BOTANICAL SCOPING STUDY OF PROPOSED SEWAGE TREATMENT OPTIONS AT CAPE POINT, TABLE MOUNTAIN NATIONAL PARK, CAPE PENINSULA.

Compiled for: Khula Environmental, Cape Town

Client: SANParks, Pretoria

16 November 2012
DECLARATION OF INDEPENDENCE

In terms of Chapter 5 of the National Environmental Management Act of 1998 specialists involved in Impact Assessment processes must declare their independence and include an abbreviated Curriculum Vitae.

I, N.A. Helme, do hereby declare that I am financially and otherwise independent of the client and their consultants, and that all opinions expressed in this document are substantially my own, notwithstanding the fact that I have received fair remuneration from the client for preparation of this report.

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(CapeNature 2006); Assessment of Driftsands South (Environmental Partnership 2006); Woodgreen housing Mitchell’s Plain (CCA; 2006); Assessment of new Eskom Briers Substation and new 66kV overhead powerline (Eskom 2006); Muizenberg erf 108161 (CndeV; 2005); Muizenberg erf 159848 (Headland; 2005); Muizenberg erf 159850 (Headland; 2005); Kommetjie Riverside Ext 2. (Headland; 2005); Ocean View extension (Ecosense; 2005); Imhoffs farm (Headland; 2005); Rocklands, Simonstown (CCA; 2005); Erf 35069 and Ptn. Erf 3418, Kuils River (SEC; 2005); Erf 550 & 552, Phillippi (Amathemba Environmental; 2005); proposed Grand Prix site next to CT International, Belhar (EnviroDinamik; 2005; Environmental Partnership 2007); Dreamworld film studio survey and Impact Assessment (Environmental Partnership; 2004 & 2005); Kompanjiestuin survey and Impact Assessment (Ecosense; 2004); Erf 11825, Fish Hoek (private client, 2004); R300 Cape Flats Ring Road surveys (Ecosense and Ecosense/Chand jv; 2003-2007); Bordjiesrif environmental education centre in the TMNP (for SRK & NPB; 2002); Elsies Peak development (private client, 2003); Edith Stephens Wetland Park Survey (Botanical Society of SA 2002); Chapman’s Peak toll road IA (Megan Anderson Landscape Architects 2002); Pelican Park, Capricorn Park, Millers Point, and Soetwater (for CoCT and Jessica Hughes, Afridev; 2000 & 2001); Plateau Road (SPM & EEU; 1999); survey of remaining areas of natural vegetation in the eastern portion of the Cape Flats (Botanical Society of SA; 1999 - 2000).

CONDITIONS RELATING TO THIS REPORT:
The methodology, findings, results, conclusions and recommendations in this report are based on the author’s best scientific and professional knowledge, and on referenced material and available knowledge. Nick Helme Botanical Surveys and its staff reserve the right to modify aspects of the report, including the recommendations and conclusions, if and when additional relevant information becomes available.

This report may not be altered or added to without the prior written consent of the author, and this also applies to electronic copies of this report, which are supplied for purposes of inclusion in other reports, including in the report of EAPs. Any recommendations, statements or conclusions drawn from or based on this report must cite this report, and should not be taken out of context, and may not change, alter or distort the intended meaning of the original in any way. If these extracts or summaries form part of a main report relating to this study or investigation this report must be included in its entirety as an appendix or separate section to the main report.
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1. INTRODUCTION

This botanical assessment was commissioned in order to help inform plans for a new sewage treatment facility at the Cape Point carpark, within the Table Mountain National Park. The current system, which involves a package plant on site and release of treated effluent via a single outlet pipe some 50m below the plant, needs to be expanded due to increased volumes, and the new system will be designed to handle 90kl per day (Murray 2012). Two options were proposed for investigation. Alternative 1 is disposal of the treated effluent into the area below and to the southwest of the carpark, via a system of perforated pipes, and covering a total area of about 1.6ha (Murray 2012; Figure 1). Alternative 2 would involve use of the Rooikrans overflow carpark as a site for drilling of a deep well, and the treated effluent would be piped from the package plant (via an existing pipeline) to this well, where it would be disposed of deep underground. Marine discharge (into the Platbank area) of the treated effluent was previously considered, but was not part of the current study.

