritage management section).

5. ASSESSMENT OF IMPACTS

5.1 The way in which heritage sites will be impacted

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large scale excavations will damage archaeological sites, as will road construction, building foundations and services.

The destruction of archaeological material is always considered to be a permanent and irreversible impact, although very often the intensity of an impact can be very low depending on the significance of the site in question.

5.1.1 Bulk excavation

The proposed activity is the building of 100 wind turbines aligned in 4 rows across the study area.

Each turbine will be mounted on a square cast concrete base of 15x15 sqm in extent. Each base will require a 2 m deep excavation of similar dimensions. Thus the proposed activity will require local excavations at each one of the proposed wind turbine sites. While the depth of excavation is relatively shallow, it is expected that the Doorbank horizon will be impacted along with any archaeological material lying on it. This will cause local destruction and disturbance of any material that may exist.

Each turbine site will need to be linked by buried electrical distribution cables with the substation to be built on site. The excavations for the cables will be an extensive linear disturbance of surface and below surface soils. The substation will also require excavations for cables and footings for transformers.

5.1.2 Surface disturbance

Each row of turbines will require a service road (initially 14m wide to accommodate a track for the heavy lift crane) which will need to be used for both construction purposes and maintenance. Effectively each row of turbines represents a corridor of surface disturbance which may impact later archaeological sites. Each turbine site will require an adjacent laydown area for plant, material and components as well as a compacted flat platform for a heavy duty crane which will be used to lift and position the steel columns, nacelle and turbine blades. This means that there will be an estimated 60x60 sqm area of surface disturbance required for each installation adjacent to the service road. This in particular has the potential to damage LSA middens at site clusters A and B.

A certain amount of excavation will be required for the construction of the access road to the site, as well as the substation and visitor's centre.

An overhead 132KV distribution power line (three alternative routes are offered) will be required to link the facility with the national power grid at Juno substation near Vredendal. The tower bases for the distribution line will require excavations for footings at intervals across the landscape. This is a minor form of surface and below surface disturbance which may impact buried heritage material.

5.1.3 The impact of the proposed activity on historical sites

Colonial period heritage is extremely scarce in the study area and vicinity. There are no built structures close to, or within the study area apart from the provincial road, off-road tracks, stock drinking troughs and wind pump reservoirs. No historical (colonial period) sites will be impacted by any of the proposed activities.

5.2 The impact of the development of the wind energy facility on pre-colonial archaeological sites

5.2.1 Late Stone Age middens

The areas of greatest concern are certain impacts to Late Stone Age shell middens that make up

clusters A and B. Expanded views from the study area are presented in Figures 8 and 9. Indications are that disturbance corridors as well as turbine construction areas and footings will potentially destroy archaeological material. Turbine row B will directly affect an estimated 11 Late Stone Age shell middens (see Figures 8 and 9) and turbine row C will affect a further 5. The effect of the proposed activities will be the further lateral and vertical disturbance of midden material, destruction of artefactual material and bone and mixing of any preserved stratigraphy.

Accumulative impacts are a concern in that middens were once common archaeological resources throughout the Western Cape but which have been impacted to the extent that well conserved middens are now cherished heritage resources. Intact middens are increasingly only found in either remote localities or conservation areas. While the middens that have been found in the study area are not particularly rich or dense and many have suffered some disturbance from past agriculture, it is important to be aware that each one of them has research potential and heritage value in terms of their group value – they are all components of a past settlement pattern which responded to the pressures of the natural and social environments of the times. Unlike many other environmental resources, archaeological sites are non-renewable.

Table 1 Summary of impact assessment: turbine construction and related activities on Late Stone Age shell middens

Bulk excavation and site preparation resulting in destruction of Late Stone Age shell middens	***Extent***	***Duration***	***Magnitude***	***Probability***	***Significance***	***Status***	***Confidence***
With mitigation	Local (1)	Permanent (5)	Moderate (3)	Probable (3)	Medium-low (27)	Negative	Certain
Without mitigation	Local (1)	Permanent (5)	High (8)	Probable (4)	High (62)	Negative	Certain

