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**An evaluation of the
vegetation impacted by
the proposed upgrade
and expansion of the
Macassar Waste Water
Treatment Works.**

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Summary

The Macassar Wastewater Treatment Works are planned to be upgraded and expanded. This report outlines the surrounding terrestrial vegetation which is likely to be impacted. The exact boundaries of the construction works are not provided, only the outside boundary to the area thus the location of the areas not suitable for development, which are to be avoided during construction and operation must be of a less specific nature. The development area is to be surrounded by a road. This is not indicated in the development plan. This report deals with the non-estuarine areas as the wetland areas are dealt with independently. Endangered Cape Flats Dune Strandveld scrub vegetation is present around the perimeter of the sludge (sediment) ponds. The exact extent of impact upon this vegetation will determine the area to be Offset at a 30:1 ratio. The current area with Dune Scrub has educational and recreational potential under strict controls. Disturbances from stock and uncontrolled pedestrian and vehicle traffic will need to be reduced to reduce erosion and unwanted human impacts.

1. Introduction

The scope for the work to be undertaken in this report will fall under the 194C contract that Zutari has with the City of Cape Town. The assessment must provide a baseline description of the site which includes, a description of the ecological drivers or processes of the system; ecological functioning and ecological processes; the ecological corridors that the proposed development would impede; the description of any significant terrestrial landscape features; a description of terrestrial biodiversity and ecosystems on the site; terrestrial critical biodiversity areas (CBA's), terrestrial ecological support areas (ESA's); protected areas as defined by the National Environmental Management Protected Areas Act of 2004; priority areas for protected area expansion; and identify the impacts of the proposed development on habitat condition and species.

The exact boundaries of the construction works are not provided, only the outside boundary to the area thus the location of the areas not suitable for development, which are to be avoided during construction and operation must be of a less specific nature. The development area is to be surrounded by a road. This is not indicated in the development plan.

This report deals with the non-estuarine areas as the wetland areas are dealt with independently.

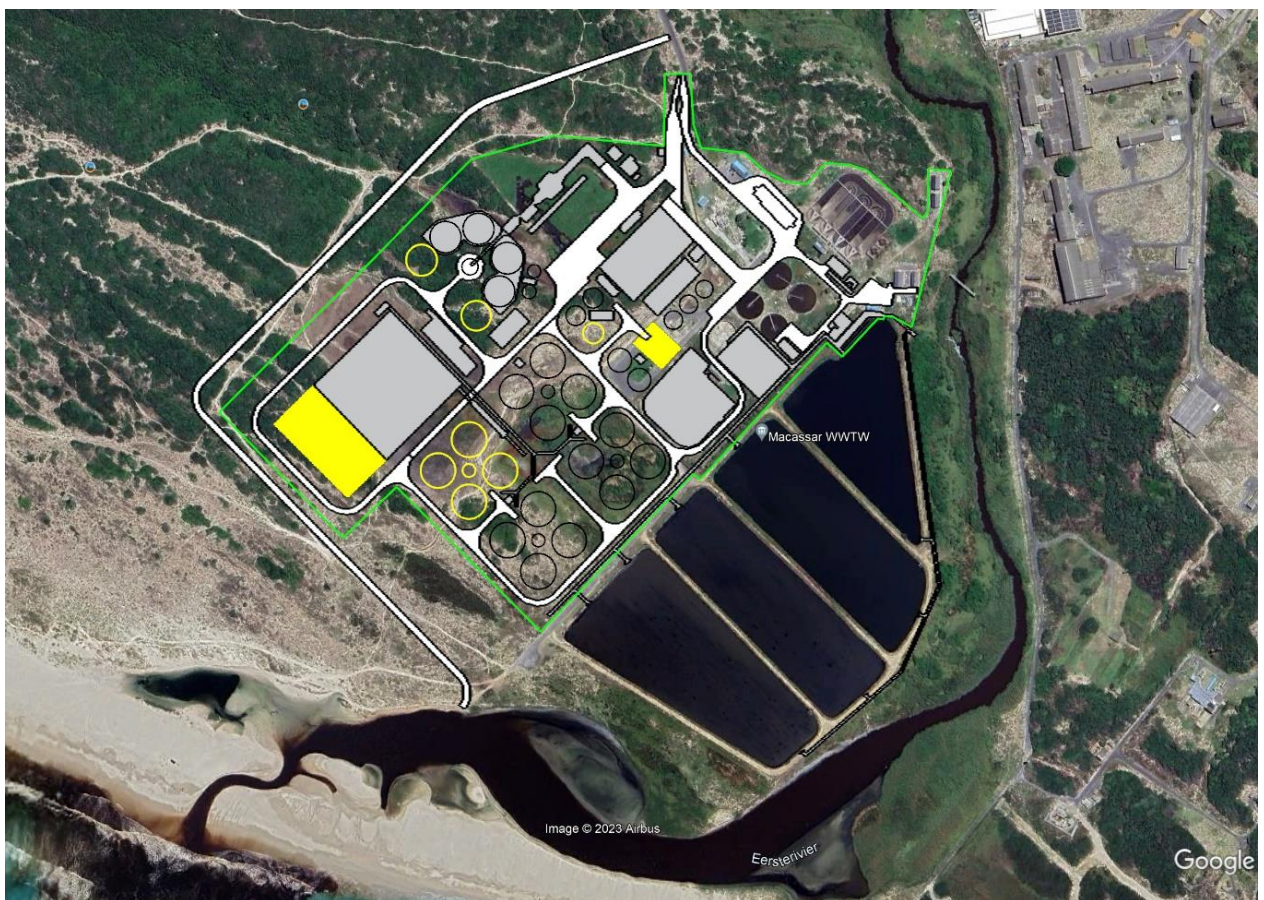


Figure 1. Macassar Wastewater Treatment Works Site layout.

2. Scope of work and methods

The vegetation in the area to be impacted by the proposed upgrading and expansion to the Wastewater Treatment Works (Figure 1) was inspected on 16 October 2023. The area was traversed on foot and the different plant communities observed were examined in the general environments they occupied and the conspicuous dominant permanently recognizable species in them were recorded.

