Terrestrial Biodiversity Assessment, Erf 3122 Mossel Bay (Hartenbos Garden Estate), Mossel Bay Municipality Western Cape Province

Bobartia macrospatha with bee-fly

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Prepared for Cape EAPrac

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CONTENTS

i. National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014, in compliance with the Specialist Protocols (2020).

ii. Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by CapeEAPrac to provide specialist consulting services for the proposed development of Erf 3122, Mossel Bay (Hartenbos Garden Estate), Western Cape Province. The consulting services have comprised of a study of the vegetation to determine botanical 'Red Flags' and to provide a constraints analysis, scoping assessment and finally an impact assessment in terms of the flora and vegetation, as well as a terrestrial biodiversity assessment based on the work of other specialists, reported here. A study undertaken by Nick Helme for the same area has also been considered.

iii. Details of Specialist

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iv. Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 40 years' experience in the field of Vegetation Science and Ecology.
- Founded Bergwind Botanical Surveys & Tours CC in 2006

- Has conducted over 600 specialist botanical / ecological studies
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

v. Declaration of Independence:

The views expressed in the document are the objective, independent views of Dr McDonald and the survey was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

I David Jury McDonald, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity;
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the specialist:
Company: Bergwind Botanical Surveys & Tours CC Date: 16 January 2023

Curriculum Vitae: Appendix 3.

vi. Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff, and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant, or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

vii. Terms of Reference

- Consider the existing biological assessment reports that were used to inform the development of a layout that would accommodate the identified constraints ;
- Conduct a terrestrial biodiversity impact assessment as per the Specialist Protocols (NEMA – 2020) of the proposed Hartenbos Garden Estate development that takes the following into consideration:
    1. Sensitive habitats;
    2. Any biota of conservation concern;
    3. Relevant environmental regulations / policies / plans stipulated by the Department of Environmental Affairs and CapeNature in terms of, amongst others, the National Environmental Management Act (NEMA) and the National Environmental Management Biodiversity Act (NEMBA);
    4. Comments from Cape Nature.

viii. Limitations and Assumptions

Since this report is a composite assemblage (summary) of information from numerous specialist studies, it stands to reason that there are some gaps where brevity prevented elaboration as in the specialist reports. It is assumed that the specialist reports for the proposed Hartenbos Garden Estate development would be read by anyone adjudicating the environmental application so and attempt has been made to avoid repetition. All limitations in the reviewed specialist reports thus equally apply to this report.

1. Introduction and Background

It is well-recognized that natural habitats are underpinned by plant species that respond to the abiotic environment, forming interacting communities that in turn support the existence of other biota in a given area. This is roughly the biological diversity or 'biodiversity' which is the diversity of organisms that inhabit a specified space. The organisms that contribute to any specified area range from soil micro-organisms to fungi to invertebrates to vertebrates such as reptiles, birds and mammals. The study of the interaction of these biota is most-often complex and not easily teased out and described. Therefore, an assessment of the biodiversity, and more specifically the terrestrial biodiversity is only possible at a coarse level in a general assessment. It is limited by the number of studies of different in a specified area and is really only a superficial overview of the biodiversity of a given area.

Plans to develop Erf 3122, Mossel Bay at Hartenbos have been tables since prior to 2006. Initially, it was the intention of ATKV Sake (Pty) Ltd, the original applicant, to obtain Environmental Authorisation to develop the property that was called Hartenbos Heuwels. Bergwind Botanical Surveys & Tours CC (Bergwind) [Dr D.J. McDonald] has been involved with botanical scoping studies and constraints analysis almost from the outset in addition to work done by Mr Nick Helme. The project has been transferred to new owners, Hartenbos Hills Propco (Pty) Ltd (HH Propco) and the project name has been changed to Hartenbos Garden Estate. CapeEAPrac has been, and continues to be, the environmental consultant company responsible for the environmental compliance applications.

The applicable botanical studies that have been concluded for the study site include: McDonald 2006; Helme 2016; McDonald, 2018 (updated 2022). Other applicable studies considered include faunal reports by Van der Walt, (2013) Todd (2018), Ewart-Smith (2021), Edge (2020), Van der Vywer (2021) and Colville & Cohen (2022).

Now that many iterations of the proposed development layouts and constraints have been considered, Bergwind Botanical Surveys & Tours CC has once again been appointed to carry out the final phase of the botanical (separate report) and terrestrial biodiversity assessment process.

This terrestrial biodiversity assessment takes careful note of the requirements and recommendations of CapeNature and the Botanical Society of South Africa for proactive assessment of the biodiversity of proposed development sites and follows published guidelines for evaluating potential impacts on the said biodiversity in an area earmarked for some form of development (Brownlie 2005, Cadman *et al.* 2016). The requirements and recommendations of CapeNature for assessment of biodiversity of

proposed development sites have also been considered and the 2020 Species Environmental Assessment Best Practice Guideline and protocols for terrestrial biodiversity specialists (Government Gazette, 2020; Enviro Insight, 2020) have been applied.

2. Project Description

It is proposed to develop a residential and other use (recreation, restaurant, medical centre) estate on Erf 3122, Hartenbos (refer to Figure 1 for location map). The estate would be named Hartenbos Garden Estate. This is the most recent proposal in a long and drawn-out history of attempts to develop the property, starting with the erstwhile owners, Afrikaanse Taal en Kulktuurvereniging (ATKV) as long ago as 2006. Iterations of the proposed development layout have been informed by numerous specialist studies.

For the scoping phase, the SDP (**Alternative 2**) in Figure 3 was applicable, but there were concerns about the visual impact of the three-storey main frail care facility. The remedy has been to lower the buildings to two storeys but spread the footprint of the facility over a slightly larger area. This is now **Alternative 3, and the preferred alternative.** The No-Go is **Alternative 1** (*Status quo*).

Further improvements with Alternative 2: Figure 2 (in response to CapeNature's comments) is that the fence that was originally going to go around the Municipal Reservoir in Alternative 2, has been realigned to the boundary of the frail care/village precinct area so that the majority of the butterfly reserve falls outside the development footprint and would allow greater movement of animal and invertebrates along the outskirts of the development footprint.

Also between the Main Entrance gate and the first houses there will now also be a gate that will be kept open during the day, but closed at night for security purposes. The object will be to improve animal movement from within the development open space to the adjoining remnant open areas around the site (shown by green arrows on map: Figure 3). A second smaller corridor has been accommodated at the traffic circle in the south-west where there will also be a gate in the boundary fence open during the day but closed at night. Both of these corridor gates will be fitted with a design that still permits the movement of small animals/reptiles to improve movement.

Figure 1. Location of Hartenbos Garden Estate indicating Alternative 1 as the Status Quo (Source: Google Imagery).

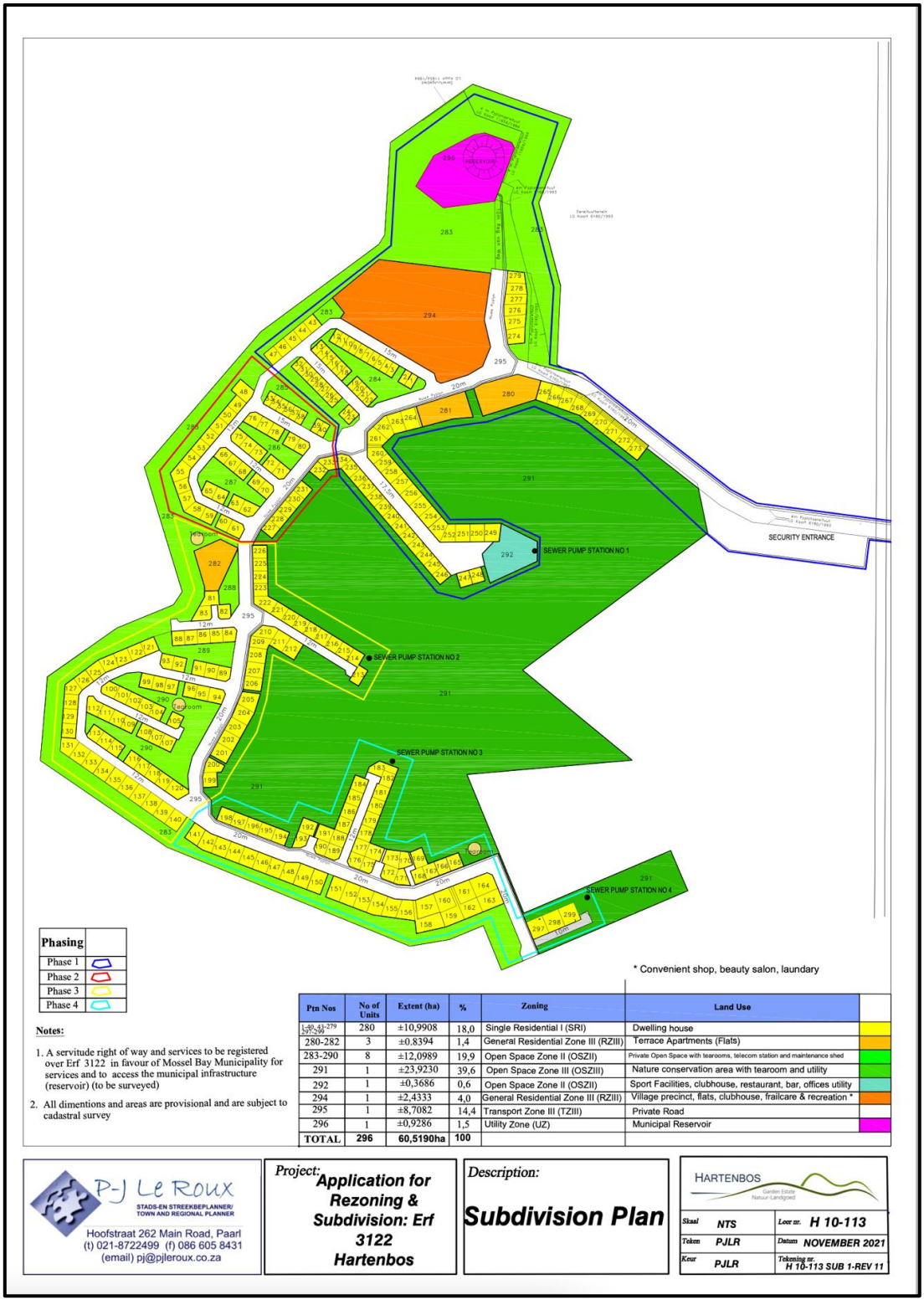
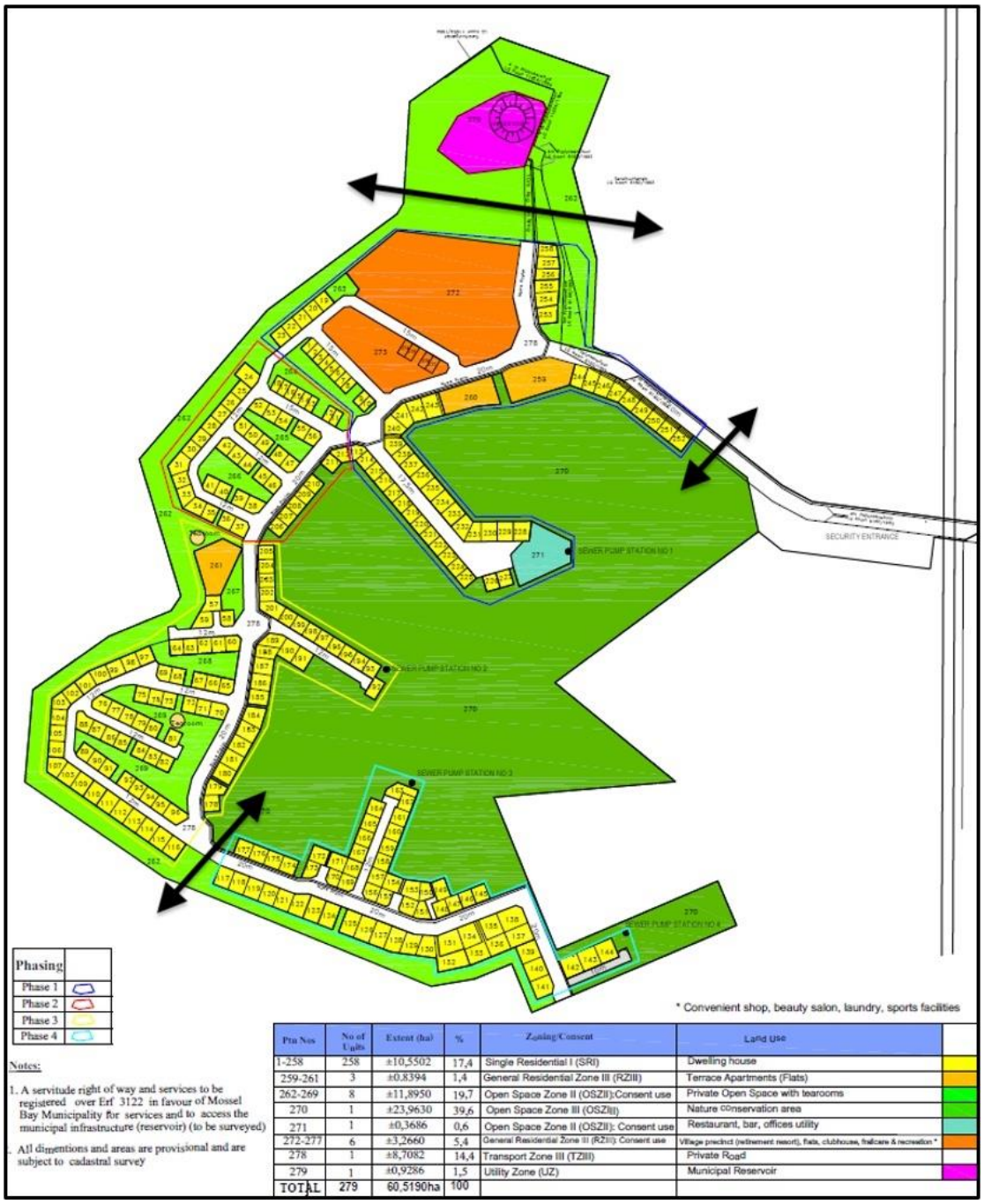


Figure 2. The scoping phase alternative, Alternative 2.



Ptn Nos	No of Units	Extent (ha)	%	Zoning/Consent	Land Use	
1-258	258	±10,5502	17,4	Single Residential I (SRI)	Dwelling house	
259-261	3	±0,8394	1,4	General Residential Zone III (RZIII)	Terrace Apartments (Flats)	
262-269	8	±11,8950	19,7	Open Space Zone II (OSZII):Consent use	Private Open Space with tearooms	
270	1	±23,9630	39,6	Open Space Zone III (OSZIII)	Nature conservation area	
271	1	±0,3686	0,6	Open Space Zone II (OSZII): Consent use	Restaurant, bar, offices utility	
272-277	6	±3,2660	5,4	General Residential Zone III (RZIII): Consent use	Village precinct (retirement resort), flats, clubhouse, frailcare & recreation *	
278	1	±8,7082	14,4	Transport Zone III (TZIII)	Private Road	
279	1	±0,9286	1,5	Utility Zone (UZ)	Municipal Reservoir	
TOTAL	279	60,5190ha	100			

Figure 3. Preferred alternative, Alternative 3 that has been modified in response to the outcome of the scoping phase allowing for greater faunal movement and linkages with adjoining natural areas. The linkages are shown by black arrows.