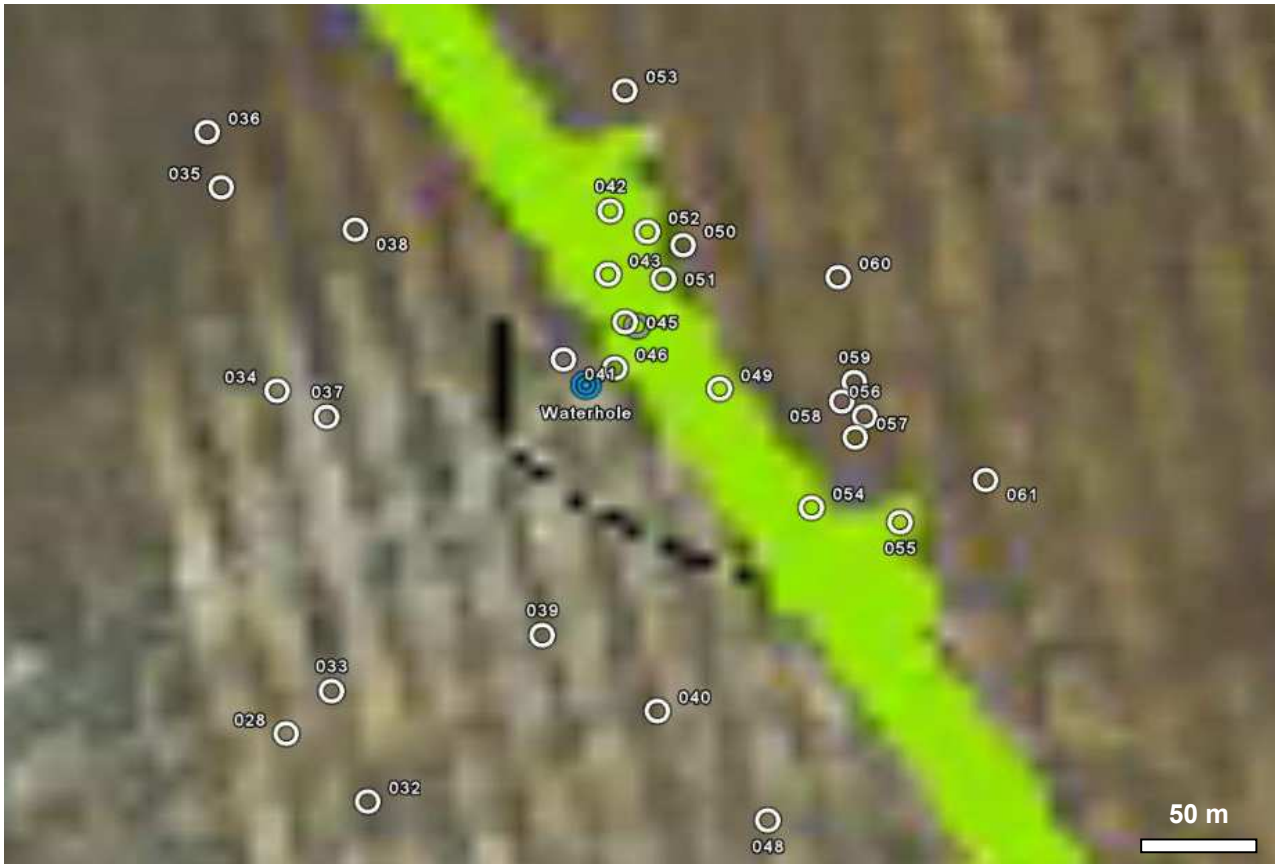

Figure 8. Row B passes through site cluster A resulting in likely impacts to LSA middens. Note each location is a single GPS fix – a radius of 30m around each point donates the site.

