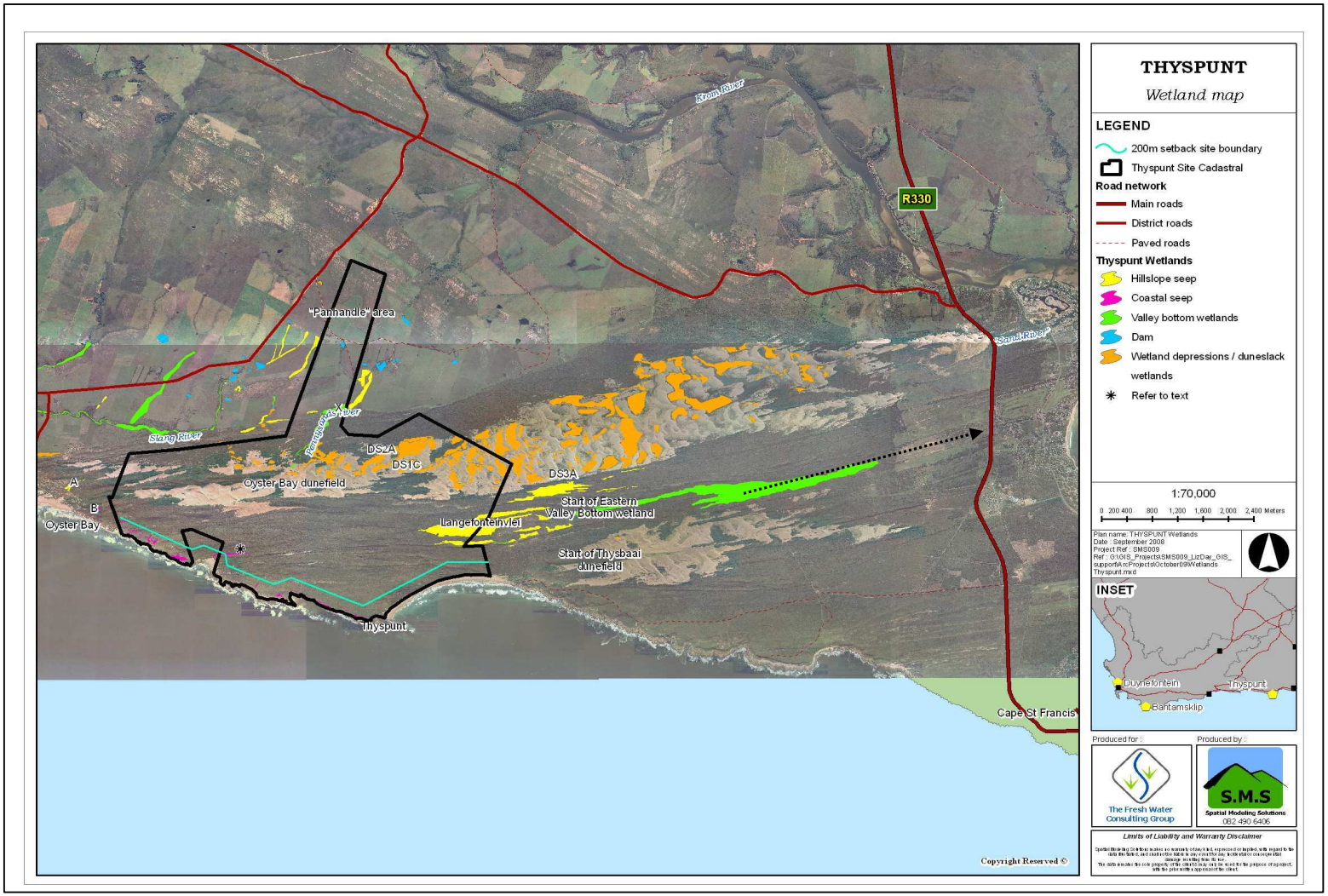


Figure 8-45: Wetlands at Thyspunt

8.6.4 Vertebrate fauna

The site lies within the Cape Floristic Region, which is largely restricted to the Western Cape and Eastern Cape provinces. This is an exceptionally biodiverse region with very high levels of species endemism. As mentioned for Bantamsklip, the CFR has been identified as a global Biodiversity Hotspot and is the focus of the Cape Action for People and the Environment. The site is registered with the DEA as a Natural Heritage Site.

The site is environmentally varied and complex, with several distinctly different habitat types, a complex topography with complex drainage, and a varied coastline. Despite the proximity of the towns of Cape St. Francis in the east and Oyster Bay in the west, the site is remarkably wild and unspoilt.

a) Habitats

Habitats on site are largely comprised of the following veld types: Algoa Dune Strandveld (Least Threatened) covering the majority of the area, Southern Cape Dune Fynbos (Least Threatened) on a relatively large area, a narrow coastal strip of Cape Seashore Vegetation (Least Threatened), and a relatively small area of Tsitsikamma Sandstone Fynbos (Vulnerable) on an inland extension of the site. The inland “panhandle” portion of the site has been largely transformed by agriculture. In addition there are small patches of thicket which have matured into low forest; also thickets of invasive alien vegetation, mainly Rooikrans *Acacia cyclops* and Port Jackson Willow *A. saligna*. Between the coastal and inland portions of the site lies and extensive transverse mobile-dune field with interspersed vegetated areas and and seasonal wetlands.

b) Amphibians

There are 15 possible amphibian species, all of which are of probable or confirmed occurrence. None of the species is *Threatened*, but there are nevertheless some important conservation issues around amphibians on site. The wetlands in the dune field are occupied by a number of species and these have been the subject of special surveys. A population of Cape Sand Toad *Vandijkophrynus angusticeps* is of special interest because it is at the eastern extremity of its range here. The population is probably isolated from all others populations of this species and may, therefore, be genetically and even taxonomically distinct. and should be regarded as a rare, important and sensitive population requiring the highest levels of protection.

Also of considerable interest are the frogs that occupy the coastal wetlands and seeps above the rocky shoreline. Six species (Common Platanna *Xenopus laevis,* Common River Frog *Amietia angolensis,* Bronze Caco *Cacosternum nanum*, Striped Stream Frog *Strongylopus fasciatus*, Clicking Stream Frog *Strongylopus grayii*, Cape Sand Frog *Tomopterna delalandii*) were observed in these habitats, which is an unusual species richness for localities so close to the sea. It can be assumed that these species are also all breeding here. Along with the occurrence of other types of freshwater-associated species (see below), this community of amphibians is of special scientific and conservation interest and needs to be protected.

Penther's Rain Frog *Breviceps adspersus pentheri,* a fossorial terrestrial frog, is a range-restricted taxon endemic to the Eastern Cape province and therefore of special conservation significance. It is of probable occurrence on the inland “pan-handle” part of the site.

c) Reptiles

There are 62 possible reptiles species, 50 of which are of probable or confirmed occurrence. Probably occurring species that are provisionally Red Listed are FitzSimons' Long-tailed Seps *Tetradactylus fitzsimonsi* (Vulnerable) and Tasman's Girdled Lizard *Cordylus tasmani* (Vulnerable). In addition, Péringuey's Coastal Leaf-toed Gecko *Cryptactites peringueyi*

(Critically Endangered) is of possible occurrence. This extremely range-restricted Eastern Cape endemic species is known from only two localities, one of which is the Krom River estuary, situated only a few kilometers to the east of the site. If it does occur, it is likely to be associated with vegetation in the splash zone along the coast.

Herald Snake *Crotaphopeltis hotamboeia* and Cape Girdled Lizard *Cordylus cordylus* were found very near to the sea, in association with the coastal wetlands. The Herald Snake is a specialist predator of frogs. These findings strengthen the impression that a community of wetland-associated species exists immediately adjacent to the marine environment.

None of the anticipated Threatened species was confirmed during the field survey (September 2009. However, one provisionally Red Listed species that was not anticipated was found, namely Elandsberg Dwarf Chameleon *Bradypodion taeniabronchum* (Endangered) (**Figure 8-46**). This is a new locality for this species, and it is well removed from other known localities. Its DNA is undergoing analysis because it may be genetically distinct from other populations of the species. If this is found to be the case, it would further underline the population's conservation importance, and that of the Langefontein wetland.

Figure 8-46: Elandsberg dwarf chameleon found at Langefontein wetland

d) Mammals

There are 58 possible mammals species, 44 of which are of probable or confirmed occurrence. Only three species are Red Listed as Threatened or Near Threatened, namely Fynbos Golden Mole *Amblysomus corriae* (Near Threatened), Honey Badger *Mellivora capensis* (Near Threatened) and Blue Duiker *Philantomba monticola* (Vulnerable). The Blue Duiker and Honey Badger are almost certain to occur.

At the coast, especially at or near to coastal wetlands, there was abundant spoor of Cape Clawless Otter *Aonyx capensis* and Marsh Mongoose *Atilax paludinosus,* as well as antelope, probably Bushbuck *Tragelaphus scriptus* and Common Duiker *Sylvicapra grimmia*. These

provided further evidence of the ecological importance, as well as the richness and sensitivity of the coastal wetlands.

There have been reliable reports of Leopards *Panthera pardus* occurring and possibly breeding on site. While the Leopard is not a Threatened species, its occurrence in coastal environments has become rare. This species is symbolic of the wild, unspoilt nature of the site, and of an ecosystem that is intact and functioning in, or quite close to, its original condition. Leopards can survive, and possibly thrive, in this environment because a number of suitable prey species still occur in good numbers (confirmed), e.g., Bushpig, Vervet Monkey, Common Duiker, Bushbuck and Red Necked Spurfowl. It is this intactness of the ecosystem which makes Thyspunt a site of substantial conservation importance for fauna, especially as it is located at the coast where most ecosystems have been radically altered.

e) Birds

There are 206 species of possible occurrence, 61 of which were confirmed during the site visit.

Several Threatened and Near Threatened species are of likely or confirmed occurrence on site: Blue Crane *Anthropoides paradiseus* (Vulnerable), Black-winged Lapwing *Vanellus melanopterus* (Near Threatened), African Black Oystercatcher *Haematopus moquini* (Near Threatened), African Marsh Harrier *Circus ranivorus* (Vulnerable), Black Harrier *Circus maurus* (Near Threatened), Secretarybird *Sagittarius serpentarius (*Near Threatened), White-bellied Korhaan *Eupodotis senegalensis* (Vulnerable), Denham's Bustard *Neotis denhami* (Vulnerable), Knysna Woodpecker *Campethera notata* (Near Threatened) and Knysna Warbler *Bradypterus sylvaticus* (Vulnerable). Threatened seabirds are likely to roost and/or forage at the coast, viz., Roseate Tern *Sterna dougalli* (Endangered) and Damara Tern *Sterna balaenarum* (Endangered).

Threatened birds likely to occur on the inland portion of the Thyspunt site, and be particularly affected by transmission lines there, are Blue Crane, Denham's Bustard, White-bellied Korhaan and Secretarybird.

There is a coastal locality which appears to be important as a roost site for terns of a variety of species. This is at the head of the sheltered bay just to the west of Thyspunt itself (**Figure 8-47**). It is also along the shoreline of this bay that the greatest concentration of coastal seeps occurs. The proximity of marine and freshwater ecosystems in this area (see above) is believed to be the result, in part, of the sheltered nature of the bay which protects the coastal seeps from saltwater invasion by wave action. The sheltered nature of the bay also creates a suitable roost site for seabirds. This bay should be viewed as a sensitive locality requiring the highest level of protection.

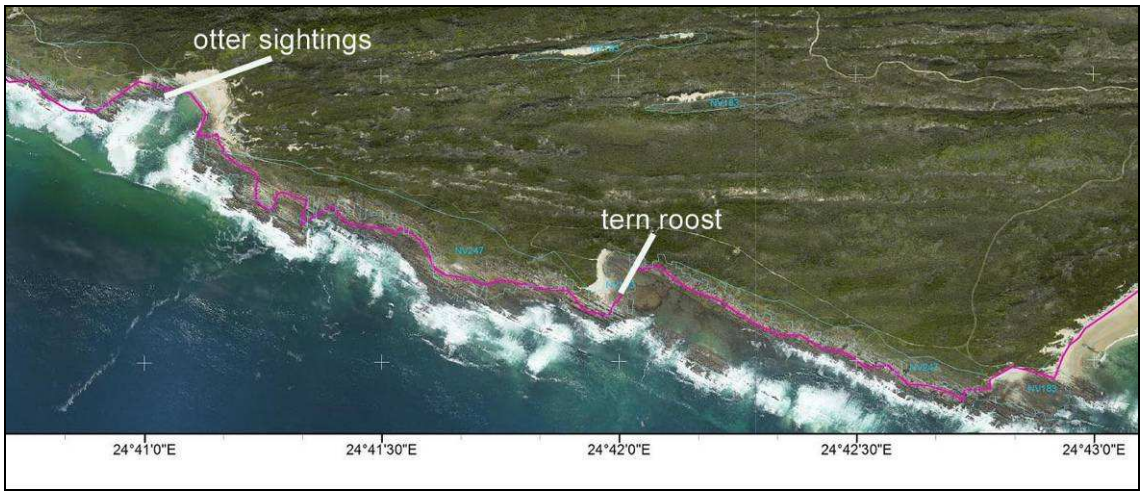


Figure 8-47: Location of tern roost and otter sightings

f) Sensitive areas

The mapping of faunal sensitivity (**Figure 8-48**) was based primarily on (a) scarce habitats important to the maintenance of faunal diversity, (b) areas important for ecological corridors, and (c) areas occupied by particularly sensitive species. In the case of Thyspunt, the areas identified as having high faunal sensitivity were:

- All wetlands, with a 100 m buffer. Wetlands have a central role in maintaining faunal diversity and faunal populations. Buffers are essential to provide semi-aquatic species with terrestrial habitat and corridors of access for terrestrial species. The Langefontein wetland is home to the Elandsberg Dwarf Chameleon (Endangered). The coastal seeps represent a rare and unusual ecosystem.
- The coastal corridor (200 m above the projected 2075 100-year high-water line; Prestedge et al. 2009). A coastal corridor provides access to coastal resources and allows movement along the coast.
- Most of the central mobile-dune field. The ecology of the dune field is highly dynamic and easily disrupted by alteration of patterns of sand movement, therefore obstructions need to be avoided. Areas containing wetlands have been indicated as having high sensitivity, otherwise medium.
- All areas containing forest (defined mostly as “thicket” by Low 2008). Many species are obligate residents of thicket and forest, and many more regularly use the resources found in these habitats, therefore they are essential in the maintenance of faunal diversity on site. The resolution of types of thicket (*viz*., strandveld thicket, dune forest, alien thickets) was not possible (Barrie Low pers. comm.), so parts of the thicket areas would, in fact, be of medium sensitivity.
- The inland area covered by Tsitsikamma Sandstone Fynbos. This is classified as a Vulnerable vegetation type (Mucina and Rutherford 2006) and, together with its rocky substrate, was found to be a rich habitat for reptiles and a probable breeding habitat for Denham’s Bustard (Vulnerable) and Blue Crane (Vulnerable) and foraging habitat for Secretarybird (Near Threatened).
- All other natural areas are of medium sensitivity.
- Areas transformed by agriculture (on the inland portion) are of low sensitivity.

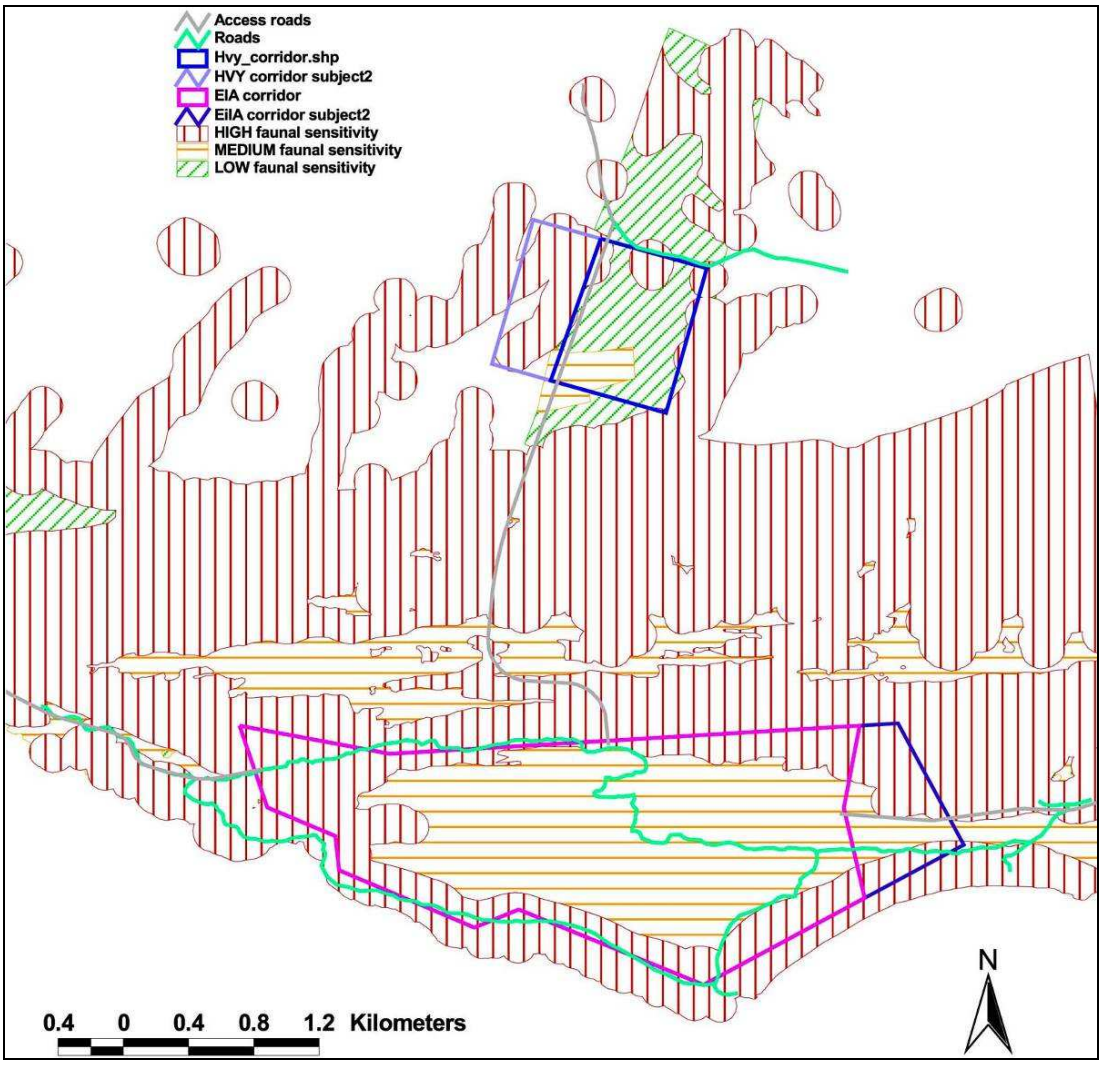


Figure 8-48: Faunal sensitivity map for Thyspunt

8.6.5 Invertebrate fauna

a) Ant species

The twenty ant samples from Thyspunt were collected within the areas indicated A-E in Figure 11. Twenty-one species were collected in total (see Appendix 6) with an estimated diversity of approximately 26 species (Michaelis-Menten estimate) - see Appendix 5. No Argentine Ant (*Linepithema humile*) specimens were found and it is considered unlikely that this species is present on the site.

Two undescribed ant species, one extremely rarely encountered ant species and one probably undescribed species were identified at Thyspunt. These are:

- *Tetramorium* sp. (an undescribed species related to *T. emeryi* and *T. erectum*), found on Unvegetated Dunes
- *Monomorium* sp. (an undescribed species related to *M. disertum*);
- *Diplomorium longipenne* (a monotypic genus that appears to be endemic to the Western / Eastern Cape border region of South Africa. It has to date only been recorded from George, Willowmore and Port Elizabeth).

- *Camponotus* sp. (A probably undescribed arboreal species). Specimens of this species, which was first found in natural Tall Thicket / Forest within the potential NPS footprint area and in similar habitat well to the west of the footprint area, were taken to the South African Museum in Cape Town in January 2010. No matching specimens could be found in this collection, although the species appears closely related to two un-named species from Tanzania. It is very likely that the Thyspunt specimens represent an undescribed species, but this remains to be confirmed.

b) Butterflies

The summed probable total butterfly species count for Thyspunt is high at 42.6 but the Red List species probability of 0.01 is very low. It must be borne in mind that these figures can be compared directly only to the other sites surveyed during this study. A total of 22 species were surveyed, of which none are locally endemic, three are regionally endemic and 3 are endemic to South Africa. **Thyspunt has the highest overall butterfly diversity of the three sites, and also potentially the largest number of rare and/or endemic species.**

c) Other invertebrates

A summary of the other invertebrates on the site, besides ants and butterflies, is listed below:

- **Velvet worms** (Onchyophora): one specimen of velvet worm was found at the edge of a field on the inland (agriculturally transformed) portion of the Thyspunt site. This was a particularly interesting find as, while Onchyophora were predicted for the Bantamsklip site, they were not predicted for either Duynefontein or Thyspunt.
- **Spiders (**(Arachnida: Araneae: Mygalomorphae): none found.
- **Scorpions** (Arachnida: Scorpiones): none found.
- **Soldier flies** (Mydaidae): none found.
- **Heelwalkers** (Mantophasmatodea): none found.
- **Monkey beetles** (Hopliini): none found.
- **Millipedes** (Myriapoda): 3 species found.
- **Jewel beetles** (Buprestidae): none found.
- **Spoonwing lacewings** (Nemopteridae): none found.
- **Horseflies** (Tabanidae): none found.

8.6.6 Marine biology

Thyspunt falls within the warm-temperate Agulhas bioregion. Although the general area is one of high marine species richness and high rates of endemicity, site surveys detected no rocky or sandy shore species endemic to the south coast. No rare or endangered species are known from the site, and no sites of special biological significance occur within the designated area, although fish traps of historical interest occur in the area.

Due to the restricted access at this site these shores have been protected from all forms of utilisation. A lucrative fishery for chokka squid *Loligo vulgaris* is located in inshore waters along this region of coast.

Figure 8-49: Sandy and rocky shores at Thyspunt

Since the mid 1980s a coastal jigging fishery for chokka squid *Loligo vulgaris* has developed along the south coast, although this species occurs from southern Namibia to approximately East London. The most important spawning grounds occur between Plettenberg Bay and Algoa Bay and it is here that squid are targeted by the fishery. Egg capsules are deposited mainly on low-profile reefs or fine sandy bottoms of large, relatively sheltered bays, such as that to the east of Thyspunt.

Shore and skiboat based recreational angling occurs extensively along the Eastern Cape coast, including in the general Cape St. Francis area. Although both demersal and pelagic fisheries operate in the area offshore from Thyspunt, these fisheries occur outside the area that will be impacted by the development of a power station and so are not considered further within this report.

While marine mammals such as Indo-Pacific bottlenosed dolphin (*Tursiops aduncus*), Long-beaked common dolphin (*D. capensis*) and far less frequently Humpback (*Megaptera novaeangliae*) and Southern right whales (*B. glacialis*) are observed in the general vicinity of Thyspunt, these species are transient within the area. Unlike at Bantamsklip, the appearance of Southern right whales in this area is random and not linked to the birth of calves. No seal colonies occur near Thyspunt.

Although plankton productivity is not considered to be high in this area, when compared with the west coast, nearshore waters are subjected to moderate sporadic coastal upwelling and resulting plankton blooms during summer. The highly dynamic nature of the open water environment translates into low sensitivity to disturbance.

8.7 Socio-economic environment - Duynefontein

8.7.1 Economic environment

Overview of the economy

The Duynefontein site is located in District B within the City of Cape Town. The city generates approximately 82% of the GGP of the Western Cape. Provincially, the Western Cape recorded a growth rate of 5.9 % in 2006. This was above the country's growth rate of 5.4 % for the year. The provincial GDP of R174,303 million was the third largest in the country. The Western Cape has an estimated population of between 5.18 - 5.30 million. The province's main economic activities are finance and business services, manufacturing, and wholesale and retail trade. Tourism is a very important sector, but is split between several of Statistics South Africa's broad industrial classifications.

Cape Town has a relatively diverse economy with approximately 93 % of businesses being SMMEs, contributing 50% of total output and 40 % of total formal employment. However, there is a shift towards the services sector with the largest areas of growth being identified in finance, business services, trade, catering, accommodation, tourism and transport and communications. Manufacturing, which accounts for 19.4 % of employment, is in decline. Unemployment has remained high at 20.7 % (2005), but it appears that the trend has been for unemployment to decrease since 2003. The total population of the City of Cape Town for 2007 is estimated at 3.2 million, of which District B accounts for approximately 5.3% (170 000). Unemployment in District B was around 15.6 % in 2005 – significantly lower than the City's unemployment rate.

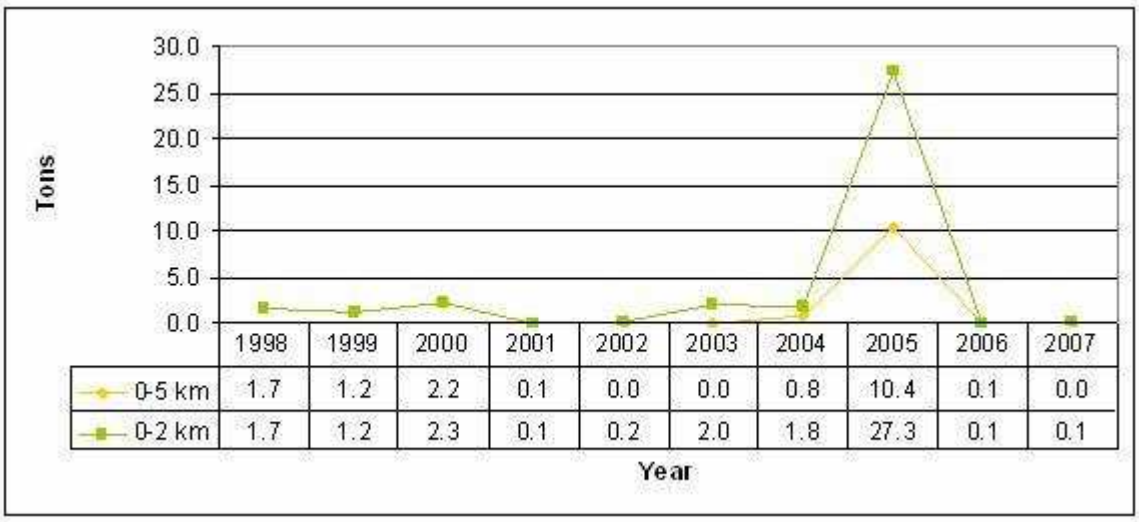
District B is one of the largest in the city and has some of the fastest growing areas, including Big Bay, Melkbosstrand, West Beach, Century City, Sunningdale and Parklands. There is a mix of urban, rural and farming areas. Most of the district is regarded as affluent, especially along the Atlantic coast. However, it also includes pockets of lower-income areas such as Atlantis and informal settlements with poor access to amenities and other services (especially economic opportunities). Century City is a key residential and commercial node in the city and will become increasingly so as the area is further developed. The majority of the land available for expansion of the City lies in the north. Thus, over the next 10 - 20 years this area is likely to become of increased importance in the Cape Town economy.

The most significant economic activity areas in the district are Table View, Killarney and Montague Gardens. Killarney and Montague Gardens are two of the City's most important industrial areas. Apart from industrial activity, the other noteworthy sectors include agriculture, tourism and retail trade. The commercial sector is growing in importance in District B.

a) Fishing

The Eskom NPS site at Koeberg and Duynefontein is not in a major commercial fishing area. Sardine trawlers operate just outside the present 2 km x 3.2 km exclusion zone laid down in the National Key Points Act (and sometimes in fact enter the zone) while skiboat fishermen catch snoek and rock lobster. According to senior staff interviewed at Marine and Coastal Management, the NPS has had no discernible effect on localised stock because of the absence of a reef, as it is located on a sandy stretch of coastline. Moreover, the impact on water temperature dissipates very quickly from the NPS outlet point, but in the small localised area both the growth speed and the size of rock lobster and abalone tend to increase.

Data for commercial fishing in the area between Blaauwberg Beach and Bok Point are shown in **Figure 8-50.** The NPS site is located about midway between these points.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0-5 km	1.7	1.2	2.2	0.1	0.0	0.0	0.8	10.4	0.1	0.0
0-2 km	1.7	1.2	2.3	0.1	0.2	2.0	1.8	27.3	0.1	0.1

Figure 8-50: Commercial Fishing, Blaauwberg Beach-Bok Point, 1998-2007 (Tons)

b) Industry

The 20 km radius around Duynefontein largely includes small rather than large industries (such as light industry), but these industries are not clustered with the exception of those at Atlantis. Large industries are located mainly outside this radius in areas such as Epping.