3. Physiography

3.1 Location

Erf 3122, Mossel Bay is located on the moderate elevation inland hills to the west and above Hartenbos,

near Mossel Bay, on the Garden Route of the Southern Cape coast, Garden Route District Municipality, Western Cape Province (Figure 4). It lies west of the N2 national road through Hartenbos, immediately west of the existing Hartenbos Heuwels and to the southwest of the R328 road between Hartenbos and Oudtshoorn.

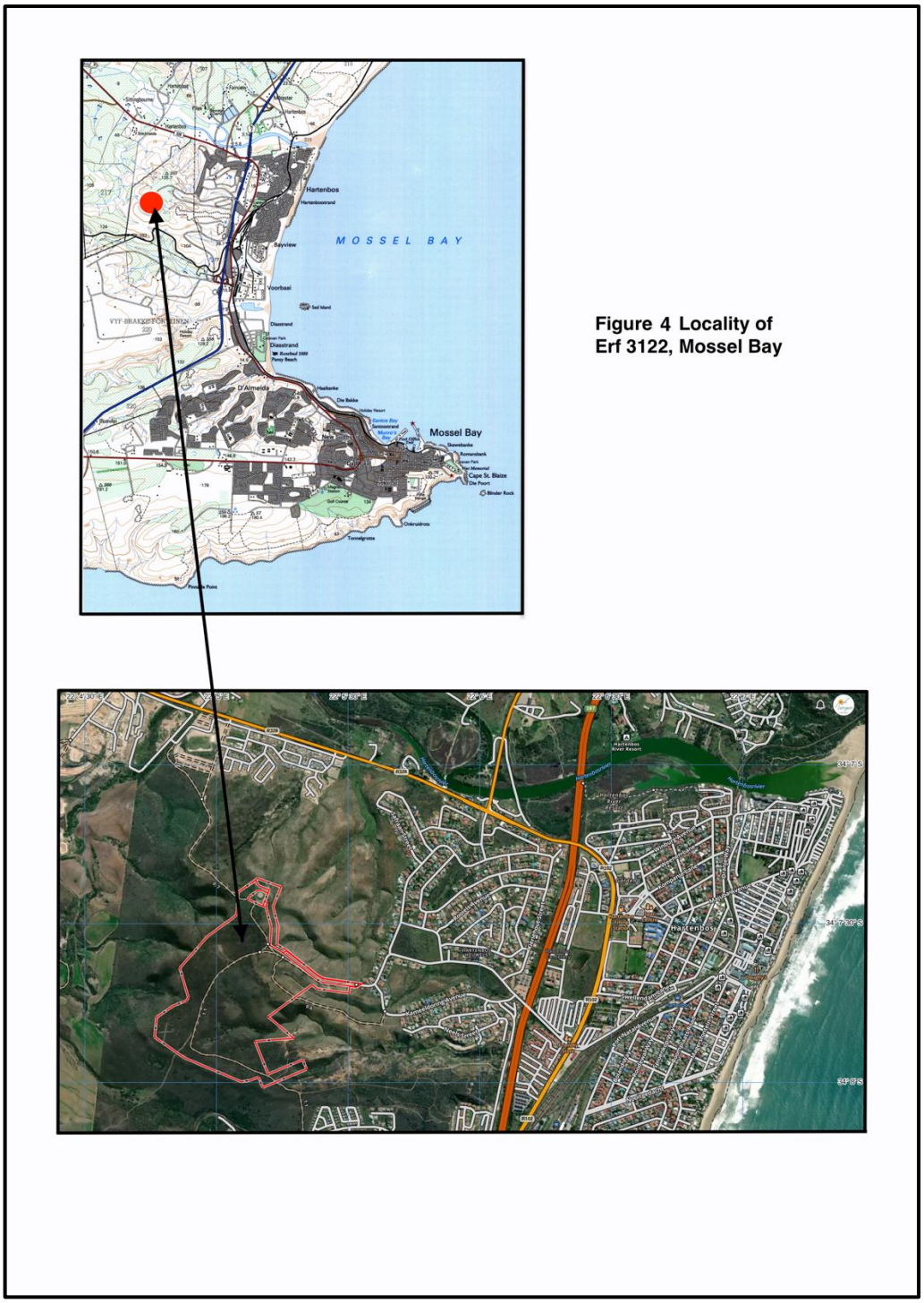


Figure 4 Locality of Erf 3122, Mossel Bay

Erf 3122, Mossel Bay, is approximately 310 ha in extent and is presently zoned for agriculture, but it has not been used for agriculture for some time. The proposed development would take up approximately 50 ha of the erf, situated mainly on the high-lying plateau.

There are two points of vehicular access to the site. One is situated at the gate on the southeast side (S 34° 07' 41.4" E 22° 05' 41.4"; elevation 99 m a.m.s.l.) and the second is from the R328 road on the north side of the property at S 34° 06 50.1 E 22° 04' 57.9. The southern access point was used for this study and would be used as the official entrance to the envisaged development.

3.2 Topography

Erf 3122 Mossel Bay, has a central plateau area that is fairly flat and has an average elevation of 120 m a.m.s.l. To the south, the plateau drops away as uniform slopes with a moderate gradient to the southern boundary near the railway line. On the southeast to northeast side the landscape is dissected by some valleys that are not very deep but do have slopes with distinctly north- and south-facing aspects. The elevation in the valleys is around 60 m a.m.s.l. so the difference in altitude between the deepest valley floor and the central plateau is approximately 60 m. The Hartenbos water reservoir is situated at the highest point on the property at 139.6 m a.m.s.l. The slopes north of the reservoir, with a northerly aspect, are moderately steep, dropping evenly to the northern boundary of the property near the R328. The western slopes drop away from the central plateau also with a moderate gradient, have a series of valleys that drain to the west into a stream which eventually flow into the Hartenbos River.

The exposure of the central plateau is uniform but the slopes and valleys that drain from the central plateau to the east, north and west result in some complexity to the topography. Together with the variability of the soils, the complexity of the topography produces a terrain with a variety of habitats and microclimates to which the vegetation responds. Watercourses and limited 'wetlands' occur mainly on the south-facing slopes.

A series of gravel roads and tracks that are aligned mainly on the central plateau and along the ridges and crests above the valleys link the different parts of the area and provide ready access to them. Some of the tracks have been constructed to provide access for the maintenance of the high voltage power line that traverses the property from south to north close to the eastern boundary. The roads and tracks are in good condition and there is no evidence of erosion resulting from them.

3.3 Geology

Erf 3122, Mossel Bay lies on sediments of the Kirkwood Formation, Uitenhage Group. These sediments consisting of variegated mudstone, lithic sandstone and sporadic conglomerates were deposited under fluvial conditions at or near the sea. The Kirkwood Formation lies above the Enon Formation that consists of silty mudstones interspersed with rounded cobbles of quartz and gravels that were deposited by rivers into a marine environment on the coastline during the Cretaceous (Figure 5) (Norman & Whitfield 2006). The geology over the whole of the study area is uniform and erosion through the gravely conglomerates has resulted in the valleys that are seen in the area today.

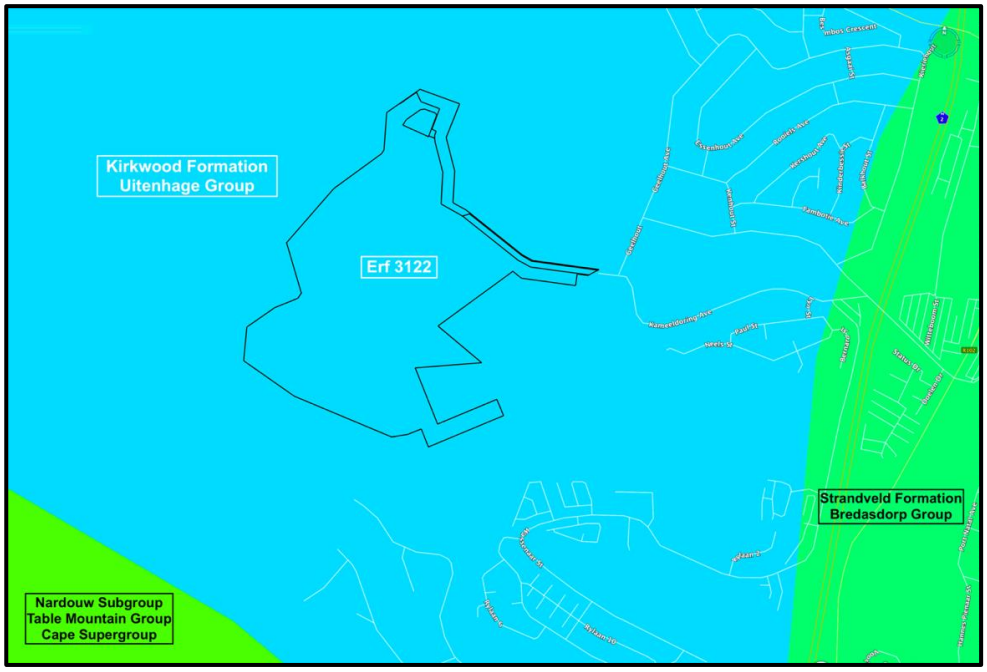


Figure 5. Erf 3122, Mossel Bay is underlain entirely by sediments of the Uitenhage Group, Kirkwood Formation.

3.4 Climate

The proposed site of Hartenbos Garden Estate has a climate transitional between the Mediterranean-type climate of the far Western Cape Province and the zone of all-year-round rainfall along the Garden Route. The climate is like that of nearby Mossel Bay. The average annual rainfall is 425--460 mm *per annum* and the distribution of rainfall shows a tendency towards being bimodal with peaks in April and August. Average temperatures do not range widely with June, July and August being the coolest months (daily minimum ± 0° C, daily maximum ± 7° C) and December and January the hottest (daily minimum ± 16° C, daily maximum ± 27° C) (Figures 6a & 6b).

Average temperature and precipitation: Hartenbos

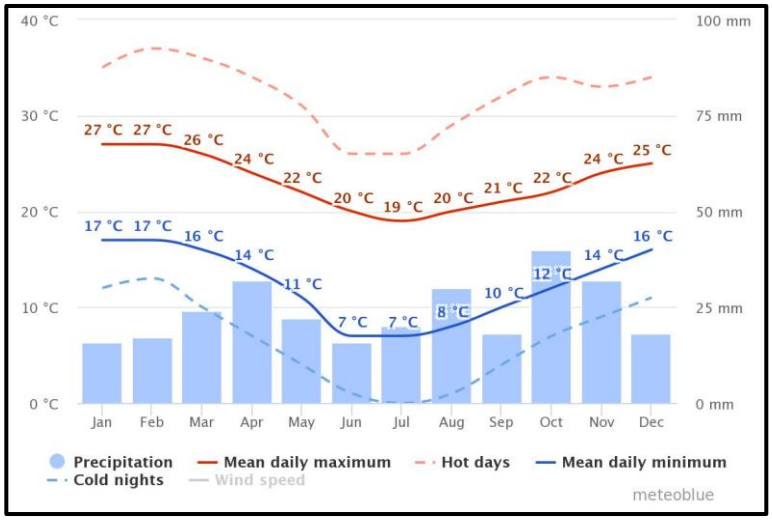


Figure 6a. Average temperature (°C) and average rainfall (mm) for Hartenbos.

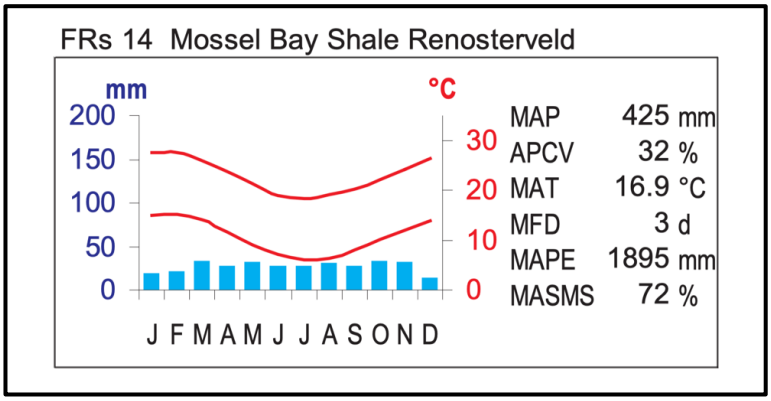


Figure 6b. Climate diagram of Mossel Bay Shale Renosterveld. Blue bars show the median monthly precipitation. The upper and lower red lines show the mean daily maximum and minimum temperature respectively. MAP: Mean Annual Precipitation; APCV: Annual Precipitation Coefficient of Variation; MAT: Mean Annual Temperature; MFD: Mean Frost Days (days when screen temperature was below 0°C); MAPE: Mean Annual Potential Evaporation; MASMS: Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply) (Rebelo *et al.* 2006 in Mucina & Rutherford, 2006).

4. Methods

4.1 Approach – for botanical studies

Erf 3122 was first visited and surveyed in December 2006. At that time there was an ambitious scheme to develop a larger area than only Erf 3122, so the survey included areas to the northeast of the municipal reservoir as well, outside the boundaries of Erf 3122. Later, the proposed development was restricted to Erf 3122 and so, for the purposes of the scoping study, Erf 3122 Mossel Bay was re-visited for two days on 24 and 25 August 2017, and records collected at 19 sample waypoints (see Figure 8). The records included lists of plant species, descriptions of the physiognomy of the respective waypoint sites, photographs of the sites, as well as any specific plant species that were of importance. In addition, where possible, notes were made about other biota present as well.

For the 2006 study (McDonald, 2006), colour aerial photography and Google Earth ™ satellite imagery was used to interpret the distribution of plant communities. This method was repeated in 2017 when a sequence of satellite images was available that showed changes in the vegetation of the site over time. One of the important revelations that was not noted in 2006 and that could be determined from the 2011 satellite image (after a fire had burnt the site) was the historical ploughing of the site (Figure 7). This agriculture has had long-lasting effects on the vegetation and consequently on the invertebrate and vertebrate fauna as well.

