RESIDUAL WETLAND IMPACT COMPENSATION PLAN FOR THE PROPOSED EXTENSION OF ERICA DRIVE FROM BELHAR TO OAKDENE OVER THE R300 AND DUALLING OF ERICA DRIVE / BELHAR MAIN ROAD, EAST OF REUTER STREET, OVER THE KUILS RIVER, WESTERN CAPE PROVINCE

Prepared for

Eco Impact Legal Consulting (Pty) Ltd

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Fluvial:	Resulting from water movement.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Intermittent flow:	Flows only for short periods.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may, in turn, have an influence on the ecological characteristics and functioning of wetlands.

LIST OF ABBREVIATIONS

CBA	Critical Biodiversity Area
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GN	Government Notice
HGM	Hydrogeomorphic
m	Meter
MC	Management Classes
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAS	Scientific Aquatic Services
STS	Scientific Terrestrial Services
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission
WULA	Water Use License Application

1 INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to compile a Residual Wetland Impact Compensation Plan (RWICP) as part of the offset investigation for the identified western wetland flat that will be impacted by the proposed extension of Erica Drive, from Belhar to Oakdene, in the City of Cape Town, Western Cape Province (Figure 1). As part of the freshwater resource verification[1] undertaken by SAS in September 2018, two natural wetland flats (known as the western wetland flat and the eastern wetland flat) were identified along the proposed route of the Erica Drive expansion. A description of the wetlands is provided in Section 3 of this report and a visual representation is provided in Figure 2 below.

The need and desirability for the offset investigation came about due to the unavoidable loss of 0,28 hectares of wetland habitat of the western wetland flat associated with the proposed extension of Erica Drive. As part of the offset investigation it was determined that 0,2 functional hectare equivalents and 0,7 habitat hectare equivalents of wetland area would need to be conserved to offset this residual loss.

This document has been compiled to guide the proponent and authorising agent with the relevant rehabilitation, maintenance and monitoring requirements that must be implemented in order to successfully rehabilitate and reinstate the western wetland flat. This report further provides recommendation for the proposed stormwater management plan and the associated attenuation facilities which will aid with the hydrological functioning of the wetland and provides overarching guidance in terms Alien and Invasive Plant (AIP) control.

[1] Scientific Aquatic Services. 2018. Freshwater Resource Verification and Offset Requirements Calculation for the proposed extension of Erica Drive from Belhar to Oakdene and dualling of Erica Drive / Belhar Main Road, east of Reuter Street, over the Kuils River, Western Cape. Report Reference Number: 218165

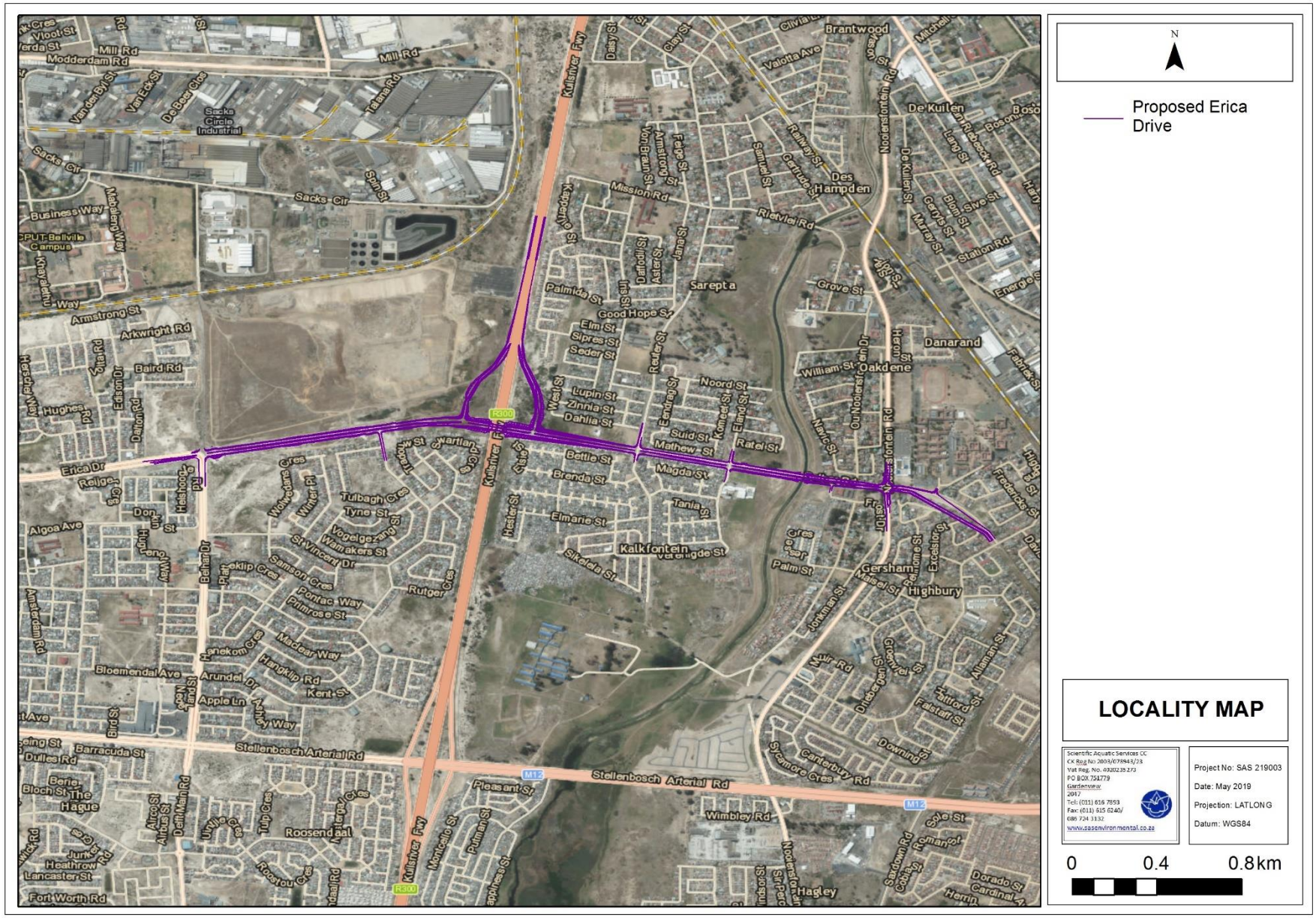


Figure 1: Digital satellite image depicting the proposed Erica Drive in relation to the surrounding areas.