The industrial sector within a 20 km radius of Duynefontein is dominated by the Chevron (Caltex) oil refinery and four cement companies. The Chevron refinery produces 74 000 barrels of refined product per day and employs 390 persons. In addition, there are 800 - 900 contractors at any one time, rising to 2 000 during the six-week biennial turnaround. The cement industry estimates its production in the area at 2 million tons of aggregate and about 120 000 m^3 of cement per annum. The turnover is estimated at between R300 - 350 million per annum, and total permanent employment at 150.

One of the largest industries at Atlantis is Bokomo Foods, which operates two factories. These preceded the construction of the Koeberg NPS. Bokomo employs 800 persons and has plans for expansion at Atlantis. With the closure of a number of industries since the withdrawal of incentives, serviced land at Atlantis is available at a reasonable price, and the Chamber of Commerce is attempting to promote the location. Although Atlantis was an artificial growth point and has not been an ideal location for industry, its appeal is likely to increase as the Cape Town metro region expands northwards.

The business sector is interested in securing a stable supply of power, and is not concerned about a second NPS at Duynefontein provided that safety measures are in place. Industries at Atlantis, including the food industry, adjoin the Duynefontein site but do not view a NPS there negatively. During field interviews, the business sector indicated that it believes that the technology will be more advanced than at Koeberg and that, therefore, the risk will be able to be managed. It further believes that it makes economic sense to provide new reticulation infrastructure parallel to that already existing at Koeberg. As the NPS would be located in a zone that is already in effect an industrial area, the sense of place would not be a significant factor.

c) Tourism

Tourism around the Duynefontein site is largely represented by the Greater Northern Cape Town tourism region. This includes Atlantis, Bellville, Blaauwbergstrand, Century City, Durbanville, Edgemead, Goodwood, Langa, Melkbosstrand, Milnerton, Parow, Pinelands, Sunset Beach and Table View.

This area is characterised by a wide diversity of enterprises in the tourism industry, and it is difficult to differentiate between the tourist assets of the area itself and those of the Greater Cape Town and West Coast destinations. However, within the immediate site proximity, activities are focused on sea and eco-tourism activities such as kite-surfing, windsailing, golf, hiking and mountain biking. The area has a well-developed tourism infrastructure with a strong supply of services, facilities and amenities, including up-market golf estates. A number of large hotel developments are currently underway, and there are plans for a further golf estate near Melkbosstrand. According to the Tourism Impact report (**Appendix E 22**), the annual turnover of accommodation establishments in the area is R497.8 million per annum.

Estate agents believe that the direction of city expansion will be to the north. Urban growth in the form of holiday resorts and retirement complexes has already leapfrogged from Melkbosstrand to the Koeberg NPS reserve and Atlantis to Grotto Bay, Uyzerfontein and Jakkalsfontein. The opening of the Koeberg NPS in 1984 has not stopped the growth of Blaauwbergstrand (which has been particularly rapid in the last 15-20 years) and Melkbosstrand where growth is of a more recent vintage. Beachfront houses at Blaauwbergstrand are popular buys for foreigners who have paid up to R16.5 million for a property. At Big Bay house prices have been in the R4-6 million range. The Atlantic Beach Golf Estate is a prime facility in Melkbosstrand with units selling for up to R3.5 million. Inland, the Durbanville area is highly sought after with property prices ranging from R2.0 - 4.5 million.

d) Agriculture

There are a number of different agricultural activities in a 20 km radius of the Duynefontein site. In recent years there has been a shift from dairying and wheat farming to vineyards, and there are some up-market wine estates in the Durbanville and Vissershok areas. Based on responses collected during fieldwork, there has never been any concern that that the Koeberg NPS would adversely affect these estates. A game farm has been established north of Silverstream Road, and a number of equestrian stables have moved from Milnerton to Grotto Bay. Pig farming is conducted in the Philadelphia area.

e) Civil structures

Table 8-4 contains information on the various civil structures that are located in the 20 km radius around the Duynefontein site. This information was collected from the City of Cape Town's Planning Districts Socio-economic Analysis. Data were also collected from the Cape Town map book produced by Map Studio. Unfortunately, data on civil installations are very scarce for the City of Cape Town. Thus, it is possible that this does not fully account for all the civil structures.

Table 8-4: Civil Structures in a 20 km radius around Duynefontein

Structure	District B: West Coast
Hotel	7
Clinic	6
Hospital	5
Shopping mall	29
Post office	6

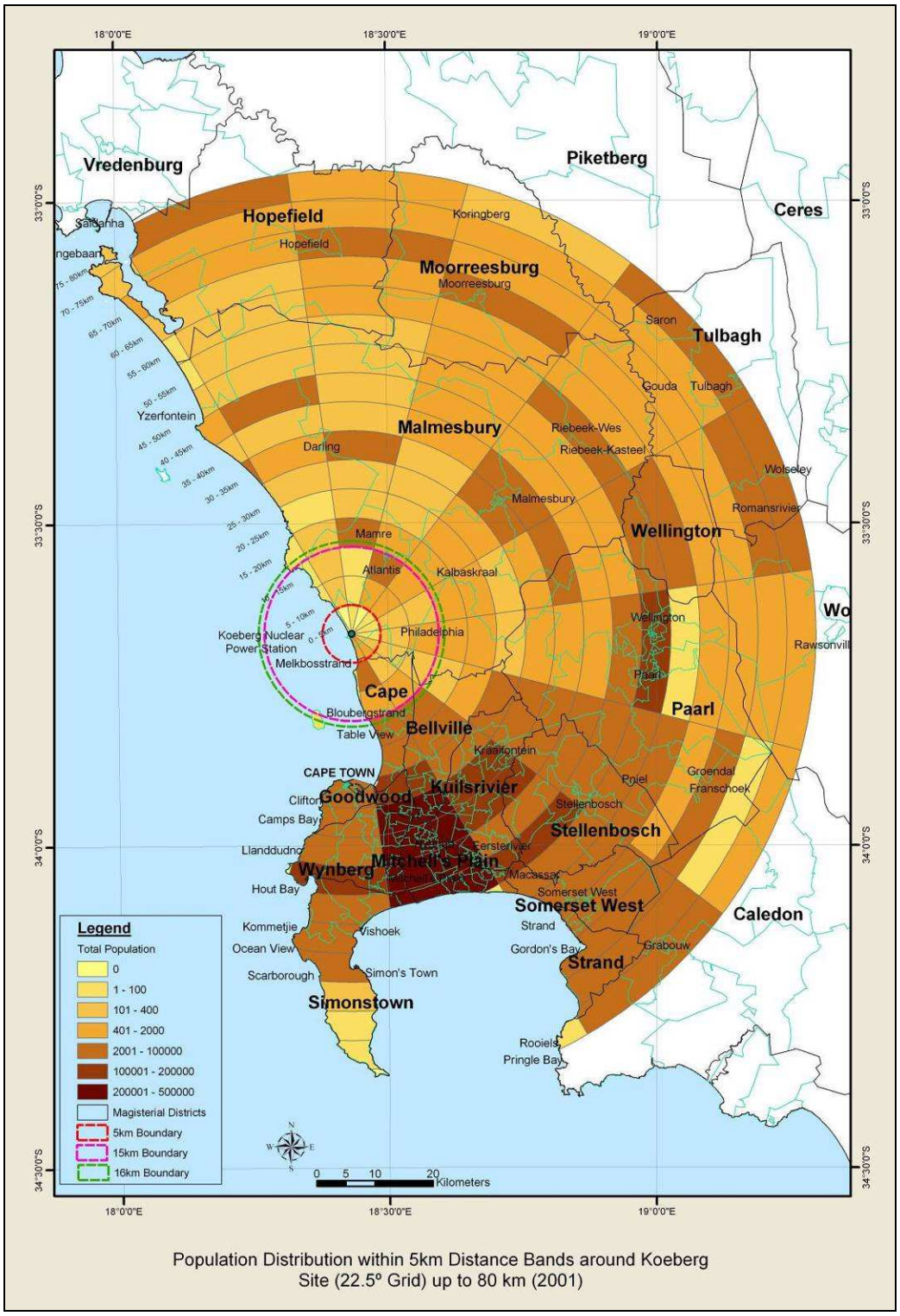
Structure	District B: West Coast
Law court	1
School	31
Service station	21
Religious site	9
Library	6
Caravan park	2
Police station	2
Fire station	3
Traffic department	1
Railway station	2
Water treatment works	3
Country club	2
Airfield	1
Refinery	1
Cement factory	1
Guest cottage/conference centre	1
Bus terminal	1
Wine estate	5

Source: Planning Districts Socio-economic Analysis 2007

8.7.2 Demographic statistics

It is estimated that about 3,5 million people resided in the 110 wards of the City of Cape Town in 2006. This tally represents an increase of 935 000 over the 1995 headcount and over 1,9 million more than in 1985. Figures provided by the Centre for Actual Research (Population Projections for the Western Cape 2001 – 2025, 2005) indicated the total population for Cape Town as 2 994 779 for 2001, 3 239 768 for 2006 and 3 368 892 for 2010.

In terms of the geographical distribution of the population, Cape Town has historically dominated the Province, and is set to continue this trend. In 1985, the city accounted for just less than two-thirds of the Provincial population. This decreased to 65,0% in 1990 and is expected to remain around that level up to 2015.



Population Distribution within 5km Distance Bands around Koeberg Site (22.5° Grid) up to 80 km (2001)

Figure 8-51: Population Distribution within 5km radii of Duynefontein

8.7.3 Visual character

The Duynefontein site is adjacent on the north side of the existing Koeberg Nuclear Plant.

a) Topography

The landform rises very gently (1:75 slope) from the coast inland to the N7 over a distance of approximately 15 km. A slightly higher (50 m amsl) landform, possibly a consolidated dune, forms a crescent around the Duynefontein NPS as its centre. This large shallow bowl is evident in the viewshed analysis. **Refer to Figure 8-52.**

The coastal area between the sea and the R27 is a dune fields with hummock dunes on the landward side of the beach.

b) Vegetation

The vegetation cover of the general area between the coast and the R27 consists of Strandveld and Duneveld.

Between the R27 and the N7 the vegetation is variable due to agricultural practices. Wetlands occur in the lower areas associated with the Sout River, which flows in a south-westerly direction.

Of particular importance is the historic avenue of bluegum trees which line the Ou Kaapse Weg, the R304.

c) Sense of place

The sense of place is drawn from the remoteness of the location and the flat dune field. The cold sea water and onshore winds add to the desolation experienced. This is tempered or downgraded by the visual prominence of the Koeberg NPS 2 km to the south.

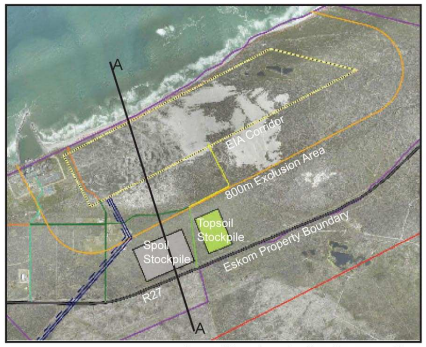
d) The character of the site and surroundings

The landscape character is one of natural bleakness and desolation caused by the wind factor, the shifting sands of the low dune field and the extensive views up and down the coast and inland. The visual dominance of the existing Koeberg NPS 2 km to the south links this edge to an industrial type character.

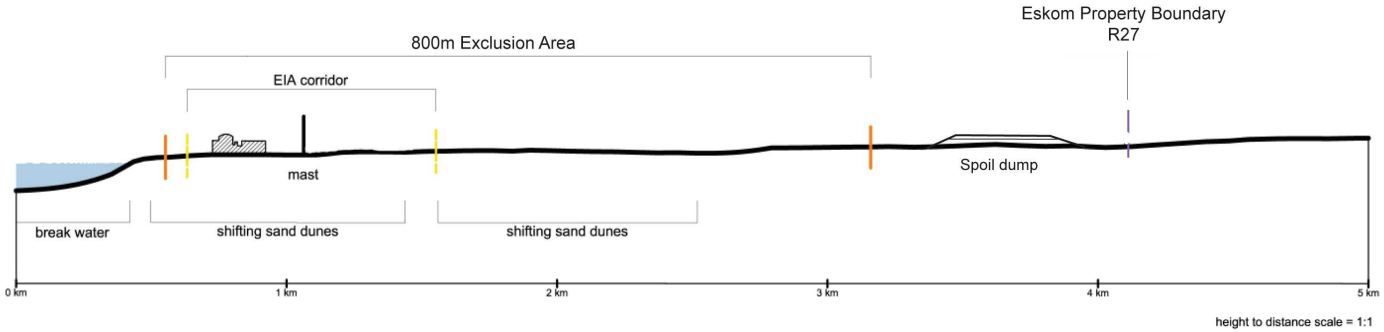
e) Surrounding land use

The current land use between the coastline and the R27 for a distance of 5 km each side of the site is undeveloped and is mostly in its natural state. However, large areas of the vegetation seaward of the R27 have been invaded by the Port Jackson Wattle. The site is located within the area of the Koeberg Nature Reserve. This area is a popular safe area for walking and is well used by the surrounding communities.

The towns of Atlantis and Melkbosstrand are industrial and holiday focused respectively. The Atlantis industrial zone is between 5 and 10 km from the site and lies west of the residential areas.



Locality plan indicating section



ESKOM NUCLEAR POWER PLANT	FIGURE 3.2.3: DUYNEFONTEIN DIAGRAMMATIC SITE SECTION	BAPELA CAVE KLAPWIJK LANDSCAPE ARCHITECTS AND ENVIRONMENTAL PLANNERS

Figure 8-52: Duynefontein diagrammatic site section

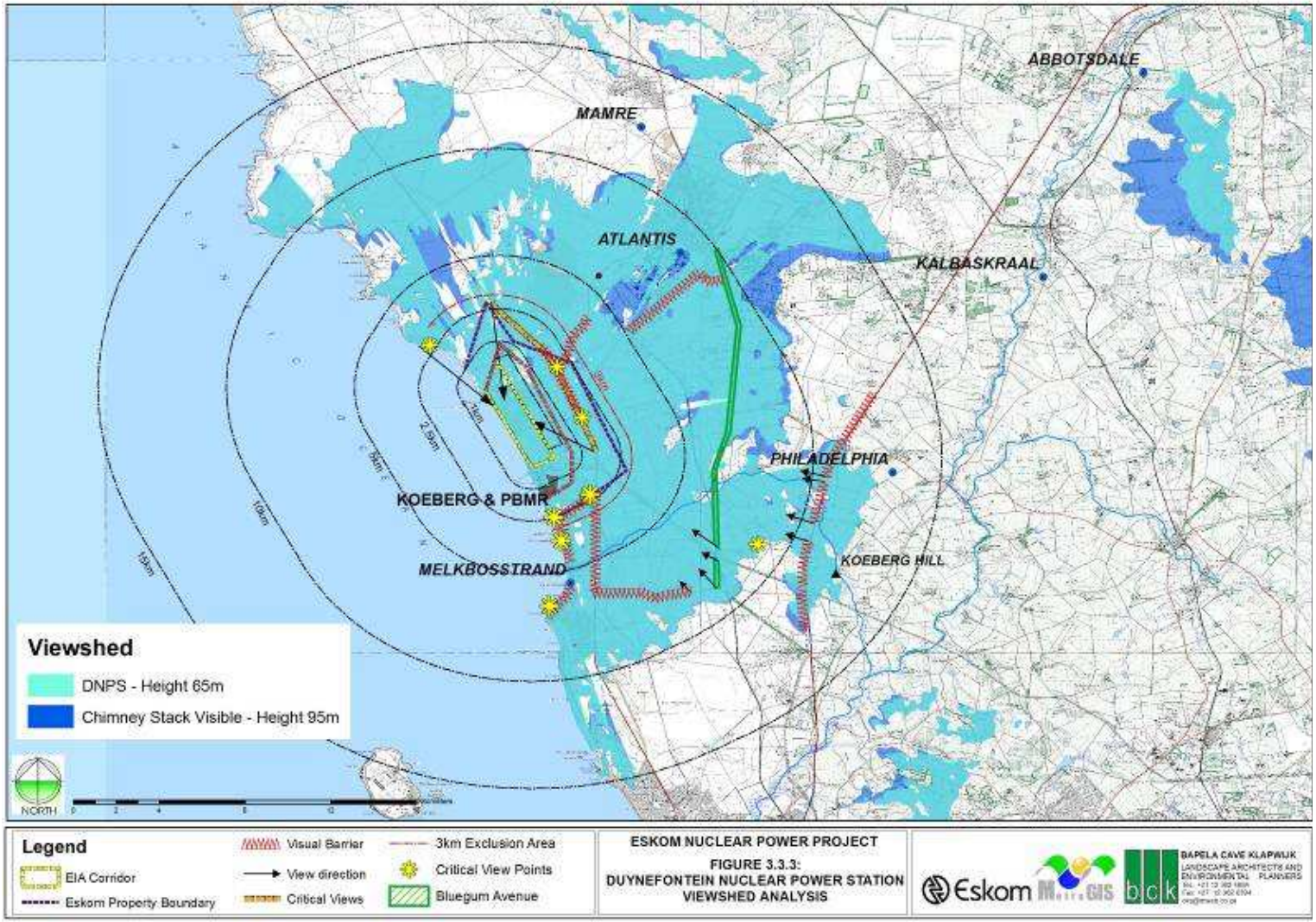


Figure 8-53: Duynefontein Nuclear Power Station viewshed analysis

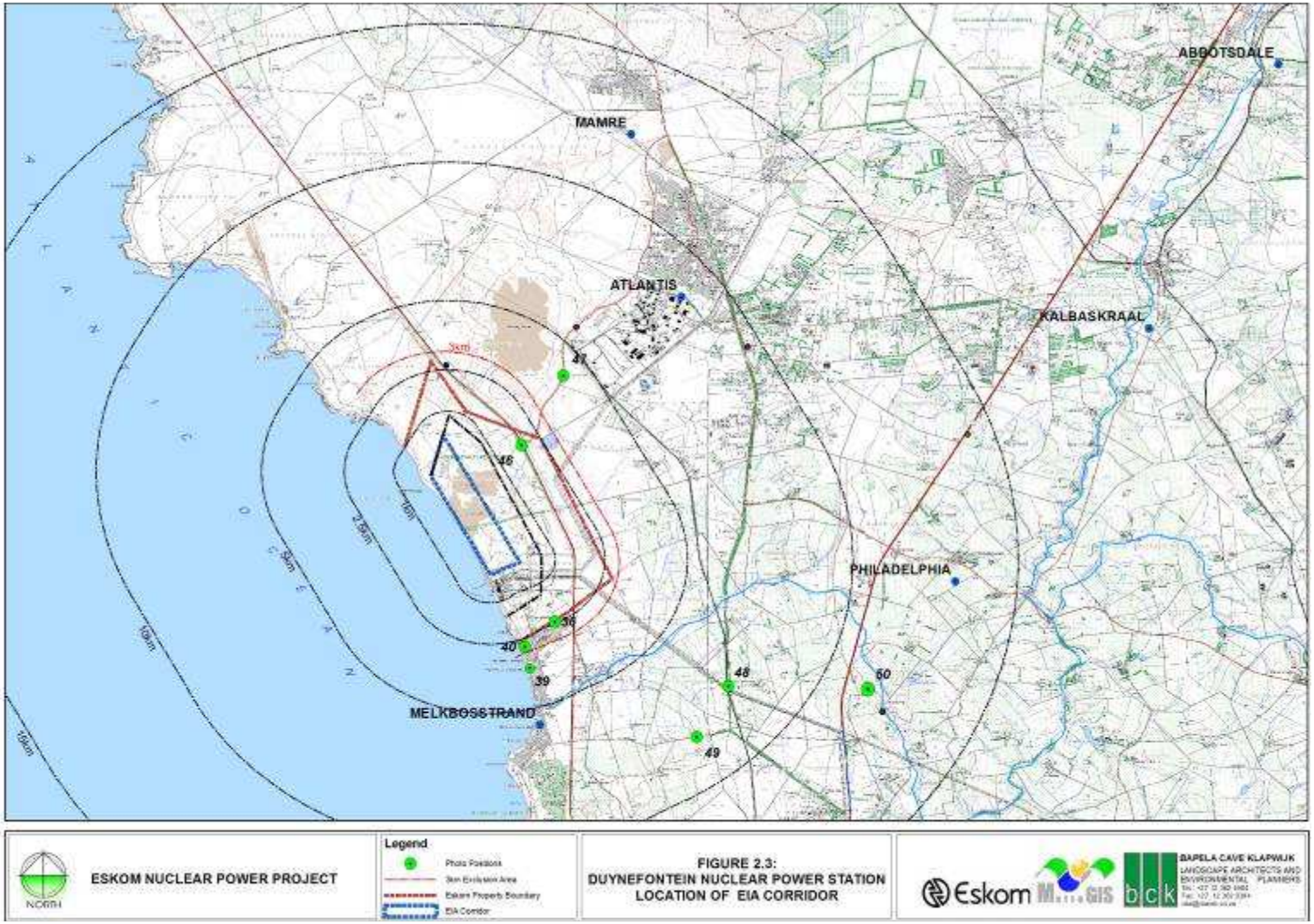


Figure 8-54: Duynefontein Nuclear Power Station: Location of EIA corridor

f) Landscape diversity

The landscape diversity in this setting is determined more by landform than by land use. This is because of the general undeveloped and natural condition of the landscape. The vegetation is sparse and low in the dune field.

The hills to the north-east of the R27 and east of the N7 provide vertical diversity in the landscape, but at a distance of 15 km from the site. This is in contrast to the generally flat coastal terrace over which the R304 has been routed.

There is little landform variation to provide visual diversity within a 5 km radius.

The views along the coastline are of open sandy beaches with no vertical elements, natural or man-made. There is some vertical diversity inland to the hills.

g) Climatic effects on visibility

The wet and misty weather in winter is brought onshore by the predominant east – north - easterly winds, which have an average wind speed of approximately 45 km per hour during the months of May to September.

The generally clear summer weather is driven by the predominant southerly winds, which also have an average wind speed of 11.16 km per hour.

8.7.4 Heritage resources and archaeology

The proposed Duynefontein site is situated just outside the Cape Town urban edge and includes large tracts of coastal Fynbos and an active dune field. Other than the coastal dunes, the topography is relatively flat. The existing power station (**Figure 8-55**) and infrastructure represent an industrial enclave in what is essentially a rural context. The two Koeberg reactor units and turbine hall which have now been in place for more than two decades is a well known landmark visible from Robben Island, Table Bay, and Table Mountain.

When bulk excavations were undertaken on site in the 1970s fossiliferous deposits were encountered in several of the geological strata that were affected. Furthermore, Pleistocene fossils and Early Stone Age artefacts were encountered. Archaeologists from the Iziko Musems of Cape Town then conducted a survey of what is today the Koeberg Private Nature Reserve noting the presence of Late Stone Age middens from the Holocene, as well as Pleistocene fossil bone accumulations at several localities within the nature reserve (Klein and Avery pers. comm. As reported in the Heritage Impact Assessment Report)

a) The regional heritage context

In recent years the West Coast has become famous for its fossil wealth. Just inland of Langebaan is the largest Miocene (5-6 million years old) fossil deposit in the world, parts of which are on display at the West Coast Fossil Park. This material was deposited in sandbar sediments at the mouth of the proto-Berg River (an ancient river and estuary that was the precursor to the Berg River), the course of which changed over the millennia in response to sea level changes.

The excavation for the existing Koeberg power station exposed fossiliferous formations of similar age. Close to Hopefield, further inland, are the Pleistocene fossil beds at Elandsfontein (last million years) famous for the discovery of the early human species *Homo ergaster* (Saldanha man). On the edges of the Langebaan lagoon Dr Dave Roberts and Dr Lee Berger discovered the 200 000 year old footprints of an early modern human fossilized in calcrete sediments. At Hoedjiespunt, Professor John Parkington has excavated on the site of

an ancient hyena lair where skull fragments and teeth of an early human were found showing that parts of the body of this unfortunate person were consumed by hyenas more than 300 000 years ago (Parkington 2006). Nearby, fossilized within the calcretes and aeoleanites are shell fish, animal bone, ashy hearths of people who lived in the area more than 100 000 years ago (Parkington, Poggenoel, Halkett and Hart 2004). Further south at Yzerfontein, Prof Richard Klein, Iziko Museums of Cape Town and the UCT ACO team has been conducting an ongoing project on a Middle Stone Age shell midden, one of the earliest known (Halkett et *al.* 2003).

b) Palaeontological heritage

The bedrock is weathered shale of the Tygerberg Formation (Malmesbury Group) and is ~600 Ma (Mega-annum - million years old), highly deformed and metamorphosed deep-sea turbidites. It has no intrinsic palaeontological potential. However, the softer zones in the bedrock were colonized by boring bivalves when the bedrock was last seabed, producing *Gastrochaenolites* trace fossils (*Glossifungites* ichnofacies). These features exhibited no offsets due to shear forces in the bedrock, which was taken as reassurance that the area had been seismically quiescent since the Pliocene 2-5 Ma ago.

The bedrock is overlain by a fossiliferous marine gravel basal to a sequence dominated by bioturbated, slightly muddy, fine quartz sand, ~10 m thick, that has been dubbed the "Duynefontyn Member" of the Varswater Formation. A thin peaty sand caps the sequence. The "Duynefontyn Member" is richly fossiliferous and includes:

- Teeth, bones and scales of sharks, rays and bony fish;
- Fossil whale bone, dolphin and seal teeth;
- Marine birds, incl. the type specimens of a unique extinct penguin, *Nucleornis insolitus*;
- Terrestrial mammals, incl. bovid, hare;
- Terrestrial reptiles, snake and tortoise; and
- Terrestrial plant pollen in the peaty sands.

The "Duynefontyn Member" is interpreted to be a regressive sequence of barrier beach coast succeeded by subtidal and intertidal facies of coastal tidal flats which are overlain by freshwater, peaty marsh deposits of coastal *vleis*.

The peaty sands are erosively overlain by a basal gravelly sand unit with gastropod casts and shark teeth, the "Gastropod Bed". The latter is overlain by a mixed fine and coarse quartz sand unit, yellow-brown in colour and becoming paler upwards, which is regarded as an aeolianite. This is the Springfontyn Formation. Some terrestrial fossils from this formation are seemingly of middle-Pleistocene age.

The section is capped by calcareous sands and calcrete which should probably be relegated to the Langebaan Formation aeolianite. Middle Stone Age artefacts occur in the calcrete. Closer to the coast the Springfontyn Formation is truncated by the sea-level highstand of the Last Interglacial 128-119 ka (ka: kilo-annum, thousand years ago), when shelly beach sands were deposited.

c) Pre-colonial heritage

In 1973, Richard Klein discovered the palaeontological site known as *Duynefontein 2* – fragments of fossil animal bone which had been un-earthed during geotechnical trial excavations for South Africa's first nuclear power station (see Figure 8-55). The site *Duynefontein 2* was excavated annually between 1998 and 2003. It produced a wealth of Pleistocene fauna (about 300 000 years old) and resulted in numerous publications of the

findings in international journals, establishing the name "Duynefontein"[3] as a place of world class scientific discovery. Klein closed the excavations once he had obtained a substantial sample of animal bone representing the diversity of species believed to be in the area during the mid-late Pleistocene. Scientists hope that this area will one day yield very rare human remains – the age and geological context are considered promising. Despite the ongoing work by Klein and others, it is not clear exactly how extensive the Duynefontein palaeontological resource is. The fact that the fossil material has been excavated at only a single locality at Duynefontein is likely to be a function of the fortuitous geotechnical excavation where the material was initially identified. It remains unknown how much more lies buried under the dune of the Witsand formation, although according to Avery (pers. comm.) pockets of fossil bone have been observed from time to time in the dune field when sand movement allows.

The coastal regions of the Western Cape were occupied in pre-colonial times by peoples who exploited marine resources for their livelihood. Human occupation of the coast is archaeologically reflected in the thousands of shell midden sites and rock shelter deposits that mostly date after the last 6 000 years. About 2 000 years ago the economic order changed with appearance of Khoekhoen herder groups in the Western Cape. Herder sites, such as at those at Kasteelberg, show occupation between 1 800 and 1 600 years ago. European explorers had contact with many of the Khoekhoen groups along the coast. These peoples included the CochoqQua, whose territory stretched from Saldanha Bay to Vredenburg, and the ChariGuriQua or GuriQua who occupied the lower Berg River area, St. Helena Bay and points around Piketberg.