3 General flora and vegetation

3.1 National vegetation types and local background studies

The natural vegetation cover mapped within and adjacent to Macassar WWTW is shown in Figure 2 below. There are two terrestrial vegetation types occurring at the site, Cape Seashore Vegetation and Cape Flats Strandveld.

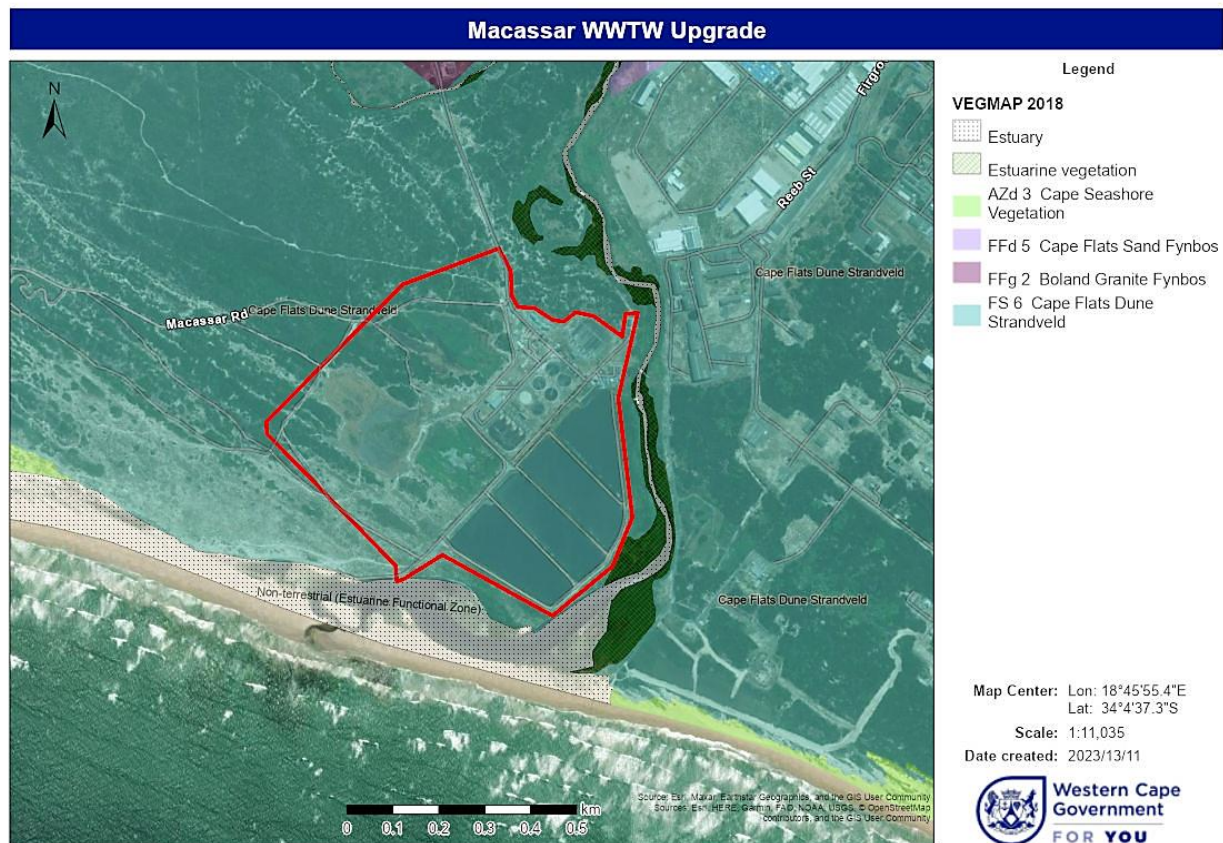


Figure 2. 2018 Vegetation map for the site (CapeFarmMapper, 2022)

Cape Seashore Vegetation (AZd3) has been attributed a conservation status category of Least Concern. It is found on beaches, coastal dunes, dune slacks and coastal cliffs. Structurally it is described by Mucina & Rutherford (2006) as an open grassy herbaceous to dwarf shrubby, often succulent vegetation often dominated by a single pioneer species. Various communities reflect the age of the substrate and of the

natural disturbance regimes, such as moving dunes, distance from the upper tidal mark and the exposure of the dune slopes (landward versus seaward) (Boucher 1974; Boucher & Le Roux 1993; Taylor & Boucher 1993).

Cape Flats Dune Strandveld (FS6), with an Endangered conservation status, occurs on dune sand along the False Bay coast (between Gordon's Bay and Muizenberg) and penetrates deep into the Cape Flats as a broad wedge as far north as Bellville. Structurally, it is a tall open to closed evergreen sclerophyll leaved shrubland with grasses and annual herbs in openings. It has been described variously through these coastal flats as *Pterocelastrus* Coast Dune Scrub & *Metalasia* Coast Dune Fynbos (Taylor 1972), *Colpoon-Rhus* Dune Scrub Boucher (1978), Broad-Leaved Thicket (Taylor 1984), *Tetragonia decumbens-Sideroxylon inerme* Mature Hind-dune Community & *Tetragonia decumbens-Metalasia muricata* Dune Community (O'Callaghan 1990).

3.2 Historic Eerste Estuary vegetation

The estuary is excluded from the impact area; thus, this vegetation is not described here. It was examined, mapped and is described by O'Callaghan, following surveys in December 1981 and June 1982, reported in Grindley (1982) (Figure 8 reproduced here as Figure 3). The following vegetation units are identified and their distribution mapped (Figure 3) in the estuary surround by O'Callaghan (Grindley, 1982):