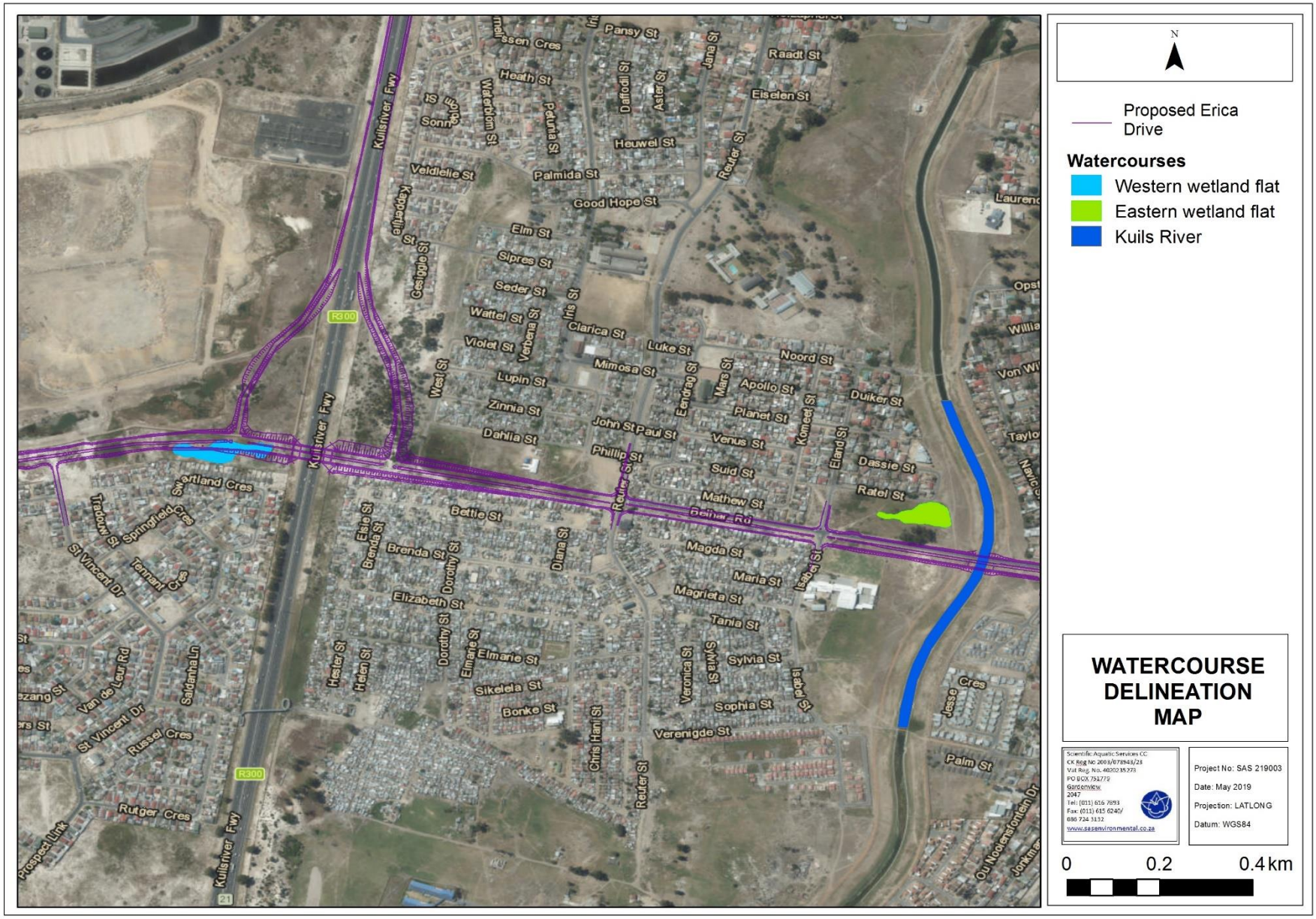


Figure 2: The locality of the identified wetlands in relation to the proposed Erica Drive.

1.1 Structure of this report

This report investigates the need for rehabilitation and maintenance activities for the proposed Erica Drive development, from a wetland resource management point of view. The report has been structured in the following way:

Chapter 1: Introduction
Provides an introduction, the structure of this report, the assumptions and limitations, as well as the including the principles and objectives of a rehabilitation and implementation plan.

Chapter 2: Project Description
Provides the location of the wetland flats under consideration in this report as well as the proposed Erica Drive road alignment and stormwater management plans. A brief description of the proposed wetland reinstatement is provided herein.

Chapter 3: Receiving Freshwater Environment
This section includes a summary of the site assessment findings undertaken by SAS during 2018 and 2019 as part of the Wetland Ecological Assessment and the Soil investigation.

Chapter 4: Legal Framework
This section provides a breakdown of the legal framework relevant to the proposed development activities as well as the compilation of this RWICP. This section also provides the project specific considerations to the DEA *et al.* 2013 mitigation hierarchy.

Chapter 5: Residual Wetland Impact Compensation Plan
This section comprises site specific details pertaining to the construction mitigation and rehabilitation measures that must be implemented. A list of the roles and responsibilities of all individuals involved in the implementation of this RWICP is provided.

Chapter 6: Projected Environmental Conditions Post Rehabilitation
This section provides an estimation of the expected ecological condition of the wetlands once the rehabilitation activities as stipulated in this report are implemented.

Chapter 7: Conclusion
This section summarises the key findings and recommendations based on the recommended rehabilitation and management actions listed and the overall requirements in order to ensure the best possible reinstatement and rehabilitation of the wetland impacted by the proposed Erica Drive development.

1.2 Wetland Rehabilitation, Implementation and Management Plan Framework

1.2.1 Principles of this Wetland Rehabilitation, Implementation and Management Plan

To assist in achieving the objectives of a RWICP, a set of principles were applied which contributed to formulating action plans and specific management measures.

Loss of biodiversity puts aspects of the economy, human well-being and quality of life at risk, and reduces socio-economic options for future generations. The importance of maintaining biodiversity and intact ecosystems for ensuring the on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and is fundamental to the notion of sustainable development. In addition, international guidelines and commitments, as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa.
Impacts on biodiversity can largely take place in four ways:

- **Direct impacts:** are impacts directly related to the proposed development including project aspects such as site clearing and soil compaction.
- **Indirect impacts:** are impacts associated with the proposed development that may occur within the zone of influence associated with the Erica Drive development, such as the surrounding terrestrial areas.
- **Induced impacts:** impacts that directly attributable to the proposed development but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries.
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous industrial/urban developments within the same drainage catchment.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted in the identification of spatial biodiversity priorities or biodiversity priority areas.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of anthropogenic activities. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level.

The mitigation hierarchy, as advocated by the Department of Environmental Affairs (DEA) *et al.* (2013) in general consists of the following in order of which impacts should be mitigated:

1. **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that recommended mitigations measures will not be adequate to limit environmental damage and eco-service provision to suitable levels;
2. **Minimise impact:** can be done through the utilisation of alternatives that will ensure that impacts on biodiversity and ecosystem services provision are reduced. Impact minimisation is considered an essential part of any development project;
3. **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable. As such, impacted areas must be returned to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land.

Rehabilitation cannot, however, be considered as the primary mitigation toll as even with significant resources and effort of rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:

a. **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;
b. **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources associated with the project and its footprint supports the intended land uses. In this regard, special mention is made of the need to ensure the continued functioning and integrity of the wetlands throughout and after the rehabilitation phase.
c. Biodiversity reinstatement which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community or community suitable for supporting the intended land use.
d. Species reinstatement which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species reinstatement need only occur if deemed necessary.

4. **Offset impact:** The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss of irreplaceable biodiversity, the residual impacts should be considered to be of a *very high significance* and offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.

1.2.2 Objectives of this Wetland Rehabilitation, Implementation and Management Plan

The objectives of this RWICP are to:

- Meet the requirements of relevant local and regional authorities;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts on the receiving environment to minimal or acceptable levels;
- Manage activities in order to maintain and/ or improve ecological integrity of the impacted wetland associated with the proposed development;
- Maximise the service provision of the impacted wetland through extensive rehabilitation;
- Re-introduce indigenous floral species;
- Provide improved and more suitable habitat for faunal species within an urban environment;
- Maximise the ecological functioning of the impacted wetland;
- Detail specific actions deemed necessary to assist in mitigating the potential environmental impact on the impacted wetland;
- Ensure as far as is practicable that the measures contained in the report are implemented; and
- Propose mechanisms for monitoring compliance with the RWICP and reporting thereon.

2 PROJECT DESCRIPTION

The proposed Erica Drive / Belhar Main Road extension is approximately 3,24km in length. Erica Drive will link to the R300 with a parclo interchange (partial cloverleaf type interchange) which will provide access to the north and in the distant future to the south. The first section of Erica Drive between Belhar Drive and New Nooiensfontein Road will be known as Erica Drive and the section between New Nooiensfontein Road and Highbury Road will be known as Belhar Main Road.

The following sections provide further detailed information on the proposed expansion as well as stormwater management requirements to support the above-mentioned outcome.

2.1 Proposed Erica Drive Expansion

The proposed plan is to construct a dual carriageway with a median that varies in width between 2m and 5m. This proposed road has two sections:

- Upgrading the existing Belhar Road from Highbury Road, over the Kuils River to Reuter Road; and
- The construction of a new dual carriageway and on-ramp/ off-ramp to the R300 highway starting at the Belhar Road, Reuter Street intersection and continuing over the R300 highway, to the south of the existing landfill site, joining with Erica Drive.

The planned cross-section comprises two 3,4m lanes, a 2,4m surfaced shoulder and a 0,3m channel on both the shoulder side and the median side per direction of travel. The road width per direction (kerb to kerb) will vary between 9,8m - 5.2m. On either side of the dual carriageway a new 2m sidewalk will be constructed to accommodate the high pedestrian volumes in the area. The proposed extension and duelling of Erica Drive will hereafter collectively be referred to as the “proposed Erica Drive”. Retaining walls, constructed from Concrete Retaining Blocks (CRBs), will be constructed along the western portion of the proposed Erica Drive expansion, associated with the required R300 flyover, on the southern section only. The maximum height of this retaining wall will be 2 metres. The footprint of the retaining wall associated with the Erica Drive flyover, and the location of the western wetland flat including the reinstated area is presented in Figure 3 below.