Shell middens have been observed locally at Blouberg Beach, Atlantic Beach and within the Koeberg Nature Reserve. The implications of this are that shell midden material could be encountered in the form of surface archaeological sites, or as buried lenses anywhere within the study area. Late Stone Age sites (the heritage of the Khoekhoen and San peoples of Southern Africa) were relatively numerous along the Western Cape coast and can be observed close to any area of rocky shoreline where shell fish and other marine resources could be exploited. These kinds of sites, which are mostly less than 5 000 years old, and characterized by piles of shellfish, stone artefacts and from time to time pottery, have been observed in the Koeberg Nature Reserve (although no comprehensive survey has been completed until now).

Unfortunately, outside of any area that is either isolated or protected, shell middens have suffered from disturbance caused by people, construction activities, property development and off-road vehicles to the extent that a once common (but finite) heritage resource has become alarmingly threatened. While compliance authorities are aware that heritage resources of this type are increasingly endangered, there is as yet no overall regional strategic conservation goal in place that would direct any strategic action within the heritage community. Nevertheless, intact shell middens have become highly valued heritage resources. Heritage authorities (HWC, SAHRA) have responded to this situation by identifying several middens for Provincial Heritage Site nomination.

d) Colonial period heritage

The landscape inland and to the north of Duynefontein is dominated by agricultural land which has its origin in early Dutch East India company grants and quitrents[4] (the Farm Duynefontein 34 being one of them). Some of the original farm boundaries can still be identified within the contemporary cadastral layout. Although along the southern portion of the West Coast many of the early farms have become sub-divided and broken up by

[3] Spelling used referring to the archaeological site published as "Duynefontein 2" as opposed to place name 'Duynfontein".
[4] A quitrent is a grant of land given for 15 years for which an annual rent is paid. Quitrent tenure was introduced to South Africa in 1732.

developments such as Atlantis Industrial Township, Brickfields, Western Province Shooting range and various sand mining operations. A number of notable farm names and associated structures have survived - Groot Olifantskop (Keert de Koe), Vaatjie, Brakkefontein and Donkergat are but a few that have been recently identified as containing early fabric. Within this area, research into the heritage of early colonial settlement is limited with only site identification surveys being completed to date.

The earliest colonial period history pertaining to the Duynefontein study area is reflected in primary archival documentation. Reference is made to a Hermanus Dempers as 'inhabitant and owner of the 'Opstal' on the loan place named 'Duynefontein'.

Dempers became the owner of the then extensive property in 1799, but it is unclear who the first grantee was. It is indicated in a complaint letter lodged by Dempers (dated 26 Sept 1811) that 'tenants' were cutting wood that belonged to him. These tenants were apparently awarded certain land rights in 1731, and paid rent to the Cape Government. The struggle over marginal land is demonstrated in the competing livelihoods at Duynefontein. Dempers was a brickmaker and as such was "always in great want of bushes and other small wood and for that reason never cut away any wood in the vicinity of his house, but always saved it in order to let it grow to greater perfection." The 'illegal' cutting of wood "even about his house" exposed his "cultivated ground to be blown away." He laments that "to his greatest sorrow in what manner some persons make ill use of the privileges which they have obtained" and begs the authorities to protect him against the "attempts of those who are striving to injure him".

When the property was surveyed in 1834 for the quitrent grant, there is no indication of houses or any built structures. There is, however, a 'Kraal Ordannantie' which features on the diagram as well as the later 1890 SW Cape survey map.

The colonial period history of Duynefontein is note worthy; however it does not reveal any particular significance in terms of associations with events, or important historical personalities. The early surveyor's diagrams have been superimposed over modern plans of the farm in an effort to locate the historic kraal. The kraal location appears to be outside of the study area. The site of Demper's house is not known as is that of any of his tenants. It is possible that ephemeral evidence of its presence may lie under the dune sands somewhere on the property.

e) Duynefontein heritage survey - findings

The physical survey of the Duynefontein study area conducted for this project revealed that that the heritage significance of the site is varied. No colonial period heritage sites were found while heritage sites relating to the Late Stone Age are few. The heritage significance of the Duynefontein option relates to its Miocene palaeontological and Pleistocene archaeological and palaeontological deposits.

Miocene Fossil Material

The fossil material that will be exposed in the excavations for Duynefontein NPS), as observed during the latter phases of construction of the KNPS during 1978. It is predicted that the main excavations for the installation will expose the bedrock, at 10-14 m bsl, underneath a vertical section of 24-28 m of sediment. The highly fossiliferous "member" of the Varswater formation which lies just above the Malmsbury shales in the local geological sequence will inevitably be encountered during bulk excavations for the proposed activity. Due to the fact that deep excavations south of the diamond areas of the West Coast are limited to that which was carried out for the first Koeberg installation and the phosphate mine at Langebaanweg, the extent of the Miocene fossil resources are relatively unknown. It can be anticipated that pockets of Miocene fossiliferous material are common from Milnerton to Langebaan.

Pleistocene Fossil Material

Occurrences of Pleistocene fossil bone are to be found in the study area in almost any area where shifting dune sands have exposed the underlying nodular ferricrete horizon (ancient

land surface). In particular there are two notable sites known to archaeologists - Duynefontein 1, a possible Pleistocene Hyena den with a very large exposure of associated fossil fauna, and Duynefontein 2, a known and important Pleistocene palaeontological site with archaeological material. Duynefontein 2 has produced results of international interest having been intensively researched by Richard Klein. Both sites lie directly under the footprint of the proposed NPS corridor. It is predicted that the fossil occurrences are far larger and deeper than that which has already been archaeologically exposed.

One of the greatest difficulties experienced in terms of the assessment of archaeological and palaeontological heritage is the fact that most of the significant material is buried. It is known that at the site of Duynefontein 2 there are at least three buried horizons (ancient land surfaces) each of which represent different ages in the Pleistocene and Holocene prehistory of the region. Klein and his team found the fossilized remains of ancient Pleistocene fauna on a 300 000 year old land surface along with traces of human activity. The animals included many species not seen in the Cape today as well as several extinct species such as the giant buffalo, giant pigs, extinct species of elephant, hippopotamus and the Cape horse. The main fossil horizon lay roughly 1m below the surface of the present day wind-blown sands. Nodular calcretes had developed over the fossil horizon making excavation very difficult at times. Deep soundings by Klein and his team revealed the presence of an even older deeper horizon; however ground waters at a depth of 2 m prevented its detailed excavation. Klein (*pers. comm.*) is of the opinion that archaeological and palaeontological deposits such as those found at Duynefontein 2 have the potential to exist anywhere within the Eskom held property and beyond – the difficulty however is that there are no known methods of establishing where they are without extensive trial excavations. Klein did not terminate the excavation at Duynefontein 2 because the fossils had run out, but because he had achieved what he believed was an adequate sample for his research purposes.

Late Stone Age

Ten possible middens were encountered (some sites without artefactual material may in part be gull drop sites). These are relatively ephemeral single occupation scatters. Interestingly the shell fish species on them consists primarily of white mussel shell (*Donax serra).* This reflects the marine resources that can be obtained from the mainly sandy beach that borders on the property. Artefactual material associated with these sites is limited to informal quartzite flakes and chunks.

Cultural Landscape

The heritage survey of the study area did not reveal any aspects of the cultural landscape and associated person-made structures that are of any particular significance, or protected by the NHRA. The layering of the landscape reflects a multitude of pre-colonial layers, the early colonial farming element is invisible being dominated by the 20th century landscape of industry and nature conservation. Before the existing power station was built, the study area was a rural landscape of sandy and mainly un-farmed land and prior to the construction of the R27, very remote. Although through the efforts of the Koeberg Private Nature Reserve staff, the property has retained its wilderness qualities in places, the NPS is an exceptionally powerful visual intrusion, which together with its support structures, and access road has completely transformed the character of the site into a peculiar combination of an industrial and rural ambience.

(Above) View over the study area towards the existing Koeberg power station

(Left) Fossilised metapodial of a medium bovid found close to Duynefontein 1 archaeological site

(Bottom left) Duynefontein 2 archaeological/palaeontological site in 2008

(Bottom right) Duynefontein 2 archaeological/palaeontological site in 2000.

Figure 8-55: Heritage features at the Duynefontein site

8.7.5 Agricultural practices

There is no agricultural production within the proposed site (EIA corridor). The potential for agricultural production on the proposed site is very limited, mainly as a result of the soil (sand dunes). As the site envelope only consists of sand dunes no soil samples were taken for this site. There is no commercial cultivation within the 800 m emergency zone but some mixed farming is being undertaken on the border of the 3 km zone.

There are broad bands of land use around the proposed site, the first being bare open vegetation close to the coast, the second the farming areas, and then the residential areas in and around Melkbosstrand and Atlantis.

The majority (approximately 80%) of the northern area is dominated by shrubland. There is a large urban area in Atlantis with industrial activity around the residential areas. There is an area that has been prepared for residential development, marked on the map as land degraded in preparation for development.

There are two distinct areas that that are dominated by smallholdings which mainly consist of subsistence farming. A wide range of enterprises produce agricultural goods but this is mainly for home consumption with very little commercial production taking place.

On one farm (Vaaitjie) there is a sand mine and adjacent brick-making business with excavations for brick-making material. Apollo Brickmakers produce an average of 3 500 000 bricks per day.

a) Current agricultural production in the surrounding area

Agricultural production around Koeberg consists of commercial farms (large to medium scale) producing mainly grapes, dairy and wheat. The two most popular farming activities in the surrounding area are wheat and grape farming. However, many small-scale subsistence or semi-commercial farms are found just out of the Atlantis industrial and residential areas.

\\ An important point that should be noted is that a very large portion of the 16k m radius of the Koeberg site is taken up by the presence of an extensive sand dune that is located across the R307 road from the Atlantis industrial park. This has very limited agricultural potential.

Many of the wine farms also grow an alternate crop like wheat or run cattle. The dairy farms mainly sell to Clover Dairies, and the sheep farms mainly to local butcheries in the Cape. There is an egg hatchery which produces 1 700 000 eggs a month, selling to Pioneer Food/Bokomo. Most of the farms have small irrigation dams, frequently emptied throughout the year.

The small-scale farms in and around Atlantis do not contribute on a commercial basis. Such farms grow a small amount of vegetables, and run some chickens and one or two goats mainly for home consumption.

A summary of the information collected from each farm is given in the Appendix 1 of the Agricultural Impact Assessment.

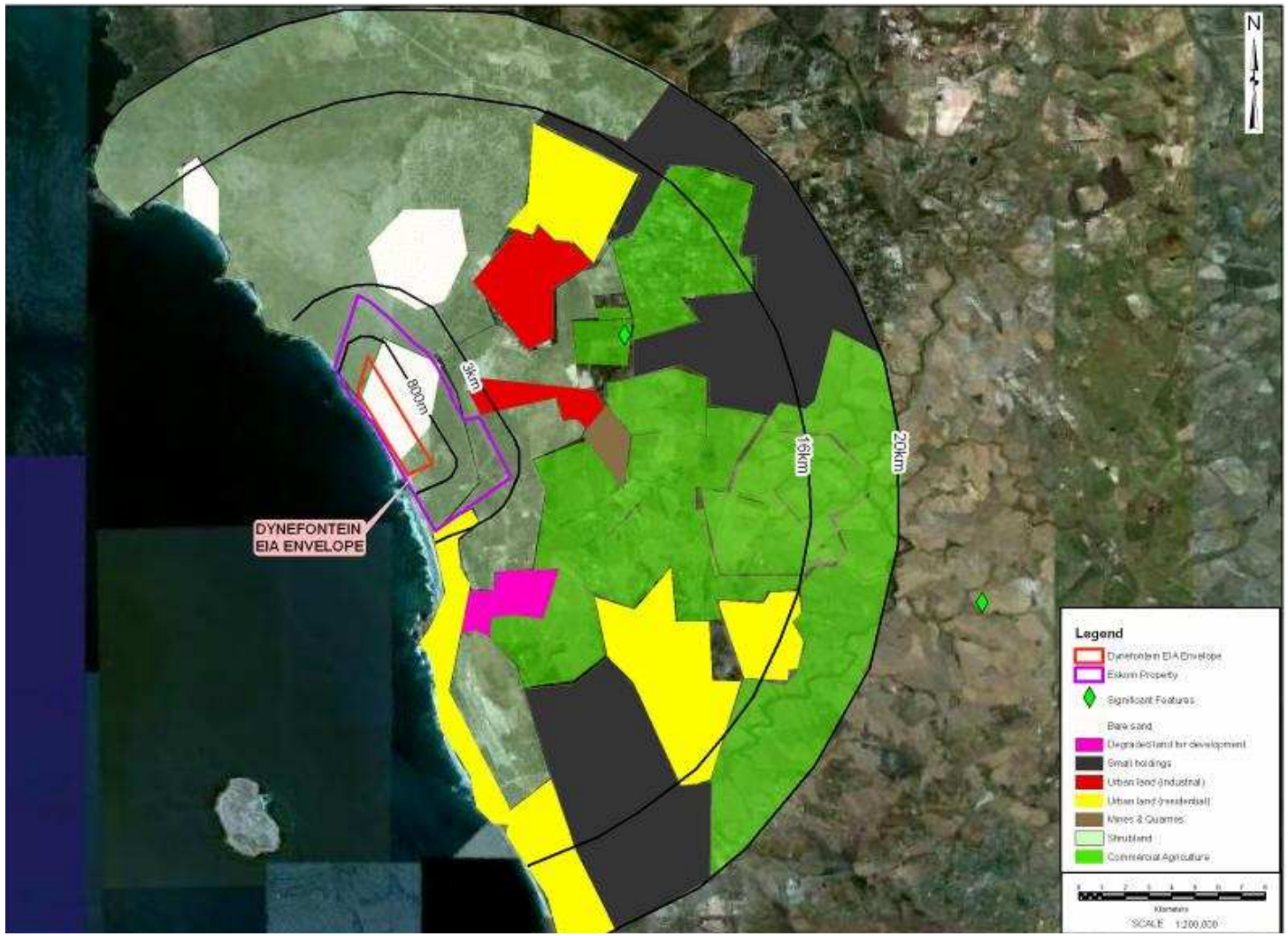


Figure 8-56: Land use map - Duynefontein

The farming practices for the Duynefontein site is summarised in **Table 8-5** below.

Table 8-5: Farming practices (number of farms)

	Duynefontein
Farming practice	
LIVESTOCK	
Dairy	2
Beef	6
Sheep	2
Pigs	1
Poultry	1
Game	0
CROPS	
Vines	4
Wheat	7
Fynbos	0
Vegetables	3
Other agric	3
Total properties	31

From the data in this table it is clear that the Duynefontein area is characterised by mixed farming with 12 of the properties carrying livestock, of which ten are dairy, beef or sheep.

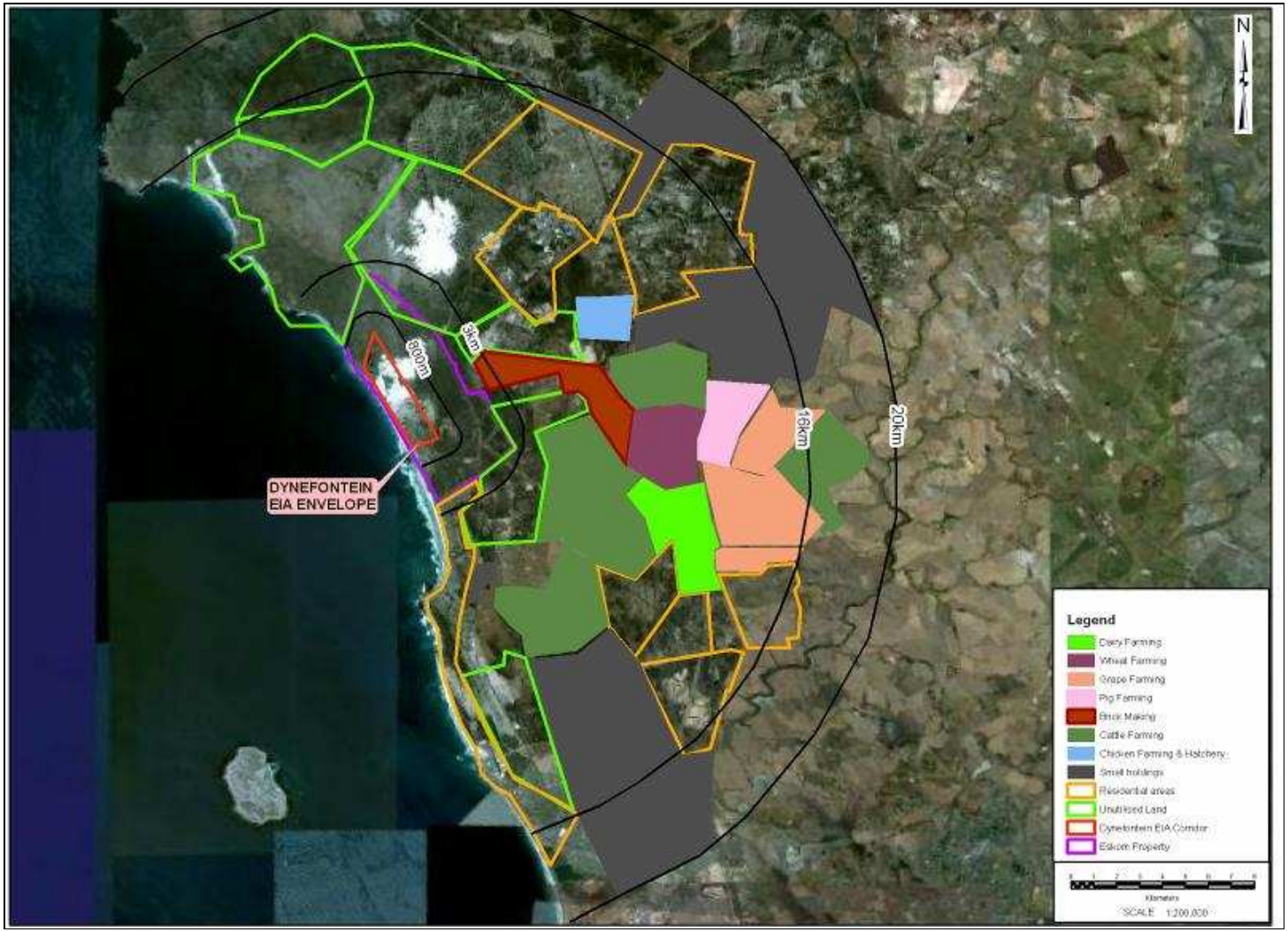


Figure 8-57: Types of farming - Duynefontein

8.7.6 Tourism industry

Duynefontein falls into the City of Cape Town. The Integrated Development Plan for the area clearly states that Cape Town is recognised as the gateway to the Western Cape. The environment is one of Cape Town's strongest assets driving tourism, and development initiatives for the next three years focus on the expansion of infrastructure that will improve access to, and the enhancement of, the local tourism experience. Tourism around the Duynefontein site is largely represented by the Greater Northern Cape Town tourism region. This includes Atlantis, Bellville, Blaauwbergstrand, Century City, Durbanville, Edgemead, Goodwood, Langa, Melkbosstrand, Milnerton, Parow, Pinelands, Sunset Beach and Table View.

This area is characterised by a wide diversity of enterprises in the tourism industry. It is difficult to differentiate between the tourist assets of the study area itself and those of the Greater Cape Town and West Coast destinations. However, within the immediate site proximity, activities are focused on sea and eco-tourism activities such as kite-surfing, windsailing, golf, hiking and mountain biking. The area has a well-developed tourism infrastructure with a strong supply of services, facilities and amenities. The area promotes a seafront residential sense of place emphasising proximity to the coast and to the Greater Cape Town tourist hub.

Three large-scale hotel developments are currently underway in Blaauwbergstrand along with numerous residential developments in all of the listed areas, including plans for a further golf estate near Melkbosstrand. These developments are a response to the accommodation requirements of the area, and it may be assumed that they will follow regional occupancy trends. When completed, these projects, as reported by the Tourism Impact Assessment conducted as part of this EIA, will increase the figures given in **Table 8-6**. Large-scale road and access developments are also currently in progress.

Table 8-6: Quantitative representation of tourism industry in the Duynefontein area

Accommodation beds	2,408
Average rate per night	528
Average annual occupancy (days)	231.05
Sub-sector turnover p.a.	R 293,756,158
House lets	1,463
Average cost per day	R 583
Average annual occupancy (days)	239
Sub-sector turnover p.a.	R 204,071,792
Total turnover p.a.	**R 497,827,950**

Figure 8.58 Duynefontein site location and sphere of impact

8.7.7 Noise

Figure 8-59 displays the proposed plant layout of the Duynefontein site north of the existing Koeberg NPS on an aerial photograph of the area. The closest occupied noise sensitive land is the residential suburb of Duynefontein, with the nearest residences approximately 1 800 m south of the existing NPS and approximately 2 900 m south of the proposed Nuclear 1 infrastructure area. The closest distance of the proposed infrastructure to the R27 would be 2 000 m.

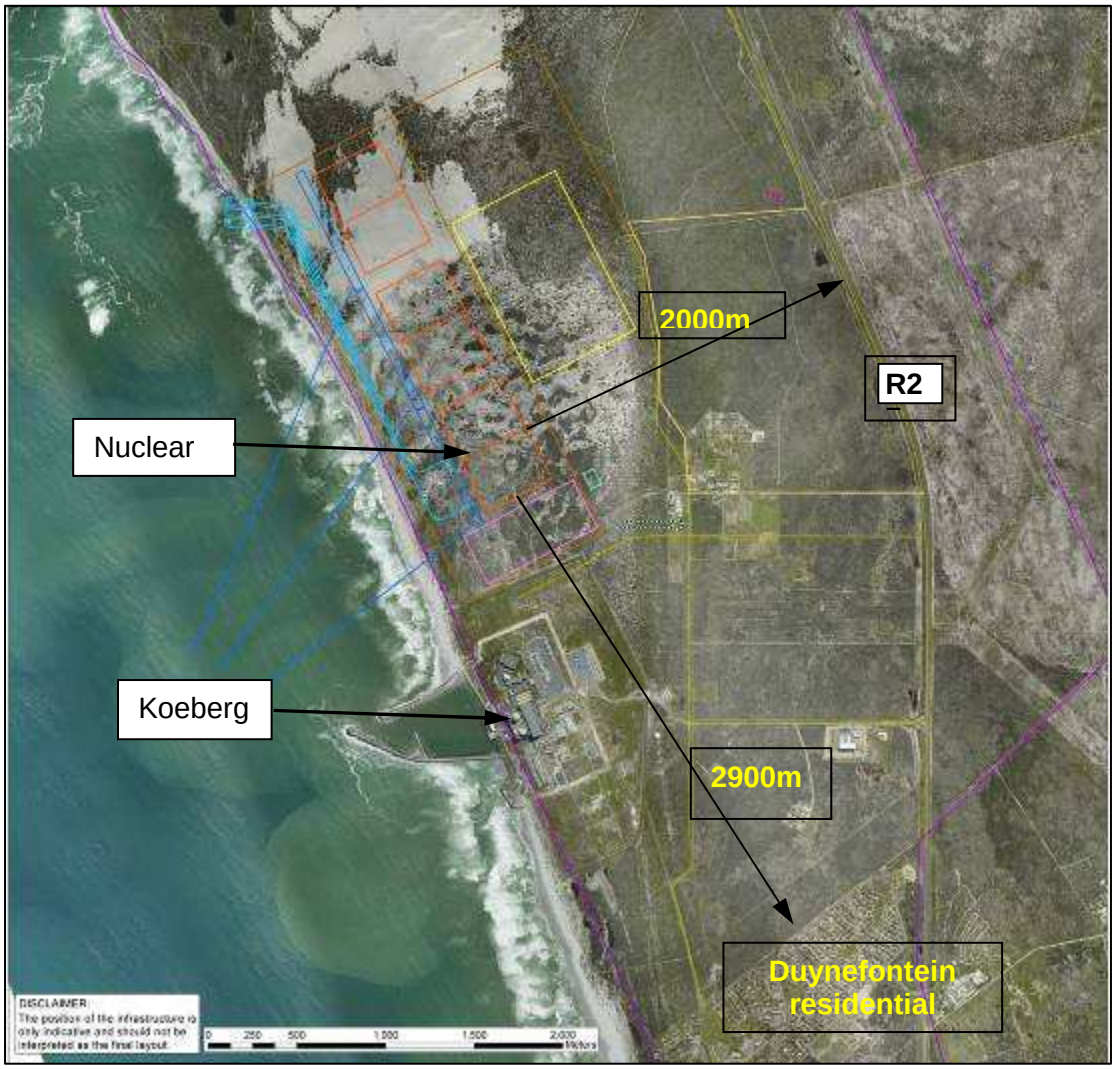


Figure 8-59: Distance to nearest noise-sensitive land uses at Duynefontein

8.7.8 Transportation

At the Duynefontein site the Koeberg NPS has a greater PAZ and UPZ than prescribed by the European Utility Requirements (EUR) for Nuclear-1. The PAZ is a 5 km zone and the UPZ is a 16km zone at Koeberg NPS. Due to the existing Koeberg NPS on the Duynefontein site the proposed Nuclear-1 exclusion and evacuation zones will be concurrent with Koeberg's existing exclusion and evacuation zones. The Duynefontein residential area falls within this 5 km PAZ radius Keoberg NPS. Melkbosstrand and Bloubergstrand, however, fall within the 16 km UPZ.

Currently a 2 km seaward exclusion zone exists around the sea shore bordering the Koeberg NPS as per the Sea-Shore Act, 1935 (Act No. 21 of 1935). No general activity (swimming, operation of sea vessels etc.) is allowed within the 2 km by 3.2 km area of the sea shore adjacent to KNPS.

Many of the Koeberg NPS staff reside in the Duynefontein & Melkbosstrand residential areas located south of the site.

a) Road network

The West Coast Road (R27) and the N7 are primary regional and national distributors as shown in **Figure 8-60**. The R27 runs in a north-south direction and links Cape Town with the west coast areas. It is located approximately 2.5 km east of the site and provides the main access to the Duynefontein site.

The R27 links with the west coast towns of Langebaan, Vredenburg, Saldanha and Velddrif. The N7 also runs in a north-south direction linking the main towns of the Western Cape and Northern Cape.

b) PBMR

It is proposed that the Pebble Bed Modular Reactor Demonstration Power Plant (PBMR) is housed on the Duynefontein site, adjacent to the existing Koeberg NPS's southern boundary. Should the proposed PBMR be built, the construction period will overlap with Nuclear 1 construction.

c) Railway network

There are two railway line branches, as shown in **Figure 8-60**, running in north-south directions from Cape Town.

The line from Cape Town to Namaqualand runs past Kalbaskraal and has two branches to Malmesbury and towards Saldanha. This line is approximately 24 km east of the site. The Atlantis goods line runs approximately 6 km east of the site, from Cape Town's CBD, traversing Table View and ending in Atlantis. It connects with the suburban rail system at Chempet Station.

d) Airports

The existing major and minor airports and landing strips in the vicinity of the site are shown in **Figure 8-60** and are listed as follows:

Major airports and landing strips:

- Cape Town International Airport;
- Ysterplaat and Langebaan (Military airfields); and
- Stellenbosch airfield.

Minor airports and landing strips:

- Diepkloof airfield;
- Rosenburg farm airstrip;
- Saldanha airfield; and
- Kersefontein airfield.

e) Harbours

The existing harbours in the vicinity of the proposed Nuclear-1 are shown in Figure 0-11 and are listed as follows:

- The Port of Cape Town; and
- The Port of Saldanha.

Figure 8-60: Duynefontein transport network

8.8 Socio-economic environment - Bantamsklip

8.8.1 Economic environment

a) Overview of the economy

The Bantamsklip site is located within the Overstrand Local Municipality, which forms part of the Overberg District Municipality in the Western Cape. Provincially, the Western Cape recorded a growth rate of 5.9 % in 2006. This was above the country's growth rate of 5.4 % for the year. The provincial GDP of R174 303 million was the third largest in the country. The Western Cape has an estimated population of between 5.18-5.30 million. The province's main economic activities are finance and business services, manufacturing, and wholesale and retail trade. Tourism is a very important sector, but is split between several of Statistics South Africa's broad industrial classifications.

The Overstrand economy is fairly diversified. The growth rate of the economy is fairly high at 5.9 % in the 2007/08 year. There has been a constant gradual decline in the growth rate from the 2004/05 high of 8.1 %, but the Overstrand Municipality has consistently exceeded the district's growth rate over this period. The population of approximately 73 000 makes Overstrand the second largest of the municipalities within the Overberg District Municipality (30.7% of the District population). The unemployment rate was 21.7 % in 2001, the latest year for which the Municipality was able to provide data. There has been a significant in-migration of low-skilled work-seekers from the Eastern Cape. It is likely that the lower unemployment levels in the Western Cape, and the consequent higher possibility of finding a job, is what has caused the immigration of workers.