- A. Semi-aquatic vegetation consisting of four types:
 - a. Intertidal Fringe vegetation with *Cotula coronopifolia*, *Paspalum vaginatum* and *Scirpus nodosus*.
 - b. *Phragmites australis* Reeds including *Scirpus littoralis* lining the estuary channel banks in places.
 - c. *Scirpus maritimus* Sedgeland in the supra-tidal zone.
 - d. Dune Marsh area alongside the sewage works with *Cotula coronopifolia*, *Juncus dregeanus*, *Paspalum vaginatum*, *Phragmites australis*, *Scirpus nodosus*, *Typha capensis* and *Zantedeschia aethiopica* as well as numerous European weeds.
- B. Terrestrial vegetation
 - a. Fore Dunes – The hummock dunes west of the river. The species listed by O'Callaghan are *Acacia cyclops*, *Agropyron distichum*, *Arctotheca populifolia*, *Carpobrotus acinaciformis*, *Carpobrotus edulis*, *Osteospermum moniliferum*, *Cynodon dactylon*, *Eragrostis cyperoides*, *Heteroptilis suffruticosa*, *Manulea tomentosa*, *Metalasia muricata*, *Morella cordifolia*, *Psoralea fruticosa*, *Psoralea repens*, *Senecio elegans*, *Scirpus nodosus*, *Tetragonia decumbens* and *Tetragonia fruticosa*.
 - b. *Searsia laevigata*-*Senecio halimifolius* Moist Shrubland in which he records *Acacia cyclops*, *Acacia saligna*, *Atriplex vestita*, *Carpobrotus acinaciformis*, *Cynodon dactylon*, *Ehrharta villosa*, *Ficinia*

dunensis, *Metalasia muricata*, *Nidorella foetida*, *Paspalum vaginatum*, *Oxalis pes-caprae*, *Searsia laevigata*, *Senecio halimifolius* and *Stenotaphrum secundatum*.

- c. *Acacia cyclops* dominated Dune Shrubland including *Carpobrotus acinaciformis*, *Carpobrotus edulis*, *Chasmanthe aethiopica*, *Osteospermum moniliferum*, *Ehrharta villosa*, *Euclea racemosa*, *Galenia secunda*, *Knowltonia capensis*, *Metalasia muricata*, *Pelargonium capitatum*, *Pennisetum clandestinum*, *Pterocelastrus tricuspidatus*, *Searsia laevigata*, *Searsia glauca*, *Sideroxylon inerme*, *Tetragonia decumbens*, *Tetragonia fruticosa*, *Trachyandra divaricata* and *Zantedeschia aethiopica*.

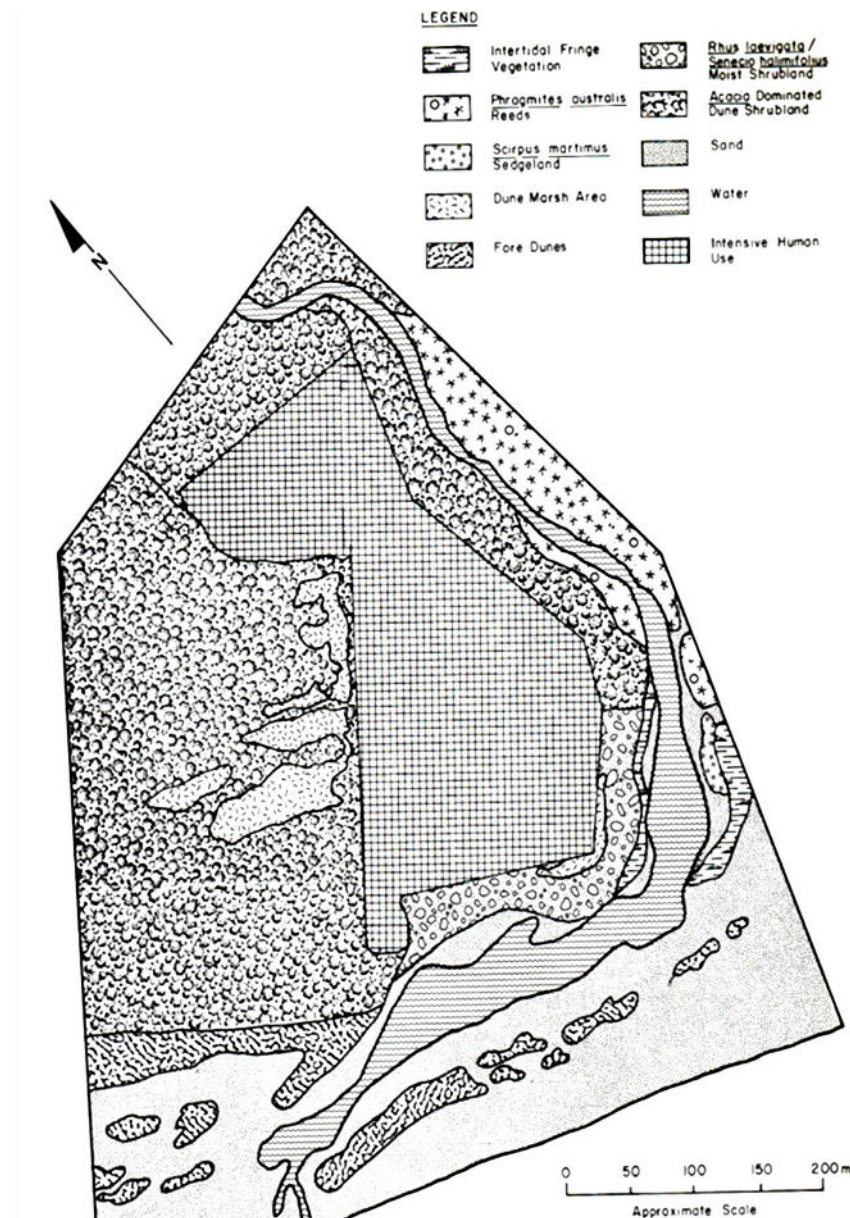


Figure 3. Historic vegetation mapping units of the Eerste River Estuary O'Callaghan in Grindley (1982).

3.3 Description of the vegetation observed at present.

The following mapping units are described below and shown in Figure 4: Sediment and Settling Dam Overflow Ponds, Inter-dune Wetlands, Dune Grassy Shrublands and Dune Scrub vegetation.