Figure 1: Proposed layout of new treated effluent dispersal system below the carpark.
2. TERMS OF REFERENCE

Although no specific terms of reference were provided for this study the standard CapeNature and Botanical Society of South Africa recommended TOR for biodiversity specialists were used as a guide, and these are as follows:

- Produce a baseline analysis of the botanical attributes of the two study areas.
- This report should clearly indicate any constraints that would need to be taken into account in considering any development proposals further.
- The baseline report must include a map of the identified sensitive areas as well as indications of important botanical constraints. It must also:
  - Describe the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of biodiversity pattern, identify or describe:

**Community and ecosystem level**

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- The types of plant communities that occur in the vicinity of the site
- Threatened or vulnerable ecosystems (cf. SA vegetation map/National Spatial Biodiversity Assessment, etc.)

**Species level**

- Plant Species of Conservation Concern (SCC; give coordinates if possible)
- The viability of and estimated population size of the SCC that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other SCC occurring in the vicinity (include degree of confidence).

**Other pattern issues**

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying
(alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).

i. The condition of the site in terms of current or previous land uses.

In terms of biodiversity process, identify or describe:

j. The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.

k. Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces or biome boundaries).

l. Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.

- What is the significance of the potential impact of the proposed project – with and without mitigation – on biodiversity pattern and process at the site and regional scale?

- Recommend actions that should be taken to prevent or mitigate impacts. Indicate how these should be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.

- Indicate limitations and assumptions, particularly in relation to seasonality.

3. LIMITATIONS, ASSUMPTIONS AND METHODOLOGY

The site was visited on 16 October 2012, which is within but towards the end of the peak spring flowering season in the Cape winter rainfall region. Most of the winter – spring flowering annuals and geophytes were thus recorded and identifiable, and most shrubs were in flower and all were identifiable. From a purely botanical point of view there were no significant seasonal constraints on this study, and confidence levels in the comprehensiveness of the observations and findings is high.

The author was able to reference the collections of the Bolus and Compton Herbaria, the Cape Rares GIS layers of the CREW (Custodians of Rare and Endangered Wildflowers) project of SANBI, plus extensive personal experience in the south Peninsula region.
Google Earth imagery dated March 2011 was used to verify vegetation patterns observed on the ground, and was used as a base image for the sensitivity mapping. Google Earth imagery going back to 2002 was also examined.

The study areas were surveyed on foot, and all plant species were noted. Certain photographs and voucher specimens were taken.

4. REGIONAL CONTEXT OF THE VEGETATION

The study area is located at the southern tip of the Cape Peninsula, which falls within the southwest coastal region of the Cape Floristic Region (CFR), and the region is part of the Fynbos biome. The CFR is one of only six Floristic Regions in the world, and is the only one confined to a single country. It is also by far the smallest floristic region, occupying only 0.1% of the world’s land surface, and supporting about 9000 plant species, almost half of all the plant species in South Africa. At least 70% of all the species in the Cape region do not occur elsewhere, and many have very small home ranges (these are known as narrow endemics). Many of the lowland habitats are under pressure from agriculture, urbanisation and alien plants, and thus many of the range restricted species are also under severe threat of extinction, as habitat is reduced to extremely small fragments. Data from the nationwide plant Red Listing process undertaken is that 67% of the threatened plant species in the country occur only in the southwestern Cape, and these total over 1800 species (Raimondo et al 2009). It should thus be clear that the southwestern Cape is a major national and global conservation priority, and is quite unlike anywhere else in the country in terms of the number of threatened plant species.