According to Statistics South Africa (2007), key sectors contributing to the Overstrand GGP are trade and catering, finance and business services, manufacturing, construction, government services and transport sectors. The trade and catering and transport sectors have been the fastest growing, followed by business services and construction. Government services and manufacturing have shown declining growth rates. The sectors employing the largest number of people are trade and catering, community services, agriculture, government and construction. The largest job losses have been in the agricultural and manufacturing sectors.

There are two dominant features of the local economy that warrant attention. First, the municipality has a fairly diversified economy and a great potential for tourism. The natural assets of the area (in terms of eco-tourism) are its single biggest asset, but the natural resource base may also limit growth if resources are not effectively managed. The Overstrand economy and its ecology are inseparable. Secondly, the highly geographically concentrated poverty of the area is a cause for concern. Economic forces (e.g. the decline in fishing and the seasonality of tourism and agriculture) negatively affect the semi-skilled and unskilled workforce, while the growth sectors have mainly benefited skilled workers. In-migration of poor and unskilled people to the area is associated with rising rates of poverty and inequality. Other than the formal safety nets of grants, the poor depend on informal work (construction) or on the third economy of illegal livelihoods (e.g. abalone poaching). A significant proportion of the population (particularly the African) live below the household subsistence level of R1,600 per month.

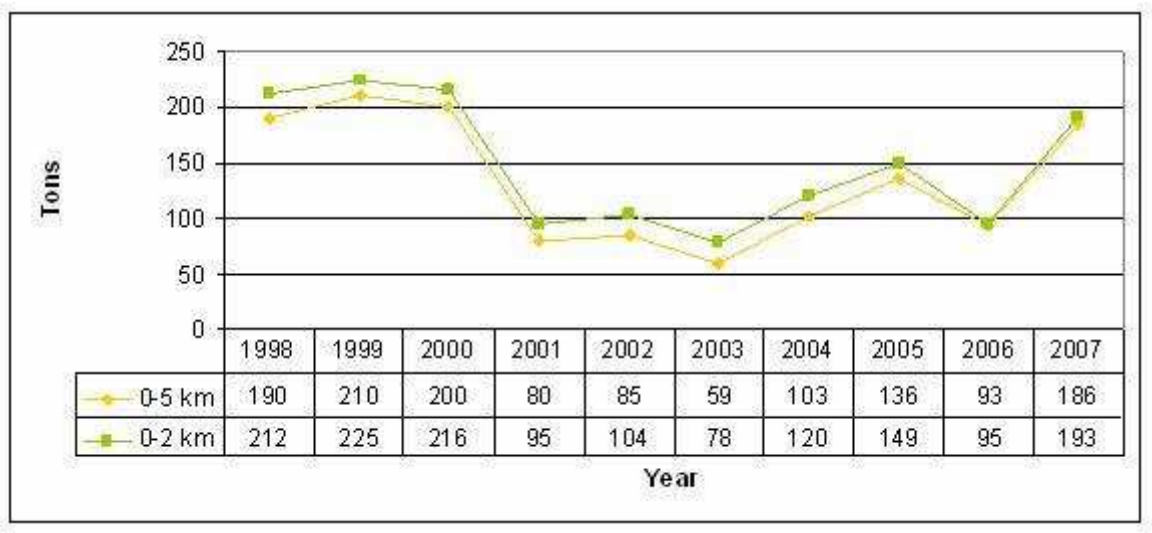
b) Fishing

Gansbaai is an important centre of the pelagic fishing industry. A factory (Gansbaai Marine) was established in 1962 and, until 1994 when tourism started growing and the area started attracting retirees, the local economy consisted of little else except the company. Gansbaai Marine is the only pelagic factory located between Mossel Bay and Hout Bay. The factory

produces canned fish for major brands, as well as fishmeal and fish oil, which are supplied to the agricultural sector. There are 12 local boats that use the harbour. The capital cost of a fully equipped boat is between R10-12 million. There are some smaller firms as well, and the local industry has a turnover averaging about R100 million per annum with 500 jobs and a salary bill of R30 million per annum. The gross markup averages 12 %. The catch fluctuates according to weather conditions, but the output averages about 20,000 tons of canned fish and 38 000 tons of fishmeal per annum.

Data from commercial fishing in the area from Quoin Point to Danger Point (roughly equivalent to the east and west respectively of the Bantamsklip NPS site) are shown in **Figure 8-61**.

The fishing industry is the major employer in Gansbaai, and its salaries and wages are higher than in construction and retail. The industry does not view a NPS as a problem, pointing to the experience in the Koeberg area where fishing has continued. However, it stresses the importance of good maintenance and management.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0-5 km	190	210	200	80	85	59	103	136	93	186
0-2 km	212	225	216	95	104	78	120	149	95	193

Figure 8-61: Commercial fishing, Quoin Point-Danger Point, 1998-2007 (Tons)

c) Agriculture

Traditionally, agriculture has been dominated by cattle farming and indigenous flower harvesting (both wild field harvesting and cultivated fields), but lately the area has developed into the Agulhas wine region. According to field interviews, cattle farming is struggling in the area and it is generally assumed that most land presently used for cattle farming will, in the coming two decades, be used for wine farming, eco-tourism and conservation. In a semi-circle of about 30 km around the proposed NPS site several wine estates have been established, and more are in the pipeline. The area is deemed to be very good for wine with respect to soil types and cool sea breezes, and is seen as a refuge from the traditional wine areas in the Western Cape if temperatures keep rising in those areas. Also raised during the field interviews was the general view that the Agulhas wine region will become of major importance to the wine industry of the Western Cape.

d) Tourism

The Bantamsklip site is surrounded by the Greater Gansbaai tourism region, which stretches from Die Kelders past Pearly Beach to Die Dam. The area is a sea-based attraction centre with a clear focus on eco-tourism. The general tourism product is relatively underdeveloped

with respect to basic services and facilities, and is overwhelmingly dominated by the whale-watching and shark-cage diving industries. The area from Gansbaai to Cape Agulhas has become a major tourism drawcard for the Western Cape in the last few years. Gansbaai is famous for being both the best land-based whale-watching spot and the prime location for cage diving to see the Great White Shark. Most boat operators launch from Kleinbaai on the Danger Point Peninsula and cruise for whales and sharks in the waters off Pearly Beach (including Dyer Island and Geyser Rock).

These marine assets draw the majority of visitors and are largely responsible for driving the local tourism economy and associated industry. Accommodation is provided by the B&B/guesthouses sector and house lets. According to the Tourism Impact report (**Appendix 22**), the total turnover of accommodation establishments amounts to R62.2 million per annum, while the revenue from shark-cage diving and whale-watching tourism amounts to R56.4 million per annum. The Tourism Impact report found that operators of whale-watching tours could be affected by a 1km exclusion zone but not by more than about 10%, and that this could be zero if the restrictions were relaxed for such operators; alternatively, the affected activities would be transferred to the rest of the area covered by the operators.

There is a strong drive for conservation in the region. The coastal area roughly from Hermanus to Cape Agulhas is gradually being converted into a conservation area. SANParks has bought a number of large properties in this area, and there is a plan to incorporate both the public sector (SANParks) and several private farms by removing the barriers and allowing the newly reintroduced animals to move freely and create a large consolidated conservation area. This will adjoin, but will be far larger than the land Eskom will conserve. There are long-term plans to build a fence along the perimeter and around towns such as Gansbaai that fall within the reserve. Because there is a move towards flower and wine fields, and much of the output is exported to Europe, there is a general perception that, by helping the environment/biosphere, the creation of a large reserve will help enterprises to fetch higher prices and set themselves apart from the competition. There is also a move towards ecotourism involving the establishment of nature reserves and fynbos estates, amongst which are: the 5-star Klein Paradys Country House near Pearly Beach, the 5-star Grootbos Private Nature Reserve near Gansbaai, and the 4-star Farm 215 Fynbos Reserve between Gansbaai and Elim. The Agulhas National Park is an important future development for tourism.

In order to stimulate tourism development in the area, the Western Cape government decided to tar the road between Gansbaai and Bredasdorp, connecting the Whale Coast to Cape Agulhas. The first phase of this project (Bredasdorp to Elim) was completed in 2008 and the second phase (Elim to Gansbaai) is scheduled to be completed between 2008 and 2010.

There is a strong speculative element in the property markets, based on the potential of the area to become increasingly attractive for holiday homes for people from Cape Town. However, the government's new policy of restricting building development on the coastal edge could limit the growth of the Gansbaai area. Property prices have remained robust and have survived the 2008 national dip better than the Cape Town housing market has.

e) Aquaculture

The area between Cape Hangklip and Cape Agulhas produces 90% of the abalone sea harvest and 50 % of the farm harvest. Within this area, Gansbaai is the heart of the abalone aquaculture industry in South Africa. The largest marine abalone population in the country occurs between Gansbaai harbour and Quoin Point. However, since 1998 the sea harvesting of abalone has given way to abalone farming. There are three such farms in Gansbaai - Kleinbaai area, together producing 300 tons per annum. With a free on board price of $27/kg, the total turnover amounts to R61 million per annum. Abalone farming is labour intensive, with total employment being about 240 persons.

There is great potential for increasing production from abalone farming in the Gansbaai area. Present output could in fact be increased by 100 tons per annum if there were a reliable

supply of power. A NPS at Bantamsklip could therefore lead to increased output through stabilising power supplies, but there is a concern in the industry about the impact of a NPS on sea temperature. The farms pump in sea water, and the industry fears a risk of disease from bacteria in warmer water. However, according to the marine biology specialist, this is not an issue as the warm water plume will not reach the farms, i.e. they will not experience significantly increased water temperatures.

f) Kelp

The coast between Cape Agulhas and the Northern Cape is divided into rights areas for seaweed resources. The only resource being utilised is kelp, most of which is cut and sold fresh to perlemoen (abalone) farms, the balance being dried and exported. Kelp is the main food for abalone farms. The supply of kelp is relatively limited, whereas the number and size of abalone farms are increasing (South Africa is now the largest producer of farmed abalone outside Japan). There are four concession holders in a 16 km radius of the Bantamsklip NPS site. This radius stretches from Walker Bay to Quoin Point and includes Dyer Island. The average annual harvest between 2001- and 2007 was 2 706 tons of wet and 304 tons of dried kelp. Fresh kelp fronds fetch R1 100/ton for an average value of R2 976 600 per annum; comparative figures for dried kelp are R550/ton and R167,200 per annum. In addition, one abalone farm collects loose seaweed rack for feeding; in 2007 this volume was eight tons valued at R8 000 (i.e. R1 000/ton).

Eskom has advised the authors that it has taken legal action against kelp harvesters who enter its property illegally in order to gain access to the beach which would fall into the 1 km coastline exclusion zone. Eskom also advised that its intention is to collect the kelp itself and make it available to the local abalone farms. In this way, there would be no reduction in the volume of kelp available to the industry as a result of an exclusion zone.

g) Retail and trading

The only significant retail establishments in the area between Die Kelders and Quoin Point are at Gansbaai, where a shopping centre was opened in 2007. Two major retail chains each independently estimated the total turnover in the sector at an annual average of R120 million per annum. This includes Spaza and small shops as well as the building industry (brickmakers and building materials suppliers) and panel beaters. The holiday peaks are over a three-week period in December-January and then again at Easter. Average growth in turnover in real terms over the last four years has been between 7 – 10 % per annum. The opening of the shopping centre has reduced the leakage of local spending power to Hermanus, which used to attract many shoppers from the Gansbaai area.

h) Civil structures

Table 8-7 contains information on the various civil structures that are located in the area of the Bantamsklip site. This information was collected from the Overstrand Municipality's most recent "Spatial Development Framework of 2004". It is possible that this does not fully account for all the civil structures but, it was the only available source. There are no gas pipelines in the area.

Table 8-7: Civil structures in the 20 km radius of Bantamsklip

Structure	Stanford	Gansbaai	Baardskeerderbos	Buffeljags	Viljoenshof	Total
Health service/clinic	1	2	1	0	0	**4**
Churches	6	13	1	0	0	**20**
Primary school	3	3	0	0	0	**6**
Secondary	0	0	0	0	0	**0**

Structure	Stanford	Gansbaai	Baardskeerderbos	Buffeljags	Viljoenshof	Total
school						
Sports fields	1	6	0	0	0	**7**
Golf course	0	1	0	0	0	**1**
Community hall	0	3	1	0	0	**4**
Police office	1	1	0	0	0	**2**
Taxi rank	0	0	0	0	0	**0**
Cemetery	3	5	1	0	0	**9**
Municipal office	1	1	0	0	0	**2**
Crèche	0	3	0	0	0	**3**
Library	1	1	0	0	0	**2**
Hospital	0	0	0	0	0	**0**
Community centre	0	0	0	0	0	**0**
Post office	1	1	0	0	0	**2**

Source: Overstrand Spatial Development Framework - Volume 1: Development Perspective, 2004.

8.8.2 Demographic statistics

Bantamsklip (Overstrand Municipality) is situated in the Overberg District of the Western Cape. The available population figures for the Overberg District Municipality are illustrated in **Table 8-8**.

Table 8-8: Population: Overberg District Municipality *(2001)*

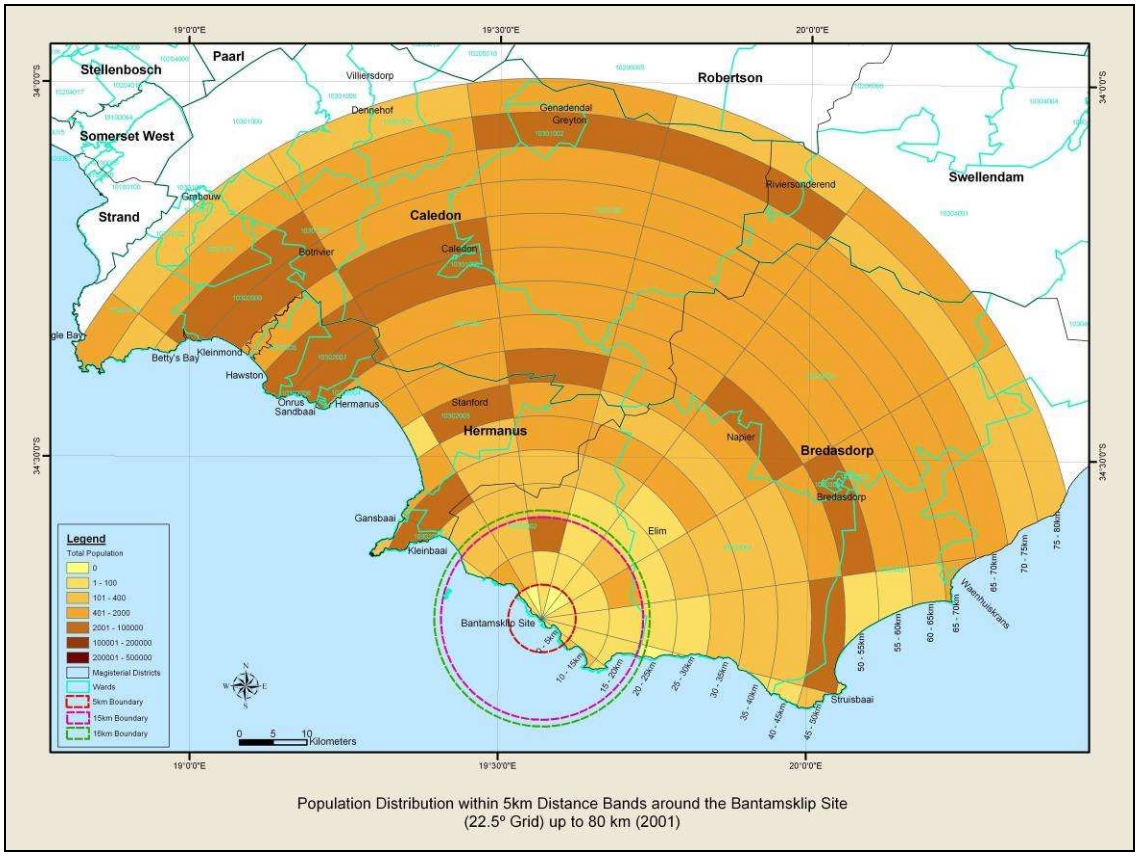
Code	Municipality	Population 1996	Population 2001	Growth %	Households 1996	Households 2001
DC3	Overberg District	159 033	203 520	27,97	41 410	56 658
WC031	Theewaterskloof	74 272	93 276	25,6	18 062	23 045
WC032	Overstrand	37 315	55 738	49,4	11 658	18 657
WC03	Cape Agulhas	22 011	26 182	18,9	5 588	7 424
WC034	Swellendam	24 620	28 075	14,0	6 102	7 493

The Overstrand features an estimated population of 73 031 people, which accounted for approximately 30,7% of the District's population in 2007. It is expected that the Municipality's population will increase to 82 773 people by 2012, should the population growth rate projected at 3,7% in the period 2006 to 2007, be realised. The Actuarial Society of Southern Africa model estimates a marginal slowing of the population growth rate to 3,1% per annum in the period 2007 to 2012.

These growth rates are, however, more rapid than the District average of 1,8%. Consequently, it is expected that the Overstrand will become the most populous municipality within the Overberg in due course.

Children form a large portion of the Overstrand's population, with approximately 8,9% of the total population being under 4 years old.

The youth (15 - 35 years) accounts for 30,1% of the Municipality's total population, a ratio that is not dissimilar to that of the District's youth population proportion of 33%. The aged currently account for 12% of Overstrand's population, reflecting the large number of retirees in the region.



Population Distribution within 5km Distance Bands around the Bantamsklip Site
(22.5° Grid) up to 80 km (2001)

Figure 8-62: Population Distribution within 5km distance radii of Bantamsklip

8.8.3 Visual character

a) Topography

The dune field on the coastal terrace between the sea and the R43 is covered with vegetation both exotic (Port Jackson Wattle) and indigenous (Strandveld). The former has established dense thickets either side of the R43, while the indigenous plants predominate on the portion of the terrace that is closer to the sea.

The indigenous flora is low, approximately 300 mm to 1 500 mm in height. The Port Jackson shrubs are mostly about 3 m in height.

There are four portions of land that comprise the Walker Bay Forestry Reserve between Franskraalstrand and Quoin Point. The Reserve accounts for approximately 30 % of the area between the R43 and the sea along that stretch of coast (**Figure 8-63**).

b) Vegetation

The site falls within the fynbos biome, and is dominated by South coast dune fynbos and Sand River primary dune community. The site has considerable habitat diversity in the form of a number of contrasting vegetation types, including subtropical forest thicket.

The dune field has been stabilised nearer to the coast by vegetation, both indigenous and exotic. The vegetation on the windward side of the dune is wind-pruned and dense. The vegetation in the "slack", the valley between the dunes, is also relatively dense, but taller than other more exposed vegetation due to these areas being sheltered from the wind.

c) Sense of place

The sense of place of the site and surroundings is based on the remoteness of the location relative to communities and the unspoilt coastline, which stretches for in both directions from the site. The visible natural character of the setting and absence of visible human elements add to the special sense of place.

d) The character of the site and surroundings

The ruggedness of the rocky coast, the stunted coastal vegetation and the exposure to the prevailing easterly winds creates and reinforces a visual character of a wild and untameable landscape.

The remoteness and inaccessibility of the area to the general public reinforces the mysterious and undisturbed ambience of the setting and the forces of nature, in particular the waves breaking over the rocky shoreline.

e) Surrounding land use

The current land use between the coastline and the R43 within a radius of 15 km is undeveloped and is mostly in its natural state. However, large areas of the vegetation seaward of the R43 have been invaded by the Port Jackson Wattle. There are four areas of the Walker Bay State forest land in this zone. These areas are effectively nature reserves as no commercial tree species have been planted.

The coastal villages of Franskraalstrand (20 km) and Pearly Beach (5 km) are essentially holiday hamlets, although there appears to be a small retired community in each town.

Fifteen km along the coast to the south-east of the site the landscape is natural and undeveloped, apart from a small number of houses, possibly holiday houses, along a short length of coastline just south of Plaatjieskraalbaai.

The area to the north-east of the R43 is mostly natural undeveloped privately-owned farmland.

f) Landscape diversity

The landscape diversity in this setting is determined more by landform than by land use. This is because of the general undeveloped and natural condition of the landscape. The vegetation is uniform in colour, texture and height.

The hills to the north-east of the R43 provide vertical diversity in the landscape. This is in contrast to the generally flat coastal terrace over which the R43 has been routed.

g) Climatic effects on visibility

The wet and misty weather in winter is brought by the predominant east - north -easterly winds, which have an average wind speed during the months May to September of approximately 5.8 km per hour.

The generally clear summer weather is driven by the predominant westerly winds, which also have an average wind speed of 45 km per hour.

8.8.4 Heritage resources and archaeology

Bantamsklip is located near the small towns of Pearly Beach and Die Dam. Situated about 9 km east of Pearly Beach, the context is rural. The general area is a cherished holiday destination on account of its scenic qualities, mild climate and "unspoiled" coastline. The study area itself has exceptional wilderness qualities and is a natural heritage site on account of its floral diversity, in particular the unique limestone formations which are home to specialised plant communities making the inland parts of the site a significant biodiversity hotspot. The farm is a registered Private Nature Reserve and a Natural Heritage Site. Its immediate neighbors are Cape Nature at Pearly Beach and Soetfontein Nature Reserves.

The study area (the broad area of land that will contain the nuclear infrastructure) lies on the seaward side of the farm Groot Hagelkraal. Most of this land is owned by Eskom and managed as a natural area. The R43 from Pearly Beach to Die Dam divides the farm into an inland and coastal portion. The inland portion lies partially on the coastal plain, however the northerly-most portion extends into a series of limestone massifs, an ancient facies of the surrounding Peninsula Formation. These limestone formations contain a multitude of rock shelters, caves and overhangs, some of which contain archaeological sites. Currently there is one cluster of standing structures on the entire property – namely the Hagelkraal farmhouse and outbuildings, all of which are conservation-worthy vernacular structures. The farm is run by a wild flower enterprise, which is friendly to the aesthetics of the area. The proposed development area lies on the south side of the road adjacent to the rocky point known as Bantamsklip. There are no buildings on this portion of land apart from a ruined farm boundary wall and a concrete water tank.

The coastal portion of the study area incorporates two rocky points framing a mostly rocky shoreline. While this shoreline is highly active, small embayments and longitudinal gullies result in the exposure of largish expanses of tranquil water and rock pools in the intertidal zone. The shoreline is flanked by a series of parallel vegetated dunes. These are stable and densely vegetated with coastal Fynbos. The dune system extends inland for 300 – 400 m, after which the landscape opens up onto a coastal plain. Towards the eastern edge of the site fossil dunes (aeolianites and calcretes) are exposed on the surface. Where the soil depths are shallow these are sparsely vegetated. There are no buildings or ruins on the coastal portion of the property. Abalone poaching is taking place on the property.

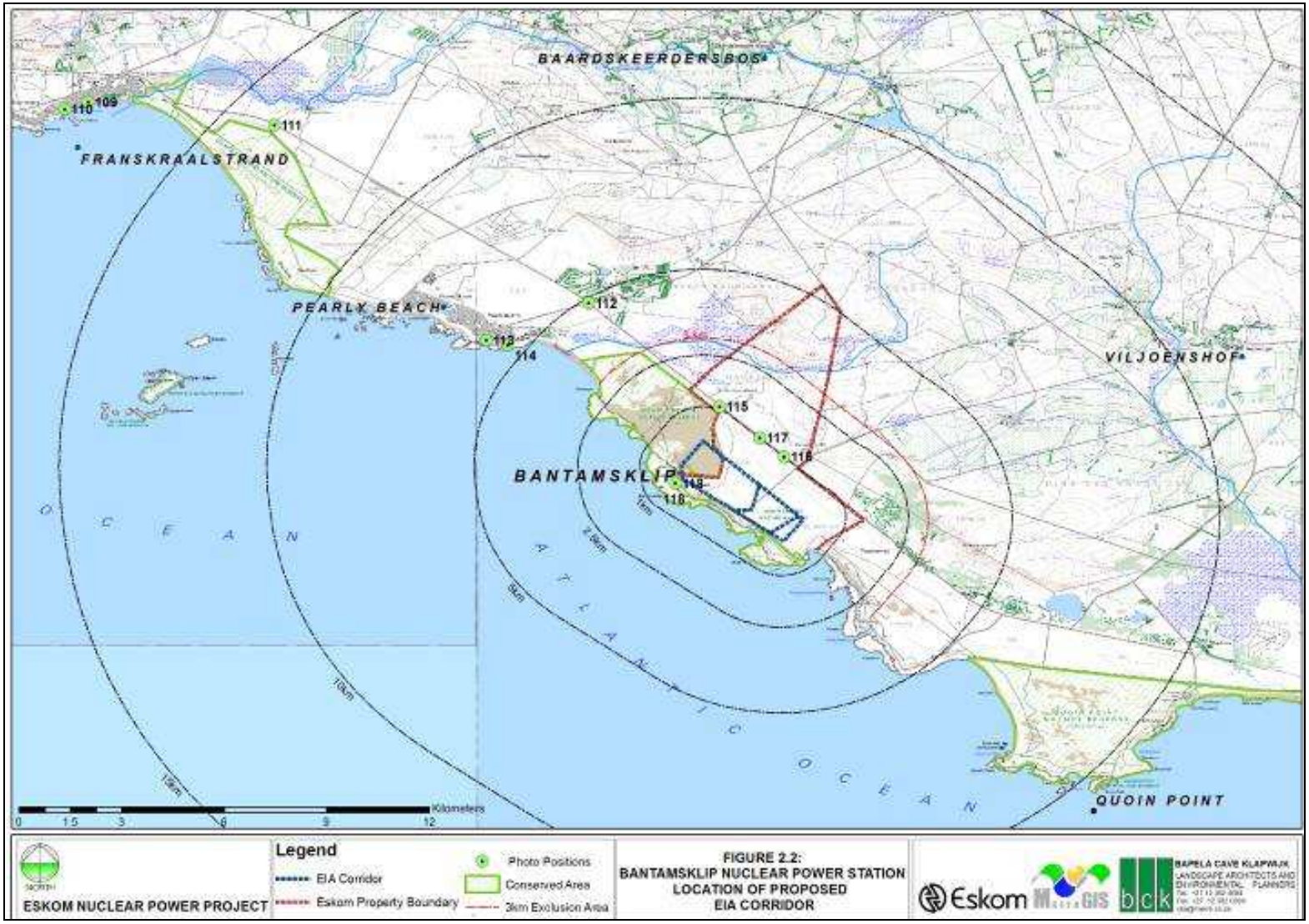


Figure 8-63: Bantamsklip Nuclear Power Station location of proposed EIA corridor

a) The regional heritage context

The Bantamsklip area has not been subject to previous heritage studies or much archaeological research, although adjacent areas have been researched by archaeologists of the South African Museum (now Iziko Museums of Cape Town) who were very active on the south coast in the 1970's and early 1980's. Studies into colonial period settlement and heritage are few with existing information focussing mainly on the early mission stations of Genadendal and Elim, however the recent Overstrand Spatial Development Framework has incorporated a heritage overview for planning purposes. .

b) Pre-colonial heritage

The first formal research into the prehistory of the Overstrand region was that published by Professor John Goodwin. This research did not involve any excavations of archaeological sites on the southern coast but was based upon a series of observations of *viswywers* (tidal fish traps) that had been built by prehistoric people - possibly the same people responsible for the accumulation of shell middens that contained numerous fish bones and fragments of pottery. Goodwin stressed the need for the archaeological investigation of sites that could provide evidence linking the contents of shell middens and the *visvywers*.

It was not until the 1970's that research by archaeologists of the South African Museum provided further insight into the prehistory of the southern cape to the west of Cape Agulhas. Excavations by Frank R. Schweitzer (1979) at Die Kelders coastal cave near Gansbaai produced early evidence (1 600 years ago) for the introduction of pottery technology and domestic stock into the Cape as well as a MSA (Middle Stone Age) occupation over 40 000 years old.

The significant pottery finds led Schweitzer (1970, 1979) to conclude that the cave occupants were in contact with herders – Khoekhoen pastoralists who made their appearance in the Western Cape (along with the skill of making pottery and herding domestic animals) roughly 2 000 years ago. He thought this view was substantiated by the change in seasonal use of the cave that seemed to be reflected through time. The earlier layers seemed to have accumulated in winter months, while the more recent layers showed longer occupation extending into spring and possibly even summer. This prolonged occupation was thought to be facilitated by an increased reliance on domestic animals for food.