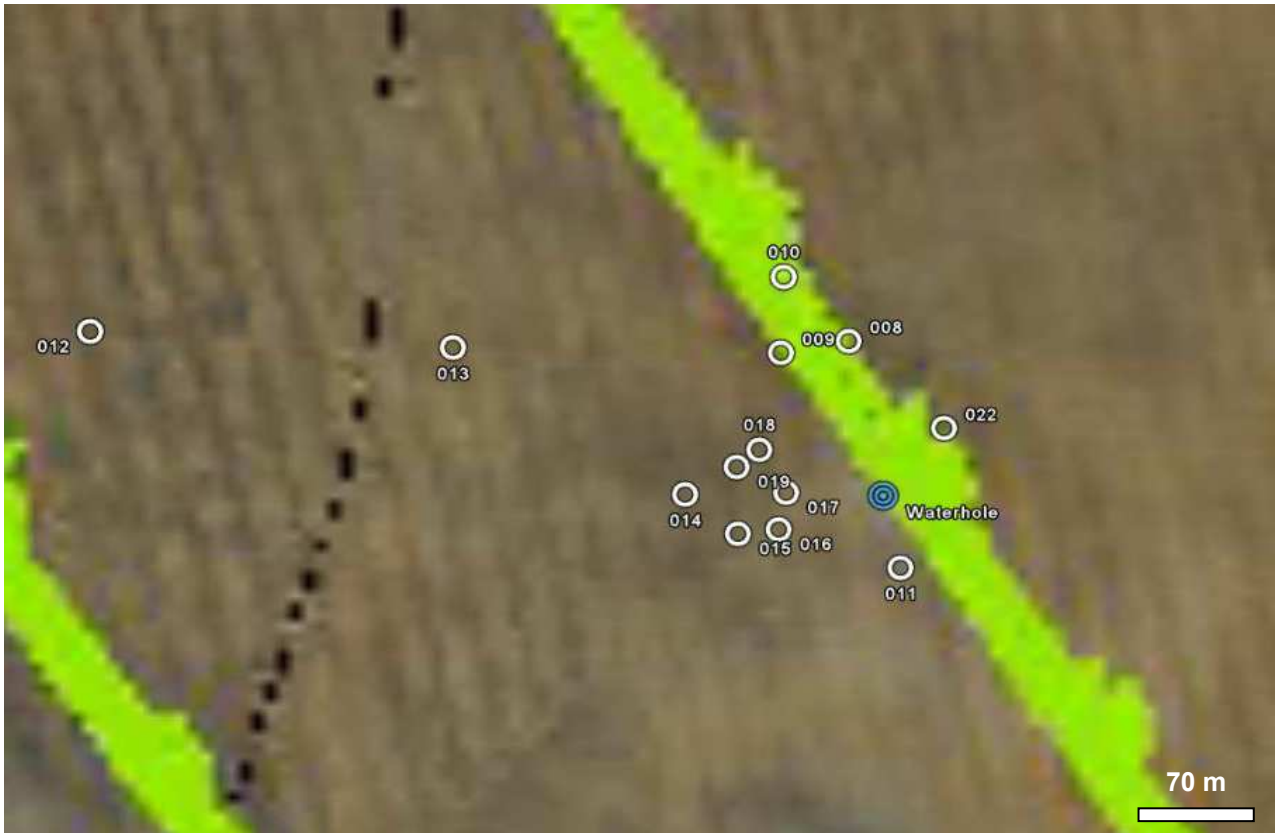

Figure 9. Row C passes through site cluster B resulting in likely impacts to LSA middens. Note each location is a single GPS fix – a radius of 30m around each point donates the site.

5.2.2 Pleistocene palaeontological/archaeological material

The 2 m deep excavations for each of the wind turbine bases will penetrate aeolian sands and may impact on the Doorbank horizon displacing any Middle or Early Stone Age archaeological material that may exist. This material is deemed to be ubiquitous throughout the region and is therefore a very wide spread resource. Furthermore the material tends to be conflated down to a single layer which means that its provenance (original context) is in doubt. It is argued that the footing excavations will not diminish the resource significantly and that the impact is therefore tolerable in terms of the massive geographical extent of the resource. Away from the coast the upper aeolian sands are not calcareous or fossiliferous, however there is a low possibility that fossil bone with archaeological material in direct association may occur (none was noted in the 3 borrow pits inspected). Ancient sites with this degree of preservation are considered important and will need immediate investigation.

Figure 10. Borrow pit close to the study area showing the typical soil profiles that are expected to be encountered in turbine footing excavations

Table 2 Summary of Impact assessment: turbine construction and related activities on Pleistocene archaeological material.