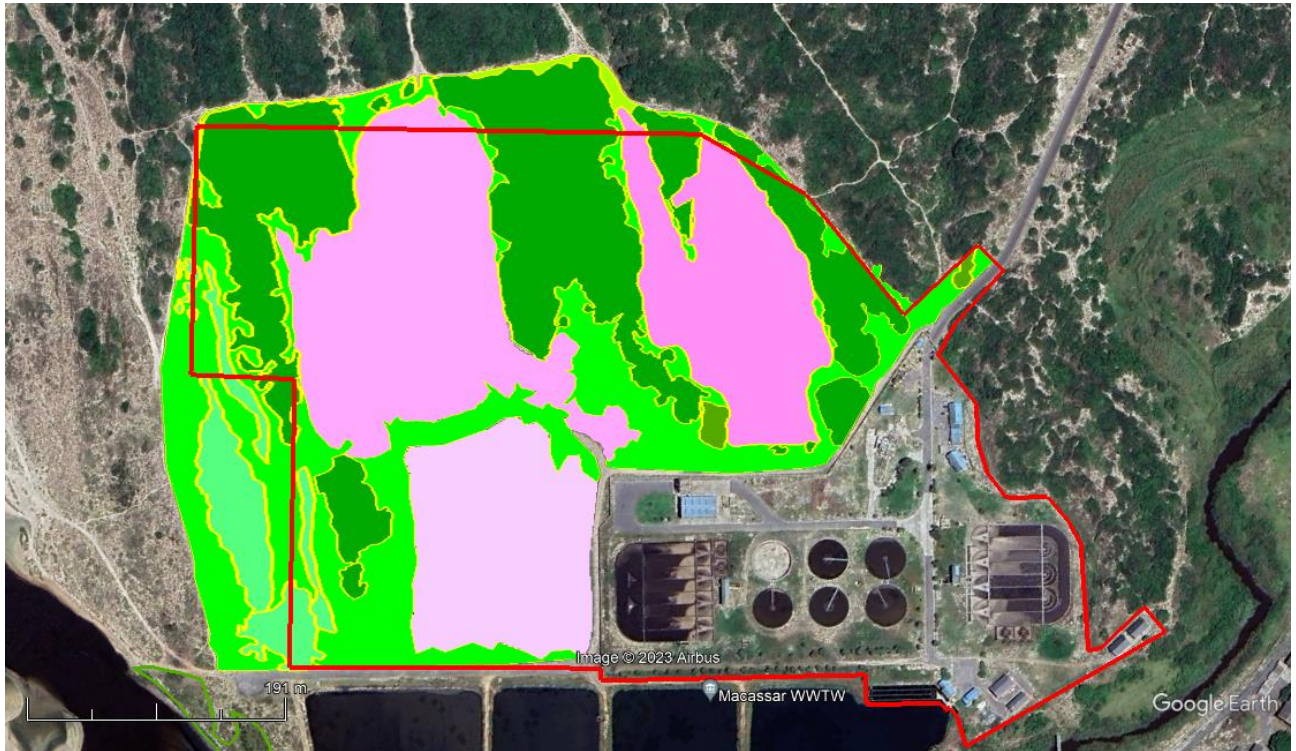


Figure 4. Map of plant communities identified in the WWTW expansion area. Sediment Ponds (pink shades), Inter Dune wetlands (blue-green), Dune Scrub (dark green), Dune Grassy Shrublands (lime green)

3.3.1 Sediment and Settling Dam Overflow Ponds

Three areas where sediment-laden water from the sewage works is currently, or was previously, discharged are shown in Figure 4. The history of each pond was not determined as this was outside the scope of the current project.

The ponds vary in their constituent species for a variety of reasons associated with their management, such as their flooding inundation duration (extent and depth) and the source (type) of water applied. These are basically overflow and sewage sludge sediment ponds. They support many diaspores in the sludge that have survived wastewater from different sources, the treatment processes applied and different inundation regimes. The ponds are also open to the elements thus miscellaneous biotic and abiotic components are added from the surroundings, such as by the wind, inundation and wash from the river and sea flooding and from uncontrolled human actions. The result is a mixture of openness or vegetation cover. The vegetation is generally ruderal and weedy, adapted to survive harsh unnatural conditions, and is particularly colonized by annual weeds adapted to survive short periods of exposure to long periods on harsh sludge deposits.

The area occupied by these ponds has increased from that illustrated in the vegetation map of O’Callaghan 1982. They have extended into the areas indicated as *Acacia*-dominated Dune Shrubland, the Dune Marsh Area and the Fore Dune area he mapped. Some of his *Searsia laevigata* – *Senecio halimifolius* Moist Shrublands have been inundated and are now acting as overflow areas (ponds) (Figures 5-7).



Figure 5. An overflow pond on the outside of and west of the current formal waste works.



Figure 6. A filled sediment pond dominated by *Cirsium vulgare* (thistle).



Figure 7. Sludge effluent accumulates when this discharge pond functions. It is densely colonised by exotic annual weeds when not inundated.

3.3.2 Inter-dune wetlands

Inter-dune Wetlands (Figure 8) are regular features in this littoral environment. Rainwater, particularly during winter months, or water discharged from or seepage from sediment ponds or from runoff off hard surfaces at or around the works are present.

Littoral wetlands associated with the Eerste River estuary lagoon are a natural feature when the lagoon is in a punctuated condition during dry summer months. The estuary has remained open for longer periods since the WWTW was established on the floodplain here.

The shrub, *Senecio halimifolius* is a conspicuous dominant emergent shrub in these saline wetlands in which a variety of saline-tolerant shrubs, herbs and grasses are present, including *Chasmanthe aethiopicum*, *Cissampelos capensis*, *Erodium moschatum*, *Geranium incanum*, *Nidorella foetida*, *Phragmites australis*, *Salvia africana-lutea*, *Bolboschoenus maritimus*, *Searsia crenata*, *Searsia laevigata*, *Stenotaphrum secundatum* and *Zantedeschia aethiopica*, while the invasive weed *Echium plantagineum* is widespread.



Figure 8. Inter-dune Wetland dominated by *Senecio halimifolius*. Note the tracks around the edge of the wetland.

3.2.3 Dune Grassy Shrublands

Dune Grassy Shrubland vegetation is found in the more recently disturbed areas both from construction activities, trampling and numerous paths from cattle grazing are present in this very exposed littoral situation where wind-blown sand areas are prevalent. It is a development stage of Dune Scrub, found in wind-protected areas behind dunes and on disturbed areas in the stable larger dune systems (Figure 9).