More recent excavations validated much of Schweitzer's work. The researchers were able to make use of more modern technologies and dating techniques to conduct excavations at a far finer degree of resolution. These excavations extended deep into the MSA layers. They were able to establish that the MSA levels were deposited over a short space of time (15 000 – 20 000 years) but that they were nonetheless a good deal more complex than had been thought by Schweitzer (Avery *et al.,* 1997). They also found that stone tools made on fine-grained materials, similar to *Howiesons Poort* (a key marker phase of the MSA) artefacts at the top of the MSA levels dated to between 80 000 and 60 000 years ago.

The recent work at Die Kelders significantly increased the number of early human remains excavated at the site, most of these being teeth of sub-adults. Analyses of the teeth, in particular, revealed that these individuals, while displaying some traits that were similar to modern Africans, were not conclusively modern.

Inland of Gansbaai on the farm Byeneskranskop are the limestone outcrops (very similar to those at Groot Hagelkraal) which contain numerous caves and shelters that attracted pre-colonial occupation. First excavated in 1974 (Schweitzer & Wilson, 1982), the main archaeological cave site at Byeneskranskop is near the top of a hill, 60 m above sea level and 19 m x 15 m at its greatest extent. The site records a relatively complete sequence of occupation over almost 13 000 years. The importance of sequences such Die Kelders and Byneskranskop is that they help researchers to understand the relative ages and cultural affiliations of the many open sites in the region.

Research in the Pearly Beach area has mainly been conducted by Graham Avery of Iziko Museums of Cape Town. Several open station shell middens in the Pearly Beach area were surveyed and excavated by him in an attempt to derive a systematic, regional understanding of

the subsistence strategies of pre-colonial south coast populations. Sites here were found to extend from locations just behind the beach dunes to up to two kilometres inland. Sites generally cluster near the rocky stretches of the coast where shellfish are abundant, while no sites were found along the sandy beaches. Avery makes the suggestion that occupation sites may be linked to the occurrence of milkwood thickets which provided shelter for people. According to Avery, the shell middens can be divided into three varieties, each characterised by a different predominant species of shellfish which occur at different depths within the intertidal zone. He hypothesised that these differences suggest the employment of different procurement and processing strategies. The relative dominance of various shellfish species in the middens could relate to the timing of harvesting or the ways and places the shellfish were prepared and eaten. Avery identifies a number of types of stone features at the Pearly Bay sites. These are: hearths with evidence for burning, hearth-like structures with no ash or charcoal, groups of large stones associated with burials and roughly semicircular features that were possible anchorages for huts or windbreaks. In recent years similar features have been associated with shell middens throughout the south and west coasts.

Avery drew the conclusion that these coastal sites reveal that the ancestors of both the Khoekhoen herders and hunter gatherer groups accumulated them as part of a cyclic or seasonal system that used both inland and coastal resources. It is now broadly accepted by archaeologists that shortly after 2000 years ago, a new economic system was introduced to Southern Africa - namely certain groups of people adopted transhumance pastoralism (in this case with herds of fat-tailed sheep and later cattle) instead of primarily relying on hunting and gathering which was universally practiced in South Africa before this time. The origin of early stock keeping in Africa is still unknown.

The only documented work that has ever taken place at Hagelkraal involves a skeleton which was excavated from dunes. It was surrounded by an ephemeral shell scatter and several large boulders. The associated cultural material suggested a Later Stone Age interment[5]. The areas surrounding the Hagelkraal vlei and the nearby limestone ridges contain a significant concentration of sites. Archaeologist Mr David Halkett recalls participating in archaeological trial excavation in a cave on the property in the early 1980's. A human skeleton was revealed, however lung distress caused by cave dust forced the group to close the site.

A study, which took place in an area with similar landforms to Bantamsklip, is worth consideration. In 1984 an area just to the west of Struisbaai was the focus of a study by archaeologists from the South African Museum and the UCT. They were interested in the way in which prehistoric people were using the different kinds of environments represented in this area. The focus of this research was an area very similar in morphology to the site currently under investigation in this report in that it involved a shoreline, coastal dunes and flat coastal plains. An exhaustive survey of this area showed that the majority of archaeological sites were located directly on the shoreline, or on the edge of the inland dune field where large dunes overlook the coastal plain. The coastal plain itself was relatively devoid of archaeological material and was clearly not a popular area for Stone Age communities. The study showed that the dune field had been favoured for occupation over the last 4 000 - 6 000 years by both earlier hunting and gathering people and possibly pastoralists later on. Further research undertaken by the ACO team throughout the Southern, Western and Northern Cape has confirmed that prominent coastal dune systems were important settlement areas during the late Holocene (up to 5 000 years ago). Prehistoric people were selecting deflation bays and inland edges of the dune fields for encampments as this provided a good location from which to exploit the seasonal water and good grazing found on the coastal plain, or the marine resources of the nearby shore. It is therefore predicted that pre-colonial settlement patterns at both Bantamsklip and Thyspunt are likely to be similar.

c) The Colonial period

Aikman *et al.* comment that Khoekhoen herders were the dominant groups of people in the Overstrand region when the Dutch East India Company started extending their interests beyond the Cape Peninsula in 17th century. A powerful herding community who occupied the Caledon plains, the Chainoqua, traded regularly with VOC outposts – the demand from the VOC for cattle for re-victualing ships was insatiable. Although the Overstrand areas were considered to be

[5] The act of burial

among remotest of the fledgling colony the pervasiveness of the colonial settlement endured. The first Europeans used small sailing craft to access the coast, eventually followed by overland wagon trails (one of which is preserved in the study area). Eventually nomadic European stock farmers and professional hunters moved into the area – they were the forerunners of permanent colonial settlement.

In the 18th century the Dutch East India Company began to "formalise" the process of granting farms in the area. Stock posts were granted east of Hermanus by the 1730's while the first hunting licences were granted in the Baardskeerdersbos area by 1706. By the mid 18th century it can be safely assumed that European settlers had made their presence known in the Pearly Beach – Buffeljags area. The Khoekhoen Herders who had grazed their sheep, cattle and goats on the coastal plains for more than 1 000 years did not fare well in what was a hopelessly unequal contest with the Europeans. They lost their traditional grazing lands and succumbed to foreign illnesses brought in by the colonists. By the 19th century the remnant populations of these once powerful communities, devastated by smallpox and the breakdown of their traditional political structures found themselves confined to mission stations or "employed" on the colonist's farms.

The towns of Pearly Beach and Gansbaai were established in the 19th century. These small towns had their origin in informal gathering places where *trekboers* converged at the coast at freshwater springs to fish and get relief form the dry interior. It is reported that it was only after relaxation of Dutch laws about boat ownership, that the small fishing villages began to develop at places such as Gansbaai. "The Uilenkraals, the Hagelkraal and the Buffeljags Rivers drew early inland stock farmers to the coast annually. This pattern continued through the 19th century and apart from a few fishermen's cottages there were few permanent dwellings along this coast until the end of the 19th century and beginning of the 20th century. Given the large number of ships to have been wrecked here this would have made it very inhospitable for survivors. Apart from some isolated groves of milkwood trees at Stanford cove, Franskraal and at Pearly Beach, it is an almost treeless landscape with coastal dunes and low scrub vegetation offering little shelter. The most famous wreck was that of the Birkenhead in 1852 off Danger Point. A lighthouse was built there in 1895. The first permanent settlement in this district would appear to have been at Gansbaai although there were already a few houses at nearby De Kelders. The fishing entrepreneur Walter MacFarlane employed 17 fishermen in Gansbaai in 1903. This became the nucleus of the fishing industry, which was to develop over the following 100 years. A harbour was constructed as well as fish meal factories, ice making and freezing facilities and canning and fish processing works".

d) Groot Hagelkraal

The farm Groot Hagelkraal as reported in the Heritage Impact Report had its origins in a series of 19th century land grants. Important heritage information is that the Cape Road crossed the study area from east to west, and that a residence/hut/dwelling of some form was present of the property when it was first granted. The existing farm complex could easily have had its origins shortly after the formal granting of the land.

e) Tidal fish traps

Since tidal fishtraps have been identified at both the Thyspunt and Bantamsklip study areas, a note on these features is relevant to this study. Following on the suggestions of Goodwin (1946), Avery (1975) put forward the notion that many coastal shell middens sites may be linked to the stone-built fish traps that are common around the shoreline of the South Coast. These traps have also been noted along the coast at Humansdorp, Gouritz River mouth, Cape Agulhas and Bredasdorp.

Fishing by means of the construction of tidal "dams" is used throughout the world – the materials from which the traps are built varies from place to place, however the basic principle is the same, namely the creation of tidal dams that result in the confinement of fish to an area where they can be easily collected or speared. The method is still used in Northern Natal (reed weirs and dams), similar traps were even used in the great intertidal zones of European rivers in the first millennium AD. Stone tidal fish traps have been recorded along the southern Cape coast, Cape Peninsula and recently at the mouth of the Berg River on the West Coast. No traps have been located along the north-west coast. Avery has observed that tidal fish

traps in the southern Cape were used in areas with specific characteristics: i.e. places where the gradient gave rise to large intertidal zones where there were ample moveable boulders and rocks, shallow sheltered conditions allowed people to create gullies and dams.

Avery's research provided solid evidence that the traps were successfully used and maintained by communities at Elim into the 20th century. Although Avery's work is well researched and detailed, he was never able to answer the question of how long fish traps were in use in the Southern Cape. He hypothesized that the traps had their origin in pre-colonial times being used by Khoekhoen herding communities who harvested the traps at favourable times of the year on their seasonal herding cycles. While this is a plausible hypothesis, in reality the age of use of fish traps and their association with pre-colonial herding peoples has not been thoroughly investigated. Hine has re-examined the issue and found compelling historical evidence that most of the tidal fish traps existing today were built by colonial farmers in the 19th century and maintained by their descendants well into the 20th century. What remains unknown is whether the tradition of tidal fish traps has historical continuity back to pre-colonial times. At present, the balance of evidence suggests this is not the case.

f) Bantamsklip heritage survey – findings

Palaeontology

The findings of the study by palaeontologist John Almond, which is contained in **Appendix 2** of the Heritage Impact Assessment, is summarised below.

The study area is located on top of a wave-cut platform incised into tough quartzitic bedrock of the Peninsula Formation (lower Table Mountain Group). Apart from the rocky coastline itself, where a modern gravel and boulder beach as well as coarse beach sands are found, the platform is mantled with a thin (11 m or less) veneer of less well consolidated late Caenozoic sediments of the Bredasdorp Group.

The bedrock platforms beneath both south coast sites are built of Table Mountain Group sediments of Early Palaeozoic age. These are moderately to highly deformed and unlikely to yield well-preserved fossil material; at most, sparse trace fossil assemblages are expected. A thin cover of Late Caenozoic / Neogene coastal sediments belonging to the Bredasdorp Group (Bantamsklip) or Algoa Group (Thyspunt) is also present. The palaeontological sensitivity of these younger sediments ranges from low to high. The Neogene units are poorly- to well-consolidated and mainly consist of sparsely fossiliferous aeolianites (wind-blown sands) of Quaternary age (<1.8 Ma), with occasional subsurface calcrete horizons. A limited range of terrestrial fossils, such as snail shells, rare vertebrate bones, teeth (perhaps associated with hyaena dens) and even trackways, as well as organic-rich peats or mudrocks might be encountered subsurface within these aeolianites, especially along palaeosol horizons.

Pre-colonial Archaeological Material

The Heritage Impact Assessment reports that the study area and neighbouring portions of land to the west, are rich in a broad suite of archaeological material ranging from Middle Stone Age scatters to numerous Late Stone Age shell middens. Two occurrences of tidal stone fish traps were also observed. Colonial period heritage is limited to the Groot Hagelkraal farm buildings and an historic boundary wall which spans the proposed nuclear corridor.

A detailed log of archaeological occurrences is presented in **Appendix 1** of the Heritage Impact Assessment.

Middle Stone Age material was noted broadly scattered on all exposed fossil dune and calcrete surfaces within the study area. This is particularly prevalent on the eastern side of the site. The material which takes the form of widespread conflated scatters of quartzite flakes and cores, sometimes cemented into the surface of the aeolianite, is highly disturbed by years of deflation and erosion. It is expected that the material will also exist on buried palaeosoles under the vegetated sand bodies. While particularly high concentrations were mapped, no discreet archaeological sites were identified – the concentrations being attributed to natural processes. No fossil bone was noted in association with any of the material, however dispersed shell fish were present. This is probably Late Stone Age material that resulted from subsequent occupation of the fossil dunes. The possibility must be considered that there may

be in-situ material contained within the fossil dune body, however ascertaining this would require trial excavation which was outside the scope of this study.

Late Stone Age shell middens are prolific within 400 m of the coastline (see Appendix 1 of the Heritage Impact Assessment), with the highest concentration being within 200 m of the shore. During the study some 115 occurrences were observed. This number is only an indicator of density as much material is likely to be buried within dune bodies or obscured by thick coastal Fynbos. Along the shoreline itself, the material is so profuse that the sites form an almost continuous ribbon of material. Away from the shoreline, distinct middens may be observed. All observations of Late Stone Age middens took place within the near-shore area and the vegetated dune cordon of secondary and tertiary parallel dunes. No middens were identified on the flat coastal plain areas inland of the dune complex. Late Stone Age sites were observed in caves and rock shelters in the limestone complex inland of the study area, however this portion of farm lies outside the scope of work.

Middens close to the shoreline (see **Figure 8-64**) are characterized by concentrations of *Haliotis midae* shells (not to be confused with shells left by perlemoen poachers which are evident in the area). Other shellfish that are present are numerous *Turbo sarmaticus* (Alikreukel), *Choromytilus meridionalis* (black mussel), *Haliotis midae*, *Oxystele spp., Burnupena spp.* and various limpets – in particular *S. argenvillei, C. longcosta and S. granatina*. On all the sites recorded the artefactual assemblage was relatively informal being dominated by quartzite chunks and flakes, flat boulders used as grinding surfaces. Exotic raw materials such as silcretes were unusually scarce. Fragments of Cape Coastal Pottery were found associated with a minority of middens indicating that some of this occupation is less than 2 000 years of age. Other cultural items such as ostrich eggshell beads were remarkably scarce. Unlike much of the South Coast the immediate coastal sites have not been impacted to a major extent by the coastal tracks and various other *ad hoc* roads onto the beach. Although some sites had been exposed in the coastal tracks, generally the preservation of the sites is good, many are stratified and of solid research value. Of interest is that the Bantamsklip middens are all very similar to each other in terms of their content.

Judging by the dominance of *Haliotis midae* on the immediate coastal sites, these localities are interpreted as “de-shucking stations” where prehistoric people were processing the meat out of the shell to decrease the weight and bulk of their catch before taking it to another destination – possibly shelters in the lime stones at Byneskranskop and Hagelkraal.

The kind of material observed is consistent with the archaeological assemblages thought by many archaeologists to be associated with settlement in the Cape after 2 000 years ago, however recent unpublished work undertaken by the ACO has shown that informal artefact assemblages tend to reflect the last 3 000 years of coastal human settlement, especially on the coast and are necessarily exclusively associated with the advent of pastoralism. In short, indications are that the coastline was utilised by ancestors of Khoekhoen herders and San hunter gatherers from about 3 000 years ago to the historic period.

<u>Colonial Period Heritage</u>

Colonial period heritage within or close to the proposed nuclear corridor is fairly limited. Within the nuclear corridor is an extensive stone wall constructed from blocks of calcrete (see **Figure 8-64**). The age of this feature is unknown, however it is anticipated that it was built in the 19th century as a field or farm boundary before the advent of barbed wire fencing.

Remains of two stone wall fish traps were identified close to the study area in shallow gullies in the intertidal zone. These are not particularly well preserved examples.

The farm houses and barns at Hagelkraal (outside of the nuclear corridor) are significant heritage buildings and are certainly worth recording on the provincial heritage register (**Figure 8-66** and **Figure 8-67**). The buildings which are all made from limestone blocks have vernacular qualities. The long cottage of which a portion is ruined is potentially the oldest house in the complex dating to possibly the early days of the farm in the late 18th to early 19th centuries.. The main farmhouse is likely to be mid 19th century – it has been recently renovated but still retains Victorian elements and an early Victorian (or even Georgian) beamed ceiling. The barn is of similar age and construction. The entire complex is remarkably intact, being picturesquely set on a limestone outcrop among a thicket of ancient

milkwood trees. Sherds of 19th century ceramics were noted in the yard indicating a possibility of colonial period archaeological potential.

Cultural Landscape

The cultural landscape qualities (setting) of the area are essentially that of a wilderness area – the dominant human cultural element is essentially pre-colonial. The colonial past is represented by a single historic farmstead set against a spectacular backdrop of milkwoods and distant limestone massifs. The Old Cape Wagon road which runs roughly parallel to and just south of the R43 is discernable on aerial photographs but very overgrown and difficult to indentify in the field.

The Heritage Impact Assessment states that "Perhaps the greatest heritage value of the area is that it is one of the last remaining stretches of the south coast that has not been subject to excessive development, which has resulted in good preservation of the pre-colonial and colonial past". It is an important biodiversity area – its natural heritage qualities are predominant over any person-made elements of the landscape. It is because of the unspoiled beauty of the place that the R43 is considered to be a scenic route in terms of the Overstrand Spatial Development Framework.

Historic limestone boundary wall

***Haliotis spp.* midden at Bantamsklip**

Figure 8-64: Heritage features at Bantamsklip

Figure 8-65: View looking eastwards over the Bantamsklip study area. The immediate fore-dune contains concentrations of shell middens forming an almost continuous ribbon along the coast.

Figure 8-66: Vernacular cottage at Groot Hagelkraal farm complex. This is a typical Cape *"langhuis"* built from south coast limestone.

Figure 8-67: Farm house at Groot Hagelkraal farm complex. Although recently renovated, the building contains mid-late 19th century fabric.

8.8.5 Agricultural practices

There is no agricultural production within the proposed site (EIA corridor) and, in fact, the potential for agricultural production is very limited. This is mainly because of the lack of available irrigation water from surface and ground water sources. As in the case of Thyspunt, soil samples were taken within the EIA envelope but their analysis is not expected to yield any results that would affect this report.

A large majority of the area surrounding the proposed site is land that is currently being used for fynbos harvesting with some commercial agricultural production taking place on a few farms. The main activity in this area is fynbos harvesting. Only farms that have planted pastures with irrigation that can supplement the natural grazing have livestock on their farms. Therefore, for agriculture production to increase in this area, more irrigation and cultivated pastures would need to be established.

The permanent residential areas in this area are relatively small in population size. Pearly Beach, for example, is a holiday location, occupied seasonally during peak tourist times; it has only a small permanent population.

Figure 8-68: Flower sorting in the Bantamsklip region

Figure 8-69: Fynbos flower picking area – The Springs Farm

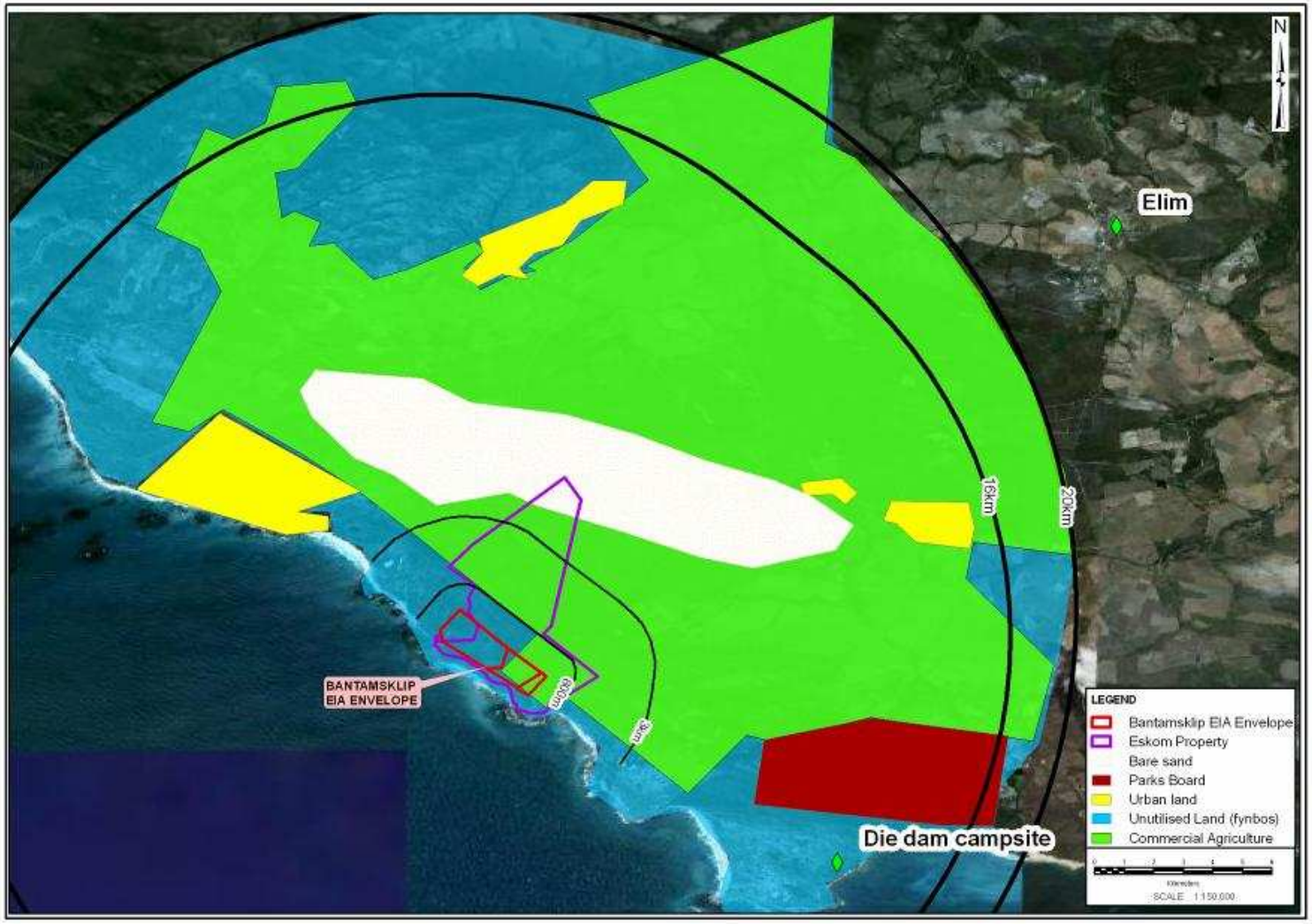


Figure 8-70: Land use map - Bantamsklip

The majority of the land within the 16km radius is natural fynbos vegetation. The farms further inland are mainly devoted to cattle or sheep. Recently the broader region has been developed into the Agulhas wine region. It is envisaged that this trend toward wine estates and eco-tourism will continue in the medium term

The coastal belt, which stretches approximately 6 km inland, is predominantly natural vegetation, with some uncultivated and cultivated fynbos. This land is used for flower harvesting, with the occasional small-scale subsistence activity or holiday property within it. The areas further inland produce dairy, cattle and sheep. Here there is a small village called Baardskeerdersbos with some small scale-farmers and a residential area.

The farms that produce dairy, cattle and sheep are all over 10 km from the proposed site. The dairy farms sell predominantly to the Parmalat Dairy. The bigger farms, other than those that do game farming, are all in dairying or fynbos harvesting. There are a few farms that produce sweet potatoes, cucumber and oats, and there is a small amount of trout farming. A butchery on one of the farms (Kleinplaas Farm) buys and sells much of the local produce. There are a number of small-scale farms in the area, most of them being operated at a subsistence level.

With regard to fynbos, the flowers are boxed and sold to local distributors for export. The primary buyers are from the UK. The fynbos production is a major source of income in the area, as many of the local people rely on such farms for seasonal employment.

A summary of the information collected from each farm is given in **Appendix 1** of the Agricultural Impact Assessment. The farming practices for the Bantamsklip site is summarised in **Table 8-9** below.

Table 8-9: Farming practices (number of farms)

	Bantamsklip
Farming practice	
LIVESTOCK	
Dairy	7
Beef	7
Sheep	5
Pigs	0
Poultry	0
Game	1
CROPS	
Vines	0
Wheat	0
Fynbos	13
Vegetables	3
Other agric	3
Total properties	33

From the data in this table it is clear that the Bantamsklip site is substantially a fynbos area with fynbos being utilised on 13 of the 33 properties. However, livestock are carried on 20 of the properties, and this includes dairy, beef, sheep and game.

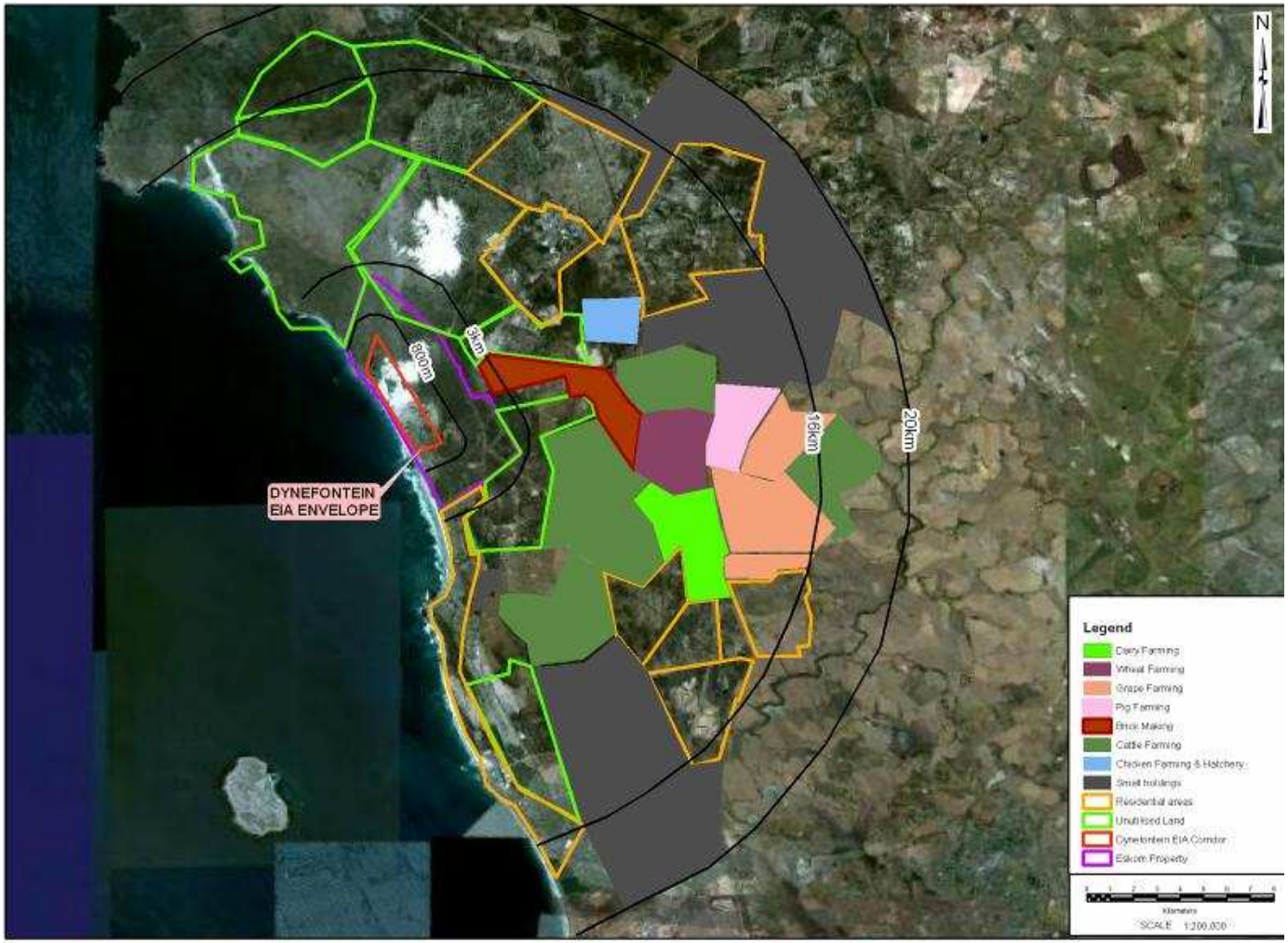


Figure 8-71: Types of farming - Bantamsklip

8.8.6 Tourism industry

Bantamsklip, as with the Duynefontein Site, falls under the Overberg Municipality, where the Integrated Development Plan outlines the importance of tourism and more specifically environmental and conservation orientated tourism. Sustainable environmental management and bio-regional planning are identified as specific elements in future tourism development plans for the area.