Possible bulk excavation impacts on buried Pleistocene archaeology/palaeontology	***Extent***	***Duration***	***Magnitude***	***Probability***	***Significance***	***Status***	***Confidence***
With mitigation	Local (1)	Permanent (5)	Low (2)	Possible (2)	Low (16)	Neutral	Certain
Without mitigation	Local (1)	Permanent (5)	High (3)	Probable (2)	Low (18)	Negative	Certain

5.3 The impact of the construction of 132KV distribution power lines on pre-colonial archaeological sites

Alternatives 1, 1a and 2 suggested for the 132KV distribution power lines run in a generally easterly direction from the proposed wind energy facility. Inspection of borrow pits and easily accessible deflation hollows along the route have shown that unless there is a specific resource focus on the landscape that would attract pre-colonial occupation, the likelihood of significant material is very low. Furthermore, the footprint of each tower is limited. This together with the fact that both options 1 and 2 traverse a landscape where heritage material is very sparse results in a very low potential for impacts.

The visual impact associated with the two distribution line alternatives are the subject of a separate visual assessment.

Alternatives:
Of the alternatives suggested, both carry similar weight in terms of expected impacts to archaeology, however the Koekenaap alternatives (1 or 1a) are supported over alternative 2 as it is preferable to confine any impacts that may occur to an existing corridor, and secondly the greater distance from the Olifants River reduces the possibility of impacting archaeological material.

Table 3 Summary of Impact assessment: construction of 132KV distribution line

Possible impact of excavation of footings and related activities for 132KV distribution lines.	***Extent***	***Duration***	***Magnitude***	***Probability***	***Significance***	***Status***	***Confidence***
With mitigation	Local (1)	Permanent (5)	Low (1)	improbable (1)	Low (6)	Neutral	Certain
Without mitigation	Local (1)	Permanent (5)	Low (1)	Improbable (1)	Low (6)	Neutral	Certain

5.4 Cultural landscape and sense of place

The visual impact of the proposed activity forms the subject of an independent visual impact assessment, however the impacts on the cultural landscape and sense of place are considered

part of the heritage environment. In the interest of producing as complete a heritage report as possible, the following comment is offered.

The cultural landscape is essentially a natural one with ephemeral traces of human modification. It has a quiet "unspoiled" character, somewhat bleak wide open spaces and uninterrupted views from horizon to horizon (Figure 11). Conspicuous changes to a landscape such as tall buildings, landscape scarring, massed housing development can change the "feel" and atmosphere of a place irrevocably. It takes only a small intervention to alter the sense of wilderness of a place and change its atmosphere. The sense of remoteness and wilderness of the place will change for the duration of the existence of the wind energy facility, and possibly beyond.

Figure 11. The wide open landscape that characterises the study area

6. MITIGATION AND CONSERVATION

6.1 Archaeological heritage

6.1.1 Late Stone Age middens

LSA middens in clusters A and B will be impacted by the proposed alignment of rows B and C of the wind energy facility. In the localities of the water holes the sites are densely distributed which means that micro-adjustment of wind turbine positions is not going to be possible without a local alteration of the alignment of the entire row , which according to Eskom is unfeasible outside

of the 200m wide corridor of disturbance assigned to each row.

The field observations show that most of the sites are quite ephemeral being shallow single occupation middens, many of them already slightly disturbed. This means that successful mitigation can be achieved through archaeological sampling. To this end the following recommendations are made:

- The disturbance corridors of rows B and C will impact site clusters A and B and their associated waterholes. Eskom has indicated it will not be possible to move entire turbine corridors (which would be ideal mitigation). The density of sites is such that options for moving the road alignments and turbine sites within the 200m corridor are very limited. This means that there is no choice but to undertake sampling of sites that will be impacted by the proposed activity. Once this is done satisfactorily, a destruction permit for the affected sites will need to be applied for and obtained from HWC by Eskom. It is not necessary to loose turbine positions. Any other sites close to the proposed activity will need to be identified and flagged as no-go areas.

  It is estimated that the following sites will require sampling or protection:

  Cluster A Middens 42, 43, 44, 45, 46, 49, 52, 52, 55
  Cluster B Middens 10, 8 9, 22

- It would be ideal if an archaeologist could accompany the Eskom Generation survey team so that sites requiring sampling or flagging can be accurately identified and on-site decisions made with respect to sampling, flagging or even wind turbine position adjustment (if possible). It would be best that all sampling is done ahead of construction work. This work is best done before commencement of construction or alternatively during construction as long as the construction work commences on non-sensitive areas first.