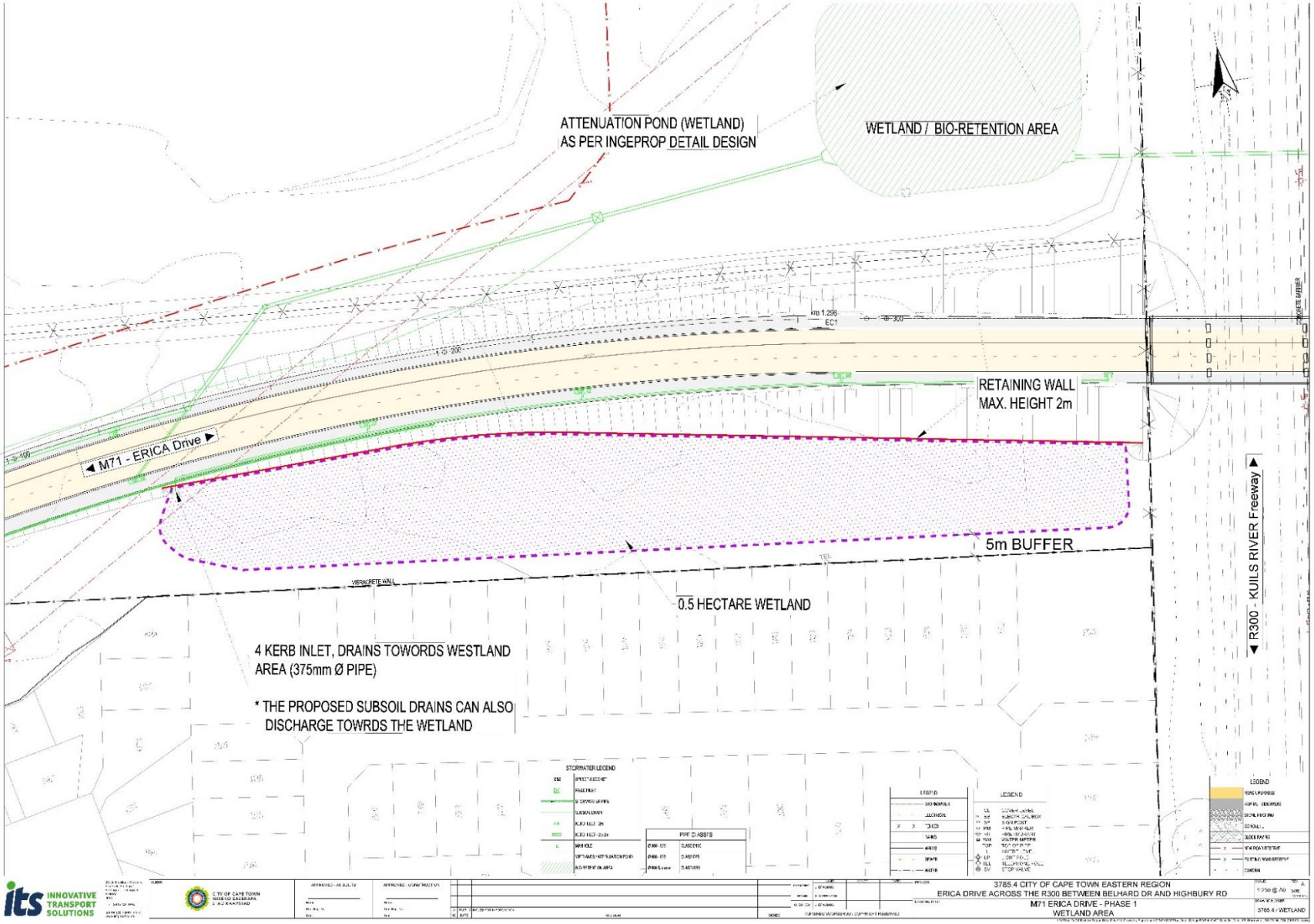


Figure 3: Proposed retaining wall and associated toe, relative to the proposed new Erica Drive extension (ITS, 2019).

2.2 Stormwater Management

A stormwater attenuation facility will be developed between the new offramp from the R300 onto Erica Drive, on the western side of the R300 and stormwater will further be directed into the reinstated western wetland flat (Figure 5 and 7). This will aid with attenuating the stormwater runoff from the newly constructed Erica Drive. A second stormwater attenuation facility will be developed just west of the Kuils River (associated with the eastern portion of the proposed Erica Drive), within the open space area at the Belhar Road and Eland Street intersection (Figure 6 and 7).

Stormwater from the expanded Erica Drive and the surrounding impermeable surfaces will be directed into these facilities. A forebay will be developed to allow for sediment to be settled before entering the larger areas of the stormwater attenuation facilities, and in the case of the western wetland flat, before entering the proposed reinstated wetland habitat. Sediment and silt will be removed from these stormwater attenuation facilities on a regular basis, thus a ramp will be constructed to allow for maintenance vehicles to easily access the forebay, limiting impacts on the attenuation facilities and wetland habitat. Both stormwater attenuation facilities have been designed with input from the wetland specialist and will function as constructed wetland habitats and will be vegetated with recommended indigenous wetland vegetation. Figure 4 provides an example of how an attenuation facility can be designed to function as a constructed wetland.

Figure 4: Urban stormwater attenuation facility with indigenous wetland vegetation species.

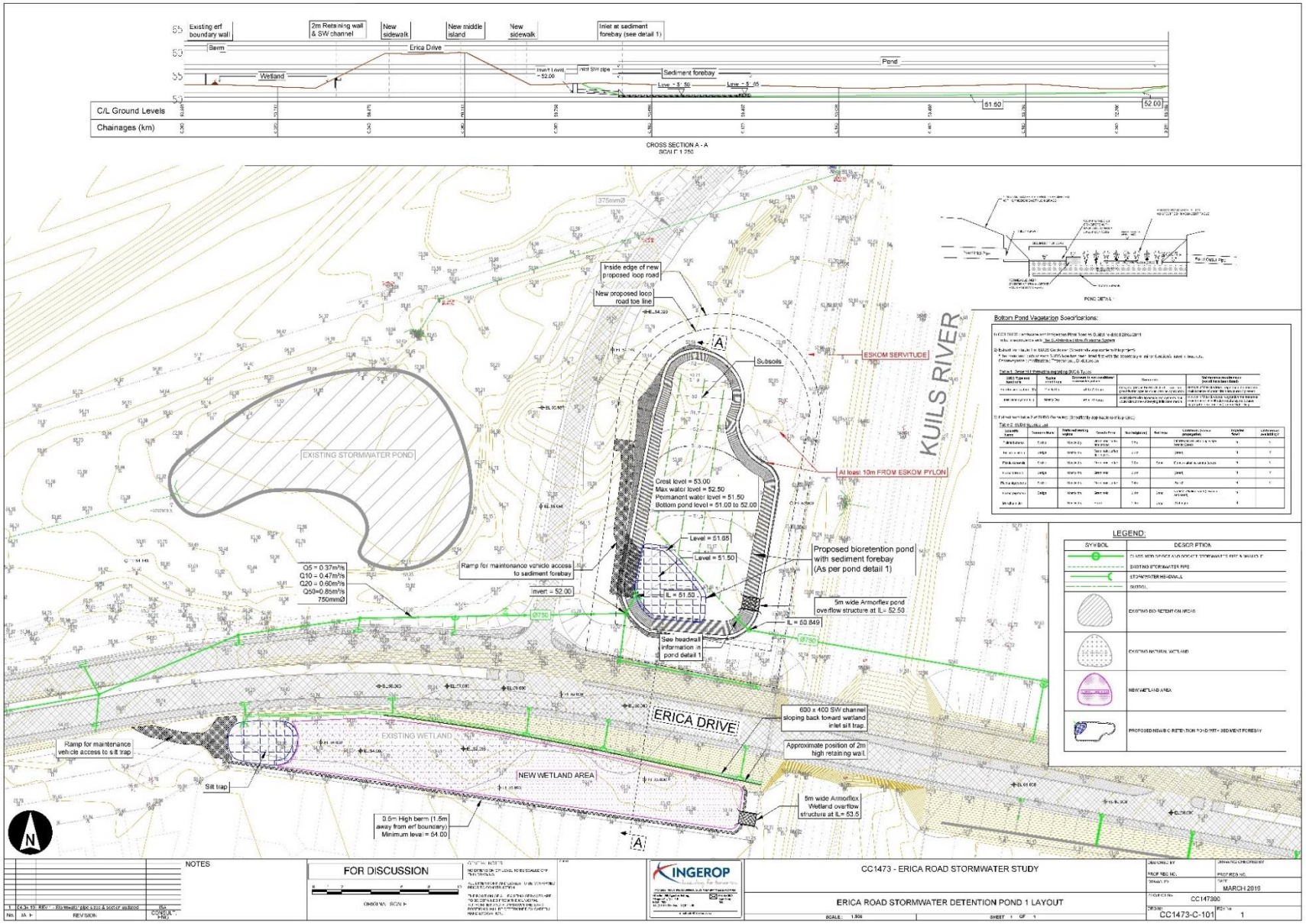


Figure 5: The proposed stormwater attenuation facility associated with the western portion of the proposed Erica Drive development (Ingerop, 2019).