The Bantamsklip site is surrounded by the Greater Gansbaai tourism region. This includes De Kelders, Gansbaai, Kleinbaai, Franskraal, Pearly Beach, Buffeljagsbaai and Die Dam. **Figure 8-72** illustrates the spatial context of the site.

The Greater Gansbaai area is a marine-based attraction centre with a clear focus on eco-tourism. The seasonal tourist period is over the Christmas and New Year holidays when the population grows from 22,000 permanent residents to 62,000. The general tourism product is relatively underdeveloped, and tourist support services, facilities and industries are few in number and still developing. Tourism in the area is overwhelmingly dominated by the whale-watching and shark-cage diving industries.

This marine asset draws the majority of visitors and is largely responsible for driving the local tourism economy and associated industry. However, many of these are day visitors who stay overnight in Hermanus where the accommodation sector is much larger than at Gansbaai. The Marine Environmental Specialist Report specifically identifies the area between Bantamsklip and Gansbaai as one of three shark-diving sites along the South African coast and a significant location for the birth of Southern Right Whales, further encouraging marine-based tourism. The area is also characterised by significant recreational fishing activities despite low marine species richness and very low endemicity.

The Visual Impact Assessment identifies the Bantamsklip section of the coastline as particularly scenic, viewed both by road-users and persons who have access to higher-lying properties. The site's sense of place is based on the visible naturalness of the setting and visual absence of human elements, with land up to 20 km inland and (except for Gansbaai and Pearly Beach) 15 km each side of the site being predominantly undeveloped and in a mostly natural condition.

The greater Gansbaai area promotes a small seaside town atmosphere, emphasising a quiet and rustic lifestyle in a natural and undeveloped environment. However, there are large-scale tourism development plans that consist of two holiday/residential apartment blocks and hotels with a further expansion of the current 9-hole golf course to 18 holes. Accommodation is provided by the B&Bs/guest-house sector and house lets. Average annual occupancy rates for the former are estimated at 40% and for the latter at 5 %.

The size of the tourism industry in the Bantamsklip area is quantified in **Table 8-10** on the basis of information obtained in the field during the Tourism Impact Assessment.

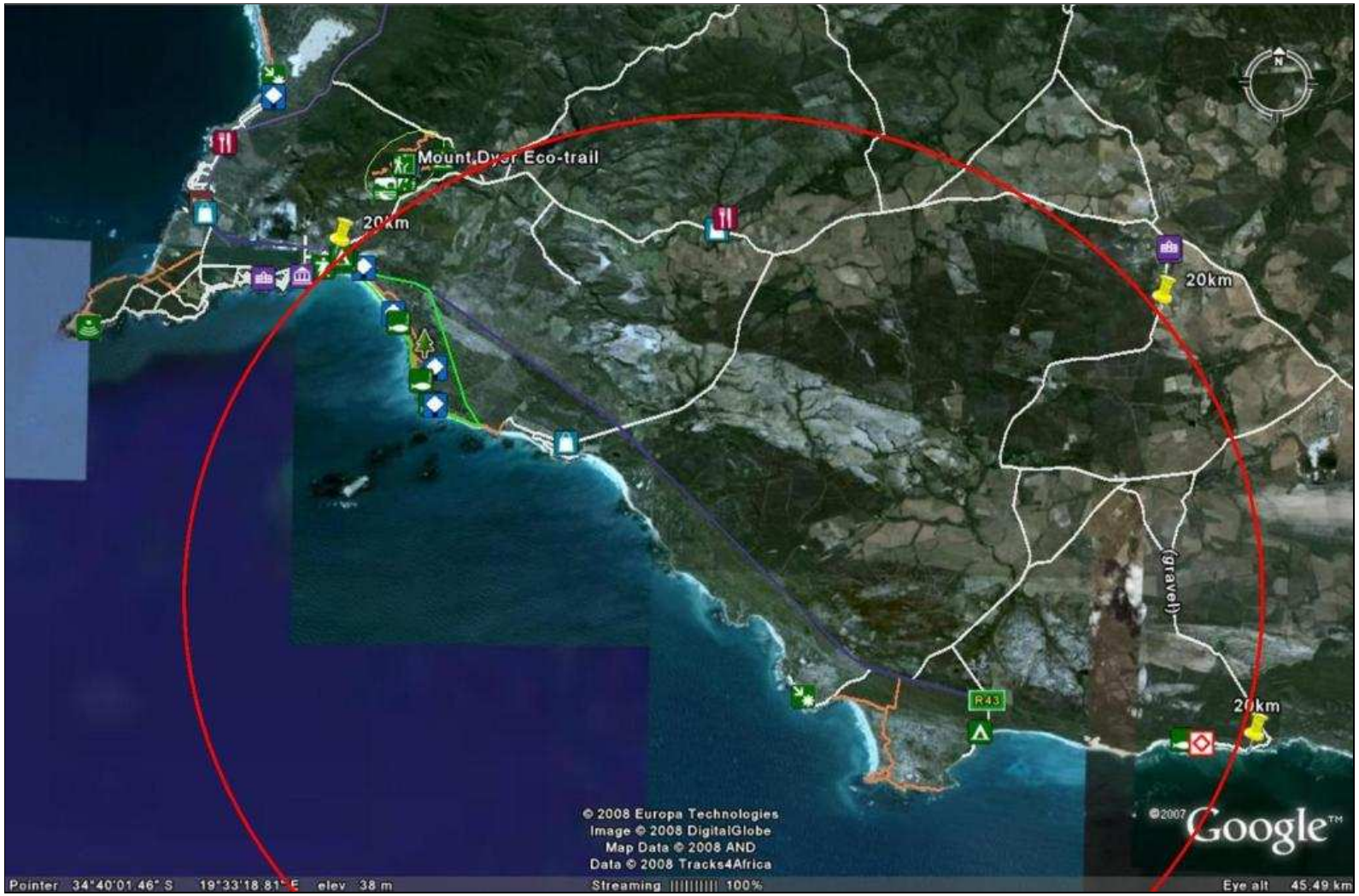


Figure 8-72: Bantamsklip site location and sphere of impact

Table 8-10: Quantitative representation of tourism industry in the Bantamsklip area

Accommodation beds	1,111
Average rate per night	R 350
Average annual occupancy (days)	146
Sub-sector turnover p.a.	R 56,772,100

House lets	150
Average cost per day	R 2,000
Average annual occupancy (days)	18.25
Sub-sector turnover p.a.	R 5,475,000

Total turnover p.a.	**R 62,247,100**

Source: Field interviews

8.8.7 Noise

Figure 8-73 displays the proposed Nuclear 1 plant layout on an aerial photograph of the Bantamsklip location. The shortest distance to the property boundary is 1 125 m. The distance to the nearest noise sensitive land appears to be a farm with the farm boundary 3.2 km northeast of the Nuclear 1 infrastructure site where the typical $L_{Req,d}$ would be 45 dBA. The nearest residential suburb of Pearly Beach is located some 7.3 km northwest of the infrastructure site. Due to surf noise the $L_{Req,d}$ at residences close to the coast would be 50 dBA or higher depending on the distance from the shoreline.

8.8.8 Transport

a) Road network

The N2 runs in an east-west direction approximately 60 km north of Bantamsklip and links to the N7 via Cape Town as shown in Figure 0-14 The N2 can be accessed from Bantamsklip via several routes along the R43, R326 and the R320. The R43 is a surfaced road, which runs adjacent to the Bantamsklip site and gives direct access to the site. The site can currently be traversed via off-road tracks.

The Overstrand Local Municipality experiences a large influx of holiday makers during the summer holidays. On average a 50% increase in vehicular traffic and a 100 % increase in pedestrians are experienced in this period.

The existing road network has sufficient capacity to carry existing traffic and should be able to do so for the foreseeable future. One outstanding exception however, is the portion of the R43, between Hawston and Hermanus. Delays in excess of 30 minutes are experienced during weekday peak hours, with increasing delays during holiday periods.

The Overstrand Municipality and the Provincial Government of the Western Cape are in discussion over the upgrading of this road section. Delays are also experienced on the N2, in the Grabouw / Sir Lowry's Pass region, but this is generally limited to holiday periods.

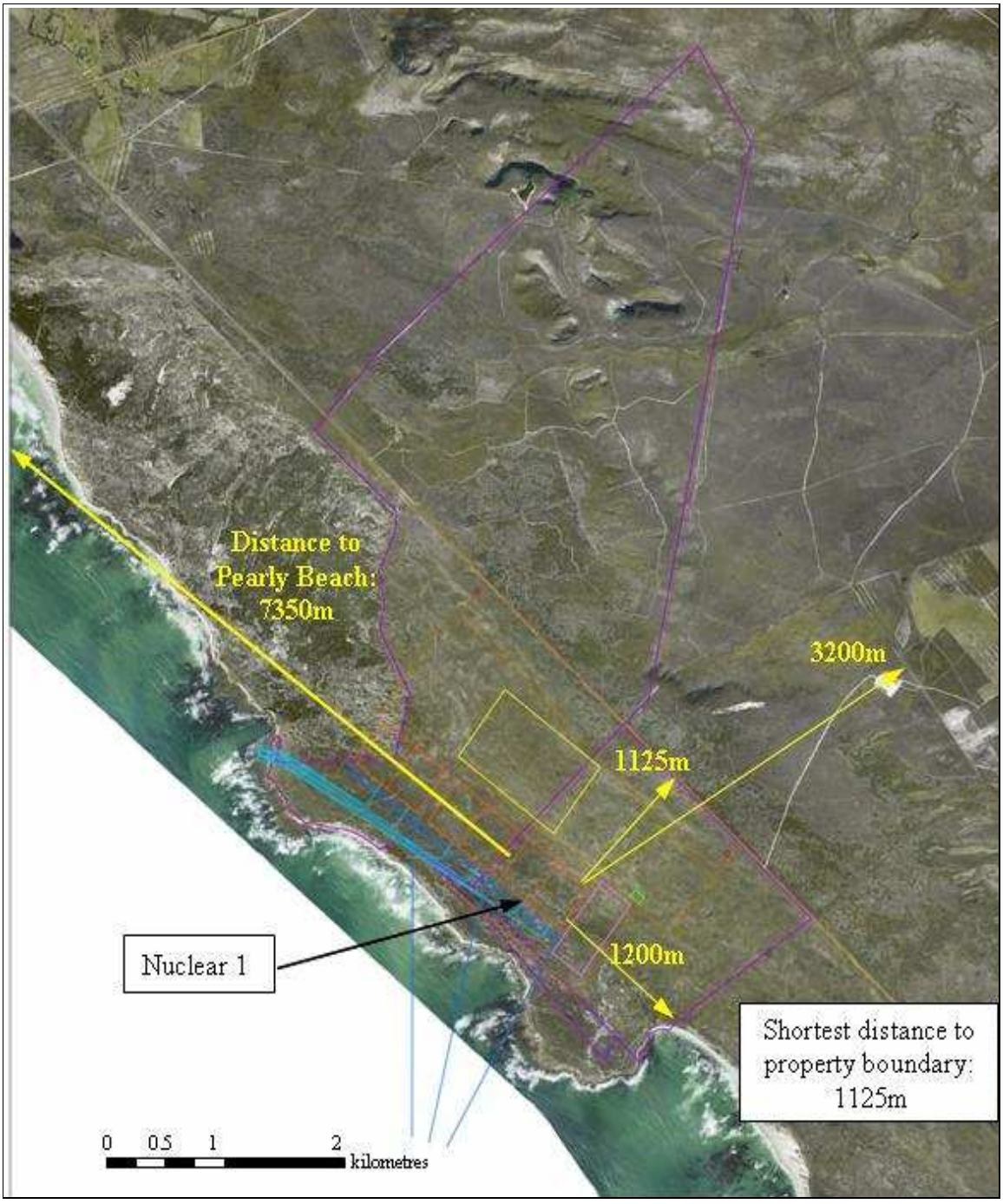


Figure 8-73: Distance to nearest noise-sensitive land uses at Bantamsklip

b) Rail network

A number of railway lines run through the Overberg District Municipality. However, very few of these are operational and where services are delivered, it is mostly limited to the transportation of goods.

c) Airports

The Overberg District Municipality has a number of airstrips. The largest is located at the Test Flight and Development Centre (TFTC) Airforce base between Bredasdorp and Waenhuiskrans in the Cape Agulhus municipal area as shown in Figure 0-14.

The Cape Agulhus municipal area also has a second private airstrip at Andrew's Field, between Bredasdorp and Struisbaai. There is also an airstrip at the Bontebok National Park in the Swellendam municipal area, which is used for the transportation of tourists. The Theewaterskloof municipal area, situated to the west of the Overstrand municipal area, also has an airstrip in Caledon.

The closest major commercial airport is at Cape Town International Airport. The TFTC Airfield is planned to be upgraded to provide domestic and international aeronautical transportation capacity for the development of the region's tourism and industrial sectors for the increased economic and social development growth through sustainable development.

d) Harbours

The Port of Cape Town is the closest harbour in the vicinity of the Bantamsklip site. The harbour is 250 km away from the site.

Figure 8-74: The location of the owner-controlled area with respect to the outer property boundary and the other farms in the Bantamsklip area

Figure 8-75: Transport networks at Bantamsklip

8.9 Socio-economic environment – Thyspunt

8.9.1 Economic environment

a) Overview of the economy

The Thyspunt site is located within the Kouga Local Municipality, which forms part of the Cacadu District Municipality in the Eastern Cape. A 20 km radius encompasses parts of Wards 1-6. According to the 2008-12 Integrated Development Plan (IDP). There is a population of approximately 28,000 in this area. Not included in this is Jeffreys Bay, which is reputed to be the fastest growing town in South Africa.

Provincially, the Eastern Cape recorded a growth rate of 5.2 % in 2006. This was marginally below the country's growth rate of 5.4 % for the year. The provincial GDP of R92 551 million in 2006 was the fourth largest in the country. The Eastern Cape has an estimated population of between 6.34-6.60 million. The province's main economic activities are finance and business services, general government services and manufacturing. Tourism is a very important sector, but is split between several of Statistics South Africa's broad industrial classifications. The Kouga economy is fairly diversified.

b) Agriculture

The area under the jurisdiction of the Agri Tsitsikamma East Agricultural Society covers parts of the Kouga and Tsitsikamma districts. It covers an area beyond the 20 km radius from the Thyspunt site. The main activity is dairying: the area around Humansdorp is the largest milk producer in South Africa. There are approximately 60 000 dairy cows producing a total of 820 000 litres per day valued at R900 million per annum. There are also approximately 5 000 head of beef cattle, and total beef production (from beef cattle and slaughtered calves) amounts to R37 million per annum. Dohne merino sheep produce wool valued at R1.2 million per annum and mutton at R5.5 million per annum. The area also produces 450 tons of wheat per annum. Using the 24 month average price of wheat, this translates into approximately R1 million per annum

c) Tourism

The tourism market around the Thyspunt site includes Oyster Bay and the St. Francis Bay area (comprising the village of St. Francis, Port St Francis and Cape St. Francis). The tourism asset is predominately centred in St. Francis village which contains the main beaches and a well-known canal area St Francis in fact was founded as a tourism destination. It has a strong eco-tourism brand with an emphasis on water sports, golf and hiking. According to the Tourism Impact report (**Appendix E22**), the tourist season is extremely short, being concentrated in a ten-day period in December-January and over the Easter week-end. Officials of the local municipality stated that the normal population of 4,000 rises to 30,000 over Christmas and New Year, and around 8 000 over Easter. There is no hotel, and accommodation is based on bed-and-breakfast establishments (B&Bs), guesthouses and house lets. The turnover of accommodation establishments was estimated at R77.7 million per annum.

Although Jeffreys Bay is beyond the 20 km radius of Thyspunt, there are strong negative perceptions in sections of the population there about the impact of a NPS. This was ascertained both during field interviews and through the comments in the interested and affected parties' response trail. Thus, Jeffreys Bay is dealt with briefly. Tourism dominates the economy of the town, and is heavily based on surfing. The normal population of 40,000 swells to 100,000 over Christmas and New Year and to 50 000 during the Billabong Pro International surfing competition over ten days in July. This is one of eleven world championship events,

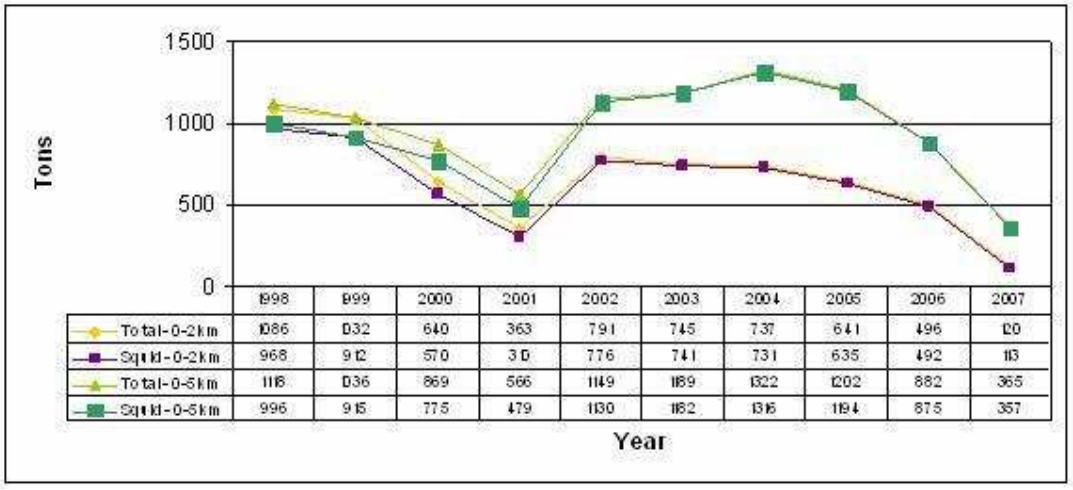
and is the most important surfing event in the country[6]. According to the Tourism Impact report (**Appendix E22**), the turnover of accommodation establishments in Jeffreys Bay amounts to R633 million per annum.

In normal years property prices have reflected the premium market that is the St Francis brand, but in 2008 prices were hit by the national economic downturn. A number of new premium housing estate developments have found it difficult to sell units, and one planned development has been abandoned. Prices over the last few years have ranged from R3-7 million for canal houses, up to R7 million for beachfront houses, and R1-3 million for non-waterfront houses in the village of St Francis.

d) Fishing

Fishing activities around St Francis Bay are part of an industry that exploits the area between Port Alfred and Plettenberg Bay, using the harbours at Port Elizabeth and Port St. Francis. The fleet consists of 136 vessels of which 36 are based at Port St. Francis and the balance at Port Elizabeth. The capital cost of a fully equipped vessel is between R2.5-6.0 million with an average cost of R3 million for boats in Port St. Francis.

Data for commercial fishing in the area between Seal Point and Slang River, of which Thyspunt is the midpoint, are shown in **Figure 8-76**.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total-0-2km	1086	832	640	363	791	745	737	641	496	120
Squid-0-2km	968	912	570	30	776	741	731	635	492	113
Total-0-5km	1118	836	869	566	1149	1189	1322	1202	882	365
Squid-0-5km	996	915	775	479	1130	1182	1316	1194	875	357

Figure 8-76: Commercial fishing, Seal Point-Slang River, 1998-2007 (Kg)

The industry does not have sufficient information on the effects of a NPS on marine life, but is concerned about possible impacts on pelagic (hake) and inshore (squid) catches. It does not believe there would be any effect on demersal (deep-sea) fishing. Its main concern relates to the demarcation of an exclusion zone at Thyspunt of an assumed similar size to that at Koeberg which is 3.2 km wide and extends 2 km into the ocean from the shore. Eskom has advised the authors, however, that the exclusion zone at Thyspunt and Bantamsklip will not exceed 1 km of coastline and 1 km out to sea. The closure of such an area off Thyspunt would have no more than a slight impact on pelagic fishing. Longline catches of hake have averaged 2 500 tons per annum in the Eastern Cape and 800 tons per annum for Port St. Francis-based vessels at an average price of €5.50/kg. During field interviews with the local fishing industry, it was found that two of the richest fishing grounds are in Thysbaai and Oyster Bay, and catching occurs between 500 metres and 4 - 5 km offshore.

The more significant impact would be on the chokka squid industry but even then it would be slight. The concentration of squid shifts according to month and weather conditions, and the

[6] Jeffreys Bay is widely recognised as South Africa's premier surfing spot with the world's longest right-hand wave break.

chokka squid catch fluctuates from year to year depending on sea temperature and wind conditions. Over the last 20 years the annual catch has ranged between 2 000 and 14 000 tons in the Eastern Cape with an average of 7 000 tons. The Port St. Francis-based companies average about 1,000 tons per annum. Squid is the most viable fishing industry in the area, almost the entire catch being exported to the EU at an average price of about €7/kg.

According to the information supplied by the South African Squid Management Industrial Association (SASMIA) (2007), between 1999-2005 an average of 33.2% of the total annual Eastern Cape catch originated in the area between 10 nautical miles (18.52 km) east and west of the proposed Thyspunt NPS site. Thus, an exclusion zone of 1 km width would account for roughly 1.8 % of the total catch. This would amount to about 127 tons per annum with an export value of €0.88 million per annum. Data from SASMIA show that in 2005 the Eastern Cape squid industry employed 2,300 fishing crew, 150 management staff and 1 500 factory staff. The industry generated approximately R400 million in foreign exchange per annum.

The fears of the local fishing industry appear to be groundless given an exclusion zone as small as 1 km^2, and this would be mitigated in toto if Eskom were to successfully apply for access to be granted to commercial fishing vessels (as it has indicated to the authors that it intends doing). Nevertheless, the fears expressed by the industry are described here for the record.

Port St. Francis has a small harbour that cannot accommodate the larger vessels, which catch an average of 250 tons each per annum. Entry is restricted to smaller vessels catching an average of 50 tons each per annum. Port Elizabeth, by contrast, can accommodate larger vessels. If the Thyspunt fishing grounds were to be closed off as part of the exclusion zone, the vessels based in Port St. Francis would have to venture further afield and therefore the companies would have to acquire larger vessels, which would not be able to enter Port St Francis. Thus, these companies would have to relocate their operations. However, vessels based in Port Elizabeth also fish off Thyspunt, and therefore any restrictions on access would also affect these vessels and not only those based in Port St. Francis.

Since fishing activities have significant linkages in terms of local employment and procurement of provisions, the effects for labour and supplies would be serious. The industry at Port St. Francis consists largely of small medium and micro enterprises which depend entirely on squid fishing and would not be able to divert their vessels so as to capture trawl and other (demersal or pelagic) revenue streams.

The largest company at Port St. Francis also operates a fish processing factory in Humansdorp. The capital cost of a fully equipped factory (including cold storage) is between R8 - 10 million. The Humansdorp factory salts, grades, packs and freezes fish. Hake is trucked to Johannesburg and air freighted to EU markets (mainly Spain and Portugal) while squid is exported by sea, mainly to Europe. The factory employs mainly women, the number varying between 20 - 140 at any one time depending on the work load.

The Port St. Francis boats are manned by local (St. Francis-Humansdorp-Jeffreys Bay) fishermen while Port Elizabeth's fishing companies also draw some of their crew from the St. Francis area. Altogether, an estimated 1 000 fishermen are from the local area. The number of men per boat ranges from 12 - 24 depending on the size of the vessels. All groceries for the Port St. Francis vessels are purchased locally as are fuel, engineering services, fishing tackle and some transport services. The impact of the fishing industry on the local economy can be seen in the closed season when employment falls, turnover of supplier's declines, spending power in the village falls and the incidence of housebreaking rises.

However, the industry is not universally popular in the area. It receives continuing criticism that the lights on the boats are so bright that they destroy the sense of place of the local inhabitants, especially those at Cape St. Francis and Oyster Bay.

Apart from the size of the exclusion zone, the other concern of the industry regarding a NPS at Thyspunt relates to perceptions in the foreign market with regard to fish caught in the vicinity of a nuclear facility. South African squid are regarded as the second best in the world behind

Morocco. The industry concedes that it has no clear idea of what the impact would be, but stresses that perceptions rule in the marketplace. Chokka squid is a high-value commodity and is very sensitive to market perceptions. The industry points out that the lobby in foreign markets for environmentally friendly and contaminant -free fish products is growing, and this lobby could exploit the close proximity of the Thyspunt fishing grounds to a nuclear site (especially with regard to the release of coolant water into the ocean). The international market is very competitive, and it would be easy for competitors to exploit the contamination issue no matter how remote the possibility of such an event might be. If this were to happen and the market were to be lost, the local fishing industry as well as the fish factories in Humansdorp would be affected and probably would be forced to close.

As with the exclusion zone, this fear of negative market perceptions appears to be mitigable. The production and distribution of scientific evidence should be sufficient to dispel such perceptions.

e) Retail and trading

The largest retail sector in a 20 km radius of the Thyspunt NPS is at Jeffreys Bay. This sector is growing, and two shopping malls opened in late 2008 expanding total retail space by 400 – 500 %. A major retail chain estimates the total turnover of the sector at R250 million per annum. The largest single enterprise in the town is the leisure apparel manufacturer and trader, Billabong, which employs 400 persons in its operations consisting of a factory print shop (finishing and embroidering imported surfing and leisure apparel) as well as wholesale and retail outlets. This enterprise estimates the total turnover in the Jeffreys Bay economy at a minimum of R500 million per annum.

The trading sector in Humansdorp consists largely of food and clothing retail stores but there is no shopping centre. A major retailer estimates the total annual turnover at R168 million.

In the St. Francis area (including Cape St. Francis and Oyster Bay), the total turnover is estimated at R70 million per annum. Turnover shows large seasonal variations in line with the seasonal variation in population size. The sector is dominated by food stores but there are some clothing and boutique outlets. A new shopping centre opened in July 2008.

f) Civil installations

Table 8-11 contains information on the various civil structures that are located in the area of the Thyspunt site. This information was collected from the Kouga Municipality's most recent Spatial Development Framework and IDP. It is possible that this does not fully account for all the civil structures but it was the only information that the municipality was able to provide.

Table 8-11: Civil structures within 30 km of the Thyspunt site

Structures	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Total
Library	1	0	0	0	2	1	4
Parks	1	3	6	2	2	2	16
Sports facilities	1	2	1	2	1	2	9
Recreational facilities	2	3	0	0	1	3	9
Cemeteries	0	1	2	1	1	4	9
Primary schools	5	3	0	-	5	-	13
Secondary schools	0	0	0	-	3	-	3
Police stations	-	1	0	-	1	-	2
Hospitals/clinics	1	2	0	-	4	-	7
Community centres	2	5	-	-	4	-	11
Day-care centres	1	-	-	-	-	-	1

8.9.2 Demographic statistics

Provincially, the Eastern Cape recorded a growth rate of 5,2% in 2006. This was marginally below the country's growth rate of 5,4% for the year. The Eastern Cape has an estimated population of between 6,34 and 6,60 million.

The total population of the Kouga Municipality was documented as 70 695 in 2001, compared to 62 542 in 1996. The CSIR, DBSA and National Department of Provincial and Local Government estimate the population growth for the Kouga Municipality on 2,4% per annum between 2000 and 2010. This indicates a rise in the population figures from 62 542 (1996) to 87 170 (2010).

Growth and development around coastal towns since 2005 was phenomenal and it is suggested that this figure is much higher than was indicated.

Jeffrey's Bay is now reputed to be the fastest-growing town in South Africa and the estimated total population in Kouga was 86 000 people in 2006. The current trend suggests a higher growth rate at 2,8%. Planning and infrastructure should take the projected population growth into account. It is anticipated that the growth will mostly take place in the urban centre.

The Municipality also deals with vast differences in population density from one area to the next, for example Ward 2 (1,2km^2) has a total population of 7 871 compared to Ward 1 (579,6km ^{2}), which has a population of 4 967. Kouga has the highest population density in the District at 24 persons per m^2.

The variations in density have an impact on the cost of service delivery (appropriate level of services) and puts pressure on existing infrastructure and housing delivery requirements. The migration patterns are placing additional pressure on areas which already have a high-density population, for example Ward 2.