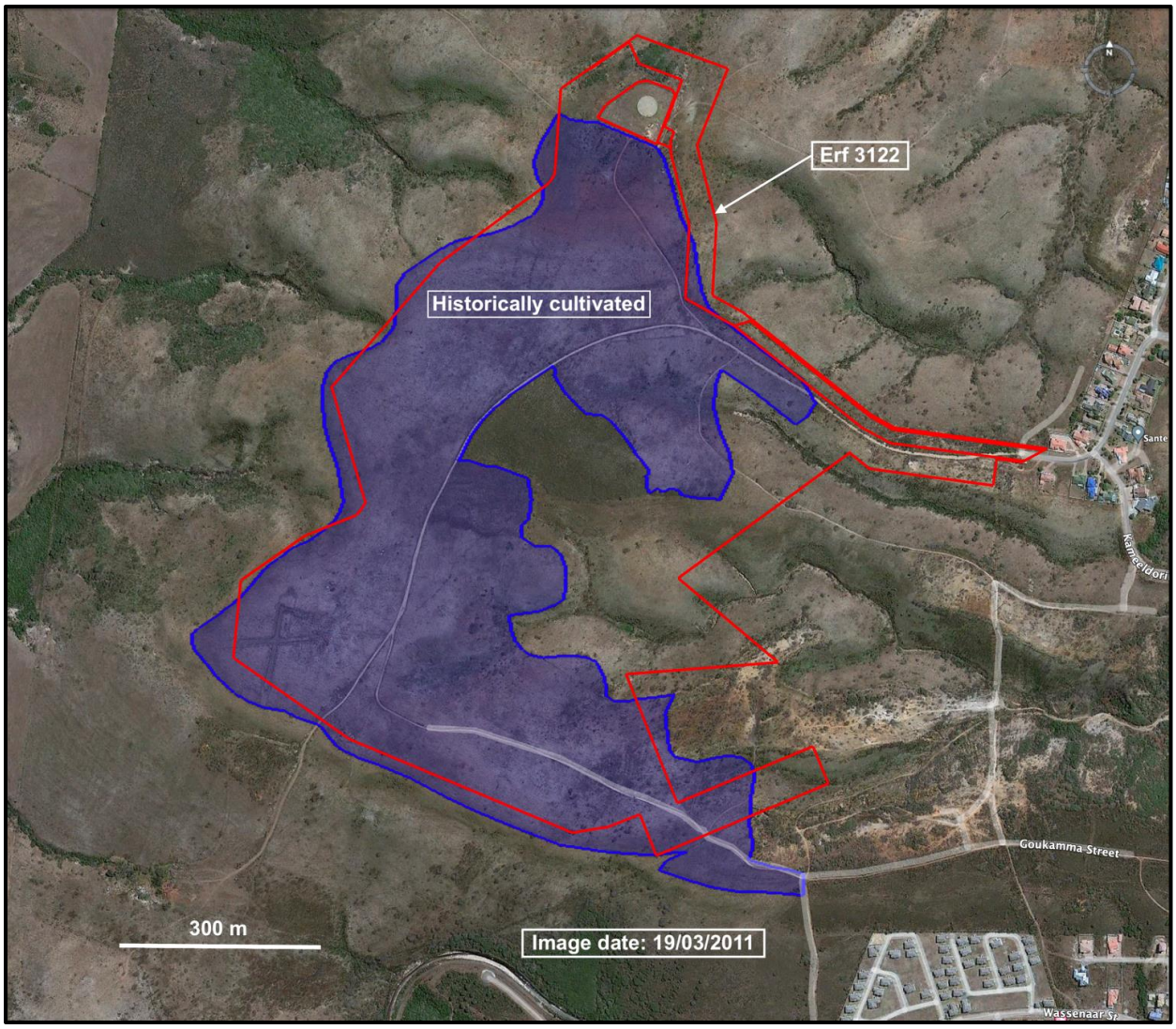


Figure 7. Aerial image of Erf 3122, Mossel Bay (Hartenbos Garden Estate) (red boundary). The image was taken in March 2011 and shows the areas of the property that were historically ploughed (blue shading). The area was also burnt prior to 2006 which apparently further contributed to loss of biodiversity .

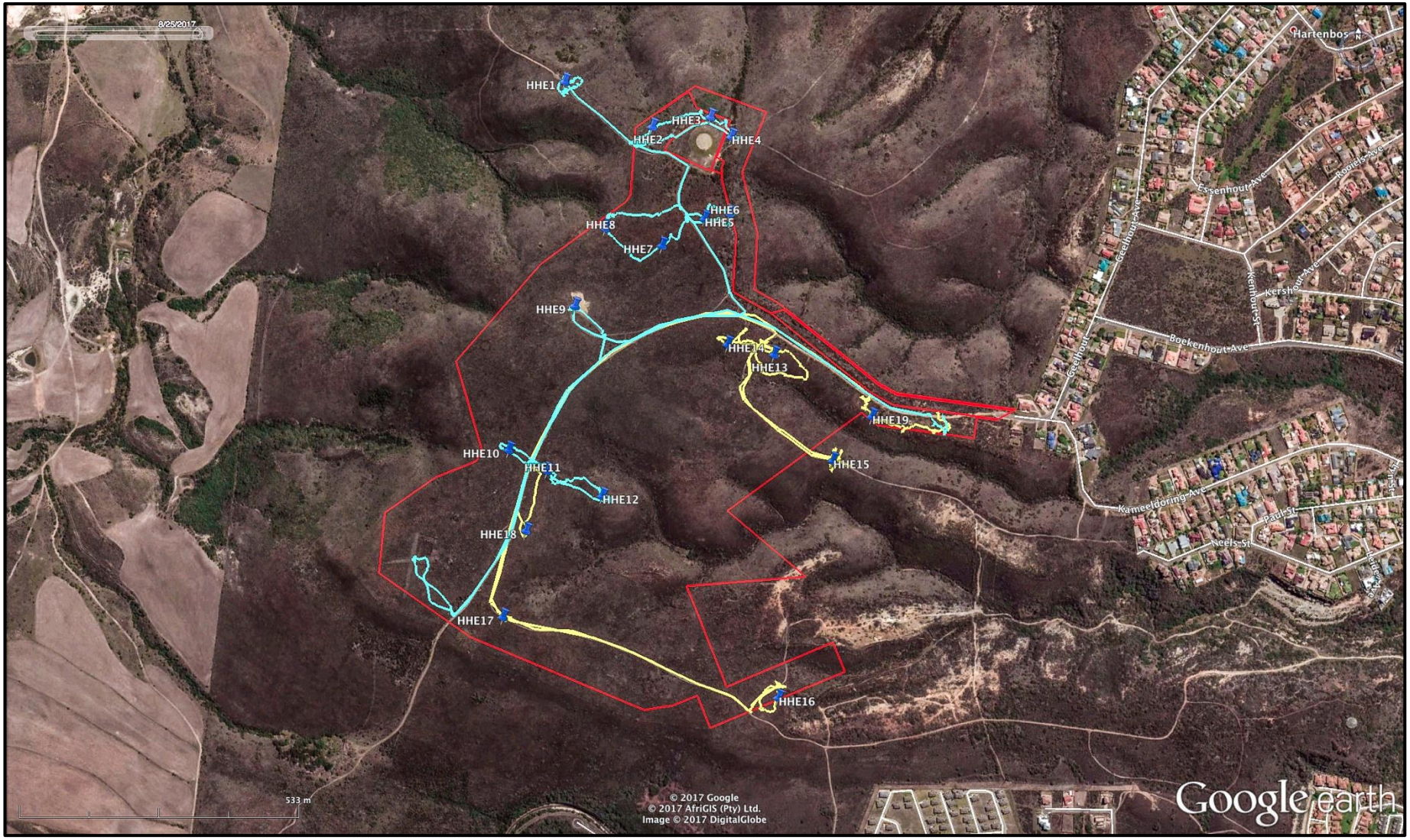


Figure 8. Aerial image of Erf 3122, Mossel Bay (Hartenbos Garden Estate) (red boundary) with sample track (light blue: 24 /08/2017; yellow: 25/08/2017) and waypoints HHE#. The aerial image was taken in March 2017 (Note: The area has been visited numerous times since 2017 for follow up and checking, e.g. with the Lepidopterist, Dr Dave Edge).

4.2 Approach – for faunal and aquatic studies

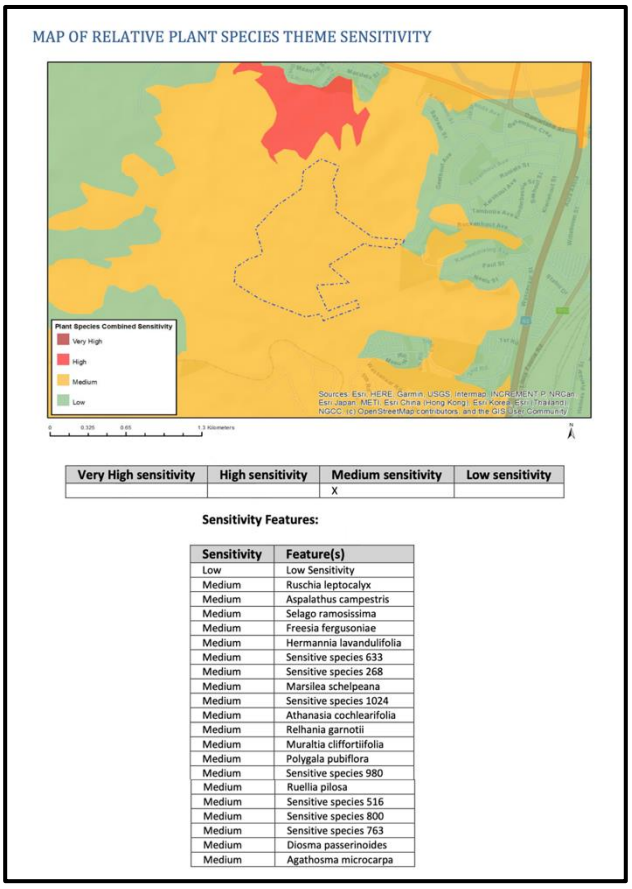
Various methods were applied by the authors of the studies of the fauna (vertebrate and invertebrate). These include sweep-netting for insect fauna (butterflies, monkey-beetles, grasshoppers) and camera traps for mammals. Reptiles were recorded as incidental observations.

For the aquatic study (Ewart-Smith, 2021) applied recognized methods for this discipline.

5. Sensitivities identified from the DFFE Online Screening Tool

5.1 Relative Plant Species Theme Sensitivity

The National Web-based Screening Tool was applied to Erf 3122, Mossel Bay and the result was that the site has a **MEDIUM** sensitivity with respect to the relative plant species theme sensitivity [Figure 9] (McDonald, 2022). There are also not many sensitive species and regarded as sensitive in the species list (the names of those species not listed were obtained from SANBI but as per protocol are not published here). However, it is known that *Hermannia lavandulifolia* is an important species since it is the food plant for the rare endemic butterfly *Aloeides trimeni southeyae* (Dr Dave Edge pers. comm.) As for other plants of conservation concern, a number of those listed in by the screening tool were not recorded in the study area and that is attributed to the historical disturbance of the site.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

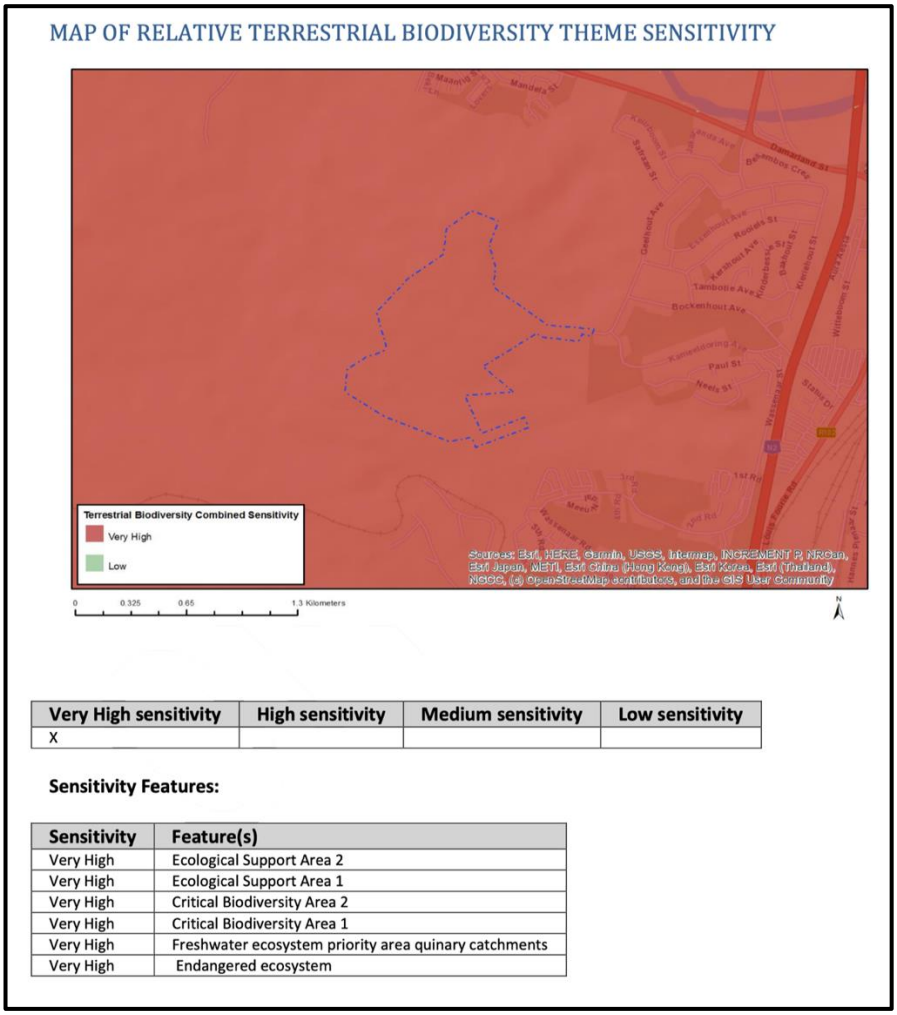
Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Ruschia leptocalyx
Medium	Aspalathus campestris
Medium	Selago ramosissima
Medium	Freesia fergusoniae
Medium	Hermannia lavandulifolia
Medium	Sensitive species 633
Medium	Sensitive species 268
Medium	Marsilea schelpeana
Medium	Sensitive species 1024
Medium	Athanasia cochlearifolia
Medium	Relhania garnotii
Medium	Muraltia cliffortiifolia
Medium	Polygala pubiflora
Medium	Sensitive species 980
Medium	Ruellia pilosa
Medium	Sensitive species 516
Medium	Sensitive species 800
Medium	Sensitive species 763
Medium	Diosma passerinoides
Medium	Agathosma microcarpa

Figure 9. Extract from the report generated for the Relative Plant Species Theme Sensitivity for Erf 3122, Mossel Bay (blue dotted polygon).

5.2 Relative Terrestrial Biodiversity Theme Sensitivity

The relative terrestrial biodiversity theme sensitivity is given as VERY HIGH in Figure 11. Both Helme (2016) and this author do not agree with the assigning of CBA1 to Erf 3122, Mossel Bay in the Western Cape Biodiversity Spatial Plan (Pence, 2017; Pool-Stanvliet, 2017). The sensitivity of the erf is overstated, because it has been selected as CBA1 (which in itself is an overestimate of the ecological value of the site) and this has been drawn down into the National Web-based Screening Tool where the 'error' has been perpetuated (Figure 10). From observations on the site and consideration of all the biotic and abiotic factors, the sensitivity is more realistically **MEDIUM**.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Ecological Support Area 2
Very High	Ecological Support Area 1
Very High	Critical Biodiversity Area 2
Very High	Critical Biodiversity Area 1
Very High	Freshwater ecosystem priority area quinary catchments
Very High	Endangered ecosystem

Figure 10. Extract from the report generated for the Relative Terrestrial Biodiversity Theme Sensitivity for Erf 3122, Mossel Bay (blue dotted polygon).