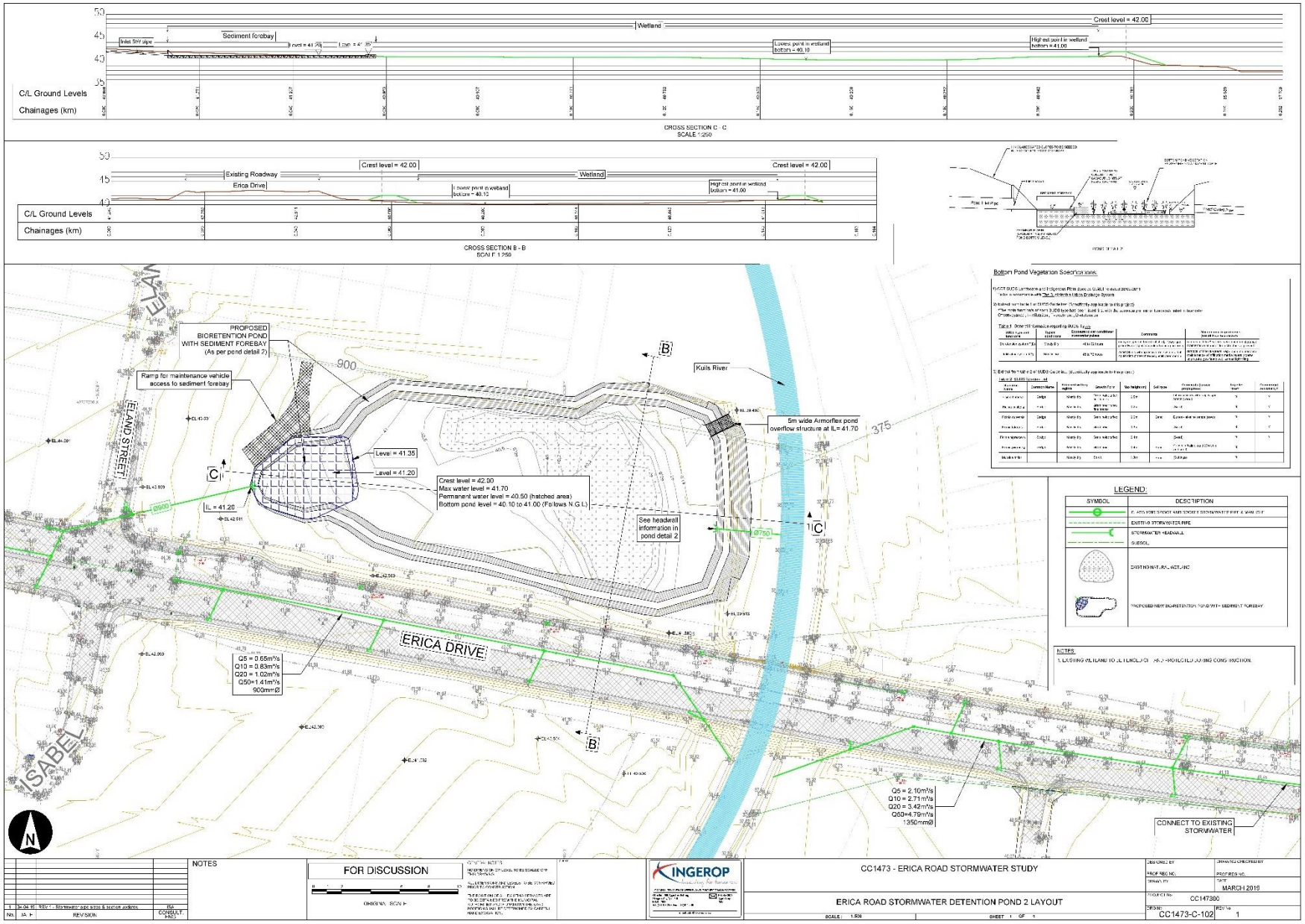


Figure 6: The proposed stormwater attenuation facility associated with the eastern portion of the proposed Erica Drive development (Ingerop, 2019).

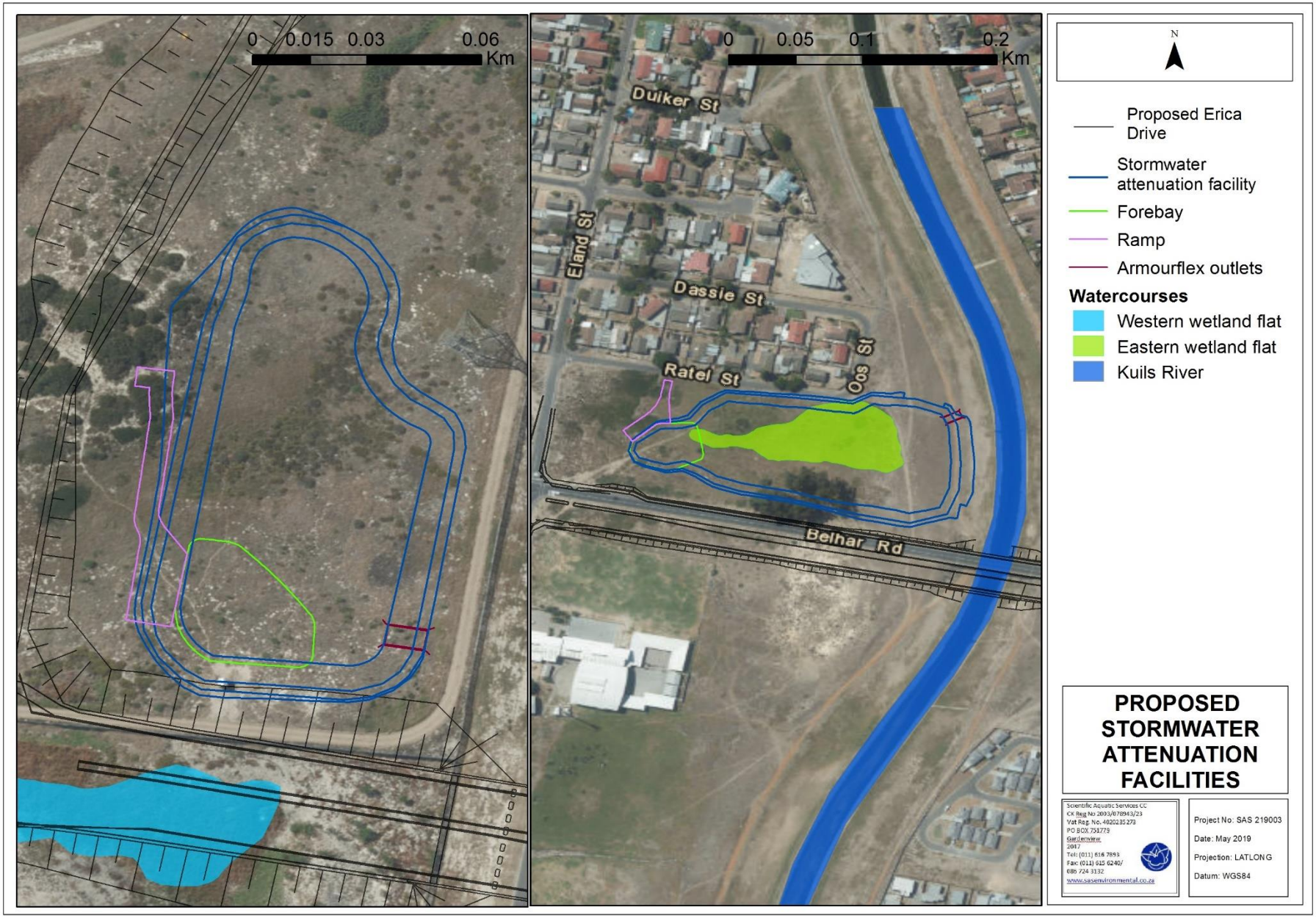


Figure 7: The proposed stormwater attenuation facilities associated with the proposed Erica Drive, relative to the wetlands identified.