The Cape Peninsula is an international “hotspot” of plant diversity (Cowling et al 1996; Helme & Trinder Smith 2006), with a phenomenal 161 endemic plant species (i.e. found only in this area; Helme & Trinder Smith 2006). The lowland areas are particularly poorly conserved within the region, and are where many of the threatened plant species are concentrated, and any lowland site must be viewed in this context. One of the primary reasons for the creation of the Table Mountain National Park (TMNP) was recognition of this exceptional botanical diversity, and the Cape Point section of the TMNP is a known “hotspot” of plant diversity and endemism with the TMNP, with about 8 species thought to be endemic to this area (Helme – unpub. data).
5. **THE VEGETATION ON SITE, PLUS SENSITIVITY**

The Cape Point study area (i.e. below and west of the carpark) faces southwest, and has sandy soils, being a mix of those derived from the weathered Table Mountain Group sandstones, and from windblown sands of marine origin. In fact, the study area is at the tail end of a dune plume that once extended southeast from the seashore north of the Cape of Good Hope. Sandstone does not outcrop within the proposed discharge area, and the sands are generally at least 1.5m deep (Murray 2012). Although not noted by Murray (2012) there is a small area of koffieklip (ferricrete) evident at and near the surface, and this also appears to have been quarried in this area (at least 30 years ago).

The Rooikrans parking area itself is heavily disturbed, and the area to the west (downslope) has clearly been disturbed in the past, presumably by gravel quarrying, as suggested by small, thin patches of remaining ferricrete. Most of the area between the carpark and the traffic circle has been scraped down to bedrock sandstone, and soils are thus very shallow and stony in this area. Most of the sandstone appears to be iron and/or manganese rich (both of which are also associated with ferricrete).

The original natural vegetation in the Rooikrans study area is Peninsula Sandstone Fynbos (Mucina & Rutherford 2006), but the Cape Point study area is a mix of this and two other vegetation types - Cape Flats Dune Strandveld and Southern Coastal Forest. It is in fact not possible to provide an accurate map of the vegetation types at the Cape Point site as the vegetation types intergrade and form a complex mosaic, as is often the case in ecotonal (transitional) areas like this. The Dune Strandveld elements are associated with the windblown dune sands that cover the lower parts of this latter area, and the Coastal Forest elements are associated with the most stable and most sheltered parts of this site.

Peninsula Sandstone Fynbos and Cape Flats Dune Strandveld are now both recognised as Endangered vegetation types at a national level, whilst Southern Coastal Forest is regarded as Least Threatened (DEA 2011).

5.1 **The Cape Point study area**

The vegetation in the study area has become denser since 2002, as can be seen on the time series images on Google Earth. This is not surprising, given that there has been no fire in the area (which would have reduced biomass), and the Dune
Strandveld vegetation on the previous dune plume edges is slowly being replaced by Southern Coastal Forest and associated Thicket elements.

Plate 1: View of dense Dune Strandveld gradually being replaced by Costal Forest elements in the Cape Point study area.

The Thicket (or Coastal Forest) elements include *Euclea racemosa* (sea guarrie), *Cassine peragua* (dune saffronwood), *Colpoon compressum* (pruimbas), *Myrsine africana*, *Pterocleastrus tricuspidatus* (spoonwood), *Cussonia thrysiflora* (coastal cabbage tree), *Tarchonanthus littoralis* (camphor tree), *Searsia glauca* (blue kunibush), *Didymodoxa capensis*, *Dipogon lignosus*, *Cynanchum obtusifolium* (melktou), *Polygala myrtifolia* (septemberbos), *Erica tristis*, *Solanum guineense*, *Asparagus lignosus*, *A. africanus*, *A. undulatus* and *Olea exasperata* (dune olive).

Manulea tomentosa. There are virtually no alien invasive species present in the undisturbed parts of both the Dune Strandveld and Thicket plant communities. Virtually the only species present which is not typical of either of these plant communities is Leucospermum conocarpodendron ssp. viridum (kreupelhout), which is a species of Peninsula Sandstone Fynbos, and only one plant is present within the study area.