- Eskom Generation and the project archaeologist will need to apply for sampling permits from Heritage Western Cape for work on archaeological sites identified as needing intervention – in other words any archaeological site that will be affected by the access road, crane track, laydown areas, turbine bases and cable trenches. The permit application will need to be accompanied by detailed specifications of which sites are to be sampled, how large the samples will be, and how and where the sampled material will be stored (the NHRA requires indefinite institutional storage of all archaeological remains). The turn around period for the issuing of permits is generally about 5 weeks and permits are usually valid for a period of a year but can be extended for a further 2 years if needs be. One the archaeological sampling is completed, a permit for destruction of any remaining archaeological material on any of the development sites must be obtained from HWC.

- It is estimated that a sampling program will require 5 weeks of field time, with an equivalent amount of laboratory time required for follow-up curation. The expected costs of such an operation will be in the region of R400 000 – R450 000 in terms of current

costing (November 2007) and level of impact.

6.1.2 Buried Pleistocene archaeological material

There is a possibility that Pleistocene material above or on the Doorbank horizon will be impacted by the excavation of the wind turbine bases. This applies to all turbine bases, however greatest likelihood of a find is in row A. Since the envisaged construction team is quite small, the most cost-effective mitigation would be to establish liaison with a responsible person on site who could photograph and report any finds to an archaeologist who would then arrange to mitigate/collect the find (if necessary). However this will only be successful with the full cooperation of contractors/site staff.

It would also be desirable that during the excavation phase for turbine bases, an archaeologist makes a visit to log exposed sections and check for the presence of any significant material.

If an important find is made, it may be necessary to divert plant to allow the necessary time to collect/record the find.

6.2 Human remains

Human remains can occur at any place on the landscape, but are particularly likely to be found on or close to archaeological sites. They are regularly exposed during construction activities along the west and south coasts. Such remains are protected by a plethora of legislation including the Human Tissues Act (Act No 65 of 1983), the Exhumation Ordinance of 1980 and the National Heritage Resources Act (Act No 25 of 1999). In the event of human bones being found on site, SAHRA must be informed immediately and the remains removed by an archaeologist under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.

6.3 Un-identified archaeological material, fossils and fossil bone

There is always a chance that archaeological material may be exposed during bulk excavation for services and foundations. All archaeological material over 100 years of age is protected and may only be altered or removed from its place of origin under a permit issued by Heritage Western Cape (HWC). In the event of anything unusual being encountered, the Province Archaeologist at HWC and/or the projects heritage consultant must be consulted immediately so that mitigatory action can be determined and be implemented if necessary (find-stop scenario or skip to the next turbine). Mitigation is at the cost of the developer, while time delays and diversion of machinery/plant may be necessary until mitigation in the form of conservation or archaeological/palaeontological sampling is completed.

6.4 Cultural landscape and sense of place

This is perhaps the most difficult heritage impact to address. There is no doubt that the wind

turbines will affect the wilderness qualities of the site, however the degree of impact will be very closely related to the visual impacts of the proposed activity (the visual impact will be separately addressed by MetroGIS).

7. CONCLUSION

Indications are that in terms of historical and archaeological heritage the proposed activity is viable, impacts are greater than initially expected, but are nevertheless controllable through with a program of archaeological sampling of Late Stone Age archaeological sites of site clusters A and B an where possible, micro adjustment of turbine and road positions. Controlling of impacts to buried archaeological material such as stone artefacts scatters on the Doorbank horizon will require the commitment of both site staff and archaeologists. However the resource is considered to be widespread and the cumulative impact is not excessive.

The construction of the site visitors centre, substation, access roads as well as the 132KV distribution lines are unlikely to result in any impacts and therefore no further action is required other than to report un-anticipated finds.

In terms of impacts to the natural cultural landscape qualities of the site, impacts are expected. This may be mitigated by the fact the study area is set back from the scenic coastal escarpment (which is most frequently used by people) and the fact that the proposed wind turbines will need very little by way of support structures or staff facilities. Input from visual assessment of the site will be needed in order to comprehensively assess potential impacts.