2.3 Compensation Plan for the western wetland flat footprint

2.3.1 Need and Desirability

The need and desirability for the offset came about due to the unavoidable loss of 0,28 hectares of wetland habitat of the western wetland flat associated with the proposed extension of Erica Drive (Figure 2). As part of the offset investigation[2] it was determined that 0,2 functional hectare equivalents and 0,7 habitat hectare equivalents of wetland area would need to be conserved to offset the residual loss anticipated as a result of the new road (please refer to Section 3 for more information pertaining to the wetland feature in question).

Following this, an investigation into potential off-site wetland features that could be utilised for the offsetting requirements was undertaken, including a meeting with CapeNature and the City of Cape Town (CoCT) on 21st of January 2019, however, it was soon noted that there were no available areas within the same local catchment that would conform to the target wetland offset requirements. In consultation with the Department of Water and Sanitation (DWS) on the 7th of February 2019 and again on the 7th March 2019, it was proposed that the existing western wetland flat be expanded, so as to rehabilitate the area and reinstate wetland habitat alongside the proposed new Erica Drive. This is based on the "like for like" concept, where biodiversity offsets generally target features or areas with similar biodiversity as that residually impacted by the proposed Erica Drive. Due to the existing high levels of urbanisation, alien invasive plant species and stormwater ingress within the surrounding area, the target of recovering at least 0,2 functional hectare equivalents and 0,7 habitat hectare equivalents was deemed to be unrealistic. As discussed with, and agreed to by the DWS, the Present Ecological State (PES) of the western flat wetland post rehabilitation and reinstatement will be maintained as per the Freshwater Assessment Report (Hanekom, 2017) (refer to Section 3 of this report) and improved upon where possible.

2.3.2 Proposed Compensation Plan

Since the proposed Erica Drive road reserve will encroach on the western wetland flat, resulting in approximately 0,28 hectares of wetland habitat that will be lost, it is proposed that the remaining wetland habitat (0.28ha) be rehabilitated (GPS co-ordinates 33°56'25.25"S 18°39'29.84"E) and an additional 0.3ha of wetland habitat reinstated (GPS co-ordinates 33°56'25.77"S 18°39'33.56"E) (Figure 9). The wetland will be extended southwards from the proposed Erica Drive, towards the residential area and eastwards, towards the R300. The area will be graded to create a permanent wetland zone (maximum depth of 0,5m), while the perimeter will be sloped to create temporary and seasonal wetland zones, as per the schematic below.

[2] Scientific Aquatic Services. 2018. Freshwater resource verification and offset requirements calculation for the proposed extension of Erica Drive from Belhar to Oakdene and dualling of Erica Drive / Belhar Main Road, east of Reuter Street, over the Kuils River, Western Cape. Report reference: SAS 218165

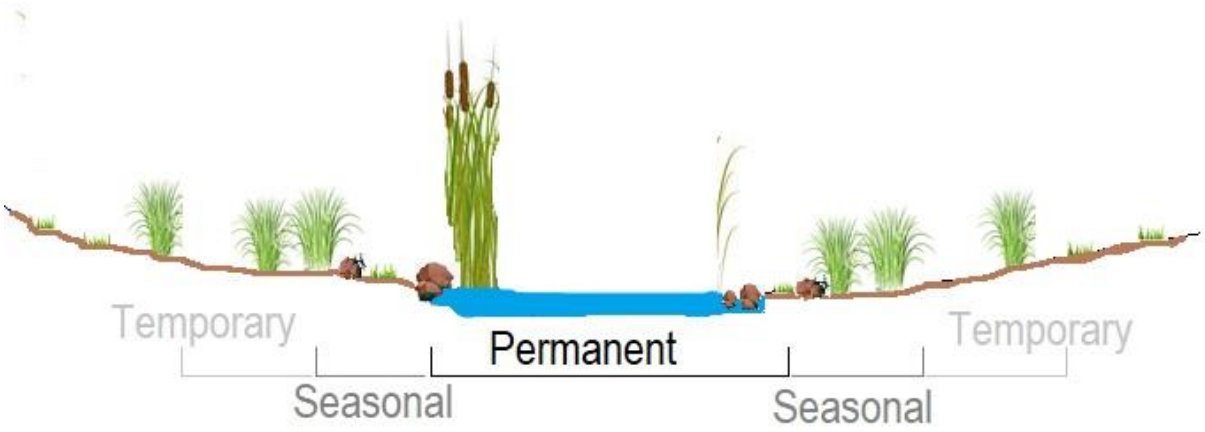


Figure 8: Schematic of the various wetland zonations that must be recreated as part of the rehabilitation and reinstatement of the western wetland flat.

The above indicated zones will be vegetated with appropriate obligate and facultative indigenous wetland vegetation, as deemed applicable. A small berm will be constructed between the reinstated wetland and the neighboring residential development, south of Erica Drive, which will be revegetated with indigenous terrestrial vegetation. This berm will provide protection to the southern residential erven from possible flooding as a result of the reinstated wetland and will provide the western wetland flat with some protection through the creation of a terrestrial buffer zone.

Stormwater runoff from the southern half (i.e. the left lanes) of the Erica Drive flyover will be released into the reinstated wetland area (via a stormwater pipe from the road into a sediment forebay) which will aid with driving the hydrological functioning of the wetland and ensuring that the seasonality of the wetland is maintained. The new wetland footprint will be approximately 0,58ha.