Many indigenous low shrubs (including scattered scrub species like *Searsia glauca* and *Searsia laevigata*), herbs and grasses and weeds are present, including *Arctotheca calendula*, *Bromus diandrus*, *Carpobrotus acinaciformis*, *Ehrharta villosa*, *Exomis microphylla* var. *axyroides*, *Metalasia muricata*, *Pentzia suffruticosa*, *Senecio elegans*, *Senecio littoralis*, *Sutera uncinata*, *Tetragonia fruticosa*, *Trachyandra divaricata* and *Tribulus terrestris*.

Indigenous species found here are pioneers or colonizers which are useful for revegetation purposes.



Figure 9. Dune Grassy Shrubland with extensive tracks and bare areas related to cattle grazing, pedestrian and vehicle traffic as much as to wind erosion creating bare areas.

3.2.4 Dune Scrub

The stable dunes naturally support low Dune Scrub vegetation (Figure 10), nationally referred to as Cape Flats Dune Strandveld (FS6). This is present in different stages of maturity associated with the post-disturbance interval.

The mature phase of this vegetation found on the undulating dunes is dominated by scrub formed by *Euclea racemosa*, *Helichrysum crispum*, *Olea exasperata*, *Osteospermum moniliferum*, *Osyris compressa*, *Pterocelastrus tricuspidatus*, *Salvia africana-lutea*, *Searsia crenata* and *Searsia glauca* and local patches of *Sideroxylon inerme*. The shrubs *Eriocephalus racemosus*, *Metalasia muricata*, *Passerina corymbosa*, *Passerina paleacea* and *Tetragonia fruticosa* are found intermingled in the scrub vegetation. Woody climbers *Cissampelos capensis*, *Galium tomentosum* and *Microloma sagittatum*, while the grass *Ehrharta villosa* is abundantly interspersed.

This vegetation is listed in the Revised National List of Threatened Terrestrial Ecosystems – 2022, No. 2747, Govt Gazette No. 47526 of 18 Nov 2022 as Endangered [EN B1 (i & iii), B2 (i & iii)] Cape Flats Dune Strandveld. This is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), and evidence of ongoing biotic disruption from invasive species.



Figure 10. Dune scrub. Bare patches are related to disturbances such as *Acacia cyclops* clearing operations. They now support Dune Grassy Shrubland.

The gazetted Threatened Ecosystem Status (**Appendix 2**) of the vegetation type to which this community belongs, namely the Cape Flats Dune Strandveld, is “Endangered”. This community represents the widespread Strandveld vegetation found on (habitat/substrate) deeper sands before the erosion of the sand exposes the basement limestone rock.

The sandy substrate is prone to erosion and invasion by invasive species when the vegetation cover is excessively disturbed on a regular basis, such as when it is heavily grazed.

4. Flora

4.1 Terrestrial Biodiversity Sensitivity

The DFFE screening tool (Figure 11) has mapped the site and surrounding area as being of medium plant species sensitivity while the terrestrial biodiversity is mapped as being very high due to the ecological threat status of the vegetation types occurring at the site.

In the Western Cape Biodiversity Spatial Plan 2017 mapping for the site (Figure 12), the disturbed Dune Scrub and Dune Grassy Shrublands are mapped as Terrestrial Critical Biodiversity Areas while the disturbed pond areas adjacent to the WWTW are mapped as Ecological Support Areas that should be restored where appropriate.

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Figure 11. DFFE Screening tool map of relative plant species sensitivity for the site