The grassy areas shown in Plate 2 are dominated by a dense sward of the alien invasive Lolium sp. (ryegrass), although other alien grasses are also present, including Hordeum murinum and Avena sp. (wild oats). The indigenous daisy Arctotheca calendula (Cape weed) is common on the fringes of these grassy areas. It is possible that these grassy areas were originally fairly open, or they may have been open sands which were subsequently dominated by alien rooikrans (Acacia cyclops), which was removed about 20 years ago.

Plate 2: View of grassy area (orange outline) in the lower part of the Cape Point study area. The dominant grass in this area is now Lolium sp. (ryegrass), an alien invasive species that outcompetes indigenous grasses (such as Ehrharta villosa), especially where moisture and nutrient levels are elevated. The yellow flowered shrub in the foreground is Cullumia squarrosa, currently Red Listed as Endangered (but due to be downlisted to Near Threatened).
However, the dominance and density of at least three species of alien invasive grasses, and the weedy *Arctotheca calendula*, strongly suggests that their abundance is correlated with increased soil moisture (observed) and nutrient (assumed) levels, presumably originating from the current treated effluent outfall, which is just above the main grassy area (pers. obs). It is highly unlikely that these grasses would be present here in such abundance and concentration without some underlying source of disturbance, which in this case is the regular outflow of treated effluent (which alters the soil nutrient and moisture status, favouring exotic species). Fynbos and Strandveld soils are typically nutrient poor, and the indigenous plant species are well adapted to these low levels of nitrogen and phosphorus in particular. Even small additions of either or both these elements has been experimentally shown to significantly shift plant community composition, heavily favouring exotic species which are better adapted to higher nutrient levels (Stock & Allsopp 1992).

### 5.1.1 Plant Species of Conservation Concern

At least five plant Species of Conservation Concern¹ (SCC) were recorded from within the proposed development area. The likelihood of other undetected SCC being present is considered low.

The most important SCC present is *Heliophila cinerea* (Plate 3). This species is currently Red Listed as Rare (Raimondo *et al* 2009), but it will probably be uplisted to Vulnerable in the next update, due mainly to threats at this site (L. von Staden SANBI) – pers. comm.). This species is currently known only from Buffels Bay, this site, Cape Maclear, Platboom and Witsands, all except the latter being within the Cape Point section of the TMNP. The total global population is probably less than 1200 plants (pers. obs.), of which about 15% occur in the proposed development area, and the site population is thus important. The plants are scattered throughout most of the undisturbed parts of the study area.

*Culumia squarrosa* (Plate 2) is currently Red Listed as Endangered (Raimondo *et al* 2009), but will probably be downlisted to Near Threatened in the next update, due to a previous underreporting of localities (which are now known to be more than 20; L. von Staden – pers. comm.). There is a fairly large population scattered within the study area, but it is fairly insignificant in a regional context.

¹ The Red List of South African Plants (Raimondo *et al* 2009) has assessed all plant species in South Africa, and all indigenous species are now technically Red Listed or Red Data Book species, and thus it is preferable to use the term Species of Conservation Concern to refer to species that are listed as either Threatened or Rare.
Leucadendron coniferum has a small (<10 plants) and insignificant population in the study area, and is Red Listed as Vulnerable (Raimondo et al 2009). The species is very common (thousands of plants) elsewhere in the Cape Point section of the TMNP.

Plate 3: Heliophila cinerea is a Rare perennial species largely restricted to the Cape Point section of the TMNP, and a significant and viable population occurs within the proposed development area, which would certainly be negatively impacted by the proposed development.

Tetraria brachyphylla is a widespread sedge found in coastal dune areas, and is Red Listed as Near Threatened (Raimondo et al 2009). Less than ten plants were found scattered in the study area, which is not significant in the context of the TMNP, or in the region.