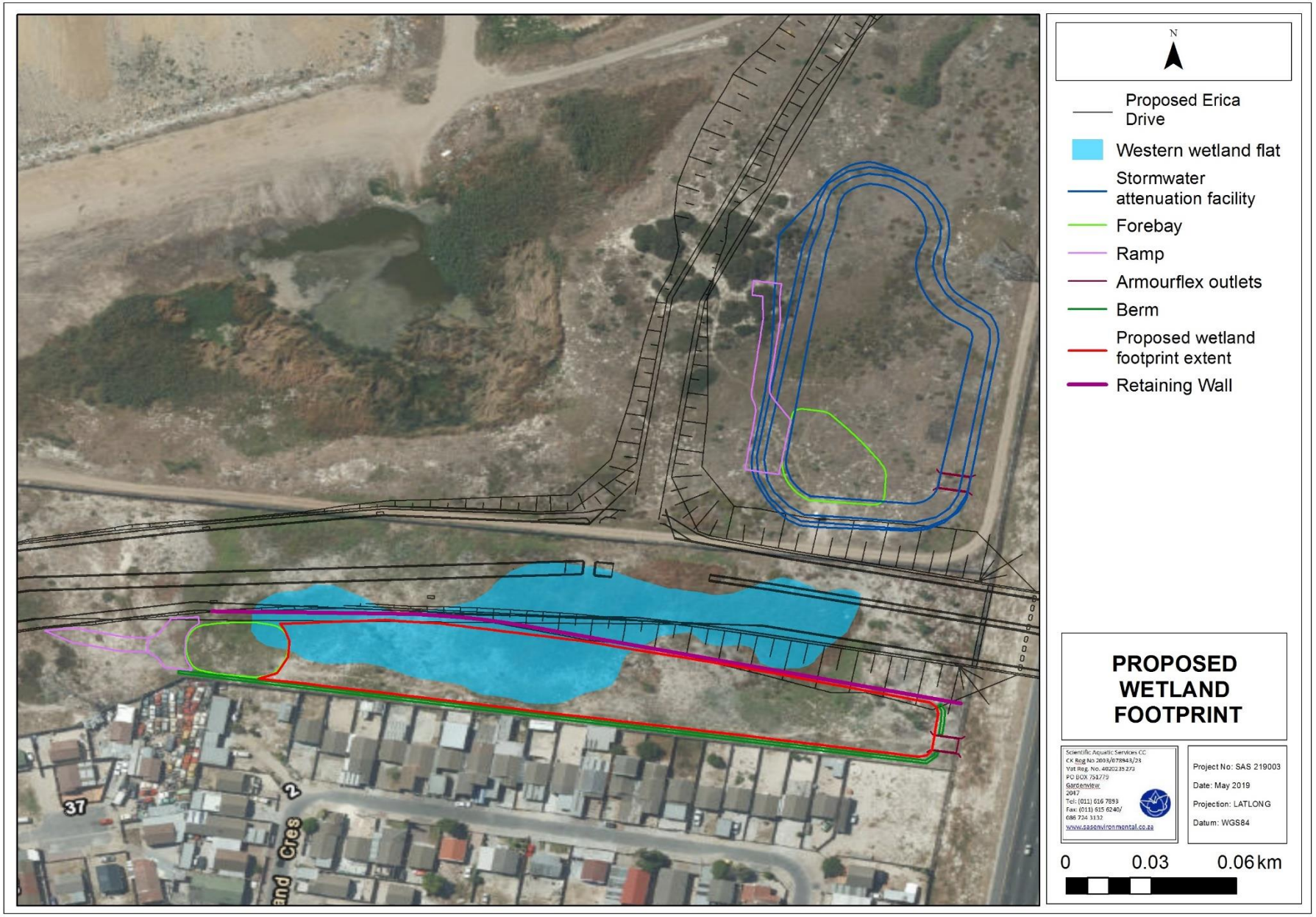


Figure 9: The current extent of the western wetland flat relative to the proposed reinstated and rehabilitated wetland footprint.

3 RECEIVING ENVIRONMENT

3.1 Wetland Ecological Assessment

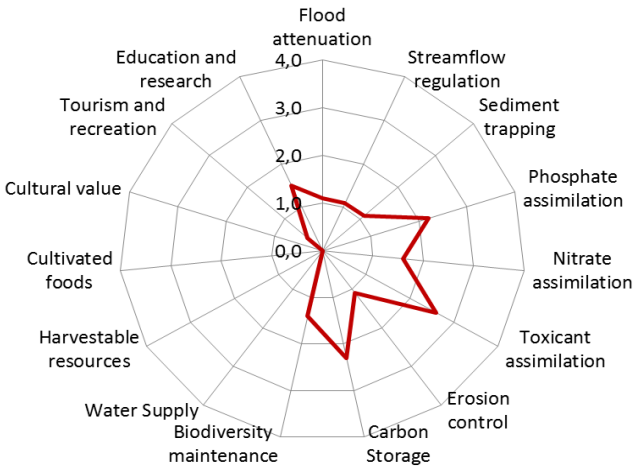
The following information on the wetland ecological characteristics of the proposed Erica Drive development are taken from a report entitled: “Freshwater Resource Verification and Offset Requirements Calculation for the proposed extension of Erica Drive from Belhar to Oakdene and duelling of Erica Drive / Belhar Main Road, east of Reuter Street, over the Kuils River, Western Cape” (SAS, 2018), which also provides further information if required.

The area surrounding the proposed new Erica Drive road reserve (western portion of the proposed Erica Drive), is considered to be significantly disturbed by anthropogenic activities. Such activities include the development of the Bellville South Industrial waste disposal site (north of the proposed Erica Drive road reserve), the location of various medium density residential households located to the south of the proposed Erica Drive road reserve, excavation and shaping of informal roads within the surrounding area and the infilling and the disposal of household refuse.

Figure 2 provides a visual representation of the locality of the two natural wetlands identified along the proposed Erica Drive development. Table 1 and 2 below summarises the findings of the field verification (SAS, 2018) and that of the Freshwater Assessment Report (Hanekom, 2017) regarding relevant aspects (hydrology, geomorphology and vegetation components) for these two wetlands. Due to the significant disturbance to both of these wetlands and their close proximity to the surrounding high-density urbanisation , it is not expected that any Species of Conservation Concern (SCC) would be found within these wetlands. On review of the proposed Erica Drive alignment in relation to the natural wetlands identified.

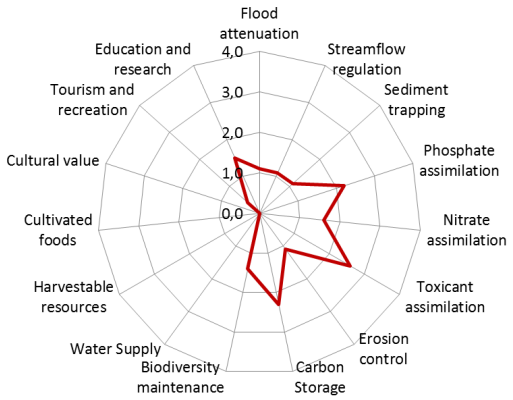
Table 1: A summary of the ecological assessment of the western wetland flat.

<table>
<tr><th colspan="4">WESTERN WETLAND FLAT</th></tr>
<tr><td colspan="4">  </td></tr>
<tr><td colspan="4">Figure 10: This wetland is highly disturbed, with infilling visible within the true extent of the wetland. No remnants of the Strandveld Wetland Vegetation Type were evident, as this wetland mainly comprises the Phragmites australis, Ficinia sedge species, Zantedeschia aethiopica, and common weed species such as Oxalis purpurea and Cotula tubinata. Alien and invasive tree species Acacia saligna were also present within the wetland and the surrounding terrestrial area. These photographs were taken in September 2018 by SAS.</td></tr>
<tr><td colspan="4">  </td></tr>
<tr><td colspan="4">Figure 11: During a site assessment undertaken by SAS in April 2019, most of the vegetation within the wetland and the surrounding area had been cleared and removed from the site. Remnants of the obligate reed species Phragmites australis were identifiable, along with short graminoid species.</td></tr>
<tr><td rowspan="3">PES discussion</td><td colspan="3">PES Category: D (Largely Modified)
As per the Freshwater Assessment Report (Hanekom, 2017), this wetland is considered to be largely modified, mainly due to the surrounding anthropogenic impacts which have degraded the overall habitat integrity and hydrological regime of the wetland.</td></tr>
<tr><td>Hydrology</td><td>Geomorphology</td><td>Vegetation</td></tr>
<tr><td>Category D - Largely Modified
Impact score: 5</td><td>Category D - Largely Modified
Impact score: 5</td><td>Category D - Largely Modified
Impact score: 4,5</td></tr>
</table>

Ecoservice provision	**Ecoservice: Moderately low** The wetland provides moderate services in terms of sediment trapping and removal of phosphates, nitrates and toxicants. It also offers moderate services in terms of controlling erosion and attenuating floods (mainly due to the high surface roughness provided by the vegetation).	
EIS discussion	**EIS Category: Moderate** This wetland is considered to be of moderate ecological importance and sensitivity, primarily due to its status as a Critical Ecological Support Area (Western Cape Biodiversity Spatial Plan, 2017) as well as its location within the Endangered Western Strandveld Wetland Vegetation Type (although no remnants of this vegetation type were observed during the field assessment).	

As this wetland will be directly impacted by the proposed Erica Drive development, the overall goal is to maintain the PES of the wetland and to rehabilitate and reinstate wetland habitat through the implementation of various remediation activities and rehabilitation interventions. Section 5 of this report provides a breakdown of how this will be achieved, with Section 6 providing the projected environmental conditions for the wetlands post rehabilitation.

Table 2: A summary of the ecological assessment of the eastern wetland flat.