6. The Vegetation

The report by McDonald (2022) summarised the previous studies of the plant communities of the study area and the development of a classification of the vegetation of the area.

For purposes of this project the vegetation units recognized follow those of Vlok & de Villiers (2007) but with the distinction that there is grassy fynbos akin to that of North Langeberg Sandstone Fynbos on the south-facing slopes. The latter vegetation is more sensitive than the renosterveld, which at Erf 3122, Mossel Bay, is mostly **secondary**, due to historical cultivation and subsequent fires. **Renosterbos (*Dicerothamnus rhinocerotis*, formerly *Elytropappus rhinocerotis*), strongly colonizes disturbed substrates, particularly shale substrates, once they have been disturbed e.g., by ploughing**. The result is that what is now mostly seen at Erf 3122, Mossel Bay is secondary vegetation (renosterveld) with a high cover, where *D. rhinocerotis* as the dominant shrub. The plant community is not as diverse as would be the case had there been no historical cultivation. The effects of the ploughing have persisted for decades; many of the other plant species were lost due to the historical ploughing and have not returned. The VEGMAP recognizes the vegetation of the entire area of Erf 3122, Mossel Bay, as Mossel Bay Shale Renosterveld (Figure 11).

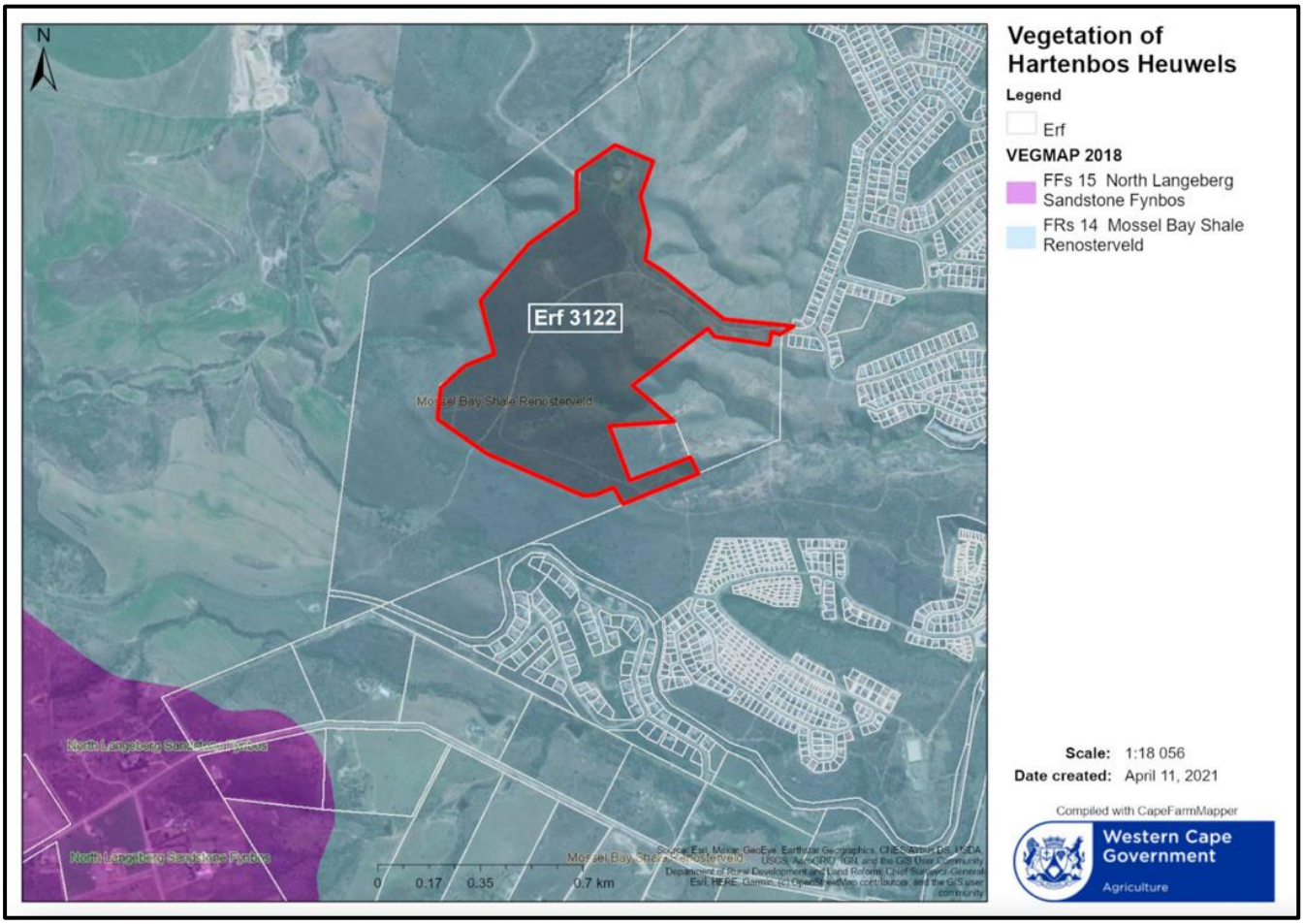


Figure 11. Portion of the Vegetation Map of South Africa, Lesotho & Swaziland (SANBI, 2018) overlaid on aerial imagery using Cape Farm Mapper. It shows that according to this classification, Erf 3122, Mossel Bay (red outline) is in Mossel Bay Shale Renosterveld.

6.1 Renosterveld

6.1.1 Renosterveld on the central plateau and warm, dry west- and north-facing slopes

Renosterveld (secondary *D. rhinocerotis*-dominated vegetation) is the dominant vegetation type on Erf 3122, Mossel Bay (Hartenbos Garden Estate). It is found on the central plateau and on the warm, dry westerly and northerly slopes. The soils are gravelly and have a clay-rich matrix. This vegetation type has a grey appearance due to the colour of the dominant shrub species, *D. rhinocerotis*, the renosterbos. Shrubs of this species are from 1—1.5 m tall and generally, but not always, form a mid-dense to dense canopy over other lower shrubs. The cover of renosterbos is from 80 – 90 % with other shrubs forming a much lower proportion of the cover. Low & Rebelo (1996) describe the physiognomy of South Coast Renosterveld as 'open to mid-dense, cupressoid and small-leaved, low to mid-high shrubland, with emergent species generally absent', and the renosterveld vegetation at Hartenbos (Figure 11) fits this physiognomic description well.

The understorey of the renosterveld can range from being a sparse covering of low shrubs, forbs and grasses to a dense grassy sward with some shrublets and forbs. The pattern in the renosterveld at Erf 3122 is that dominance can change and renosterbos can be completely absent in which case grasses, particularly *Hyparrhenia hirta*, dominate. This results in either a patchy mosaic of small grass-dominated patches within larger renosterbos-dominated stands of vegetation or the opposite where grasses dominate over wide areas with renosterbos either absent completely or occurring in varying density but usually sparsely.

Renosterveld, wherever it occurs **in an undisturbed state**, is well-known for its diversity of species. When the author surveyed Erf 3122, Mossel Bay in 2006, it was found that there was a limited species richness in the renosterveld. An exhaustive species list was not compiled for the renosterveld at Erf 3122 but genera and species that were found to occur include, *Asparagus africanus*, *Asparagus* cf. *falcatus*, *Berkheya* sp., *Boophone disticha*, *Brachiaria serrata*, *Bulbine* sp., *Carissa bispinosa*, *Carpobrotus acinaciformis*, *Chrysocoma ciliolata*, *Commelina africana*, *Cynanchum viminale, Dianthus caespitosus*, *Digitaria eriantha*, *E. rhinocerotis, Ehrharta* sp., *Eragrostis curvula*, *Eriocephalus africana, Euclea undulata*, *Glottiphyllum depressum*, *Gnidia* cf. *polystachya*, *Hermannia flammea, Hibiscus sp., Indigofera* sp., *Jamesbrittennia argentea*, *Lobelia* sp., *Merxmuellera stricta*, *Ornithogalum dubium*, *Osteospermum moniliferum, Polygala myrtifolia*, *Pteronia* spp., *Rhus glauca*, *Ruschia* cf. *hamata*, *Selago* spp., *Tephrosia* sp., *Themeda triandra*, *Ursinia* cf. *nudicaulis* and species in the Acanthaceae (cf. *Blepharis* sp.).

One misinterpretation of McDonald (2006) was that the lack of geophytes found in the 2006 survey was attributed to season. Subsequently it was realized that the lack of geophytes is more likely due to a large area of the central plateau having been cultivated and the geophytic flora lost (see above). It may be argued that the renosterveld has restored to its original state, but that is not the case!! The dominance of renosterbos is misleading. The historical land-use has had a profound effect that, although masked by the renosterbos-dominated shrubland is, in fact much poorer in species, especially geophytes, that were lost due to historical agricultural activity.

6.2 Scrub thicket

Both Acocks (1988) and Low & Rebelo (1996) recognized the incidence of thicket patches within the renosterveld. Acocks judged that these thickets were probably relics of a once more widespread vegetation type whereas Low & Rebelo suggested that thicket occurs where the relief is greater, rainfall is low, and fire cannot spread easily into these protected microhabitats.

The thicket vegetation is dense, thorny, and impenetrable and at Erf 3122 Mossel Bay (Hartenbos Garden Estate) the thicket community includes species such as, *Aloe ferox*, *Azima tetracantha*, *Bulbine* sp., *Carissa bispinosa* (Num num), *Crassula* sp. *Cussonia spicata* (Cabbage tree), *Cynanchum viminale, Diospyros lycioides*, *Gymnosporia buxifolia* (Common spike-thorn), *Olea europaea* subsp. *africana* (Wild Olive), *Rhus lucida*, *Schotia afra* (Boerboon), *Sideroxylon inerme* (Milkwood).

6.3 Fynbos on the cool, south-facing slopes

In contrast to the renosterveld on the dry slopes, the cooler south-facing slopes, that are probably also moister, support fynbos vegetation. Even though certain elements of fynbos such as some restios (Restionaceae) and *Bobartia macrospatha* (Iridaceae) occur in the renosterveld, the clue to the presence of true fynbos communities is the presence of Ericaceae, Restionaceae and Proteaceae growing together. The substrate is like that on which the renosterveld is found; the surface of the soil is covered (80%) with round pebbles of varying sizes (10 mm – 200 mm) but is probably gravellier, with a lower clay fraction, than where renosterveld is found. This, however, was not confirmed. The fynbos community has a cover of 80% with two layers and emergent shrubs up to 2 m. *Erica peltata*[1] is dominant in the upper stratum, <1 m high, with a cover of 60 %. The lower stratum < 50 cm high is graminoid and dominated by grasses and restios. Depending on the location, emergent shrubs such as *Leucadendron salignum*, *Protea lanceolata* and *Erica discolor* var. *speciosa* have variable cover. *L. salignum* and *E. discolor* var. *speciosa* generally have a low

[1] This *Erica* sp. was incorrectly identified as *Erica hispidula* in the botanical assessment (McDonald, 2022).

cover whereas *P. lanceolata* can form dense stands of a large number of individuals. Another striking aspect of the fynbos vegetation is the occurrence of many plants of *Bobartia macrospatha* (Iridaceae) (see cover photo) which have a relatively low cover but high abundance and are very obvious in the overall appearance of the fynbos in this area. (Note: The areas where fynbos occurs were not historically cultivated.)

The bright red geophyte, *Tritoniopsis antholyza*, was in flower at the time of sampling in December 2006. At that time, it was abundant and, from the evidence of porcupine digging, it was concluded that the corms are obviously much sought after by these animals. No other geophytes were found while searching through the fynbos and this was most likely because the season was well advanced into summer rather than due to historical ploughing as in the renosterveld.

The most important aspect of the fynbos vegetation is the occurrence of *Protea lanceolata* (Lance-leaved Protea). According to Rebelo (1995) this species occurs on Potberg (De Hoop) and the Riversdale Flats and at the fynbos / thicket ecotone at Mossel Bay on gravels from 0 – 200 m. It was listed in the Red Data list as VULNERABLE (Hilton-Taylor 1996; Raimondo *et al.* 1999) and Rebelo (1995) attributed this to the invasion of its habitat by rooikrans (*Acacia cyclops*). However, in the most recent appraisal (2019) (http://redlist.sanbi.org/species.php?species=799-68) it is classified as Least Threatened. At Hartenbos H Garden Estate, three distinct stands of *P. lanceolata* were found on south-facing slopes in fynbos vegetation by McDonald (2006). At one of these sites the stand of *P. lanceolata* is being heavily impacted by invasive rooikrans (*A. cyclops*) and this situation needs to be remedied. Only one part of the current study area i.e., near the eastern entrance gate, supports *P. lanceolata.*

6.4 Vegetation Map of Erf 3122, Mossel Bay.

In order to simplify the appraisal of the vegetation and biodiversity in general at Erf 3122, Mossel Bay, a vegetation map was compiled that recognizes only two vegetation types, renosterveld and grassy fynbos (Figure 12). The renosterveld, as mentioned above, is largely secondary, having 'restored' on areas that were once cultivated. This vegetation is considered to have **low sensitivity,** whereas the grassy fynbos which occurs on steeper slopes, and has not been historically cultivated, is considered to mostly have **high sensitivity.** The area along the road leading to the reservoir, and the area in the vicinity of the reservoir itself, have **moderate sensitivity** (Figure 13).