Leucospermum conocarpodendron ssp. viridum (kreupelhout) is Red Listed as Near Threatened (Raimondo et al 2009). A single plant is present in the area, and this is an outlier, and is not considered to be significant in the context of the south Peninsula or TMNP, where it is still common.

5.1.2 Conservation Value

The overall conservation value of the vegetation in the study area is deemed to be High at a local scale (TMNP), with the only exception being the areas currently invaded by alien grasses, which have a Low conservation value at the moment (but
which could be rehabilitated). Factors contributing to this assessment of High conservation value include the threatened status of two of the three underlying vegetation types, the generally good condition of the vegetation, and the presence of five plant Species of Conservation concern. Factors contributing to the assessment of Low conservation value include the low diversity in these areas, the dominance of alien invasive species, and the absence of plant Species of Conservation Concern.

5.2 Rooikrans parking study area

The actual parking area of course contains no significant natural vegetation. The area downslope (to the west and northwest) is presumably where some impact of a deep soakaway in the carpark area might be felt, and was hence the area examined for this study.

The Peninsula Sandstone Fynbos vegetation in the study area is mostly secondary, in that it has re-established since quarrying ceased, probably more than twenty years ago, and is subtly but distinctly different from nearby undisturbed areas. There is also extensive evidence of quarrying east of the parking area. There is a small, excavated low point just west of the carpark (see Figure 1) which is now dominated by *Orphium frutescens* (vleiroos), a species of seasonal wetlands, and about 80m west of the carpark is a poorly developed wetland area (Figure 1) indicated by *Elegia nuda* (a restio), *Athanasia crithmifolia*, *Baeometra uniflora*, *Plecostachys serpyllifolia* and *Drosera trinervia* (sundew). Judging by satellite imagery this particular area may not have been disturbed by quarrying.

The dominant species in the previously disturbed areas are *Metalasia densa*, *Searsia glauca*, *Erica tristis*, *Cullumia ciliaris*, *Passerina corymbosa* and *Erica plukenetii*. Additional species include *Drosera trinervia*, *Agathosma capensis*, *Vellereophyton dealbatum*, *Orphium frutescens*, *Athanasia crithmifolia* (draadblaar), *Sebaea minutiflora*, *Stoebe capitata*, *Aspalathus ericifolius*, *Aspalathus chenopoda*, *Aristea africana*, *Elegia nuda*, *Baeometra uniflora*, *Anthospermum galioides*, *Plecostachys serpyllifolia*, *Cynodon dactylon* (fynkweek), *Restio gracilis*, *Cliffortia obcordata*, *Protea neriifolia*, *Helipterum gnaphaloides* and *Tarchonanthus littoralis*. Most of these species are common and widespread in the region. There is no significant alien invasive vegetation in the study area.
The undisturbed areas are characterised by a higher diversity of species, and a greater numbers of species such as *Leucadendron coniferum*, *Leucadendron xanthoconus*, *Protea neriifolia* and *Leucospermum conocarpodendron*.

**Figure 1**: Annotated satellite image showing extent of previously disturbed areas around the Rooikrans carpark study area (green line). The small excavated wetland west of the carpark is also shown. North is to the top of the image.

No plant Species of Conservation Concern (SCC) were recorded from within this study area, and the likelihood of undetected SCC being present is considered low. There are however various SCC in the immediately adjacent, undisturbed areas, including *Leucospermum conocarpodendron* (Near Threatened) and *Leucadendron coniferum* (Vulnerable). The Endangered bulb species (Helme & Raimondo 2005) *Gladiolus vigilans* is only known from a single population in the vicinity of the Gold Fields Centre, about 600m southeast of the study area, but it is unlikely to occur in the study area as it occupies a different habitat (rocky slopes), and is also unlikely to tolerate soil disturbance (such has occurred in much of the study area).