8.9.3 Visual character

a) Topography

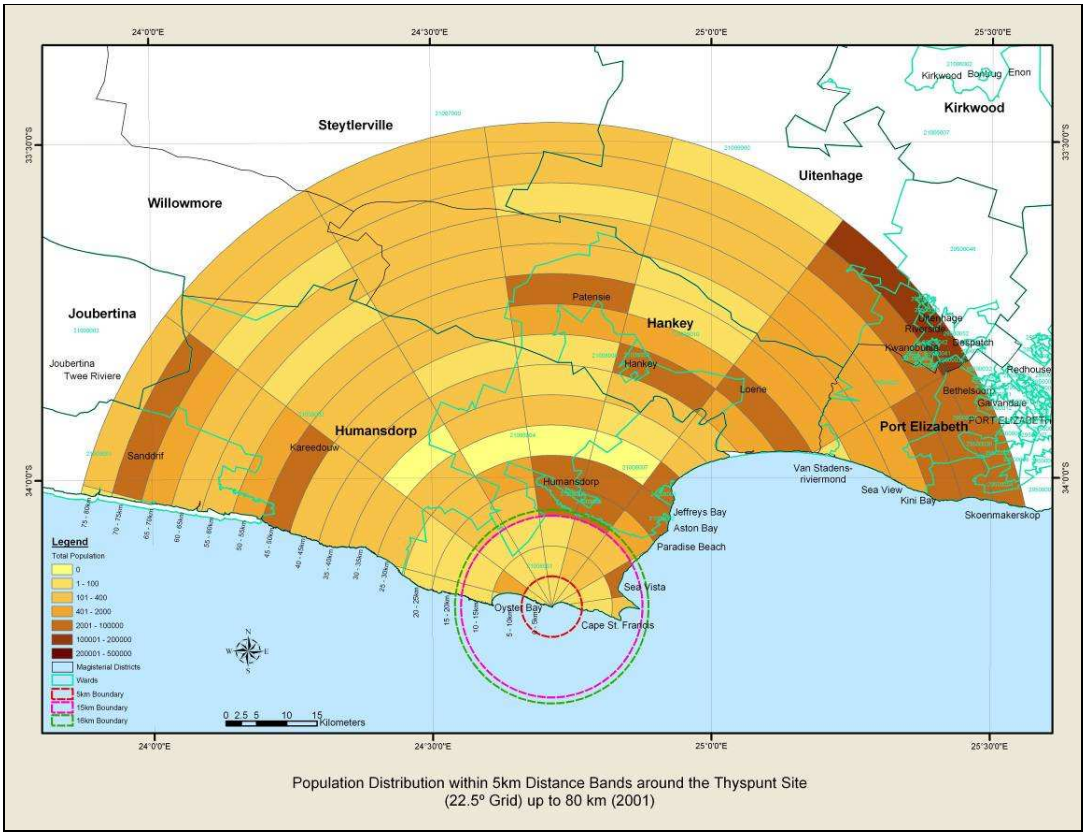
The site falls within the fynbos biome, and is dominated by South coast dune fynbos and Sand River primary dune community. The site has considerable habitat diversity in the form of a number of contrasting vegetation types, including subtropical forest thicket.

The dune field has been stabilised nearer to the coast by vegetation, both indigenous and exotic. The vegetation on the windward side of the dune is wind-pruned and dense. The vegetation in the "slack", the valley between the dunes, is also relatively dense, but taller than other more exposed vegetation due to these areas being sheltered from the wind.

b) Vegetation

The site falls within the fynbos biome, and is dominated by South coast dune fynbos and Sand River primary dune community. The site has considerable habitat diversity in the form of a number of contrasting vegetation types, including subtropical forest thicket.

The dune field has been stabilised nearer to the coast by vegetation, both indigenous and exotic. The vegetation on the windward side of the dune is wind-pruned and dense. The vegetation in the "slack", the valley between the dunes, is also relatively dense, but taller than other more exposed vegetation due to these areas being sheltered from the wind.



Population Distribution within 5km Distance Bands around the Thyspunt Site
(22.5° Grid) up to 80 km (2001)

Figure 8-77: Population Distribution within 5km distance radii of Thyspunt

c) Sense of place

The sense of place of the site and surroundings is predominantly related to the remoteness of the general location and the jagged and narrow solid rock shoreline, which rises relatively steeply to the sand covered rock terrace. This interface between land and sea is rugged and private, as access to the Eskom property is prohibited. Views landward are restricted by the series of parallel vegetated dunes.

The setting offers privacy with a wildness that touches all of the senses, because of its relative remoteness.

d) The character of the site and surroundings

The rocky and varied coastline of that location is backed by a vegetated dune field, which rises to approximately 110 m amsl. The area has an unspoilt natural character. The restricted visual access of the site reinforces the remote natural landscape character.

e) Surrounding land use

The land use between the coast and the ridgeline of inland vegetated dunes is primarily nature reserve.

The western edge of the reserve abuts the coastal village of Oyster Bay while the eastern edge borders land that is undeveloped and in private ownership.

This land has a number of private houses, mostly holiday homes which are built near the edge of the consolidated dunes and overlook the rocky sea shore. Refer to **Figure 8-78** and **Figure 8-79**.

It is noted that an application for a township has been lodged on the farm Ongegunde Vryheid east of the site and adjacent to the western town boundary of Cape St. Francis. This property is known as Rocky Coast Farm. The current proposal is for a cluster layout in the vicinity of existing houses. The balance of the area will be a nature reserve.

f) Landscape diversity

The diversity of the site and immediate surroundings is made up of the varied rocky coastline and small bays. The latter provide secluded havens in the natural and undisturbed land and sea interface. The dune field is uniformly green and rises in a series of parallel dunes, which give a uniform visual effect. Some holiday homes to the east of the site are visually prominent and out of context as they perch on the edge of the terrace and rocky shore (**Figure 8-78** and **Figure 8-79)**. There is limited vertical diversity in the topography and vegetation inland from the coast.

Figure 8-78: Typical house placement east of site

Figure 8-79: Holiday home on beach east of site

g) Climatic effects on visibility

The wet and misty weather in winter is brought onshore by the predominant westerly winds, which have an average wind speed during the months May to September of approximately 21.24 km per hour.

Onshore wind at the sea surface is mostly experienced through October to March, during which time there is increased vertical motion in the waves.

The generally clear summer weather is driven by the predominant easterly winds, which also have an average wind speed of 45 km per hour.

8.9.4 Heritage resources and archaeology

Thyspunt is a coastal site situated on the south coast of the Eastern Cape between the holiday towns of Cape St. Francis and Oyster Bay. Like Bantamsklip, the area is rural in character. Economic activities in the immediate area are mainly dairy farming; however there is a fishery at Cape St. Francis. Oyster Bay is a small upmarket holiday/retirement community. Infrastructure in the town is limited and the population is highly seasonal. Cape St. Francis is a developed upmarket community which supports a relatively small permanent population of mostly retired persons. During the summer holiday season the population increases dramatically – the area is well set up for tourism being replete with hotels, restaurants and B&B facilities. Outdoor activities are clearly important as themed adventures, diving and surfing, big game fishing and golfing facilities are available. The area is cherished for its scenic beauty – dramatic dunes and beachscapes, natural heritage and mild climate. Accelerated property development activities have had a devastating impact on the functioning of the large headland-bypass dune system which is a significant natural feature of the area. The interruption of the natural feeding and flow of aeoloian sands has resulted in vegetation changes and the cessation of sand deposition at St. Francis Bay Beach, which is now severly eroded. Eskom's land holding in the area has in part put a brake on seemingly un-controlled westwards expanding property development.

The Thyspunt study area, which is a natural heritage site, includes a number of landforms which have played a role in the distribution and quantity of heritage sites. The most inland portion (a

long panhandle of land) consists of cultivated meadows which have been leased out for dairy farming. Between the agricultural lands and the coast is an extensive dune field, a very large stretch (15 km) of which is active shifting sand. Towards the coast the dunes are stable and vegetated with a mixture of dense coastal thicket and coastal Fynbos. Wetlands are found in many of the dune bays, while amongst the active dunes pools of fresh water accumulate on ancient land surfaces exposed in the deeper blowouts. The vegetated dune peaks reach a maximum height of 10 m amsl – the gradient towards the shoreline consisting of a series of substantial parallel undulations. The coastline is characterised by mostly an active rocky shoreline apart from a stretch of beach at Thysbaai. Springs flow into the sea at the interface of the dune complex and bedrock – freshwater pools and wetlands along the shoreline are numerous. The immediate shoreline vegetation is lush and often swampy under foot. There are two small sheltered bays (at White Point and Tony's Bay). Tony's Bay contains an extensive stone fish trap complex. Wild life noted in the study area includes small and medium bovids, bush pigs, small carnivores, numerous avian species. Like Bantamsklip the shoreline would have provided prehistoric communities with ample marine resources.

The human made environment at Thysbaai is limited to the existing Eskom Workshop, conservation office and accommodation facility and several small cottages (shacks). Eskom has "inherited" various informal arrangements set up by previous landowners of the property. The cottages are used by various families for holidays and fishing trips. Notable among these is the St Andrews shack which is used by the school (St Andrews, Grahamstown) for outdoor education, recreation and may be hired by persons associated with the school. The "shack" apparently is a source of cherished memories for generations of past pupils and teachers since the 1960's (**Appendix 4 of the Heritage Impact Assessment**). Access to the cottages is via a sandy track (suitable for vehicles with off-road capability) from Oyster Bay although access can also be gained from the Cape St. Francis side of the property. The only other built environment within the study area are various small "dams" at spring eyes close to the shore from which residents collect fresh water, various storage tanks and a single abandoned 19th century house on the edge of the agricultural land in the inland portion.

The Thyspunt site has been subject to previous heritage related studies, in particular by Dr Johan Binneman of Albany Museum, Grahamstown. He has published several papers and completed a PhD dissertation on the archaeology of the area. In addition, stakeholders in this area include a local Khoikhoi group (Gamkwa community) who are particularly concerned about the future of their heritage.

a) Regional heritage context

A deeds survey has revealed that farms were first granted in this area by the British colonial government in the 1820's, while it would appear that large tracks have remained "Crown" or government land until recently.

Virtually no published information is available with respect to the colonial period history of Oyster Bay and Cape St. Francis; however it is known that the Kromme River was historically navigable for light steamers and small sailing craft. The history of the place relates to its beginnings as a small informal port. During the 19th century the coastal shipping trade played an important economic role as it was the only way available way to move large quantities of goods at relatively high speed. The 19th century light house at Seal Point, Cape St. Francis is the only proclaimed heritage site in the immediate area. A search of web-based material has revealed that Leighton Hulett and members of the Hulett family were the first people to develop the area when they established a holiday home in what was a wilderness area in 1954. According to La Cock and Burkinshaw the area was largely undeveloped in 1960, apart from a few holiday cottages. In 1967 the first canals were excavated and by 1970 there were about 161 holiday houses in the area. Hence most of the built environment is of very recent construction.

Unfortunately the lack of published information, or systematic built heritage surveys in the Eastern Cape has somewhat restricted the regional historical synopsis presented in this report. The regional pre-colonial heritage however has been studied in some detail and is very well published.

b) Palaeontology

Unlike Duynefontein the Palaeontological significance has never been formally appraised until a study was commissioned to evaluate its potential. This is commented on in the findings of the heritage survey as discussed later in this section.

c) Pre-colonial heritage

The south coast was one of the first areas recognised by professional archaeologists as being important for the study of South African prehistory. South coast sites and places have lent their names to many stone tool industries, including the Mossel Bay Industry from the Cape St Blaize site and the Robberg from Nelson Bay Cave. Already, Goodwin is prompted to state, "The southern Cape, from Port Elizabeth to Swellendam, is by far the most important archaeological area in Southern Africa…This is the southern wall of the continent, against which culture after culture has made its last stand before inevitably disappearing under the next wave of peoples." He continues "Here South Africa has evidence of value to the world of prehistory and it is essential that it should be protected so far as it is humanly possible.". Regrettably, this has not been the case.

Recent studies have fulfilled Goodwin's assertion about the heritage significance of the Southern Cape. The Southern and Eastern Cape Coast has seen human occupation since the Early Stone Age. It has been suggested that the human presence in the Southern Cape dates back as long as 700 000 years ago. Sites such as Blombos at Still Bay, Klasies River Mouth near Humansdorp (west of the study area) which have been rigorously scientifically excavated and studied have revealed the earliest evidence known to human-kind about the behaviour of early modern humans and the evolution of abstract thought or symbolic behaviour. Sites that have the potential to provide this kind of evidence are limited to a mere handful in the old world, and as such have extraordinary value.

The archaeological site "Klasies River Mouth" is perhaps the most significant archaeological site close the study area. It was first reported to archaeologists at the South African Museum in 1955. The massive sequence of deposits contained within this coastal cave has been subject to study by local and international teams of archaeologists since the 1960's. Excavations were conducted in the 1960s by Singer and Wymer who described four phases of Middle Stone Age occupation, including a Howiesons Poort level between phases II and III and two Later Stone Age phases.

Smaller but more thorough excavations have since been undertaken by Hillary Deacon during the 1970's and 1980's. These revealed more detail about the dating of the site and the palaeoenvironmental conditions. Both excavations yielded fragmentary human remains associated with MSA deposits. These fragments, dated to around 90 000 years ago with some as old as 120 000 years, probably don't reflect intentional burials and it has even been suggested that they were the result of cannibalism. The human specimens would appear to be morphologically modern and aspects of modern behaviour and cognition are attested to by Deacon and his post-graduate students. The early humans created middens in selected areas for waste disposal. Deacon (1995) suggests that cannibalism is always associated with symbolic behaviour. If cannibalism is evidenced by the fragmentary nature of the KRM remains, they therefore may indicate modern cognitive abilities. The Howiesons Poort levels have been argued to show modern thought too: the choice of artefact type and material – which was imported from as far as 20 km away – is thought to be stylistic. However, no evidence for fishing and an apparent reliance on docile, young or aged prey animals that were fairly easy to hunt would indicate that food procurement strategies were not fully developed, indicating that fully modern levels of technological sophistication had still not been reached. Klasies River Mouth is thus one of a small suite of internationally significant archaeological sites (limited to southern Africa) that are pivotal to our understanding of the emergence of modern human behaviour.

At Thyspunt and Cape St. Francis a number of studies have been completed on the numerous later Stone Age sites and shell middens of the Holocene period.

Feast excavated a burial from dunes in the Cape St. Francis area some 150 m from the shore. The burial was accompanied by a shell necklace and a grindstone was placed above his/her cranium. Near the cranium, too, were several pieces of ochre and some stone flakes and chips. The burial has been dated to the mid-Holocene, approximately 5 000 years ago.

Further excavations at Cape St. Francis revealed a human buried with a dog. The dog bones have been dated to 1150 years ago. As dogs may have accompanied herders, these finds suggest the presence of Khoekhoen pastoralists in this area.

Cairns excavated several circular stone platforms in this area as well as a human burial. The stone platforms are most likely to be hearths, possibly used to cook shellfish meat. These platforms have been identified at a number of other sites along the south coast at Slang River, Noetzie and Pearly Beach.

Deflation horizons at Oyster Bay, west of Cape St. Francis have yielded the first known occurrence of an open-air Howiesons Poort assemblage. These stone artefacts have been proven to be contemporaneous with hyena coprolites from the same horizons, allowing for palynological examinations of the environmental conditions during the early Last Glacial. The studies showed that the landscape during the Last Glacial period accommodated complex patchworks of vegetation and was generally cooler with the climate closer to inland conditions.

Johan Binneman of Albany Museum, Grahamstown, has conducted by far the most detailed archaeological work in the area. He has completed surveys of the Cape St. Francis Dunefield, visited and sampled sites at Thyspunt on a number of occasions since the early 1980's as well as completed a preliminary survey commissioned by Eskom.

Binneman has identified a suite of sites in the area that contain artefactual material characteristic of the full range of archaeological sites that are known to have occurred over the last 7 000 - 10 000 years. In addition his studies revealed the presence of a never before described artefact tradition (the Kabeljous industry) which occurred in this area during the mid-late Holocene.

Within the study area he described microlith rich sites characteristic of the mid-Holocene (5 000 - 6 000 years ago), the late Holocene, as well as ceramic rich sites which may be attributed to the Khoekhoen herders of the last 2 000 years. Significantly Binneman also identified numerous ESA and MSA artefacts including Howiesons Poort scatters on paleosoles exposed in the Thyspunt Dune Field. Some of these are associated with fossil hyena droppings (coprolites) as well as fossilised bones of extinct mammals such as the Giant Buffalo (*Pelorovis antiquus*).

In his PhD dissertation Binneman remarked on the extraordinary variety and richness of the suite of archaeological sites in the area. He comments that most of the sites lie within 300 m of the coast. Nilssen. who recently did mitigation work at the St. Francis Links Golf Estate located numerous shell middens several kilometres from the ocean. Many of these were buried or obscured by sand and vegetation – a factor that must be considered in the evaluation of heritage significance in this study.

d) Colonial period heritage

Like other parts of the South Coast during the Later Stone Age, the introduction of pastoralism roughly 2 000 years ago was a significant event that broke the ancient tradition of hunting and gathering that had been the method of human subsistence for thousands of years. Before colonisation of the Eastern Cape by the British in the early 19th century, Khoekhoen herders formed powerful transhumant communities (herding cattle and sheep) throughout the coastal plain and from time to time into the Great Karoo. They enjoyed dominance as far as the Great Fish River where they shared a loose border with farming communities to the East. European farmers (Trekboere) were the vanguard of formal colonisation and accelerated granting of land by the British Colonial Government. Land which was viewed as a shared resource by the Khoekhoen was no longer available to them.

Research conducted as part for this study has shown that the area known as Thyspunt was made up of farm Thyspunt (Farm 744) and the Farm 741 both in the Humansdorp District. Farm 741 has always been unregistered state land and as such there is no title deed for it.

Farm 744 on the other hand is made up of portions of the farms Welgeleë, Buffels Bosch and Langefontein. All three farms were originally granted in 1816 or 1817, in other words, early in British colonial rule. The farms have been extensively subdivided but ownership of the portions largely remained within the same group of families.

Farm Welgeleë (Farm 743) comprises Lot A of farm Welgelegen (Farm 735) and Portion C, Portion 15 and remainder of Portion D of the farm Buffels Bosch. The farm Welgelegen was first granted in 1817 in perpetual quitrent to Hendrik van de Watt; portion A was divided of in 1886 when H.J. Potgieter and 4 others sold it to Hendrik Frederick Peter Sinn. The original title deed diagram indicated one fresh water spring, no built structures and described the land partly as grazing land, partly as sand and thicket.

Farm Buffels Bosch was initially granted on quitrent in 1816 to Wessel Hendrik Moolman. It was regranted in 1890 under the Act "The Land Beacons Amendment and Extensions Act" (Act No. 9 of 1879) to Herman Jacobus Potgieter and 15 others who all held shares in the farm. The oldest title deed diagram only shows the swamp and two roads but no structures or springs. The diagram of 1886 shows a network of new roads, at the convergence of which four buildings are indicated next to two springs, furthermore three dams were present and the swamp (probably the water bodies to the north of the dune field) is also still indicated. Portions 3 and 4 were divided of the original farm in 1891. Portion 9 was divided off Portion 4 in 1957.

Farm Langefontein (Farm 736) was only named as such when it became part of the Humansdorp District. It was originally Erf 467 in Oesterbaai. It was granted in quitrent in 1817 to Hendrik van der Watt. Portion 1 was divided of in 1963 when Tzitzikama Estate (Pty) Ltd sold it to Anthony Auret. The Surveyor General diagrams show the run-off of a spring to the ocean across the farm and a road along the coastline from the one end of the farm to the other.

Hence the colonial period heritage of the site is unremarkable and no doubt typical of a great many others in the area. The existing farm buildings at Welgelegen (apparently all fairly modern) probably relate to the site of the early 19th century structures indicated on diagrams. A single small historic cottage on the inland portion of the study area was probably a *Bywoners* cottage

e) Findings of the heritage survey - Thyspunt

Palaeontology

The palaeontological potential of Thyspunt is in many ways similar to Bantamsklip in terms of geological context. However the dune field complex at Thyspunt is large and deep, which means that there is a very high potential for Pleistocene palaeontology and archaeology to exist below the dune bodies.

The proposed nuclear corridor at Thyspunt is situated on top of a low-lying coastal platform that has been carved by wave action into resistant, quartzite-dominated sediments of the Nardouw Subgroup (upper Table Mountain Group / TMG). The TMG platform surface mostly lies between 4 to 8 m amsl, rising to a maximum of 10 m amsl, and is mantled with a thin veneer of late Caenozoic coastal sediments of the Algoa Group. Various formations within the Algoa group are potentially moderately fossiliferous.

Of greater concern is the more recent Pleistocene palaeontology and archaeology that is exposed from time to time in the active dune system. Fossil remains within the active dune system have been reported. Fossil bone found lying on palaeosoles associated with hyena coprolites and suggests that hyena activity during the Pleistocene may have been responsible. Also identified were extinct mammal species (*Pelorovis antiquus* – giant buffalo) that suggests that the fossil material dates to within the Pleistocene. Binneman (pers. comm.) commented on the high frequency of Middle Stone Age material within the deflated areas in the dunes, some of which he considered to be relatively undisturbed. Since Binneman had made most of his observations in the 1980's the vegetation has encroached (based on aerial photographs)

over areas where he had made many of his observations. Today these areas are impenetrable, however the significance of Binneman's findings must be considered in the overall impacts that will result from the proposed activity.

Pre-colonial Archaeology

Taking into account the earlier findings by Binneman (1996, 2001) and the findings of the Heritage Survey, the pre-colonial heritage in the study area is extraordinarily prolific. Bearing in mind that dense vegetation growth only allowed for searching of the sandy tracks, coastal strip and active dune areas, archaeological material was found almost everywhere where ground surface visibility allowed. It stands to reason that the total number of archaeological sites that exists on the affected properties is perhaps ten times more that the 145 occurrences that were found during the course of this study. Shifting dunes and oscillating vegetations patterns have obscured many sites that were identified years ago.

Despite the restrictions experienced during the Heritage Impact Assessment, information about the distribution of archaeological sites may be deduced. The area within 300 m of the rocky shoreline was densely occupied, and probably contains more than half the sites in the entire study area. The shoreline offered pre-colonial people abundant resources. There are sheltered bays and pools where shellfish could be easily collected as well as ample opportunity for fishing. Numerous fresh water springs along the shoreline would have made this locality a veritable paradise for pre-colonial people. It is quite likely that there is a drop off in the frequency of pre-colonial sites adjacent to the the beach at Thysbaai as beaches were not nearly as attractive to pre-colonial people as resource rich rocky shorelines. A recent survey of land adjacent to Thysbaai beach, although very restricted by dense vegetation growth indicated a drop off in the frequency of archaeological site in this area opening up a possible less sensitive option within the proposed nuclear corridor.

Middle Stone Age material was noted broadly scattered on almost all exposed palaeosoles within the active dune system. While much of the material was dispersed, at least one site – an artefact manufacturing area - appeared to have well preserved spatial patterning. Fragments of bone are numerous, however much of this is recent and out of context. Due to shifting vegetation patterns and dune movement the Middle Stone Age *Howiesons Poort* material was not relocated. The evidence collected by ourselves and other authors suggests that the ancient Pleistocene land surfaces that evidently lie preserved under the dune system are highly sensitive. Due to the dynamic state of the dunes, surveys should ideally be repeated over a number of years before a comprehensive picture can be determined.

Late Stone Age shell middens are numerous within 300 - 400 m of the coastline and in the active dunes, with the highest concentrations being situated on the shoreline close to shallow bays in rocky shores and spring eyes. During the study some 145 occurrences were observed. This number is only an indicator of density as much material is likely to be buried within dune bodies or obscured by thick coastal Fynbos. Along the shoreline itself, the material is so profuse that the sites form an almost continuous ribbon of material (**Figure 8-80**). Notable is the fact that many middens take on the form of large vegetated mounds, which can be seen from a distance due to the fact that specific kinds of coastal vegetation grow on them. The majority of the middens are very well preserved as access to the coast is restricted and only attainable by off-road vehicle.

Middens are characterised by an eclectic mix of shell species. While at Bantamsklip *Haliotis midae* (perlemoen) would seem to have formed the meat bulk of resources, this was not the case at Thyspunt. Very few *Haliotis spp.* shells were seen at all. The staple appears to have been *Turbo sarmaticus* (Alikreukel) which was noted on virtually all sites together with a diversity of limpets *Scutellastra longcosta*, *Cymbula oculus* as well as high numbers of *Scutellastra. cochlear. Perna perna* (brown mussel) was also noted on most sites. Of particular interest was the presence of *Oyxstele tigrina* dominated middens which are interpreted by Binneman (1996) as being attributable to quick expedient coastal forays that were the style of subsistence during the pastoralist period. While this shellfish is commonly available in the Western Cape it is very seldom present on middens in large quantities – this points to some form of cultural preference at Thyspunt.

On all the sites recorded the artefactual assemblage was relatively informal being dominated by quartzite chunks and flakes, flat boulders used as grinding surfaces. Exotic raw materials such as silcretes and fine grained quartzites are also present, however formal artefacts quantities are low. Binneman (1996) has reported recording microlith dominant assemblages on sites within the dune system but not on the immediate coast. Fragments of Cape Coastal Pottery (**Figure 8-80**) are common – much more so than at Bantamsklip. Also noted in at least one instance was the presence of large backed artefacts that fit the description of the Kabeljous Industry first described by Binneman.

Late Stone Age middens were also recorded in the active dune fields between 700 m and 2 km inland. Although these sites are quite far from the shoreline, they are surprisingly numerous. They are generally discreet, well preserved and exhibit good within-site spatial patterning including hearths and stone platforms in some instances (**Figure 8-80**). Pottery of the Cape Coastal variety is common, some of it elaborately decorated. Bone is in evidence throughout the dune field, although not all of it is archaeological. The dune field sites are remarkably intact considering the dynamic environment in which they exist. Judging by the range of artefacts on them, they have not been picked over by tourists and souvenir hunters. If access control was not in place and the dunes easier to access, the sites would be in far poorer condition.

The colonial period heritage of the study area is limited. An abandoned farm house (**Figure 8-81**) situated on farm 735 portion 2 is the only structure on the entire property which could be securely identified as being greater than 60 years of age and thus protected by the general protections of the NHRA. The house dates to the 19th to early 20th century. Joinery and wood work is in place but deteriorating through abandonment. It is possible that this cottage is one of the earlier Welgelegen farm buildings. Its demolition may be necessitated by the construction of the HV Yard.

A well preserved complex of historical fish traps (**Figure 8-81**) is situated in the shallow bay below the St Andrews cottage. Long thought to have been built by pre-colonial pastoralists, new research (Hine 2007) indicates that they were either built or inherited by colonists who used them to provide a cheap source of protein for themselves and their staff.

The St. Andrews Shack (**Appendix 4 of the Heritage Impact Assessment**) is associated with a long tradition of use by this famous Eastern Cape School (**Figure 8-81**). It is a place cherished by many people and has been integral to their education. There are distinct traditions associated with the shack such as the maintenance of the diary by all visitors. The St. Andrews Shack is a place of tradition and may therefore be conservable and gradable as "living heritage" as defined in the NHRA. Demolition of this structure is not supported.

According to the National Shipwreck Register (SAHRA) three ships were wrecked in Thysbaai during the 19th century. These are likely to have been driven up onto the rocks or beach.

The cultural landscape qualities of the study area refer mainly to its natural heritage and high biodiversity. A rare aspect of the area is the active dune field – a headland bypass system almost 15 km in length, which together with the wide range of archaeological and palaeontological resources on it, place it among a few surviving landforms of this kind and size around the country.

8.9.5 Agricultural practices

The Agricultural Impact Assessment reports that there is currently no agricultural production on the proposed site (EIA envelope) but given the land use on surrounding farms, there is the potential for agricultural development. This would mainly be the allocations of planted pastures for dairy production. Soil samples from within the EIA envelope were taken, and are being analysed at Cedara for the sake of completeness, but no significant outcome that would affect the analysis is anticipated.

There is no agricultural production within the 800 m emergency zone. The 3km emergency zone borders onto a dairy farm on the northern side of the proposed site but will have no impact on agricultural activities.

With regard to the new proposed access roads to the site, the proposed northern access road will pass through cultivated pasture land used for dairy production. The exact extent of the amount of pasture land taken out of production as a result of the road will depend on the final route of the road. This area is considered to be a prime dairy production area, and the estimated value of pasture land is in the region of R 20 000 – 25 000 per hectare. It should also be noted that dust from the northern access road will have a negative impact on surrounding pastures, i.e., dust settling on the leaves and reducing photosynthesis of the pasture. The proposed western and eastern access roads will have no significant impact on agricultural production.