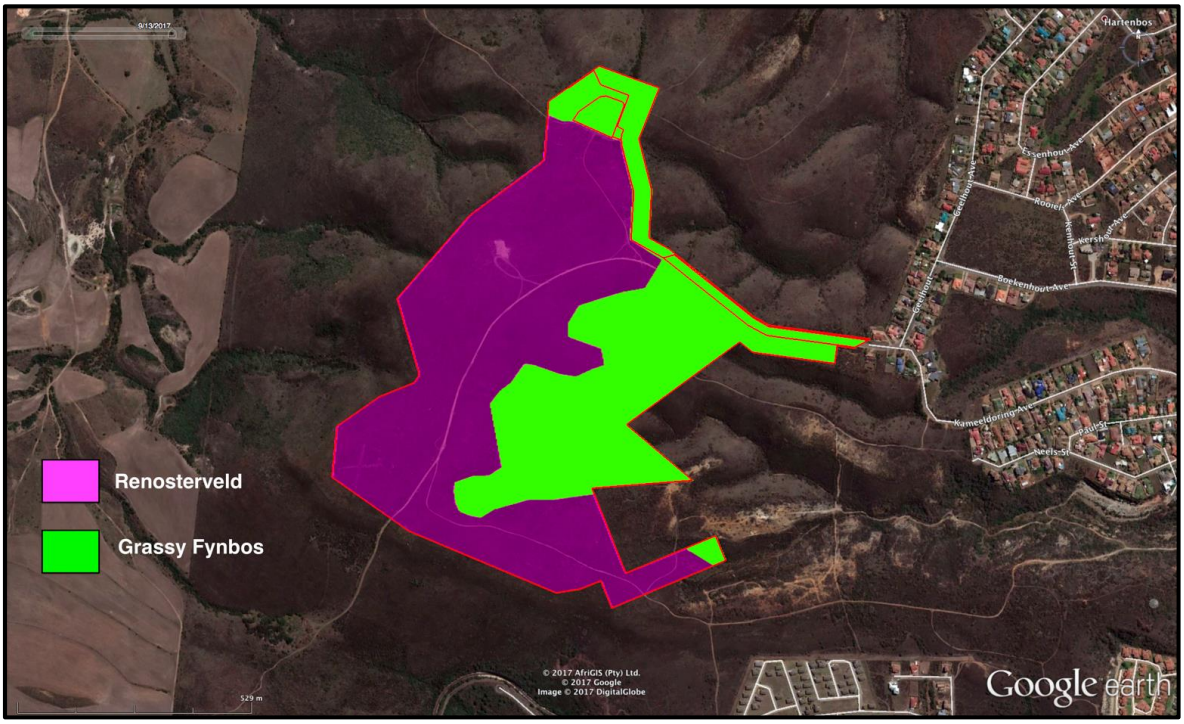


Figure 12. Simplified vegetation map for Erf 3122, Mossel Bay.

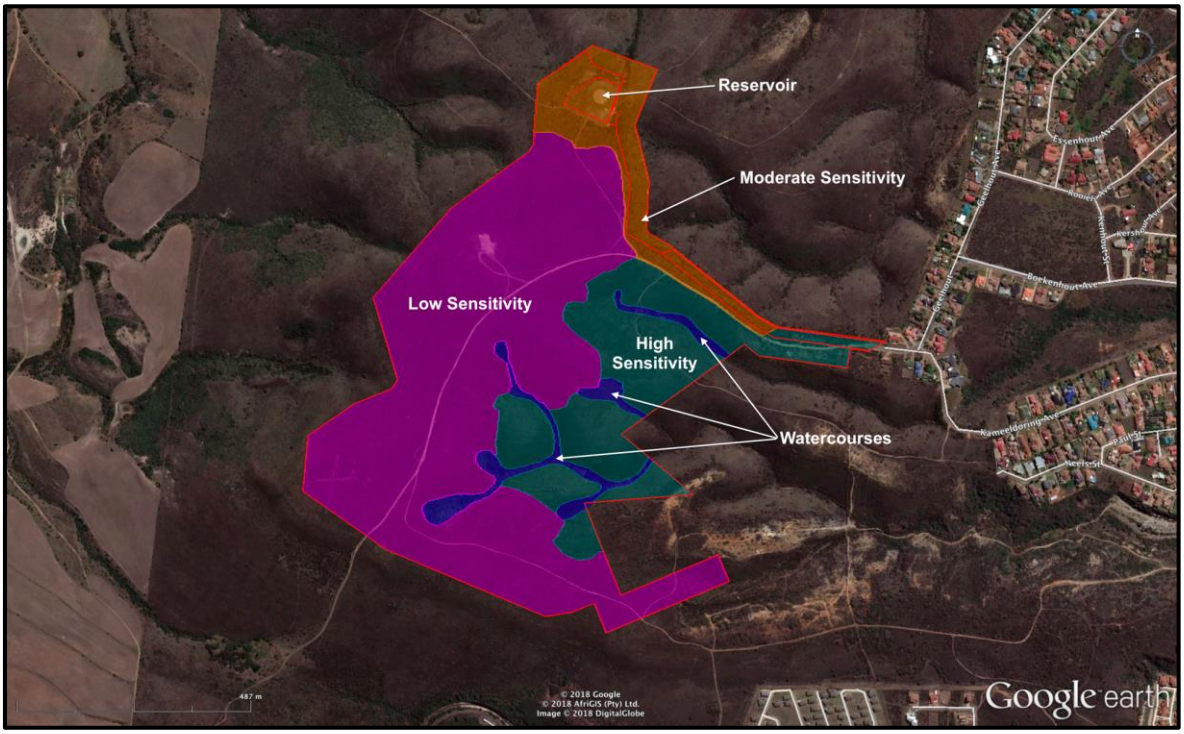


Figure 13. Habitat sensitivity map for Erf 3122, Mossel Bay.

7. Vertebrate Fauna

The vertebrate fauna has been exhaustively studied by five specialists since 2013, (Van der Walt, 2013; Todd, 2018, Van der Vywer, 2021, and Colville & Cohen, 2022). For details, the original reports should be consulted. The report of Van der Vywer (2021) was a desktop assessment that was based on the reports of Van der Walt (2013) and Todd (2018). It provided no new information and also erroneously reported that the study area had not been previously disturbed. This report is of little value and highlights the danger of 'desktop assessments' i.e. excluding any fieldwork. A summary of the other reports is given here. For convenience, the vertebrate fauna is subdivided into (1) Mammals, (2) Reptiles, (3) Amphibians and (4) Birds. Insect studies have been confined to an assessment of butterflies occurring in the study area.

7.1 Mammals

The disturbed history of the study area is such that relatively few mammal taxa occur there now. Van der Walt (2013) recorded six mammal species through sightings, vocalizations or signs. They are *Genetta genetta* (Common Genet), *Herpestes pulverulentus* (Cape Grey Mongoose), *Hystrix africaeaustralis* (Cape Porcupine), *Ictonyx striatus* (Striped Pole Cat), *Lepus saxatilis* (Scrub Hare) (*most likely Cape Hare based on distribution*), *Orycteropus afer* (Aardvark) and *Sylvicapra grimmia* (Common Duiker). It was assumed that *Cryptomys hottentotus* (African Mole Rat) is also present.

Todd (2018) reported occurrence of *Caracal caracal* (Caracal), *Hystrix africaeaustralis* (Cape Porcupine), *Lepus capensis* (Cape Hare), *Proteles cristatus* (Aardwolf) and *Sylvicapra grimmia* (Common Duiker) and *Tragelaphus sylvaticus* (Bushbuck) from camera traps. The proposed development Alternative 3 will allow for gates to be opened at least twice daily during the day, with other measures such as gaps in the fence to allow animal movement at night. This is perceived as a positive mitigation i.e., to allow for movement of these species, but it is uncertain to what extent these measures would be beneficial to the species.

Colville & Cohen (2022) mentioned only the mammal species of conservation concern but these species were not named as per the protocols in such cases. More details are available from the relevant document.

Van der Walt (2013) also mentioned a number of bat species that may occur over the study area but these are itinerant over the site and do not roost there. No bat monitoring has been carried out.

7.2 Reptiles

The Little Karoo Dwarf Chameleon (or Robertson's Dwarf Chameleon) (*Bradypodon gutturale*) was recorded by Van der Walt (2013) and Todd (2018) cited the SARCA database where 21 reptiles that are not of conservation concern have been recorded in the vicinity of the site. A further 21 are known from the wider area. *Chamaesaura anguina*, the Cape Grass Lizard, that is listed as data deficient (DDT), and that favours grassy areas or fynbos, could potentially be found in the study area. Other reptiles that could be found on the site are, Boomslang (*Dispholidus typus*), Cape Cobra (*Naja nivea*), Cape Legless Skink (*Acontias meleagra*), Brown House Snake (*Lamprophis capensis*), Marbled Leaf-toed Gecko (*Afrogecko porphyreus*), Mole Snake (*Pseudaspis cana*), Red-lipped Herald (*Crotaphopeltis hotamboeia*), Red-sided Skink (*Trachylepis homalocephala*), Puffadder (*Bitis arietans*).

Three tortoise species, *Chersina angulata* (Angulate Tortoise), *Homopus areolatus* (Parrotbeaked Tortoise) and *Stigmochelys pardalis* (Leopard Tortoise), have been recorded in the quarter-degree square containing the study area, but no tortoises have actually been found on the site. This is ascribed to the history of disturbance of the site when it would have been completely transformed to habitat not suitable for these species.

Colville & Cohen (2022) also recorded *Bradypodon gutturale,* but they did not dwell on the reptilian fauna in their report.

7.3 Amphibians

Van der Walt (2013) recorded the Common Caco (*Cacosternum boettgeri*) and Colville & Cohen (2022) recorded *Hyperolius marmoratus* (Painted Reed-frog). Nine frog species have been recorded in the FrogMap database for the area, with *Vandijkophrynun angusticeps* (Sand Toad) highly likely to occur (Todd, 2018). Since the frogs mainly occur in drainage lines, Todd (2018) concluded that the amphibian fauna is unlikely to be strongly impacted by the proposed development which is confirmed also by Ewart-Smith as the aquatic specialist (2021).

7.4 Birds

The study area is such that it would only support birds that favour mid-high shrubland, mid-dense shrubland for foraging or nesting. Use of the SABAP2 map for the birds found in Erf 3122, Hartenbos can thus be misleading. The list of birds has been refined from that of Van der Walt (2103) and Todd (2018) by Colville & Cohen (2022) and the following species of conservation concern, have a medium to high probability of occurrence based on habitat conditions:

Black Harrier (*Circus maurus*); (recorded by Van der Walt (2013) and Colville & Cohen (2022), the latter observed behaviour conducive to possible nesting.

Denham's Bustard (*Neotus denhami*); Van der Walt (2013) reported Ludwig's Bustard but this is most likely to be Denham's Bustard.

Lanner Falcon (*Falco biarmicus*); recorded by Van der Walt (2013).

Knysna Warbler (*Bradypterus sylvaticus*) – not observed but potentially in the area but not on the development footprint where the habitat is not suitable.

Southern Black Korhaan (*Afrotis afra*) – not observed by Colville & Cohen (2022) but highlighted as potentially present.

8. Invertebrate Fauna

Van der Walt (2013) listed four butterfly species, *Lepidochrysops littoralis, Aloeides trimeni southeyae*, *Aloeides pallida littoralis, Aloeides thyra orientis*, that could occur in the study area but she had no specific records of any of these species.

Dr Dave Edge was appointed to conduct a butterfly investigation and he focused on *Aloeides trimeni southeyae,* a species of Lycaenid butterfly of conservation concern that is dependent on ants in the genus *Lepisiota* to complete their life-cycle. Edge (2018) made collections of the butterfly species in the study area and proposed a butterfly reserve in the north-eastern part of the study area. The majority of this habitat has been accommodated in both Alternative 2 & 3 with the latter now excluding this nature reserve from the fenced development area.

Colville & Cohen (2022) (with Andrew Morton) found that the habitat in parts of the project area are suitable for the Critically Endangered butterfly, *Chrysoritis thysbe mithras* as well, since its host plant, *Osteospermum moniliferum* and associated ant species, *Crematogaster peringueyi* both occur. They also found the butterfly *Pseudonympha magus* (Least Concern) abundantly in several parts of the project site.

Colville & Cohen (2022) indicated that the widespread species of conservation concern, *Aneuryphymus montanus* (Brown 1960) [Yellow-winged Agile Grasshopper] could occur at the site but this was not confirmed by collection during fieldwork.

9. Conservation Status

9.1 The Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan [WCBSP] (CapeNature 2017, Pool-Stanvliet *et al.* 2017) was consulted to determine conservation status and critical biodiversity areas of Erf 3122, Mossel Bay. The required shapefiles were obtained from the South African National Biodiversity Institute (SANBI) BGIS website and then the critical biodiversity areas (CBA) map for the Hartenbos Garden Estate study area was overlaid on a Google Earth ™ image and carefully examined to compare what was observed in the field with the aerial image when overlaid with the CBA map. The presence of CBAs (and ESAs -- Ecological Support Areas) suggests that areas where they have been mapped are ecologically sensitive. However, that is not always the case. Part of the objective of the ground-truthing was to determine the veracity of the units mapped as CBAs and ESAs in the WCBSP as applicable to Erf 3122, Mossel Bay.

The critical biodiversity areas map for Erf 3122, Mossel Bay, is determined mostly by the vegetation attributes, but vertebrate and invertebrate attributes are also considered. In the latter case, the area is viewed as a potential area for range extension of Bontebok (*Damaliscus pygargus dorcas*). This eventuality is not likely to ever happen so this, in my opinion, is a spurious criterion.

Virtually the entire area of Erf 3122, Mossel Bay is mapped as CBA1 with small areas mapped as CBA2 and even fewer areas mapped as ESA1 (Figure 14). From field observations there is poor correlation between the WCBSP map and the sensitivity of the vegetation and habitat that it forms. The areas covered by renosterveld are, in my opinion, not botanically sensitive and have low plant species diversity. I thus contend that the renosterveld area should be mapped as ESA1 and not CBA1 or CBA2. This contention is taken into account when determining the constraints on the site (see Figure 17).

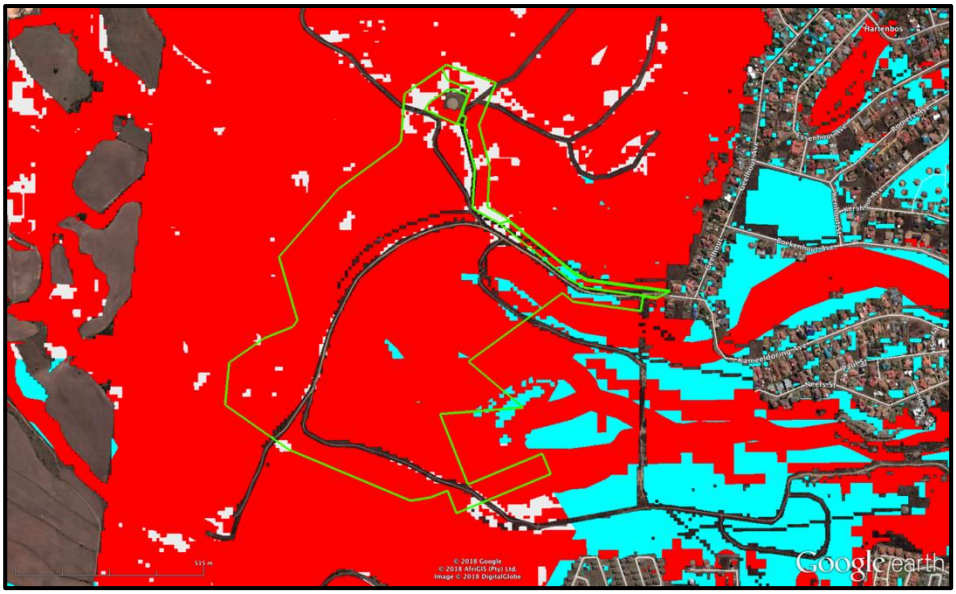


Figure 14. Critical Biodiversity Areas map for Erf 3122, Mossel Bay (green boundary). Red=CBA1; White = CBA2 and Light blue = ESA1.