<table>
<tr><th colspan="4">EASTERN WETLAND FLAT</th></tr>
<tr><td colspan="4">  </td></tr>
<tr><td colspan="4">Figure 12: This wetland is located west of the Kuils River (blue line – left photograph). Historical infilling, potentially from the construction of the surrounding roads (Dassie Street north of the wetland; Isabel Street west of the wetland), have significantly altered the topography thereof. (Right) Disturbance to the vegetation was also evident, however, patches of the indigenous sedge species Cyperus longus were present.</td></tr>
<tr><td rowspan="3">PES discussion</td><td colspan="3">PES Category: D (Largely Modified)
This wetland is also considered to be largely modified (as reported in the Freshwater Assessment Report (Hanekom, 2017). Impacts on this wetland are related to the construction of the surrounding road infrastructure and the associated surface runoff entering the wetland. Informal paths and trampling by residents through the wetland, have also impacted on the vegetation component of this wetland.</td></tr>
<tr><td>Hydrology</td><td>Geomorphology</td><td>Vegetation</td></tr>
<tr><td>Category D - Largely Modified</td><td>Category D - Largely Modified</td><td>Category D - Largely Modified</td></tr>
<tr><td>Ecoservice provision</td><td colspan="2">Ecoservice: Moderately low
The wetland provides moderate services in terms of sediment trapping and removing phosphates, nitrates and toxicants. It provides moderate services in terms of carbon storage (as evidenced by the soil organic matter during soil sampling), promoting the storage of organic carbon. However, due to the frequent human activity within the wetland and surrounding area, it is not considered to provide habitat to a variety of faunal and floral species.</td><td> 
</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: Moderate
This wetland is considered to be of moderate ecological importance and sensitivity, mainly due to its status as a Critical Ecological Support Area (Western Cape Biodiversity Spatial Plan, 2017).</td></tr>
</table>

3.2 Soil Assessment of the Western Wetland Flat

In order to ensure that the proposed reinstated wetland area associated with the western wetland flat will be hydrologically sustained, a brief field soil investigation was undertaken by SAS in April 2019. It is assumed that the primary hydrological source for this wetland is shallow interflow, of which a shallow confiding layer perches the shallow interflow, to which a wetland response has formed.

The first 50cm in depth of soil associated with the permanent zone of the western wetland flat was investigated. The soil, within the first 50cm of the soil surface, can be described as sandy, consisting of coarse sand particles throughout the soil core sample taken. The topsoil (between 10 – 20 cm) is dark, containing organic material, after which the soil becomes completely gleyed (from 30cm and deeper) (Figure 13).

Figure 13: (Right) sandy topsoils and (left) sandy, gleyed soils associated with the western wetland flat.

Gleying is characterised by the development of grey or blueish-grey colours in the mineral soil component. Certain soil components, such as iron and manganese, are insoluble under aerobic conditions. Iron is one of the most abundant elements in soils, and the iron oxide (rust) coatings over soil particles is responsible for the red and brown colours of many soils (DWAF, 2008). However, under prolonged anaerobic conditions iron becomes soluble and can thus be dissolved out of the soil profile. Once most of the iron has been dissolved out of a soil, the soil matrix is left a greyish, greenish or bluish colour, and is said to be gleyed (DWAF, 2008). The gleyed profile of the western wetland flat indicates constant saturated soil conditions, which corresponds to the permanently inundated zone of the wetland flat and indicates that the wetland is hydrologically driven by groundwater.

The soil profile of the area to which the wetland habitat will be reinstated was also investigated. The soil core samples investigated, indicated that a thicker organic topsoil layer is present. Gleying within the soil profile became evident at a depth of 60 – 70cm. At a dept of 70cm and deeper the soil was white and completely saturated. These soils are known as regic sands, which are deep sandy soils associated near coastal areas and in areas with a high water table (Job, 2009) (Figure 14).

Figure 14: Regic sands noted within the area wetland habitat will be reinstated.

Based on the above discussion, it is evident that the shallow water table hydrologically drives the seasonal western wetland flat. The presence of the water table below the area where the reinstated wetland habitat is proposed, indicated that seasonal wetland areas can be developed, which will be sustained by the seasonal fluctuation of the water table and the additional ingress of stormwater from the proposed Erica Drive.

4 LEGISLATIVE FRAMEWORK FOR THIS WETLAND REHABILITATION AND MANAGEMENT PLAN

The following legislative requirements were considered as part of the development of this Rehabilitation, Implementation and Management Plan (Please also refer to Appendix A).

- National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA):Alien and Invasive Species Regulations (Government Notice 864 as published in the Government Gazette 40166 of 2016); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)

Section 21 of the National Water Act (Act No. 36 of 1998) lists the following activities as water uses:

- Section 21 (c): impeding or diverting the flow of water in a watercourse; and
- Section 21(i): altering the bed, banks, course or characteristics of a watercourse.

It is important to note that **rehabilitation impacts** are applicable to areas where impact avoidance and minimisation are unavoidable and where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use. Rehabilitation cannot, however, be considered as the primary mitigation toll as even with significant resources and effort, rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation as presented in this report are aimed to undertake the following best practise rehabilitation phases: should consist of the following phases in best practice (a description of each of these phases are provided in Section 1.2.1):

- Structural rehabilitation;
- Functional rehabilitation;
- Biodiversity reinstatement; and
- Species reinstatement

In line with the mitigation hierarchy, as advocated by the Department of Environmental Affairs (DEA) *et al.* (2013) the following were considered as part of the investigation for the proposed Erica Drive:

Table 3: Mitigation hierarchy considered as part of the Erica Drive development.

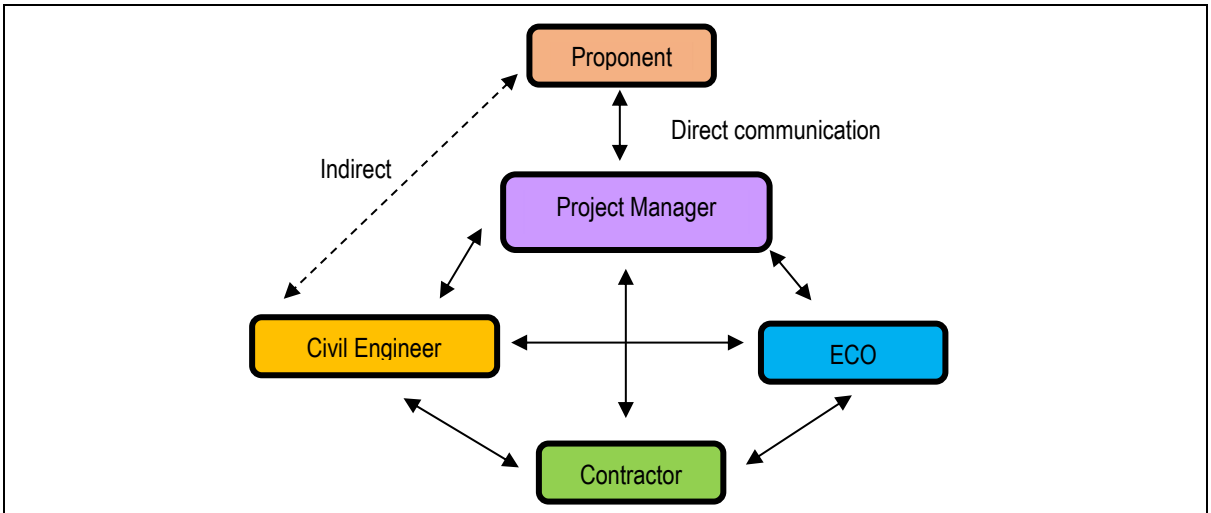
Avoid/Prevent Impact	As part of the assessment, no other alternatives were deemed feasible due to the high urbanisation of the surrounding area, the location of the Kuils River in the east as well as the R300 highway. This limited areas where the expansion could be undertaken.
Minimise Impact	The impacts on the western wetland flat were minimized as far as feasibly possible. A meeting was undertaken with the freshwater specialist, the Environmental Assessment Practitioner (EAP) and the relevant engineers to determine how best to minimize the impacts of the Erica Drive expansion. It was agreed that a two metre high retention wall along the southern portion of the road would be implemented so as to reduce the hectare loss of wetland habitat (approximately 4 metres from the road edge is retained as a result of the retaining wall instead of using backfilled materials). A larger retaining wall was not favoured as this posed safety concerns for the surrounding residents.
Rehabilitate/ Offset the Impact	Based on the retaining wall, approximately 0,28 hectares of wetland habitat would still be lost as a result of the Erica Drive road expansion and flyover the R300. The remaining wetland habitat will be rehabilitated, and additional wetland habitat reinstated on site as part of the offset investigation/ requirements. Section 5 below provides all relevant mitigation measures and rehabilitation actions that will be implemented.

5 RESIDUAL WETLAND IMPACT COMPENSATION PLAN

5.1 Roles and Responsibilities

The following table provides a summary of the various parties that are involved with the implementation of this RWICP as well as their responsibilities.

Table 4: Summary of various parties involved with the implementation of this RWICP.