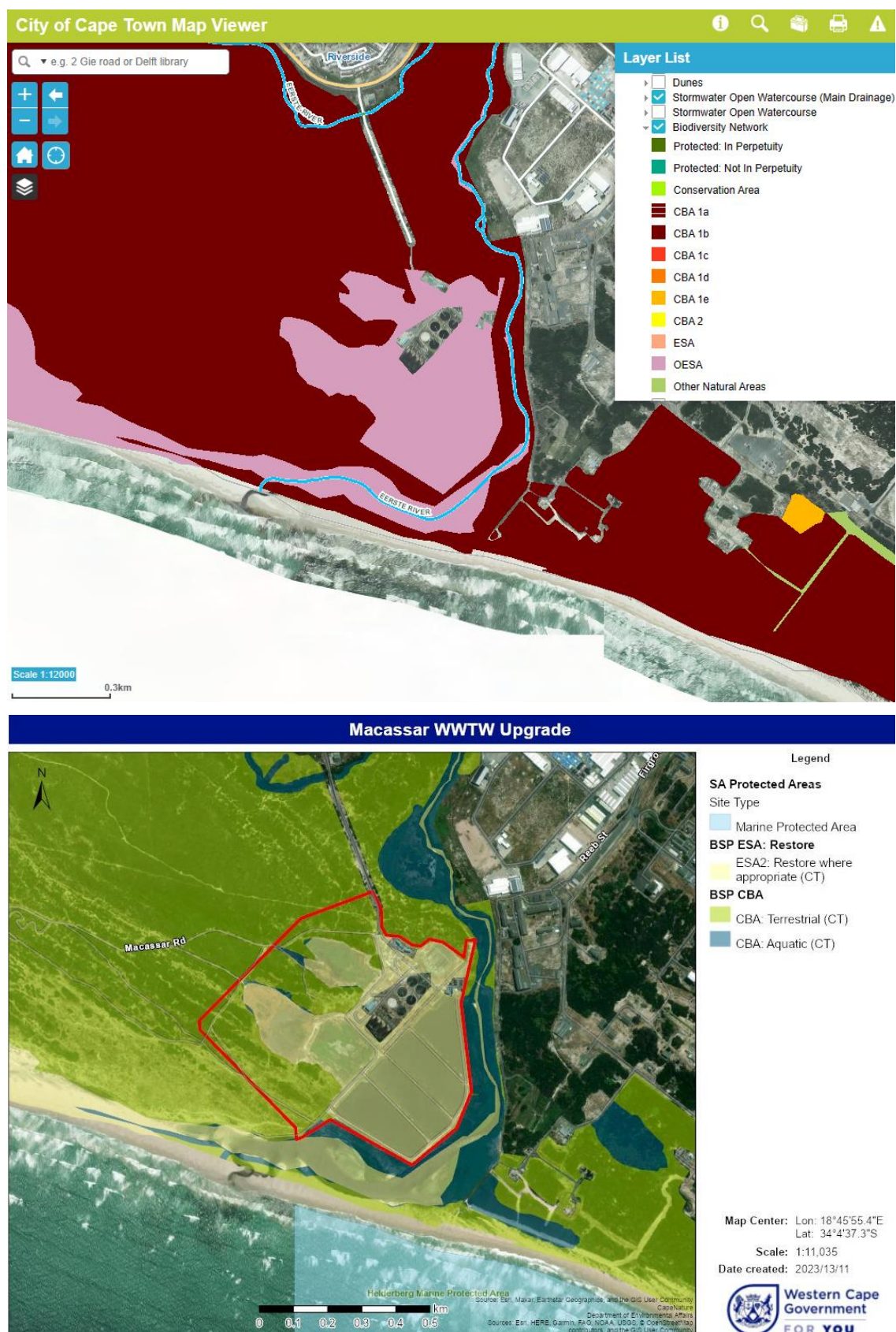


Figure 12. Western Cape Biodiversity Spatial Plan 2017 (CapeFarmMapper, 2023) (top) and the City of Cape Town Biodiversity Network (City of Cape Town Map Viewer) (bottom) for the site

4.2 Species of Conservation Concern

No species of conservation concern were observed as the area was examined during dry early summer conditions. An exhaustive examination of the dunes and riverine vegetation should reveal that some important species are present judging from the threatened status of the Cape Flats Dune Strandveld in general. Individuals of *Sideroxylon inerme*, a protected species under the National Forests Act No. 84 of 1998, in the Dune Scrub vegetation, have been severely impacted by previously dense *Acacia cyclops* and *Acacia saligna* infestations. These invasive species have occupied space and shaded the local species as well as increasing wildfire temperatures as they are highly flammable in contrast to the indigenous scrub vegetation.

The wood from local scrub, even in the green state, of *Euclea racemosa*, *Pterocelastrus tricuspidatus* and *Sideroxylon inerme* is preferred for local use as they burn for longer periods at lower temperatures and are easier to carry by hand, according to information given to the author by local wood collectors. The protection of this scrub through correct management without its destruction or its exploitation of indigenous species for firewood is a fundamental use of the area. Control over access is required.

Disturbance from domestic cattle grazing and people is causing an increase in annual grasses through trampling and the numerous paths they make through the dunes contribute to increased wind erosion.

4.3 Naturalised species

Woody alien invasive species remain a considerable threat to the Fynbos Biome vegetation (Stirton 1978). Previous heavy invasions by exotic species could have contributed to a decline in the indigenous plant diversity of the area. They change the structure of the vegetation. Naturalised species observed on the site included *Acacia cyclops* (rooikrans), *Acacia saligna* (port jackson willow), *Cirsium vulgare* (thistle) (Figure 4), *Pennisetum clandestinum* (kikuyu grass). *Myoporum serratum* (manatoka) (Figure 10) and *Nerium oleander* (oleander, Ceylon rose) are invader species that are used in landscaped areas. *Pennisetum clandestinum* has escaped into the surrounding wetland vegetation, particularly where nutrient-enriched water is released. It suppresses parts of this moister vegetation.

Acacia cyclops is not as visually prominent in the landscape now as was documented by O'Callaghan in 1981-1982 (Grindley 1982). Patches evident in the Dune Scrub in Figure 8 might be due to the controlled removal of *Acacia cyclops*.

The control of any weeds and invader plants needs to be done under professional supervision to avoid bare areas resulting that are potentially subject to wind erosion. The use of locally indigenous species for revegetating disturbed areas is advocated.

The planned construction at the WWTW is an opportunity to remove invasive aliens currently used on the terrain, replacing *Myoporum serratum* (Figure 11), for instance, with *Pterocelastrus tricuspidatus* (kershout) and *Sideroxylon inerme* (milkwood) trees.



Figure 13. *Myoporum serratum* (manitoka), used for shade, is an invasive species on these dunes and should be replaced with locally indigenous species, such as *Pterocelastrus tricuspidatus* and *Sideroxylon inerme*.

5. Surrounding Conservation Areas

The wider Macassar Dune System was rated as having a Very High conservation value by Low (1989) and McDowell & Low (1990) for the Very High richness of indigenous species (over 210 species being recorded by them) (Low 1989). They also record “a relatively rich riverine system on the banks of the Eerste River near its estuary as well as a few small temporary wetlands in parts of the dune slacks.” McDowell & Low (1990). These ratings still apply.

The coastal zone from the mouth of the Eerste River to the mouth of the Lourens River is a designated Marine Protected Area (Helderberg Marine Protected Area).

6. Discussion and Conclusions

6.1 Management issues

Vegetation removal and destabilization of sand substrates, particularly the disturbance of dunes, leads to wind erosion and sand blow-outs. The active stabilization of disturbed devegetated areas is concomitant to any earthworks here.

Sediments accumulated in stilling ponds should be utilized so that the ponds remain viable and do not fill up. An alien vegetation management plan is required, which includes the control of herbaceous weeds, and the development of cover of indigenous species in any dysfunctional sediment ponds.

A management plan to ensure the survival of the important vegetation and protected flora on site is implicit to the expansion development of the WWTW. This plan should include control over movement through the dunes by humans and their stock. The area should have a carefully designed system of paths (and guides) for educational access.

6.2 Evaluation of vegetation on site

In addition to the estuarine vegetation consisting of Intertidal fringe, *Phragmites* reedbeds and *Scirpus maritima* sedgeland, O'Callaghan (1982) mapped and described vegetation of the Dune Marshes, marshes in the Foredunes, a Moist Shrubland and *Acacia cyclops* Dune Shrublands. Low (1989) and Low & McDowell (1990) also refer to the highly invaded nature of the dune area, but nevertheless comment positively about the very high need to conserve the area because of its species richness. The latter authors identify the limestone outcrops as an important environmental feature.