9.2 Red Listed Ecosystems

An appraisal of remnants of important ecosystems of South Africa was carried out by Skowno *et al.* (2019) and published by SANBI (2021) as the 'Red List of Ecosystems' (RLE). The available shapefile was overlaid and a Google Earth Pro ™ image together with a boundary outline of the proposed Hartenbos Garden Estate development footprint and an outline with shading of the areas mapped as having been ploughed in the past. The resulting composite image (Figure 15) shows that the proposed development footprint is mostly within or in places marginally outside the historically ploughed areas and the Critically Endangered Ecosystems are outside the development footprint.

Endangered Mossel Bay Shale Renosterveld RLE as mapped by SANBI (2021) overlaps on the ploughed area at the areas enclosed by the ovals at '1' and '2' in Figure 15. At the oval labeled '3' the RLE overlaps with the entrance corridor to the proposed development. In addition, the greater part of the area within Oval 1 is to be set aside as a conservation area for the endangered butterfly, *Aloeides trimeni southeyae.*

It must be concluded, therefore, that the proposed development at Erf 3122, Mossel Bay would for practical purposes have a very low impact on the mapped RLE.

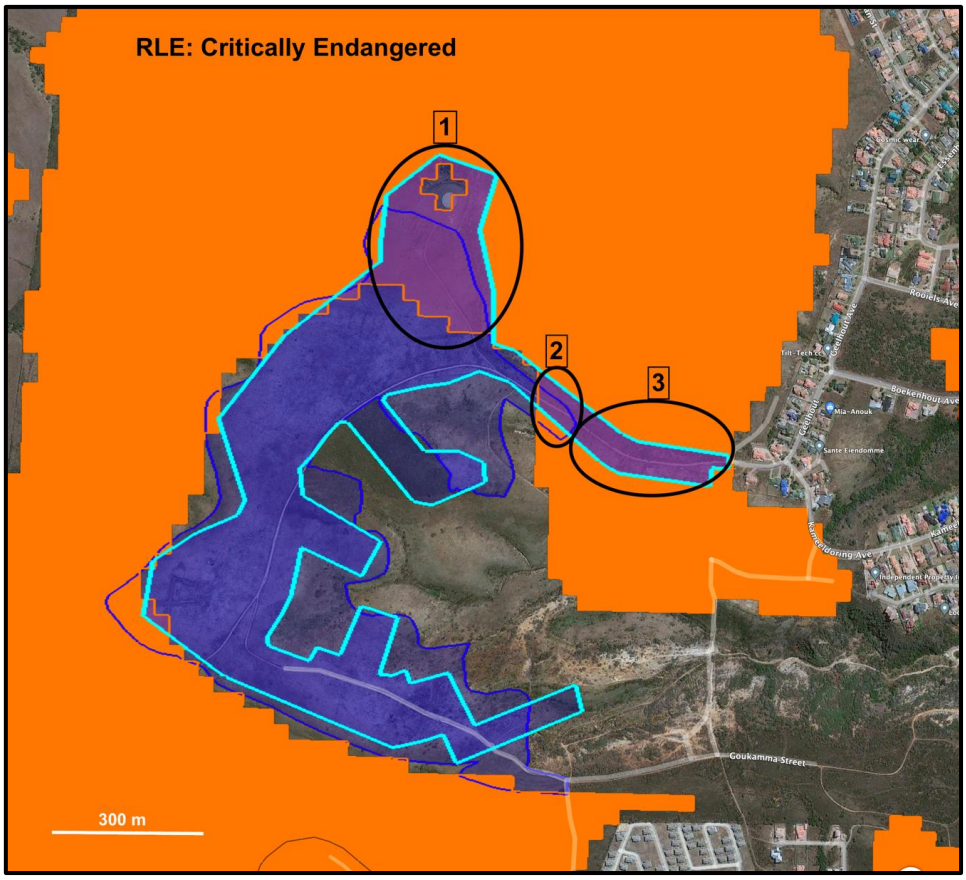


Figure 15. Google Earth Pro ™ with the mapped historically ploughed areas at Erf 3122, Mossel Bay (dark blue outline with dark blue shading); the development footprint, light blue outline and the Red List Ecosystem (RLE) [Critically Endangered] mapped as orange shading. Ovals 1, 2 & 3 are overlap zones of the three indicators; historical ploughing, development footprint and RLE.

9.3 Plant Species of Conservation Concern

As for the study by Helme (2016), no plant species of conservation concern (SCC) were found on the site in this study. Helme (2016) made observations of endangered species and regional endemics that occur in the near vicinity of the study area. He speculated that these species could occur on the site but that the probability of their occurrence is low, with which I concur. The following is an extract from Helme (2016):

"No rare or localised plant species were recorded on Erf 3122, but this does not mean that none are present, and there is deemed to be a medium to high likelihood that a few such species are in fact present on site, most likely within the undisturbed parts of the site. ***The likelihood of there being any such species within the proposed development footprint is low*** [my emphasis].

Mossel Bay Shale Renosterveld is known to support a number of rare and threatened *Haworthia* species (Bayer 1999; Mucina & Rutherford 2006), and these small, highly cryptic succulent plants could well be present on the undisturbed parts of Erf 3122. *Ruschia leptocalyx* (Plate 6) is a rare succulent Red Listed as Endangered (Raimondo *et al.* 2009), and was recorded along the edges of thicket patches some 1km north of the study area, but is not present on site (see Plate 6). A still unidentified *Lotononis* (Fabaceae) was also recorded just north of the study area, and may prove to be a localised, undescribed species (Dr J.S. Boatwright – pers. comm.). *Ruellia pilosa* is a regional endemic (Swellendam to Mossel Bay) and is Red Listed as Vulnerable (Raimondo *et al* 2009), and may be present in low numbers on the undisturbed parts of the site."

None of the above species were found at any of the sample waypoints recorded by McDonald (2017) and during subsequent visits. The local Garden Route CREW Group (CREW Outramps) were also requested by Dr Dave Edge (Edge, 2018) to visit the site to look for threatened plant species. However, should such species have been recorded, they have not been accessioned to the *iNaturalist* database. It is thus assumed that such species were not found by this group of well-informed amateur plant enthusiasts.

10. Botanical Constraints

Notwithstanding the classification of the entire Erf 3122, Mossel Bay, as CBA1 in the Western Cape Biodiversity Spatial Plan (Pence 2017) (Figure 14), the field observations indicate differently. Taking all the relevant indicators into consideration, a constraints map was compiled. The constraints map reflects the view that the renosterveld has **low sensitivity** and the grassy fynbos has **high sensitivity** with consequent low and high constraints as mapped in Figure 16.

The constraints map was used to inform the iterative process of the site layout. It was recommended at a team workshop (31 October 2017) that any proposed development of Erf 3122, Mossel Bay, should only take place in areas identified as 'Low Constraints'; mostly areas occupied by secondary renosterveld.

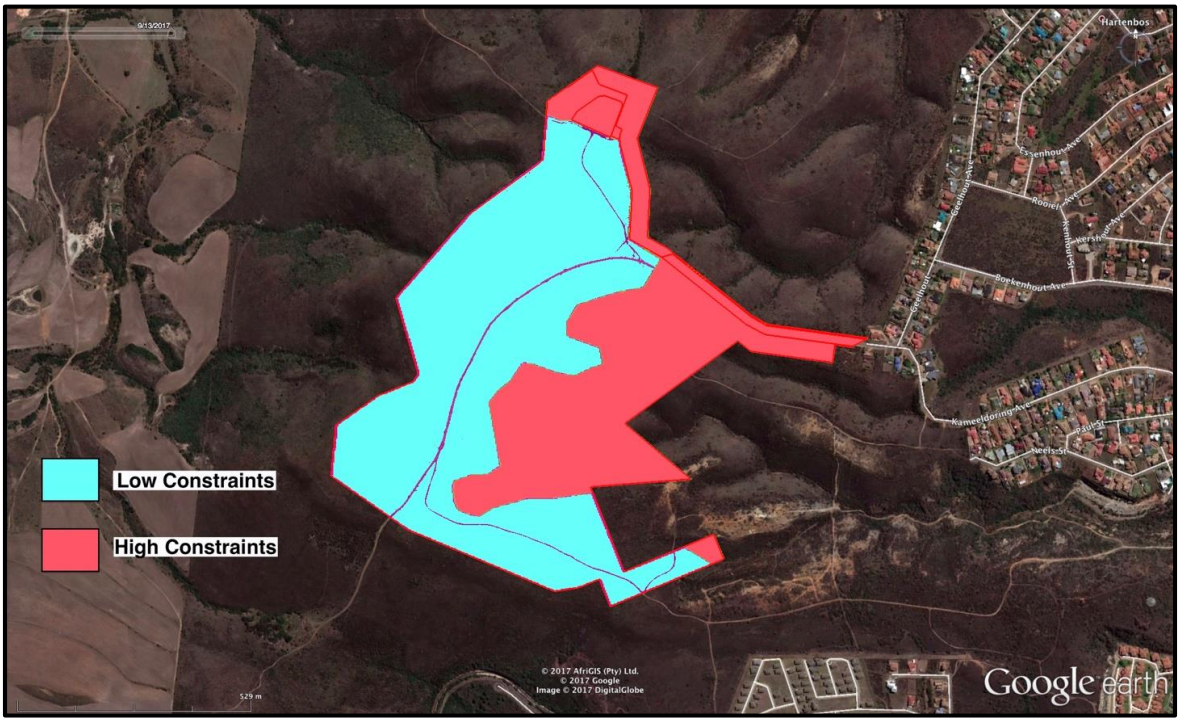


Figure 16. Botanical constraints for Erf 3122, Mossel Bay.

11. Responses to Cape Nature's comments on the scoping reports

The comments in the letter from Cape Nature dated 08 March 2022, Ref E14/2/6/1/6/6/ERRF3122_development_hartenbos, have been thoroughly considered. If the constraints of Critical Biodiversity Areas and Ecological Support Area are applied as intimated in this letter, the development as proposed at Erf 3122, Mossel Bay, may as well be halted immediately. Notwithstanding the comments about the merits or demerits of CBAs and ESAs, and the respective definitions and objectives of these classifications, a considerable effort has been made on the part of numerous specialists over a long period of time to arrive at an acceptable development proposal. The proponents of the development proposal, under the guidance of biological specialists, has sought to address the constraints published in the Western Cape Biodiversity Spatial Plan, with respect to botanical, entomological, faunal, and fresh-water considerations in great detail. In addition, a 'fire study' to develop a fire management plan has also been carried out.

The comments and recommendations in the letter are, in essence, a summarised version of all the aspects that have been thoroughly investigated and do not bear repeating. Reference is also made to Hartenbos Heuwels Erf 1852; Erf 1853; Portion 59 of Farm 217 and Portion 4 of Farm 217 and the recommendation of Biodiversity Stewardship and involvement with Cape Nature's Protected Area Expansion Strategy. The

above properties are not of concern in the Hartenbos Garden Estate development and so this is completely irrelevant to this project and is not considered any further here, suffice to say that the Hartenbos Garden Estate aspires to be as eco-friendly as possible e.g. to allow for ecological corridors (including for movement of animals through specially designed fences), and for ecosystem processes to persist with implementation of Alternative 3 as the preferred development option.

12. Site Ecological Importance

The Species Environmental Assessment Guidelines (SANBI 2020) require that Site Ecological Importance is calculated for each habitat on site, and provides a methodology for making this calculation. The dominant vegetation (habitat) in the footprint of the proposed Hartenbos Gardens Estate is secondary renosterveld with grassy fynbos being less extensive and subordinate. The ecological importance is calculated for these habitats.

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor site and its resilience to impacts (SEI = BI + RR). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. BI = CI + FI.

Table 1. Site ecological importance for habitats found in the study area.

Habitat (H)	**Conservation importance (CI)**	**Functional integrity (FI)**	**Receptor resilience (RR)**	**Site Ecological Importance (BI)**
Secondary renosterveld	**LOW** No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.	**MEDIUM** Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (	**LOW** Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	**LOW** (BI = Low)
Fynbos (grassy)	**MEDIUM**	**HIGH**	**MEDIUM**	**MEDIUM** (BI=MEDIUM)

	Any area of natural habitat of threatened ecosystem type with status of VU. > 50% of receptor contains natural habitat with potential to support SCC.	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Only minor current negative ecological impacts with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	

Table 2. Guidelines for interpreting SEI in the context of the proposed development activities:

Site ecological importance	**Interpretation in relation to proposed development activities**
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The Site Ecological Importance (SEI) of the renosterveld areas of the development footprint has thus been determined as **LOW** *(which agrees with the sensitivity given in Section 10. Botanical Constraints)*, with the SEI of the fynbos (grassy fynbos) areas determined as **MEDIUM**. This analysis is for the **HABITAT**.

A **multi-taxon SEI analysis** has not been carried out but is inferred from the habitat analysis. The most important element here is the loss of habitat that could occur for the rare and sensitive butterfly species, *Aloeides trimeni southeyae.* The conservation importance (CI) of the 'butterfly conservation area' is **HIGH**, with the functional integrity(FI) **MEDIUM**, giving a **MEDIUM** Site Ecological Importance (SEI). The receptor resilience (RR) is **MEDIUM**. Consequently, taking the above SEI for habitat as medium, together with the result of the analysis for *Aloeides trimeni southeyae*, the multi-taxon SEI in this instance is **MEDIUM**.

13. Impact assessment of the proposed development

The 'no-development' or 'No-Go' scenario is labelled **Alternative 1** in this assessment. Under this alternative, the site remains as is with no specific use of the land, no active fire management or burning regime, no alien vegetation clearing nor management of pedestrian and/or vehicular traffic.

The process followed to reach an 'acceptable' site development plan has integrated **numerous factors**, not only vegetation. Fauna (vertebrate and invertebrate), aquatic aspects and habitat, and ecological processes have also been taken into account. There is an intentional strong relationship between the first iteration of the SDP (Figure 2, referred to further as **Alternative 2**) and the botanical constraints map (Figure 16) since the vegetation on the site underpins most of the other interacting aspects of the ecology. Further refinement of the site development plan (SDP) took place as a result of the outcome of the scoping phase This happened under the direction of Hartenbos Hills Propco (Pty) Ltd. The SDP has responded to the landscape and ecology (secondary renosterveld that has returned after historical ploughing, including other associated biota) and it is predicted that with further mitigation, the resultant impact on the ecology is likely to be **Low Negative** to **Very Low Negative** (Tables 3—8) since only the low sensitivity areas would be directly affected. The areas where fynbos (as opposed to renosterveld) occurs, are likely to be affected very little, hence very low **direct** impacts and similarly very low to negligible **indirect** impacts.

The site development plan developed as a result of the scoping outcome, is the most recent SDP. The changes are seen in Figure 3 and this is referred to as **Alternative 3**.