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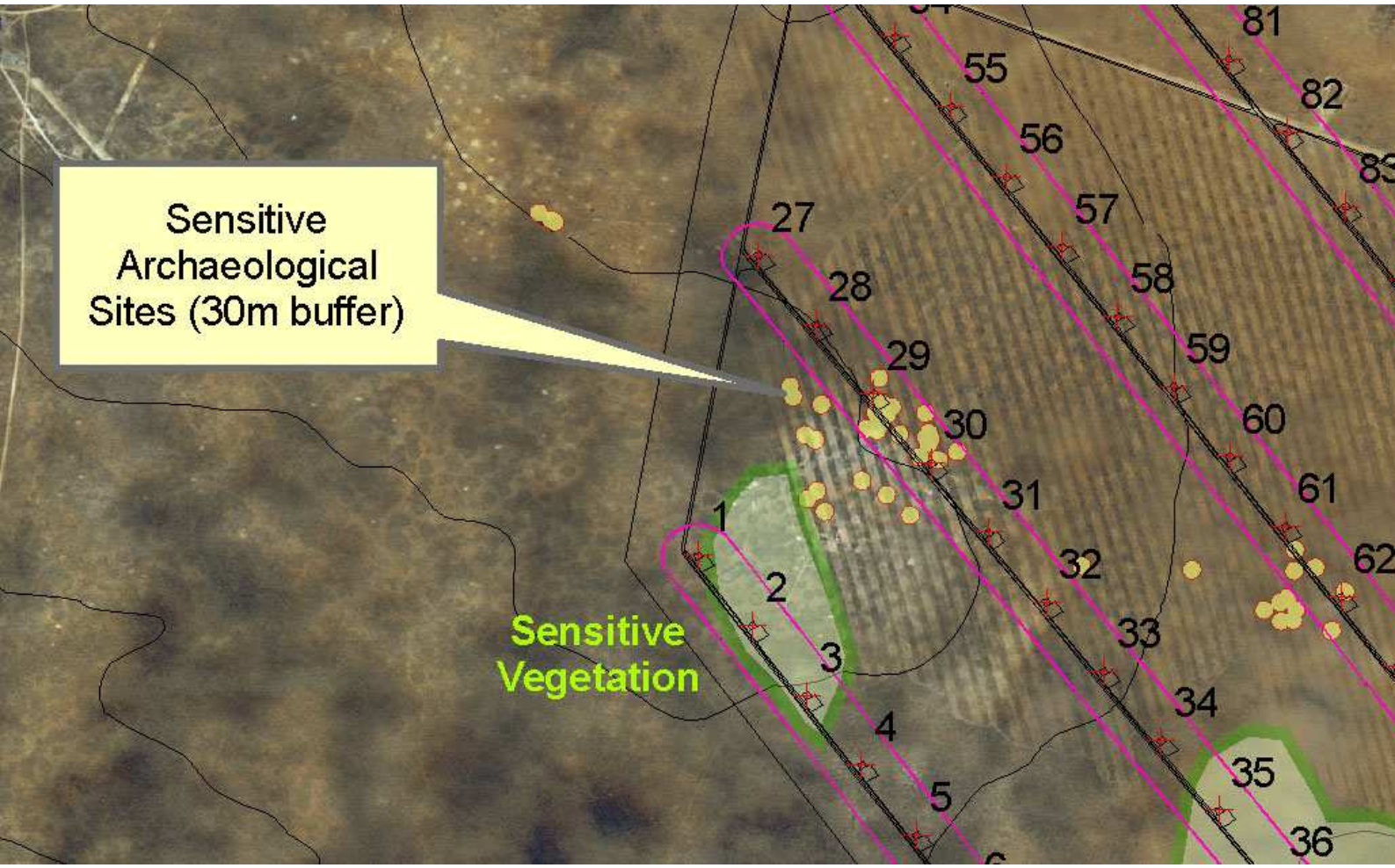
APPENDIX A

The following are co-ordinates of archaeological sites recorded within or close to the study area. Each fix marks the center of a site. It is recommended that for planning purposes a safety radius of 30m is utilised around each co-ordinate. Sites printed in bold text are which are estimated to require sampling.