In the current study, some 40 years later, these units could still be distinguished (see map in Figure 1 for their current distribution), but with some changes (compare to Figure 2 by O'Callaghan in Grindley, 1982). Three major sediment ponds have been established, each containing its own suite of species (mainly of exotic weeds) depending on their development stage and history. The vegetation on the foredunes is identified here as Dune Grassy Shrubland, which is also found in a variety of disturbed situations, such as along roads and tracks and between the Dune Scrub. Inter Dune Wetlands are still present between the dunes, which equates to O'Callaghan's Moist Shrubland (compare the distribution in Figure 1 here to that in O'Callaghan's 1982 map). O'Callaghan's (1982) map shows *Acacia cyclops* Dune Shrubland to be present throughout the whole of the upland area. This is no longer the case as the dominance of invasive *Acacia cyclops* has changed, through appropriate management practices, into a fully developed Dune Scrub of the Cape Flats Dune Strandveld (Holmes, 2008; Mucina & Rutherford, 2006; Mucina, Rutherford & Powrie, 2005), with a Threatened Ecosystem Status of Endangered (B1(i), B2(i), B1(iii), B2(iii)) (Government Gazette 2022b).

Any destruction of the Endangered Cape Flats Dune Strandveld vegetation, which is found on the site examined here, is subject to an Offset ratio of 30:1 in the area (ratio for outside an urban area) if its destruction cannot be avoided (refer to Department of Environment Affairs & Development Planning (DEA&DP), 2015; Government Gazette 2022a & 2022b). The precise area of the Dune Scrub to be impacted would need to be measured as part of an independent offset determination.

6.3 Corridors

The Eerste River estuary, including the current site of the Wastewater Treatment Works, is located on a natural corridor through the landscape linking the coast to the interior, mainly along the Eerste River corridor. This habitat and route are utilized by fauna such as small antelope, otters and birds as well as water fauna.

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Taylor, H.C. & Boucher, C. 1993. Chapter 9. Dry coastal ecosystems of the South African south coast. In: E. van der Maarel, Dry Coastal Ecosystems: Africa, America and Oceania. Ecosystems of the World 2B, pp. 89-107.

Appendix 1. Threatened Vegetation categories

Mucina and Rutherford (2006) use the following categories of threat for their national vegetation types:

- Critically Endangered – This type has been transformed to such an extent that the remaining habitat is less than that required to represent 75% of species diversity (i.e., the biodiversity target).
- Endangered – These types have lost up to 40% of their original extent and are exposed to partial loss of ecosystem function.
- Vulnerable – This vegetation has lost up to 20% of its original extent, which could result in some ecosystem functions being altered.
- Least Threatened – No significant ecosystem functioning disruption is assumed. This vegetation still possesses more than 80% of its original extent intact.

Appendix 2. Threatened Ecosystem categories

The Biodiversity Act (Act 10 of 2004) provides for the listing of threatened or protected ecosystems in one of the following four categories, with further qualification using criteria listed in the table below. The list of threatened terrestrial ecosystems presented here supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (NSBA) of 2004.

- **critically endangered (CR) ecosystems**, are ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- **endangered (EN) ecosystems**, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- **vulnerable (VU) ecosystems**, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems;
- **protected ecosystems**, are ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

Criteria used to identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems

Criterion	CR	EN	VU
A1: Irreversible loss of natural habitat	Remaining natural habitat $\leq$ biodiversity target	Remaining natural habitat $\leq$ (biodiversity target + 15%)	Remaining natural habitat $\leq$ 60% of original area of ecosystem
A2: Ecosystem degradation and loss of integrity*	$\geq$ 60% of ecosystem significantly degraded	$\geq$ 40% of ecosystem significantly degraded	$\geq$ 20% of ecosystem significantly degraded
B: Rate of loss of natural habitat**			
C: Limited extent and imminent threat	--	Ecosystem extent $\leq$ 3 000ha, and imminent threat	Ecosystem extent $\leq$ 6 000ha, and imminent threat
D1: Threatened plant species associations	$\geq$ 80 threatened Red Data List plant species	$\geq$ 60 threatened Red Data List plant species	$\geq$ 40 threatened Red Data List plant species
D2: Threatened animal species associations**			
E: Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan	Very high and high threat	Very high irreplaceability and medium threat	Very high irreplaceability and low threat
F: Fragmentation**			

* Because of data constraints, Criterion A2 has been applied to forests but not to other vegetation types.

** Because of data constraints, Criteria B and D2 are dormant at this stage and thresholds have not been set for these criteria. Further testing of Criterion F is needed to determine whether it is a workable criterion for terrestrial ecosystems.

Appendix 3. Dr Charles Boucher Abridged CV

OCCUPATION : Botanical Ecological Consultant
NAME OF FIRM & STAFF : Sole Proprietor - C Boucher Ecological Surveys
PROFESSIONAL EXPERIENCE : 55 Years
NATIONALITY : South African

PROFESSIONAL REGISTRATION

- South African Council for Natural Scientific Professions - Registered Professional Botanical Scientist (current - since 1983). Registration no. 400737 / 83.

Membership of PROFESSIONAL Organizations and Societies

- Botanical Society of South Africa (life member).
- South African Association of Botanists (life member).

PROFESSIONAL LISTING

- Marquis Who's Who in the World 2005
- Outstanding Scientists of the 21st century – inaugural edition.

KEY QUALIFICATIONS

M.Sc. 1972. University of Cape Town. (Thesis title: *The vegetation of the Cape Hangklip Area.*)

Ph.D. 1987. University of Stellenbosch. (Thesis title: *A phytosociological study of transects through the western Cape coastal foreland, South Africa.*)

Fifty-three years botanical, ecological and vegetation survey research experience. Specialist in Southern African riparian and wetland vegetation ecology, of the littoral vegetation of South Africa and of the general vegetation of southern South Africa. Experienced in rehabilitation of vegetation in the Cape. Undertaken research into Cape endemic plants, rare species, utilizable species, invader problem plants and riparian & wetland vegetation zonation patterns through South Africa and Lesotho. Nineteen years full-time lecturing experience presenting numerous courses and guidance annually to 1st, 2nd, 3rd, honours, 23 masters and six PhD students. Specialist consultant to the South African and Western Cape Provincial government and to private firms on selected environmental issues requiring botanical ecological expertise.

EMPLOYMENT RECORD

1986 – present Proprietor of C Boucher Botanical Ecological Consultancy.