13.1 Direct Impacts

The 'No Go' (Alternative 1) would result in no change to the *status quo*. In this case the target area would be left undeveloped with no management and scant protection. It is speculative to suggest that the habitat would improve or degrade but it is possible that it may degrade in the future due to continued invasion by alien invasive plants. Uncontrolled fires could also result in problems due to a lack of implementation of a fire management plan to control aging biomass. On the other hand, if left undeveloped, the ecological processes currently in play on the site would continue unhindered except if there were negative influences such as alien invasion, lack of suitable fire management and indiscriminate use by trespassing people with vehicles. To determine how the ecology would be affected would take concerted research investigation over many years, so no valid comment can be put forward here as to the future of the site. This underscores the need for informed assumptions given the location of the site (close to other Hartenbos suburbs), the already invading *Acacia* spp. and *Hakea sericea* and the risk of spread of wild fires either from the site to the neighbouring residential areas or vice versa. Uncontrolled accessibility to pedestrians, vehicles, bicycles and motorcycles could lead to erosion and further illegal dumping. Poaching of small mammals and reptiles

could also take place as has happened on the adjacent Mossel Bay Municipality 'conservation area' that is not being managed adequately. It can be reasonably assumed that these negative factors could occur if the 'No Go' or *Status Quo* (Alternative 1) is followed. Assuming the above, the 'No Go' alternative could be **Medium Negative** (Table 3).

Direct impacts of Alternative 2, the alternative assessed during the Scoping Phase, are given in Tables 4 and 5. Direct impacts would be **Medium Negative** without mitigation in the construction phase and **Low Negative** with mitigation. The direct impact of the operational phase would be Low Negative without mitigation and *Very Low Negative* with mitigation. Alternative 2 equates to the assumed impact of Alternative 1, the 'No Go' option. No irreplaceable resources would be lost but once the development is in place, any direct impacts would be irreversible. The impact on the vegetation, habitat and biota present would not be much different between Alternative 1 and Alternative 2.

The lowering of the height of the frail care facility (for visual impact reasons) would have no effect on the footprint as relevant to the habitat and biological organisms. However, the improvement in corridors and provision for measures that will improve movement of wildlife when the 'faunal gates' are closed (see Figure 3) would be positive.

Direct impacts are assessed in Tables 3—6.

There would be some difference between the impacts of Alternative 2 and Alternative 3 as they pertain to the movement of wildlife, but not the habitat. The only difference is that there would be improved corridors for movement of fauna. This difference, however, is not easily assessed as it is assumed that the corridors, opening of gates during the day and installing measures to improve animal movement at night (when the faunal gates are closed) will be necessary and effective for connectivity of habitat. The latter mitigation should be implemented on the assumption of there will be animal movement but this is not based on observations at the site.

Therefore the impacts given in Tables 3—6 are much the same with respect to the habitat with its resident biota i.e. the terrestrial biodiversity, with the post-mitigation for the construction phase being **Low Negative** and the post-mitigation for the operational phase being **Very Low Negative**.

Table 3. Impact of the loss of degraded renosterveld on the vegetation and faunal biota due to the **non-development** of Hartenbos Garden Estate (Alternative 1- 'No Go').

NO LOSS OF VEGETATION AND EFFECT ON INVERTEBRATE AND VERTEBRATE BIOTA				
PROJECT PHASE	*N/A*			
DIRECT IMPACT	*Non-removal of natural vegetation: degraded renosterveld; spread of alien invasive plants, illegal dumping and risk of wildfire etc.*			
INDIRECT IMPACT	*None determined*			
CUMULATIVE IMPACT	*None*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*Long-term*	*-8*	*2*
EXTENT	*2*	*The non-development impacts would be localized to the designated footprint as described.*		
SEVERITY	*-2*	*The severity of the potential impact will be moderate (medium) negative.*	***Slightly Detrimental***	***Likely***
IMPACT ON IRREPLACEBLE RESOURCES	*0*	*No irreplaceable resources would be impacted.*		
SIGNIFICANCE	***-16***	***Very Low Negative***		
PROPOSED MITIGATION MEASURES				
None				

POST-MITIGATION				
DURATION	4	*Long Term*	*-6*	*2*
EXTENT	2	*The extent of the impact is treated as 'Site' as if it would be developed, and adjacent properties*		
SEVERITY	-1	*The severity of the impact is rated as **Low Negative** as the impact would affect the environment in such a way that it would mostly be restricted to secondary renosterveld – i.e. the veld that returned after ploughing and then left fallow.*	***Negligible***	***Definite***
IMPACT ON IRREPLACEBLE RESOURCES	0	*No irreplaceable resources would be impacted.*		
SIGNIFICANCE	**-12**	***Very Low Negative***		
CONFIDENCE LEVEL				
High				

Table 4. Impact of the loss of degraded renosterveld on the vegetation and faunal biota due to the **construction phase** of the development of Hartenbos Garden Estate (Alternative 2).

LOSS OF VEGETATION AND EFFECT ON INVERTEBRATE AND VERTEBRATE BIOTA				
PROJECT PHASE	*Construction Phase*			
DIRECT IMPACT	*Removal of degraded renosterveld (with consequent loss of habitat) with effect on faunal biota.*			
INDIRECT IMPACT	*None determined*			
CUMULATIVE IMPACT	*Loss of degraded renosterveld habitat and associated biota.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will be phased with each year estimated to take 3—4 years.*	*-18*	*3*
EXTENT	*2*	*The impacts will be localized to the site as described*		
SEVERITY	*-3*	*The severity of the potential impact will be High negative.*	***Slightly Detrimental***	***Definite***
IMPACT ON IRREPLACEBLE RESOURCES	*0*	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	***-54***	***Medium Negative***		
PROPOSED MITIGATION MEASURES				
*(1) The mitigation measures necessary would be the relocation of geophytes from the development footprint (there are a few present!). Ideally the bulbs should be lifted when they are dormant (summer) but that would mean traversing the entire area of the proposed development in the preceding winter and marking every occurrence of these plants. A more practical approach would be to unearth the bulbs during the construction phase and to then relocate and plant them soon after removal. (**Note: A clearing permit as well as a permit for removal of and relocation of geophytic plants would be required from Cape Nature.**)*				

(2) The setting aside of the butterfly conservation area. *(3) All construction activities must take place within the footprint of the development. Areas outside the development footprint (except for access roads) MUST be avoided. Any areas within the development footprint that will not be used later should rehabilitated with natural vegetation native to the area.*				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last at least 5 years and therefore it is considered to be Long Term.*	*-6*	*3*
EXTENT	2	*The extent of the impact is treated as 'Site' as it affects the development area and adjacent properties*		
SEVERITY	-1	*The severity of the impact is rated as **Low Negative** post-mitigation*	***Slightly Detrimental***	***Definite***
IMPACT ON IRREPLACEBLE RESOURCES	0	*No irreplaceable resources would be impacted.*		
SIGNIFICANCE	**-18**	***Very Low Negative***		
CONFIDENCE LEVEL				
High				

Table 5. Impact of the loss of degraded renosterveld on the vegetation and faunal biota due to the **operational phase** of the development of Hartenbos Garden Estate (Alternative 2).

LOSS OF VEGETATION AND EFFECT ON INVERTEBRATE AND VERTEBRATE BIOTA				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Removal of degraded renosterveld (with consequent loss of habitat) with effect on faunal biota.*			
INDIRECT IMPACT	--			
CUMULATIVE IMPACT	*Loss of degraded renosterveld habitat and associated biota..*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term*	*-6*	*3*
EXTENT	*2*	*The extent of the impact is the area of the 'footprint' as it will only affect the area in which the proposed activity will occur.*		
SEVERITY	*-1*	*The severity of the impact is rated as **Low Negative** as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected.*	***Negligible***	***Likely***
IMPACT ON IRREPLACEBLE RESOURCES	*0*	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	***-18***	***Very Low Negative***		
PROPOSED MITIGATION MEASURES				
Undertake vegetation clearing during the dry season; Keep vegetation cut low but not eradicated along firebreaks. *Only clear vegetation where absolutely necessary.*				

POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last > 5 years and as such is rated as long term*	*-5*	*2*
EXTENT	1	*The extent of the impact is recognized as the footprint as it only affects the area in which the proposed activity will occur*		
SEVERITY	-1	*The severity of the impact is rated as **Low Negative** since the impact during the operational phase will not affect the environment in such a way that natural, cultural and social functions and processes will be affected any more than in the construction phase.*	***Negligible***	***Likely***
IMPACT ON IRREPLACEBLE RESOURCES	0	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	**-10**	***Very Low Negative***		
CONFIDENCE LEVEL				
Medium				

Table 6. Impact of the loss of degraded Mossel Bay Shale Renosterveld due to the **construction phase** of the development of Hartenbos Garden Estate (**Alternative 3 -**preferred alternative).

LOSS OF VEGETATION AND EFFECT ON INVERTEBRATE AND VERTEBRATE BIOTA				
PROJECT PHASE	*Construction Phase*			
DIRECT IMPACT	*Removal of natural vegetation: degraded renosterveld and impact on faunal biota, but excluding a butterfly conservation area.*			
INDIRECT IMPACT	*None determined*			
CUMULATIVE IMPACT	Loss of degraded renosterveld but saving habitat for *Aloeides trimeni southeyae,* an endemic and rare butterfly.			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will be phased with each year estimated to take 3—4 years.*	*-15*	*3*
EXTENT	*1*	*The impacts will be localized to the designated footprint as described (excluding the butterfly reserve)*		
SEVERITY	*-3*	*The severity of the potential impact will be High Negative.*	***Moderately detrimental***	***Definite***
IMPACT ON IRREPLACEBLE RESOURCES	*0*	*No irreplaceable resources would be impacted.*		
SIGNIFICANCE	***-45***	***Medium Negative***		
PROPOSED MITIGATION MEASURES				
The mitigation measures necessary would be the relocation of *geophytes from the development footprint. Ideally the bulbs should be lifted when they dormant (summer) but that would mean traversing the entire area of the proposed development in the preceding winter and marking every occurrence of these plants. A more practical approach would be to unearth the bulbs during the construction phase and to then relocate and plant them soon after removal. (**Note: A clearing permit as well as a permit for removal of and relocation of geophytic plants would be required from Cape Nature.**)* *Secondly, all construction activities must take place within the footprint of the development. Areas outside the development footprint (except for access roads) MUST be avoided. Any areas within the development footprint that will not be used later should rehabilitated wit natural vegetation native to the area.*				

Alternative 3 excludes the butterfly conservation area from the enclosed development footprint area (It should be fenced off prior to any construction activities). However, see Table 7.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last at least 5 years and therefore it is considered to be Long Term.*	*-6*	*3*
EXTENT	2	*The impacts would be localized to the designated footprint as described plus management of the butterfly reserve.*		
SEVERITY	-1	*The severity of the impact is rated as **Low Negative** as the impact would affect the environment in such a way that it would mostly be restricted to secondary renosterveld – i.e. the veld that returned after ploughing and then being left fallow.*	***Negligible***	***Definite***
IMPACT ON IRREPLACEBLE RESOURCES	0	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	**-18**	**Very Low Negative**		
CONFIDENCE LEVEL				
High				

Table 7. Impact of the loss of degraded Mossel Bay Shale Renosterveld due to the **operational phase** of the development of Hartenbos Garden Estate (**Alternative 3 -**preferred alternative).

LOSS OF VEGETATION AND EFFECT ON INVERTEBRATE AND VERTEBRATE BIOTA				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Removal of natural vegetation: degraded renosterveld and impact on faunal biota, but excluding a butterfly conservation area.*			
INDIRECT IMPACT	--			
CUMULATIVE IMPACT	Loss of degraded renosterveld but saving habitat for *Aloeides trimeni southeyae,* an endemic and rare butterfly.			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term*	*-6*	*3*
EXTENT	*2*	*The extent of the impact is rated as the area of the 'footprint' as it will only affect the area in which the proposed activity will occur, including management of the butterfly reserve.*		
SEVERITY	*-1*	*The severity of the impact is rated as **Low negative** as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected*	***Negligible***	***Likely***
IMPACT ON IRREPLACEBLE RESOURCES	*0*	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	***-18***	***Very Low negative***		
PROPOSED MITIGATION MEASURES				
Undertake vegetation clearing during the dry season; Keep vegetation cut low but not eradicated along firebreaks. *Only clear vegetation where absolutely necessary.*				

Size and position of corridors for wildlife movement are marginally improved (increased). *The butterfly reserve must be included in the management of the development. It will be the responsibility of the Applicant / HOA to ensure continuous alien clearing and that controlled ecological burns are carried out.*				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last > 5 years and as such is rated as long term*	*-6*	*1*
EXTENT	2	*The extent of the impact is rated as the area of the 'footprint' and the butterfly reserve.*		
SEVERITY	-1	*The severity of the impact is rated as Low Negative since the impact during the operational phase will not affect the environment in such a way that natural, cultural and social functions and processes will be affected any more than in the construction phase.*	***Negligible***	***Likely***
IMPACT ON IRREPLACEBLE RESOURCES	0	*No irreplaceable resources will be impacted.*		
SIGNIFICANCE	**-12**	***Very Low negative***		
CONFIDENCE LEVEL				
Medium				

Table 8. Impact Assessment Summary Table

	WITHOUT MITIGATION		**WITH MITIGATION**	
	Construction	**Operation**	**Construction**	**Operation**
ALTERNATIVE 1 – STATUS QUO	Very Low Negative (construction is not applicable here *per se*)	Very Low Negative (operation not applicable here *per se*)	N/A	N/A
ALTERNATIVE 2 – SCOPING SDP	Medium Negative	Very Low Negative	Very Low Negative	Very Low Negative
ALTERNATIVE 3 – PREFERRED SDP	Medium Negative	Very Low Negative	Very Low Negative	Very Low Negative

13.2 Indirect impacts

By definition, indirect impacts occur away from the 'action source' i.e., away from the development site. The impact here is specifically how the proposed Hartenbos Garden Estate would have indirect impacts on vegetation and flora as well as vertebrate and invertebrate biota away from the development area. No indirect impacts are obvious for any of the alternatives.

13.3 Cumulative impacts

The proposed development of the Hartenbos Garden Estate would be in an area of the Garden Route known for its natural beauty. It will also be placed in an area mapped as CBA1. However, as has been demonstrated above, the footprint of the development would be restricted to substrates that were historically ploughed and now support substantially altered and degraded renosterveld. The intrinsic properties of undisturbed Mossel Bay Shale Renosterveld have largely been lost. As far as can be determined, the actual loss of any remaining **undisturbed** renosterveld would be limited and there would thus be no further loss of any undisturbed Mossel Bay Shale Renosterveld in the future due to the proposed development.

Alternative 1: 'No Go' (*Status Quo*) – **Very Low Negative,** since there would be no alteration to the site apart from effects of lack of management.

Alternative 2: Scoping SDP – **Low Negative**, since the vegetation on the site (footprint) is degraded with low conservation value and no longer contributes to the quantum of

UNDISTURBED Mossel Bay Shale Renosterveld and its associated faunal biota over its known distribution range.

Alternative 3: Preferred SDP **- Low Negative**, since the vegetation on the site (footprint) is degraded with low conservation value and no longer contributes to the quantum of **UNDISTURBED** Mossel Bay Shale Renosterveld and its associated faunal biota over its known distribution range.