The co-ordinates were taken using a Garmin map 60csx set on WGS84

1	S31.498849	E018.168315	DEFLATION HOLLOW SITE WITH EHEMERAL SCATTER OF LSA
2	S31.516602	E018.119599	FERRICRETE OUTCROP
3	S31.519217	E018.121867	FERRICRETE OUTCROP WITH MSA SCATTER
4	S31.535293	E018.123731	DEFLATED MSA SCATTER
5	S31.530666	E018.122700	FERRICRETE WITH MSA SCATTER
7	S31.518097	E018.114596	EPHEMERAL LSA MIDDEN
8	**S31.510032**	**E018.098113**	**LARGE LSA MIDDEN WITH STONE ARTEFACTS, CERAMICS**
9	**S31.510129**	**E018.097495**	**LSA MIDDEN WITH STONE ARTEFACTS**
10	**S31.509516**	**E018.097520**	**LSA MIDDEN WITH STONE ARTEFACTS**
11	S31.511871	E018.098588	EPHEMERAL LSA MIDDEN
12	S31.509976	E018.091301	EPHEMERAL LSA MIDDEN
13	S31.510095	E018.094529	EHPEMERAL LSA MIDDEN
14	S31.511275	E018.096623	EPHEMERAL LSA MIDDEN
15	S31.511594	E018.097104	DENSE LSA MIDDEN WITH STONE ARTEFACTS
16	S31.511559	E018.097475	EPHEMERAL LSA MIDDEN
17	S31.511261	E018.097543	LSA MIDDEN
18	S31.510913	E018.097298	LSA MIDDEN
19	S31.511053	E018.097092	EPHEMERAL LSA MIDDEN
22	**S31.510737**	**E018.098984**	**EPHEMERAL LSA MIDDEN**
27	S31.489733	E018.078144	LSA MIDDEN
28	S31.508032	E018.083332	EPHEMERAL MIDDEN
29	S31.499697	E018.075522	LSA MIDDEN
30	S31.499961	E018.075984	DENSE LSA MIDDEN WITH STONE ARTEFACTS
31	S31.499907	E018.075891	DENSE LSA MIDDEN WITH STONE ARTEFACTS
32	S31.508400	E018.083840	EPHEMERAL LSA MIDDEN
33	S31.507801	E018.083613	EPHERAL LSA MIDDEN
34	S31.506165	E018.083265	LSA MIDDEN
35	S31.505054	E018.082917	LSA MIDDEN
36	S31.504752	E018.082829	LSA MIDDEN
37	S31.506308	E018.083574	DENSE LSA MIDDEN WITH STONE ARTEFACTS
38	S31.505283	E018.083748	LSA MIDDEN
39	S31.507498	E018.084919	DENSE LSA MIDDEN WITH STONE ARTEFACTS
40	S31.507910	E018.085634	LSA MIDDEN
41	S31.505992	E018.085045	LSA MIDDEN
42	**S31.505175**	**E018.085336**	**LSA MIDDEN**
43	**S31.505525**	**E018.085323**	**LSA MIDDEN**
44	**S31.505807**	**E018.085504**	**LSA MIDDEN**
45	**S31.505786**	**E018.085429**	**LSA MIDDEN**
46	**S31.506040**	**E018.085365**	**LSA MIDDEN**
48	S31.508507	E018.086319	LSA MIDDEN WITH CERAMICS
49	**S31.506152**	**E018.086021**	**EPHEMERAL LSA MIDDEN**
50	S31.505363	E018.085792	EPHEMERAL LSA MIDDEN
51	**S31.505549**	**E018.085670**	**LSA MIDDEN WITH CERAMICS**
52	**S31.505289**	**E018.085568**	**EPHEMERAL LSA MIDDEN**
53	S31.504512	E018.085427	LSA MIDDEN

54	S31.506804	E018.086595	LSA MIDDEN WITH CERAMICS
55	**S31.506885**	**E018.087150**	**EPHEMERAL LSA MIDDEN**
56	S31.506303	E018.086929	EPHEMERAL LSA MIDDEN
57	S31.506419	E018.086870	EPHEMERAL LSA MIDDEN
58	S31.506221	E018.086786	EPHEMERAL LSA MIDDEN
59	S31.506114	E018.086865	EPHEMERAL LSA MIDDEN
60	S31.505537	E018.086764	EPHEMERAL LSA MIDDEN
61	S31.506653	E018.087690	EPHEMERAL LSA MIDDEN
62	S31.490389	E018.141303	EPHEMERAL LSA SCATTER IN DEFLATION HOLLOW
65	S31.495566	E018.138756	EPHEMERAL LSA SCATTER IN DEFLATION HOLLOW



Appendix A Figure 1: Spatial patterning of shell middens in relation to corridors of disturbance.