The land use within a 20 km radius of the Nuclear-1 site is dominated by commercial dairy farming as indicated in **Figure 8-84**. About 65 % of the entire body of land within the radius is used for commercial agriculture. Strandveld (thicket) is found along the coastline together with a larger portion of bare sand in the form of dunes (the Sand River). The residential areas are Humansdorp, St. Francis, Cape St. Francis and Oyster Bay. Humansdorp is the most populated residential area as the other areas consist predominantly of holiday homes, occupied only seasonally. There is a large area of degraded land which is indicated in **Figure 8-84**. The causes of degradation appear to be wind erosion and perhaps overgrazing in the past. The rest of the area is reasonably well vegetated and no significant degradation was evident. A conservation area runs along the southern part, and other portions of the Sand River dune area are in the process of being registered as a conservancy. There is a borrow pit in this area that was used for road construction and ongoing maintenance work. The only sand mine in the area is next to Cape St. Francis which has also been used for local road-building work. The Krom River catchment is within the 20km radius, and supplies most of the local area's fresh water.

Some of the land close to the shoreline is residential, specifically in Oyster Bay, which is situated about 5 km from the proposed Nuclear-1 site. There are holiday residential houses along the Krom River, most of which are unoccupied out of peak holiday season.

Existing agro-industrial developments are the Woodlands Dairy in Humansdorp (which markets its products nationally) and large silos situated near Humansdorp. These silos are used for storing wheat but, due to the changing regional trend from wheat to dairy, are not being fully utilised.

Further afield within a 30km radius (**Figure 8-84**), other features to note include scattered natural forest outcrops and the Kob River, which is a tourist attraction in-season for recreational camping and fishing activities close to Jeffreys Bay.

(Above) Coastal midden at White point, Thyspunt

(Above right) Decorated ceramic from a Dune Field site, Thyspunt

(Right) Stone feature on dune midden at Thyspunt

(Below) A large shell midden at Thyspunt vegetated with low shrubs and grasses. Coastal middens are often distinguishable by the low vegetation cover.

Figure 8-80: Middens and decorated ceramics at Thyspunt

(Above) Tidal fish traps at Tony's Bay, Thyspunt

(Left) The St. Andrews cottage shack built from old packing cases has been used as a "getaway" by persons associated with the school.

(Below left) This cottage close to Welgelegen is the only generally protected building in the study area

(Bottom left) Lath and beam ceiling in the abandoned cottage remain intact.

(Bottom right) Victorian window frame at the abandoned cottage.

Figure 8-81: Tidal fish traps and built structures at Thyspunt

Figure 8-82: Borrow pit area

Figure 8-83: Woodlands dairy

a) Current agricultural production in the surrounding area

The Thyspunt area is dominated by dairy farming. Within the 16km radius there is only one other farm type which is a large property (over 2,000 ha in extent) carrying a flock of 6 500 sheep. The farms supply milk to dairies such as Woodlands, Parmalat, Nestle and Clover Dairies. Woodlands Dairy and Clover Dairies together produce an average of 700 000 litres of milk a day to sell, and make dairy products such as cheese, butter and yoghurt.

The dairy farms consist mainly of cultivated pastures and maize production (mostly for silage) for dairy cows. Much of the natural vegetation in the area is shrub land with the occasional outcrop of alien bushveld. Many of the farms produce their own silage for their own use or to sell to other local farmers. Some land is used for wheat production.

A summary of the information collected from each farm is given in the Appendix 1 of the Agricultural Impact Assessment.

The farming practices for Thyspunt site is summarised in **Table 8-12**.

Table 8-12: Farming practices (number of farms)

Farming practice	Thyspunt
LIVESTOCK	
Dairy	16
Beef	0
Sheep	1
Pigs	0
Poultry	0
Game	1
CROPS	
Vines	0
Wheat	0
Fynbos	0
Vegetables	0
Other agric	3
Total properties	26

From the data in this table it is clear that the Thyspunt area is predominately a milk-producing area with dairy production on 16 of the 26 properties.

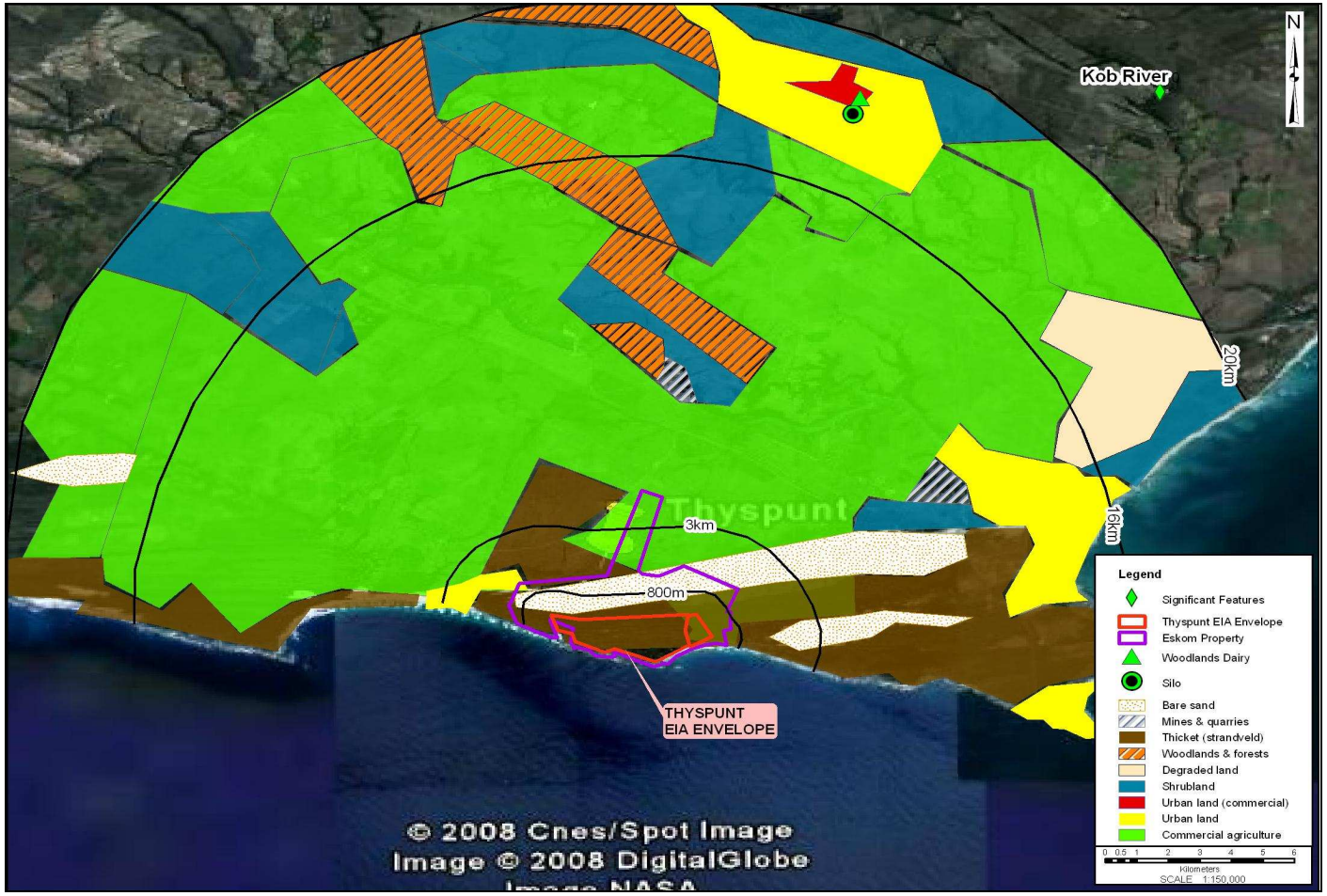


Figure 8-84: Land use map - Thyspunt

Figure 8-85: Extensive silage production on most farms

Figure 8-86: Silage bales

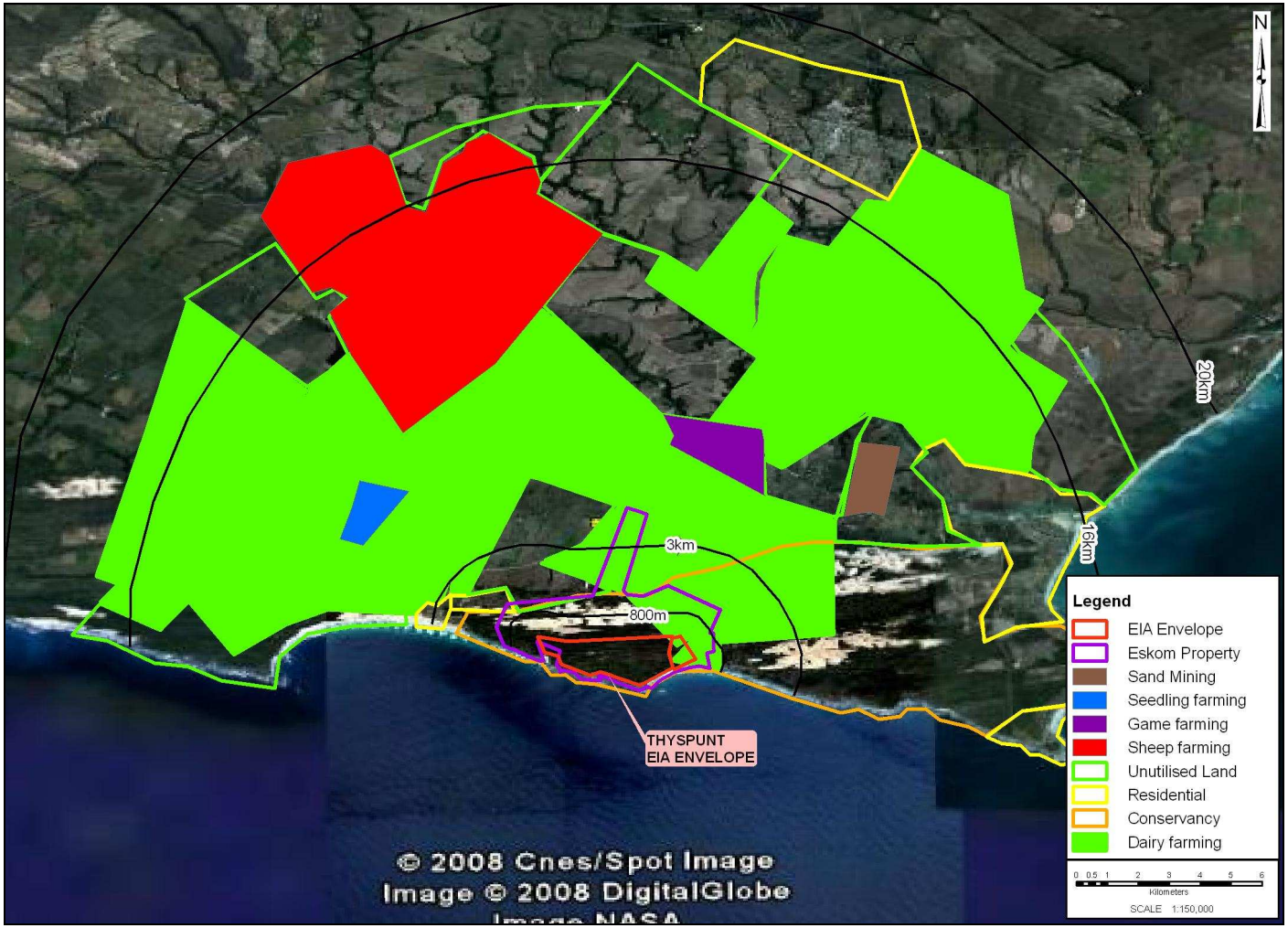


Figure 8-87: Types of farming - Thyspunt

8.9.6 Tourism industry

Thyspunt falls under the Cacadu District Municipality. The Integrated Development Plan (IDP) (Cacadu 2007) states that tourism is becoming an increasingly important economic activity for the area and is earmarked as a key element in local economic development strategies. The municipality has identified a number of natural, historical and cultural features that could be further exploited to attract local, domestic and international tourists to the area, and is currently drafting a tourism development master plan and arranging funding to promote local tourist initiatives and construct an effective communication and marketing system. The tourism market around the Thyspunt site includes Oyster Bay, St. Francis Bay, Cape St. Francis, Port St. Francis and Humansdorp. **Figure 8-88** illustrates the spatial context of the site.

Although Jeffreys Bay falls outside the immediate sphere of direct influence of a proposed Nuclear-1 at Thyspunt, it is discussed briefly here because of its position in the surfing industry. Jeffreys Bay is widely recognised as South Africa's premier surfing spot with the world's longest right-hand wave break. Aside from the strong sports-tourism market it represents, the surfing community has a very pronounced environmental consciousness. It has made considerable efforts to voice its objections to the proposed nuclear power station in the form of international surfing-media publications, while a formal petition indicating boycotts and sponsorship withdrawal has been signed by most of the local surfing market and a number of the top international merchandise brands connected with the sport and their top sponsored performers. To indicate the value of this surfing-tourism market, **Table 8-13** shows the approximate income generated from the ten days of the Billabong Pro, a top event on the international surfing calendar.

Table 8-13: Approximate visitor expenditure during the billabong pro

Average number of visitors per day	5,000
Approximate average daily visitor expenditure	R 500
Duration (days)	10
Approximate value of visitor spending	R 25,000,000

The total turnover in the Jeffreys Bay economy is estimated by local business at about R500 million per annum of which 80 % is related to surfing. Despite current negative perceptions and a threatened boycott on the part of the International Association of Surfing Professionals, it appears from other specialist studies that the fears of the Jeffreys Bay and international surfing communities are groundless, and that the continuing attraction of the unique wave conditions will offset any long-term impact. Jeffreys Bay is not vital to this study, and this area, therefore, has not been factored into our quantitative analysis as the release of scientific findings should influence the surfing associations to withdraw their threats of boycotts.

The tourism asset within the radius is predominantly centred in St Francis. Indeed, the area was founded as a tourism destination. It has a strong eco-tourism brand with emphasis on water sports (including surfing, sailing and fishing) and other outdoor activities such as golf and hiking.

In discussing tourism it is necessary to make assessments of a marine and visual nature due to the inherent coastal setting of the relevant tourism product – visual aesthetics and marine resources are two of the defining characteristics. Thus, the reports of the Marine and Visual specialists were consulted in order to correlate pertinent conclusions.

The Marine Environmental Specialist Report identified no particular marine species endemic to the south coast, nor were any rare or endangered species or species of biological significance found. However, the importance of shore- and skiboat-based recreational angling was emphasised.

The Visual Impact Assessment describes the sense of place of the Thyspunt site and its surroundings as predominantly related to the remoteness of the general location. The area promotes a strong "green" community of quiet and remote exclusivity, emphasised by luxurious coastal living in a relatively unspoilt natural location. A well-developed tourism infrastructure exists with a broad range of services and facilities. Three large hotels are planned and two further sectional-title holiday residential developments are under construction.

The tourist season at St Francis is extremely short, being concentrated into a ten-day period in December-January and over the Easter week-end. The normal population of 4 000 rises to 30 000 over Christmas and New Year and perhaps to 8 000 over Easter. There is no hotel, but B&Bs and guest houses offer 1,200 beds while there are approximately 300 houses which are let during the peak seasons. Average annual occupancy rates are estimated at 40 % for B&Bs and 5 % for house lets.

Humansdorp has no real tourism industry with minimal facilities and services. It acts predominately as a transition node for tourists en route to St Francis or Jeffreys Bay. The only tourist activity is extremely seasonal and revolves around an overflow from St Francis and Jeffreys Bay during the Christmas and Billabong Pro peaks.

The size of the tourism industry in the Thyspunt area is quantified in **Table 8-14** on the basis of information obtained in the field.

Table 8-14: Quantitative representation of tourism industry in the thyspunt area

Accommodation beds	1,200
Average rate per night	R 350
Average annual occupancy (days)	146
Sub-sector turnover p.a.	R 61,320,000

House lets	300
Average cost per day	R 3,000
Average annual occupancy (days)	18.25
Sub-sector turnover p.a.	R 16,425,000

Total turnover p.a.	**R 77,745,000**

It will be noted that the average price of house lets is highest in Thyspunt. This is explained by the up-market, prestige nature of tourism in this area compared to Bantamsklip. In the areas surrounding Duynefontein there is a large stock of various kinds of accommodation leading to relatively low rates for house lets.

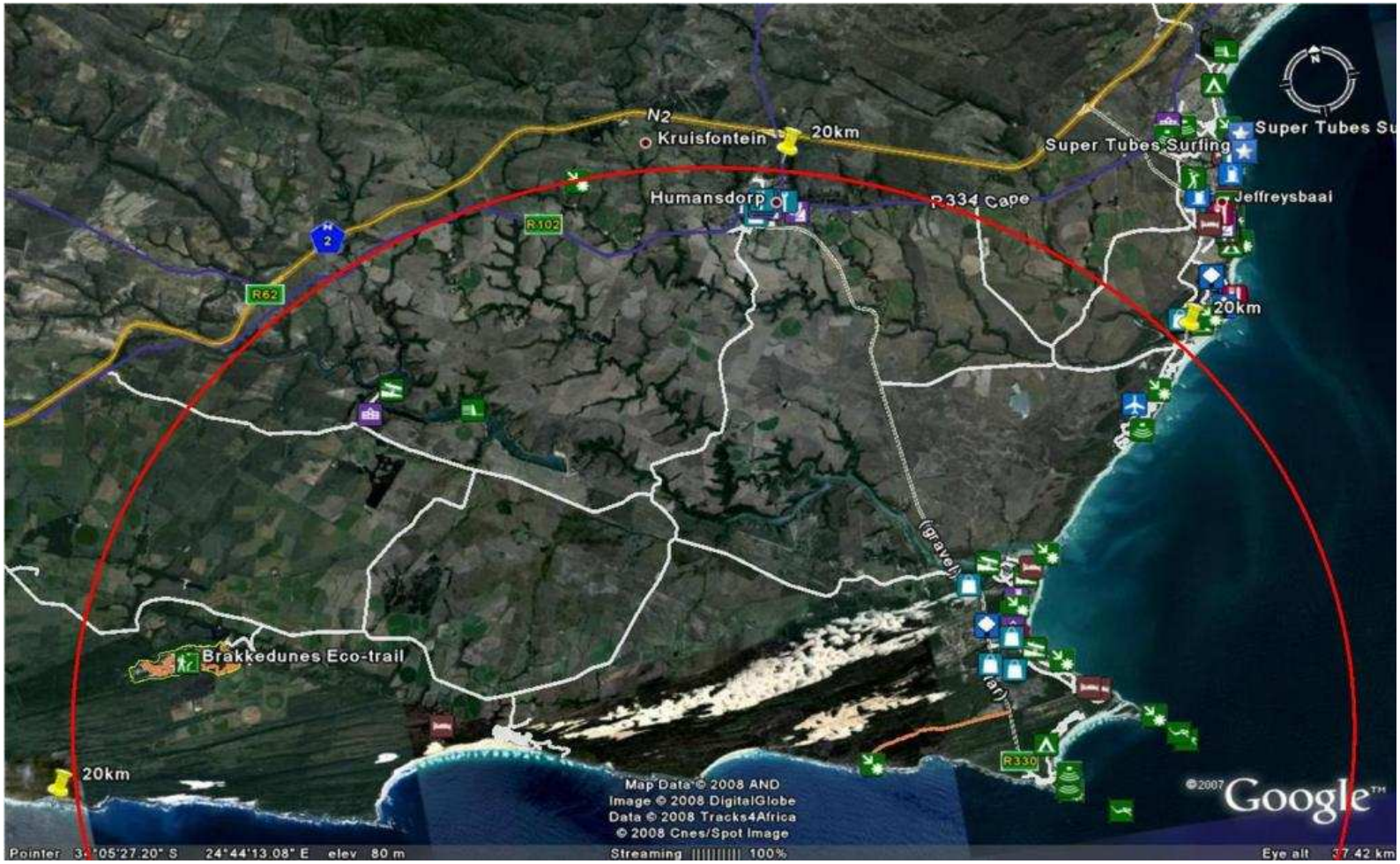


Figure 8-88: Thyspunt site location and sphere of impact

8.9.7 Noise

Figure 8-89 displays the proposed Nuclear 1 plant layout on an aerial photograph of the Thyspunt site. The Nuclear-1 infrastructure site would be 4.2 km east of residential land at Oyster Bay. Most of the residences are located on the slopes of a dune overlooking the coast and are exposed to surf noise with a $L_{Req,d}$ in excess of 50 dBA depending on the distance from the shoreline. An $L_{Aeq,T}$ of 43 dBA was measured behind the dune on the road leading to the Umzamowethu township. The only audible sound was that of the distant surf.

A green rectangle shows the proposed location of the High Voltage (HV) yard, where it is also proposed to locate two Open Cycle Gas Turbine (OCGT) peaking power plants with a combined electrical capacity of 50 MW. Outlined in green circles are the nearest farm residences. One residence (small circle) is situated just outside of the HV yard boundary. The remaining two farm residences are each situated approximately 1 000 m from the proposed HV yard. The typical $L_{Req,d}$ for the farm residences is 45 dBA.

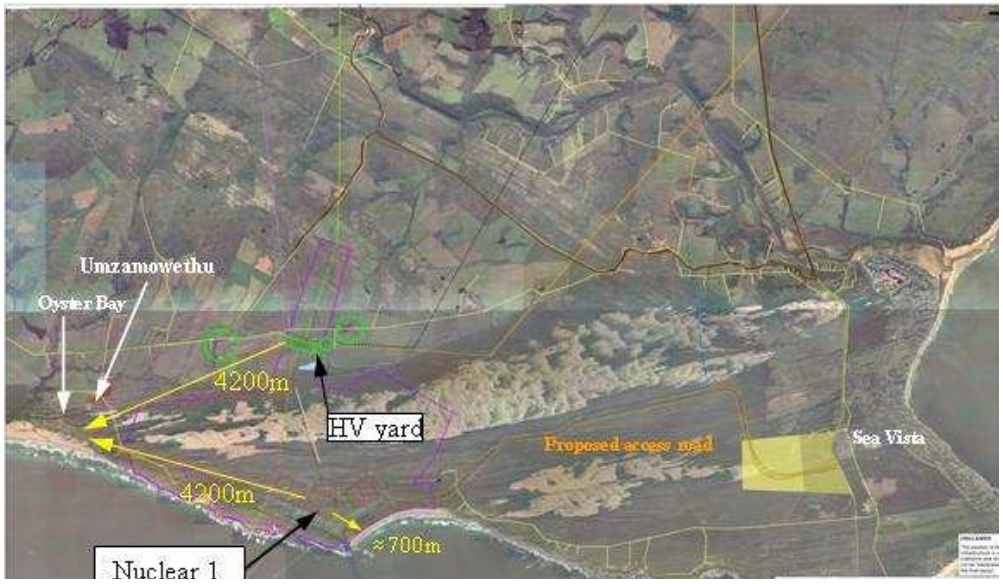


Figure 8-89: Distance to nearest noise-sensitive land uses at Thyspunt

It was observed from a study of elevation contours that the terrain in the vicinity of the proposed Duynefontein site was similar to that at Thyspunt in so far as this would influence the propagation of noise inland, away from the coastline. The almost flat topography of the land areas extending at least 750 m around both sites would have negligible influence on the propagation of noise away from the noise sources.

8.9.8 Transport

a) Road network

The N2 runs in an east-west direction connecting the main centres along the east coast, such as Port Elizabeth, George and Cape Town as shown in **Figure 8-90**.

The N2 links to the N7 via Cape Town. Access to the N2 from Thyspunt is via Humansdorp along the R330 or the unsurfaced Oyster Bay Road. The R330 is a surfaced road that runs from Humansdorp in a southerly direction past St. Francis Bay to Seal Point on the coast. The existing unsurfaced road, which runs from Humansdorp south to Oyster Bay, is in fairly good condition during the dry season and requires more maintenance during the wet season.

b) Rail network

There are currently two railway services operating on the railway lines in the Cacadu District Municipality, as shown in **Figure 8-90 ,** and these are as follows:

- Alicedale – Grahamstown; and
- Port Alfred – Bathurst.

The Alicedale – Grahamstown service is mostly used by work seekers and shoppers travelling to Grahamstown, whereas the Port Alfred – Bathurst service is mostly used by tourists to explore the Bathurst area.

c) Airports

The main air access to the Cacadu District is via the national airport in the Nelson Mandela Metro as shown in **Figure 8-90**. However, there are other airports in the District which perform significant regional functions.

The provincial government owned air landing field in Ndlambe Municipality is leased by a private company that owns the property around the facility and is utilised for training pilots. About 200 to 250 learners are taught to fly an aircraft per year for both commercial and air transport plane licenses.

The facility has three grass runways and no sophisticated landing instruments are used due to unavailability of tarred runways and other facilities. The private company has requested funding from the Province to surface one of the runways.

Airports that can accommodate light aircraft are located at St. Francis Bay, Humansdorp and Paradise Beach.

d) Harbours

The main sea access to the Cacadu District is via the national harbour in the Nelson Mandela Metro as shown in **Figure 8-90**. However, there are other harbours which perform significant regional functions in the District.

There are small boat harbours, which have been constructed by private developers, at Port Alfred and Port St. Francis. These are mainly used for recreational purposes.

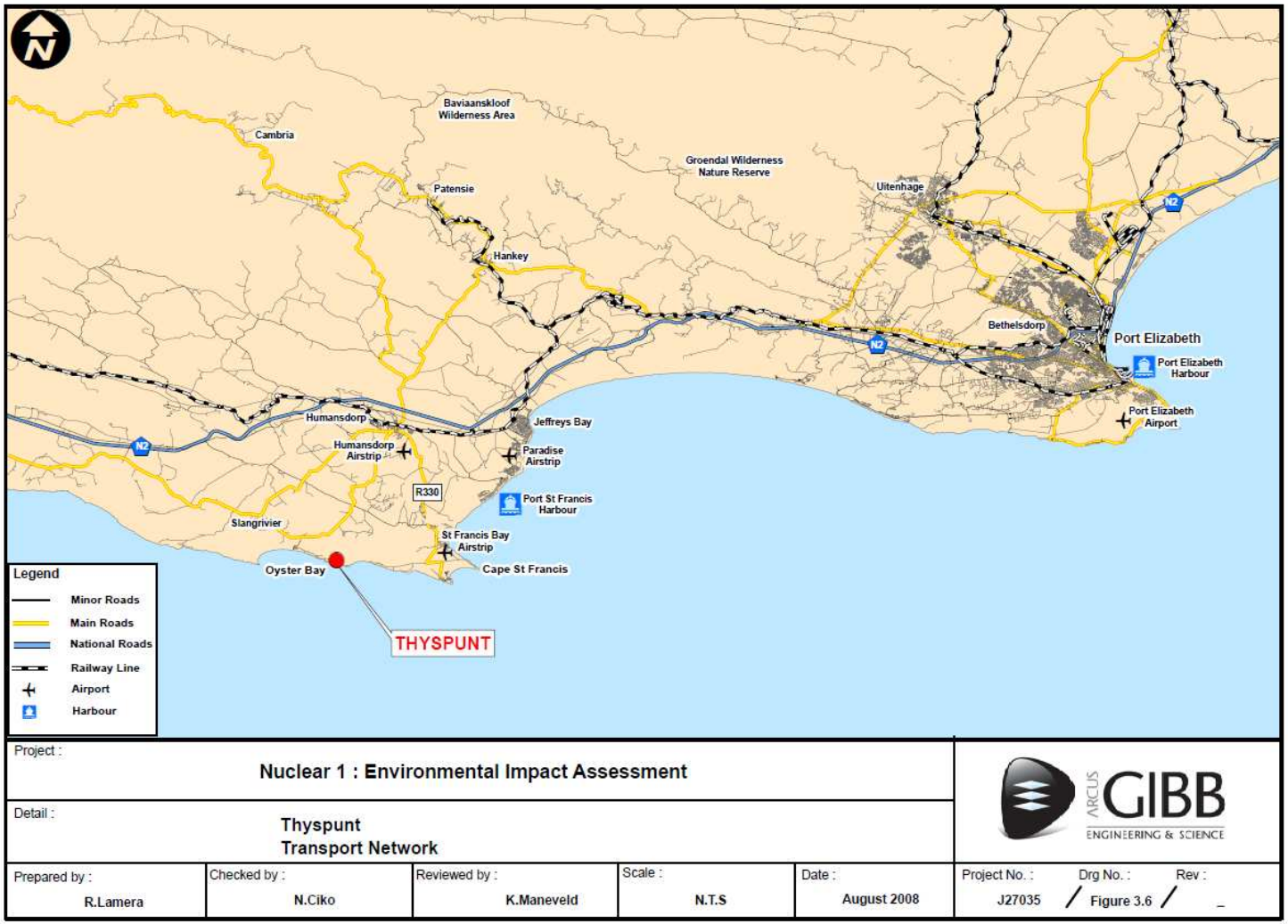


Figure 8-90: Thyspunt transport network