14. General Assessment and Recommendations

- A single vegetation type, Mossel Bay Shale Renosterveld is mapped as occurring in the footprint of the proposed Hartenbos Garden Estate. However, the vegetation is secondary with the renosterveld a degraded and poor 'restoration' of cover dominated by *D. rhinocerotis.* A second, poorly described vegetation type, named here as grassy fynbos, lies outside the development footprint but still on Erf 3122, Mossel Bay.
- Undisturbed Mossel Bay Shale Renosterveld is Critically Endangered and not conserved in any formal conservation area over its range. The loss of the renosterveld at Erf 3122, Mossel Bay, would not contribute to further loss of undisturbed Mossel Bay Shale Renosterveld.
- No rare or threatened plant species were found during the survey. The probability of the occurrence of species of conservation concern (SCC) in the development footprint is low due to historical disturbance by ploughing.
- No rare or threatened mammals and reptiles were documented for the site.
- A rare endemic butterfly, *Aloeides trimeni southeyae*, has been found on the site and a reserve is proposed for the conservation of this species and associated ants (*Lepisiota* sp.) This would be a positive mitigation.
- The National Web-based Environmental Screening Tool the terrestrial biodiversity overestimates the sensitivity specifically of the development footprint which has been determined by on-site evaluation and the application of the Site Ecological Importance (SEI) equation to have **Low Ecological Importance** for the habitat and for the multi-taxon, the SEI is **Medium.**
- Based on the data collected and analyzed for the target area for the development of Hartenbos Garden Estate, no fatal flaws or any other obstacles were found with respect to the terrestrial biodiversity as a whole.

15. Conclusions

A simple definition of biological diversity or biodiversity is "the variety of plant and animal life in the world or in a particular habitat, a high level of which is usually considered to be important and desirable" (Oxford Languages on Google). There are various types of biodiversity, and this report has not addressed the intricacies of ecological interconnectivity that result from interaction between different organisms. It merely attempts to address the biodiversity, at a high level, of the receiving environment of the Hartenbos Garden Estate development.

The report is also biased in terms of botanical aspects due to the author's own bias but also the understanding that plants (fungi notwithstanding) are the primary producers that create the habitat and living conditions for other biota.

From a botanical perspective Erf 3122, Mossel Bay can be divided into two main vegetation types, low sensitivity renosterveld and high sensitivity grassy fynbos. These vegetation types occupy two distinct areas with the renosterveld being found on the upland plateau. It was historically ploughed and this disturbance has carried through despite the area having apparently restored to 'good' vegetation. Analyses of collected data shows that the renosterveld is relatively poor in plant species with a significant complement of the original species having been lost. The fynbos, on the other hand, is relatively undisturbed and has high sensitivity. The latter vegetation would be completely unaffected by the proposed development.

Despite virtually the entire area of Erf 3122, Mossel Bay (Hartenbos Garden Estate) being classified as CBA1 in the WCBSP (2017), it has been determined from field studies (ground-truthing) that the ***development area specifically*** is occupied by renosterveld that should at best be re-classified as ESA1. The renosterveld in the proposed development area has low botanical constraints and apart from the occurrence of the rare butterfly, *Aloeides trimeni southeyae* (Lycaenidae) it does not support a diverse and important fauna.

The results of this terrestrial biodiversity assessment show that the "No Go" alternative (Alternative 1) would have a **Very Low Negative** impact. The Alternative 2 SDP would have a **Low Negative** impact as would the preferred alternative, Alternative 3, after mitigation. There is thus not much that separates Alternative 2 from Alternative 3 from a biodiversity perspective, but Alternative 3 would conceivably offer more advantages to the fauna through provision of habitat

connectivity. It also has a demarcated butterfly reserve that is a strong mitigation for conservation of the single identified endemic species of both flora and fauna.

The assessment of the terrestrial biodiversity of Erf 3122, Mossel Bay, indicates that development Alternative 3, the preferred alternative, would be the supported.

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Appendix 1: Impact Assessment Methodology (from GIBB Environmental)

The objective of the assessment of potential impacts is to identify and assess all the significant, potential impacts that may arise as a result of the project.

For each of the main project phases the existing and potential future impacts and benefits (associated only with the project) will be described using the criteria listed below. The assignment of ratings has been undertaken based on past experience of the team, as well as through research. Subsequently, mitigation measures will be identified and considered for each impact and the assessment repeated in order to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented).

Table 1: Impact Assessment Criteria

Criteria	Rating Scales	Notes
Nature	Positive	An evaluation of the effect of the impact related to the proposed development
	Negative	
Extent	Footprint	The extent of the impact is rated as footprint as it only affects the area in which the proposed activity will occur
	Site	The extent of the impact is rated as site as it will affect only the development area
	Local	The extent of the impact is rated as Local as it affects the development area and adjacent properties
	Regional	The extent of the impact is rated as Regional as the effects of the impact extends beyond municipal boundaries
	National	The extent of the impact is rated as National as the effects of the impact extends beyond more than 2 regional/ provincial boundaries
	International	The extent of the impact is rated as International as the effect of the impact extends beyond country borders
Duration	Temporary	The duration of the activity associated with the impact will last 0-6 months and as such is rated as Temporary
	Short term	The duration of the activity associated with the impact will last 6-18 months and as such is rated as Short term
	Medium term	The duration of the activity associated with the impact will last 18 months-5 years and as such is rated as Medium term
	Long term	The duration of the activity associated with the impact will last more than 5 years and as such is rated as Long Term
Severity	High negative	The severity of the impact is rated as High negative as the natural, cultural or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected.

Criteria	Rating Scales	Notes
	Moderate negative	The severity of the impact is rated as Moderate negative as the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected
	Low negative	The severity of the impact is rated as Low negative as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected
	Low positive	The severity of the impact is rated as Low positive as the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally improved
	Moderate positive	The severity of the impact is rated as Moderate positive as the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are positively affected
	High positive	The severity of the impact is rated as High positive as the natural, cultural or social functions and processes are altered to the extent that valued, important, sensitive or vulnerable systems or communities are substantially positively affected.
Potential for impact on irreplaceable resources	No	No irreplaceable resources will be impacted.
	Yes	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental	A combination of extent, duration, intensity and the potential for impact on irreplaceable resources
	Highly detrimental	
	Moderately detrimental	
	Slightly detrimental	
	Negligible	
	Slightly beneficial	
	Moderately beneficial	
	Highly beneficial	
	Extremely beneficial	
Likelihood of the impact occurring	Unlikely	It is highly unlikely or less than 50 % likely that an impact will occur.
	Likely	It is between 50 and 75 % certain that the impact will occur.
	Definite	It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.
Significance	Very high - negative	A function of Consequence and Likelihood
	High - negative	
	Moderate - negative	

Criteria	Rating Scales	Notes
	Low - negative	
	Very low	
	Low - positive	
	Moderate - positive	
	High - positive	
	Very high - positive	

Table 2: Impact Assessment Criteria and Rating Scales

Duration		Extent		Irreplaceable Resources		Severity		Consequence = (Duration + Extent + Irreplaceable Resources) x Severity		Likelihood		Significance (Consequence x Likelihood)		Confidence
1	Temporary	1	Footprint	1	Yes	-3	High - negative	-25 to -33	Extremely detrimental	1	Unlikely	-73 to -99	Very high - negative	Low
2	Short term	2	Site	0	No	-2	Moderate - negative	-19 to -24	Highly detrimental	2	Likely	-55 to -72	High - negative	Medium
3	Medium term	3	Local			-1	Low -negative	-13 to -18	Moderately detrimental	3	Definite	-37 to -54	Moderate - negative	High
4	Long term	4	Regional					-7 to -12	Slightly detrimental			-19 to -36	Low - negative	
		5	National			1	Low -positive	0 to -6	Negligible			0 to -18	Very low - negative	
		6	International			2	Moderate - positive							
						3	High - positive	0 to 6	Negligible			0 to 18	Very Low - positive	
								7 to 12	Slightly beneficial			19 to 36	Low - positive	
								13 to 18	Moderately beneficial			37 to 54	Moderate - positive	
								19 to 24	Highly beneficial			55 to 72	High - positive	
								25 to 33	Extremely beneficial			73 to 99	Very high - positive	

Ascribing Significance for Decision-Making

The best way of expressing these cost benefit implications for decision-making is to present them as risks. Risk is defined as the consequence (implication) of an event multiplied by the probability (likelihood)2 of that event. Many risks are accepted or tolerated on a daily basis because even if the consequence of the event is serious, the likelihood that the event will occur is low. A practical example is the consequence of a parachute not opening, is potentially death but the likelihood of such an event happening is so low that parachutists are prepared to take that risk and hurl themselves out of an airplane. The risk is low because the likelihood of the consequence is low even if the consequence is potentially severe.

It is also necessary to distinguish between the event itself (as the cause) and the consequence. Again using the parachute example, the consequence of concern in the event that the parachute does not open is serious injury or death, but it does not necessarily follow that if a parachute does not open that the parachutist will die.

Various contingencies are provided to minimise the likelihood of the consequence (serious injury or death) in the event of the parachute not opening, such as a reserve parachute. In risk terms this means distinguishing between the inherent risk (the risk that a parachutist will die if the parachute does not open) and the residual risk (the risk that the parachutist will die if the parachute does not open but with the contingency of a reserve parachute) i.e. the risk before and after mitigation.

Consequence

The ascription of significance for decision-making becomes then relatively simple. It requires the consequences to be ranked and likelihood to be defined of that consequence.

In **Table 3** below a scoring system for consequence ranking is shown. Two important features should be noted in the table, namely that the scoring doubles as the risk increases and that there is no equivalent 'high' score in respect of benefits as there is for the costs. This high negative score serves to give expression to the potential for a fatal flaw where a fatal flaw would be defined as an impact that cannot be mitigated effectively and where the associated risk is accordingly untenable. Stated differently, the high score on the costs, which is not matched on the benefits side, highlights that such a fatal flaw cannot be 'traded off' by a benefit and would render the proposed project to be unacceptable.

Table 3: Ranking of Consequence

Environmental Cost	Inherent risk
Human health – morbidity/ mortality, loss of species	High
Material reductions in faunal populations, loss of livelihoods, individual economic loss	Moderate – High
Material reductions in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance	Moderate – Low
Negative change – with no other consequences	Low
Environmental Benefits	**Inherent benefit**

[2] Because 'probability' has a specific mathematical/empirical connotation the term 'likelihood' is preferred in a qualitative application and is accordingly the term used in this document.

Net improvement in human health and welfare	Medium – High
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic development	Moderate – Low
Positive change – with no other benefits	Low

Likelihood

Although the principle is one of probability, the term 'likelihood' is used to give expression to a qualitative rather than quantitative assessment, because the term 'probability' tends to denote a mathematical/empirical expression. A set of likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring, is presented in **Table 4** below.

Table 4: Likelihood Categories and Definitions

Likelihood Descriptors	Definitions
Highly unlikely	The possibility of the consequence occurring is negligible
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely
Likely	The consequence may not occur but a balance of probability suggests it will
Highly likely	The consequence may still not occur but it is most likely that it will
Definite	The consequence will definitely occur

It is very important to recognise that the likelihood question is asked twice. The first time the question is asked is the likelihood of the cause and the second as to the likelihood of the consequence. In the tables that follow the likelihood is presented of the cause and then the likelihood of the consequence is presented. A high likelihood of a cause does not necessarily translate into a high likelihood of the consequence. As such the likelihood of the consequence is not a mathematical or statistical 'average' of the causes but rather a qualitative estimate in its own right.

Residual Risk

The residual risk is then determined by the consequence and the likelihood of that consequence. The residual risk categories are shown in **Table 5** below where consequence scoring is shown in the rows and likelihood in the columns. The implications for decision-making of the different residual risk categories are shown in **Table 6** below.

Table 5: Residual Risk Categories

Consequence	High	Moderate	High	High	Fatally flawed	
	Moderate – high	Low	Moderate	High	High	High
	Moderate	Low	Moderate	Moderate	Moderate	Moderate
	Moderate – low	Low	Low	Low	Low	Moderate
	Low	Low	Low	Low	Low	Low
		Highly unlikely	Unlikely but possible	Likely	Highly likely	Definite
		Likelihood				

Table 6: Implications for Decision-Making of the different Residual Risk Categories

Rating	Nature of implication for Decision – Making
Low	Project can be authorised with low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised

Appendix 2: Minimum Content Requirements for Botanical and Terrestrial Biodiversity Specialist Reports as per Protocol for the Specialist Assessment of Environmental Impacts on Terrestrial Biodiversity (GN 320 of 20 March 2020)

Protocol ref	**Botanical and Terrestrial Biodiversity Specialist Assessment Report Content**	**Section / Page**
3.1.1.	contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Cover & Page 4
3.1.2.	a signed statement of independence by the specialist;	Page 5
3.1.3.	a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Pages N/A
3.1.4.	a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Pages 15--19
3.1.5.	a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Page 6
3.1.6.	a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	N/A
3.1.7.	additional environmental impacts expected from the proposed development;	N/A
3.1.8.	any direct, indirect and cumulative impacts of the proposed development;	Pages 34—47
3.1.9.	the degree to which impacts and risks can be mitigated;	Pages 34—47
3.1.10.	the degree to which the impacts and risks can be reversed;	Pages 34—47
3.1.11.	the degree to which the impacts and risks can cause loss of irreplaceable resources;	Pages 34—47
3.1.12.	proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	N/A
3.1.13.	a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	N/A
3.1.14.	a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Pages 48-49
3.1.15.	any conditions to which this statement is subjected.	N/A

Appendix 3. Curriculum Vitae

Dr David Jury McDonald Pr.Sci.Nat.

Name of Firm: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

Work and Home Address: 14 A Thomson Road, Claremont, 7708

Tel: (021) 671-4056 **Mobile:** 082-8764051 **Fax:** 086-517-3806

E-mail: dave@bergwind.co.za

Website: www.bergwind.co.za

Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide

Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Seventeen years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality: South African (ID No. 560807 5018 080)
Languages: English (home language) – speak, read and write
Afrikaans – speak, read and write

Membership in Professional Societies:

- South Africa Association of Botanists
- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications :

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute)
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.

- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications; involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.

- Further tasks involved the day-to-day management of a large non-profit environmental organisation.

- **Independent botanical consultant** (2005 – to present) over 300 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained
and major subjects passed:

B.Sc. (1977), University of Natal, Pietermaritzburg
Botany III
Entomology II (Third year course)

B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
Botany (Ecology /Physiology)

M.Sc. - (Botany), University of Cape Town, 1983.
Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.

PhD (Botany), University of Cape Town, 1995.
Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.

Certificate of Tourism: Guiding (Culture: Local)
Level: 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record:

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**

August 2000 - 2005 : Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa

January 1981 – July 2000 : Research Scientist (Vegetation Ecology) at National Botanical Institute

January 1979—Dec 1980 : National Military Service

Further information is available on website: www.bergwind.co.za