### 5.2.1 Conservation Value

Other than the currently hard surfaces (such as the carpark itself) the entire study area as shown in Figure 1 is deemed to have a **Medium** botanical conservation value
at a regional scale (TMNP). This assessment is informed by the unremarkable nature of the vegetation, the fact that at least half of the area has been previously disturbed, the current absence of alien invasive vegetation, and the absence of any plant Species of Conservation Concern.

Plate 4: View looking south, showing previously quarried area in foreground (now partly rehabilitated), with Rooikrans overflow carpark visible in the background.

Plate 5: View of the study area northwest of the carpark, looking northwest. Most of this area was previously disturbed by quarrying and has passively rehabilitated.
6. IDENTIFICATION AND BRIEF ASSESSMENT OF LIKELY BOTANICAL IMPACTS

The proposed release of large quantities (up to 90kl per day) of treated effluent into the surface and shallow subsurface environment within natural vegetation in the proposed footprint area at Cape Point is likely to have various negative botanical impacts.

The first impact will be direct construction related impact, whereby placement and underground burial of the extensive (1.6ha) network of perforated hoses will damage and disturb the established root network of most plant in this area. This will be particularly important for any perennial species whose roots may be damaged or cut, and could in fact lead to direct mortality of certain specimens.

The second impact is perhaps more serious, and will arise during the operational phase of the project. Daily release of treated effluent into this area will elevate the soil moisture and soil nutrient status throughout the duration of operation. Particularly important in this regard will be elevated levels of nitrogen and phosphorus, both of which are in short supply in natural Fynbos habitats. When these elements are added, particularly on a sustained basis, they will facilitate invasion by alien plants (notably alien grasses) that are better adapted to higher soil nutrient levels. The negative effects of the current effluent disposal system can already be clearly seen on site, and will only be exacerbated by the proposed system. The elevated soil moisture levels allow many of these alien grasses to effectively become perennial, which leads to permanent smothering of the indigenous vegetation. The elevated nutrient impacts will be ongoing throughout the operational phase, and are in fact likely to persist for at least five years after closure of the plant (due to elevated soil nutrient levels, which can only be leached out by rainfall).

The botanical impact of deep well drilling at the Rooikrans carpark, and disposal of up to 90kl of treated effluent into the deep well cannot be predicted, as it depends largely on how good infiltration will be from the release point. If infiltration is good it should have no significant botanical impacts. If poor, and effluent water rises to the surface, even some distance from the well, it may have negative effects similar to those currently seen at Cape Point.
7. CONCLUSIONS AND RECOMMENDATIONS

- The proposed expansion of the current effluent disposal system in the Cape Point area is not recommended, as it is very likely to have a significant negative impact on the natural vegetation in the area.
- The existing system should also be either modified, or terminated, as it is already causing unacceptable negative botanical impacts, notably a severe invasion of alien grasses.
- One solution would be to ensure that the effluent release has nutrient levels that are in line with natural rainfall, which would mean that the specifications for the treatment plant would need to be significantly improved. In essence the treated effluent should have to be of a potable standard. However, even this would not deal with the issue of massively increased volumes being flushed into the system, but if the water is not nutrient rich the plants should be able to cope with it, and the vegetation will merely shift to a Coastal Forest habitat (which is not inherently negative), although at the expense of the site populations of most of the five threatened plant species (which are not Coastal Forest species).
- It is thus strongly recommended that geotechnical studies should proceed at the Rooikrans carpark in order to ascertain whether deep well discharge here is feasible from a geotechnical and infiltration perspective. Should it be feasible from an infiltration perspective this option is unlikely to have any significant negative botanical impacts, but it would require ongoing monitoring in the downslope areas, particularly if the effluent nutrient levels are not reduced to negligible levels.
- It is also strongly recommended that a feasibility analysis for marine discharge in the vicinity of Platbank be undertaken. This option is unlikely to have any significant negative terrestrial botanical impacts, and is recommended from a botanical perspective.

8. REFERENCES