1988 – 2005 Senior Lecturer, Botany Department, University of Stellenbosch. (Acting Head of Department when head absent). Retired 2005.

1986 – 1987 Lecturer, Botany Department, University of Stellenbosch.

1983 – 1985 Officer-in-Charge, Botanical Research Unit, Stellenbosch.

1968 – 1985 Agricultural Researcher, Botanical Research Institute.

1966 – 1967 Assistant Curator, Botanic Garden, University of Stellenbosch.

Professional service

MAJOR PROJECTS

Vegetation survey of the Kogelberg State Forest and surrounding areas.

An autecological investigation of the rare-and-endangered Proteaceae, *Orothamnus zeyheri*.

A broad-scale categorization and description of the vegetation of the western Cape Coastal Foreland.

Germination experiment and salt tolerance determinations of selected indigenous grazable Namaqualand plants.

Vegetation rehabilitation experiments along the Namaqualand Coastal Plain.

Littoral vegetation of South African coastline from Namaqualand to Eastern Cape

Development of personal computer programmes to analyse phytosociological data.

The compilation of a data catalogue for the Fynbos Biome.

Contributed Fynbos Biome vegetation maps and selected descriptions for Vegmap Project

The restoration of part of the Lourens River.

Investigations for the Olifants-Doring Rivers Irrigation Schemes.

Determination of baseline botany for monitoring of Berg River.

Development of botanical ecological management and conservation systems for Western Cape golf course estates and for a number of estates.

Assessment of botanical impact of raising wall of Clanwilliam Dam.

Establishment of a conservation system on the Harmony Flats, Gordon's Bay.

Terrestrial fauna & flora component, Cape Metropolitan Area sensitivity analysis and mapping.

Specialist Botanical Ecological Consultant for the assessment of the ecology of riparian and wetland vegetation of portions of the following rivers and wetlands, including botanical aspects relevant to the water demand in respect of proposed dams and revegetation issues of the Berg, Breede, Diep, Doring, Eerste, Elands, Groen, Groot Brak & associated Wilderness rivers, Hex, Hopies, Klapmuts, Klein, Lourens, Molenaars, Mosselbank, Olifants (WC), Palmiet, Riebeeck, Riviersonderend, Silvermine, Sir Lowry's Pass, Spoometkloof, Swart and Witels, Sandveld Seasonal Rivers as well as Lower Orange in South Africa, Senqu, Senqunyane, Matsoku & Malibamatso Rivers in Lesotho and wetlands Rietvlei, Papenkuils & Zeekoeivlei.

Numerous specialist ecological and management contributions, *inter alia*, in the following organizations: South African Association of Botanists; Cape Peninsula protected natural environment advisory board; Stellenbosch town council; National Botanical Institute vegmap project; UNESCO MAB specialist ecological consultant for the establishment of the West Coast Biosphere Reserve; ecological & geomorphological principles for river rehabilitation; Dept. Water Affairs & Forestry, advisory committee for development of Western Cape regional water resources strategy; Overberg review committee for assessing management of properties on the Agulhas Plain owned by Cape Nature Conservation and the Denel group; WRC groundwater (aquifer) dependant ecosystems in key hydrological settings in South Africa; greater Val De Vie Estate development; advisory board Paarl Mountain Nature Reserve; Table Mountain group aquifer study & pilot abstraction alliance for City of Cape Town; DEA review panel for Eskom's proposed nuclear power station(s); WCPA upgrading the MR269 road from Shaw's Pass through the Hemel-en-Aarde Valley,

AWARDS

Botanical Advisor - Revegetation of the National Road (N1) through Du Toitskloof (1990-1997). Team awarded the South African Institution of Civil Engineering / Construction World Award for Engineering Excellence for 1997.

Member, Environmental assessment, monitoring and restoration Working Group of Houwteq Industrial Site, Houwhoek (1987-1996). Team awarded 1992 National Premium EPIC award for Integrated Environmental Management.

Specialist Consultant for development of the Lower Silvermine River Flood Control Scheme (1998-2002). Team awarded the South African Institution of Civil Engineering Branch Award for Excellence in Civil Engineering in the Western Cape for 2002.

De Lange, J.H. & Boucher, C., 1990. Autecological studies on *Audouinia capitata* (Bruniaceae). 1. Plant-derived smoke as a seed germination cue. S. Afr. J. Bot. 56(6): 700-703. Highest quotation index of all the articles published in the S. Afr. J. Bot. since its inception (evaluated in 2013).

De Lange, J.H., Van Der Walt, J.J.A. & Boucher, C., 1993. Autecological studies on *Audouinia capitata* (Bruniaceae). 5. Seed development, abortion and pre-emergent reproductive success. S. Afr. J. Bot. 59(2): 156-167. Awarded the Compton Prize for the best publication in the South African Journal of Botany during 1993.

Botanical Advisor – The restoration of part of the Lourens River for Megan Anderson Landscape Architects through Crowther Campbell & Associates (1999-2003). Team won national Award of Excellence for Design for the period 2009-2011 from the Institute for Landscape Architecture in South Africa.

Educational

Led 6 Ph.D. And 24 master degree students to complete their studies. External examiner for 4 Ph.D. Students. External evaluator for 1 professorate and 6 masters degree students. Internal examiner for 5 master degree students. Referee / reviewer for 8 professional journals.

Trustee

Member of board of trustees for the Molly Lazarus Trust, which serves to manage the Puntjie national heritage site and Nature Reserve, Heidelberg district.

Total number publications, reports & presentations = 519, consisting, *inter alia*, of:-

Theses (2), Chapters in books (15), Scientific articles in refereed journals (71), Articles without referees (8), Articles in CD's (2), Articles in conference proceedings (14), Unpublished botanical reports (317), International presentations (10), National congress and workshop presentations (52), Regional meeting presentations (28), Public lectures (26) & Total number of conferences, symposia, working groups attended (97).

Appendix 4. DECLARATION OF INDEPENDENCE OF PRACTITIONER

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 Vita*.

I, Dr Charles Boucher (Sole proprietor of C Boucher Ecological Surveys), 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 and certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications and experience.



Date: 31 October 2023

CHARLES BOUCHER
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