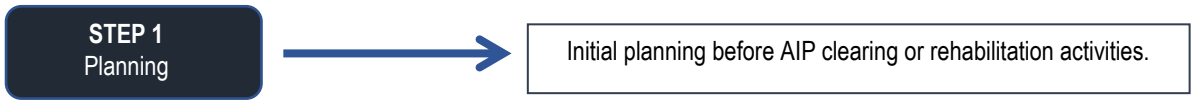


Party	Responsibility
Proponent	• The Proponent will be responsible for the appointment of a suitably qualified independent Environmental Control Officer (ECO) for the construction phase of the project; • A management body (I.e. Project Manager) must be appointed to ensure compliance with the RWICP; • The Proponent will be responsible for ensuring all Contractors receive a copy of this document and understand its contents; • The Proponent is responsible to ensure there is sufficient funding for the required rehabilitation and management actions as set out in this RWICP; and • The Proponent can also be the Project Manager should they not wish to appoint a separate Project Manager.
Project Manager	• The Project Manager must ensure a clear communication line between all parties working on the project, to ensure all environmental concerns and measures as stipulated within this RWICP are implemented/adhered to; • The Project Manager should have direct communication with the Proponent; • The Project Manager should call a meeting with all responsible parties should there be conflict/ remediation requirements to ensure a suitable solution is found and implemented; • The Project Manager must ensure that there is sufficient funding and resources for an ECO to adequately perform their role and • The lead Project Manager must ensure that the RWICP is implemented and that suitable penalties are in place for non-conformance to the RWICP by Contractors (as indicated by the ECO).
Registered Civil Engineer	• Issue all instructions/ drawings to the Contractor; • Must immediately inform the Project Manager and ECO if any changes to the project are envisaged; • Must immediately inform he Project Manager and ECO if any aspects of the RWICP and/or Record of Decision (RoD) for the relevant authorities cannot be complied with; and

	• Must remain in communication with the ECO and the Project Manager to ensure that any design changes required are issued to the Contractor.
Environmental Control Officer (ECO)	• The ECO is the person responsible for the monitoring of the implementation of the RWICP during the implementation of the activities and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of construction activities and be responsible for ensuring that all rehabilitation activities are implemented. The ECO is mandated to do the following: · Ensure that all contractors/ subcontractors/ employees/ construction workers are fully aware of their environmental responsibilities. This should take the form of an initial environmental awareness-training program in which requirements of this document will be explained; · Monitor site activities on a regular basis to ensure that there is minimal environmental impact due to construction activities. A monitoring report should be submitted to the Contractor, the Civil Engineer (should there be any design changes required) and the Project Manager; · Ensure that a 'hotline' exists for reporting incidents and resolving any problems rapidly; · The ECO must regularly audit the operation and establish whether the measures in the RWICP are applied, where after the ECO reports to the lead project manager; · All reports compiled by the ECO must be submitted to the relevant compliance office within the DWS and the DEA&DP; · The ECO has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the construction operations; and · Conduct a final environmental audit and a review of management and rehabilitation measures. • Should the appointed ECO not have any freshwater ecological experience, a suitably qualified Freshwater Ecologist should be appointed to assist the ECO as and when needed.
Contractor	• The Contractor/s in this case refers to any contractor/s on site, including the building contractor/s and sub-contractors on any item of infrastructure being erected or demolished; • Such contractor/s will take full responsibility for each of his/her employees and any penalties imposed; • The Contractor must immediately inform the Project Manager and ECO if any changes to the project are envisaged and if any aspects of this RWICP or the RoD cannot be complied with; • All design change instructions must come from the Project Manager and/or Civil Engineers; • It is the responsibility of the Contractor/s to ensure that the measures stipulated within this RWICP are adhered to; and. • Should the Contractor require clarity on any aspect of the RWICP the Contractor must contact the ECO for advice.

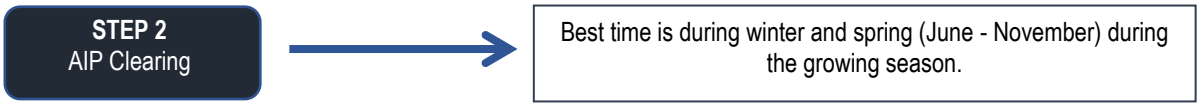
5.2 Site Specific Rehabilitation, Implementation and Management Plan

This Implementation plan is based on a four – step approach, which includes:



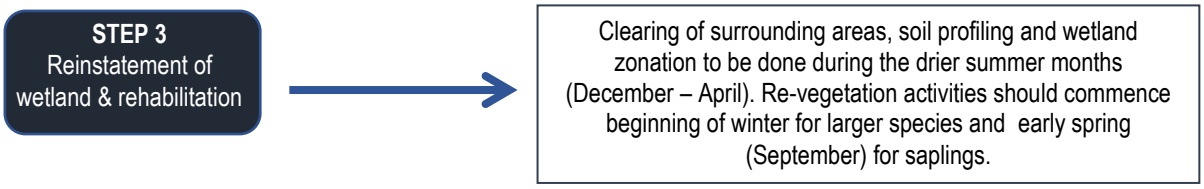
All plans and authorisations must be in place prior to commencement of the rehabilitation activities. This includes but it not limited to:

a) Obtaining all required authorisations and permits;
b) Appointment of a Contractor and ECO;
c) Planning for on-site requirements; and
d) Timeframes and budgetary allowances.



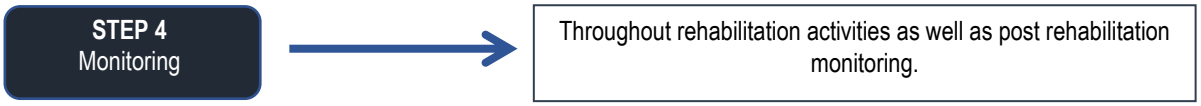
Before any rehabilitation activities can commence, the rehabilitation areas must be cleared of AIPs. This will include:

a) Mechanical removal of all large stems (focus mainly on the NEMBA listed species *Acacia saligna*); and
b) Chemical treatment of AIPs and weed species within the surrounding terrestrial areas.



The rehabilitation of the wetland will enhance the service provision of the wetlands through:

a) Removal of infilled soils and excavation activities required for the reinstatement and creation of wetland zonation;
b) The re-vegetation of the rehabilitation areas will commence on completion of any required re-profiling and removal of all AIPs. Only indigenous vegetation species may be reinstated. It is noted that *Phragmites australis* is already established in the wetland and will have to be managed over the long-term.



Ongoing monitoring and auditing of the rehabilitated wetland, the attenuation facilities and IAP clearing will be required throughout and following completion of these activities. A list of monitoring and auditing requirements has been provided to maximize success of the rehabilitation.

These steps have been expanded upon in greater detail in the sections that follow.

Step 1: Planning

1.1. Obtaining all relevant authorisations and permits

Before rehabilitation activities can commence all necessary permits and authorisations will be required, including but not limited to:

- Water Use Authorisation for all rehabilitation activities; and
- Rezoning/ conservation servitude or similar for the rehabilitation areas this may not be in place before rehabilitation commences, however, proof of initiation of this process should be available on request.

1.2. Appointment of a Contractor and all required specialists

During the planning phase certain aspects need to be considered in order to effectively implement this plan. This includes:

- Appointment of a suitably qualified Contractor(s) to undertake the required work:
- Appointment of an ECO to audit and monitor the rehabilitation activities as well as to undertake the required post rehabilitation monitoring;
    - The ECO is to compile a monthly audit report indicating all observations, actions and any remediation measures that were implemented and the reports are to be submitted to the DWS.
- Should the Contractor not have the appropriate expertise for implementation of this plan then it is the responsibility of the Contractor to appoint a suitably qualified freshwater ecologist to oversee the implementation.

1.3. Planning for on-site requirements

The following objectives and control measures must be implemented as part of the planning phase.

Table 5: Relevant objectives and control measures to be implemented as part of the planning phase

Objectives or requirements	Control Measures
Establishment and Access.	➢ The properties on which the western and eastern wetland is located must be correctly zoned as an open conservation servitude and no future developments may be allowed. ➢ The existing wetland footprint area and the proposed reinstatement footprint area must be pegged by a suitably qualified freshwater ecologist and demarcated with danger tape (although fencing is considered preferable). At no point should construction equipment extend past the designated construction site (unless for the required rehabilitation works). All vehicles must remain within the proposed Erica Drive road reserve and approved access roads to enter the site. No indiscriminate movement of vehicles is allowed within any of the wetlands. ➢ Adequate signage (in the adequate various languages) must be placed around the planned rehabilitation areas.
Indigenous plant harvesting and propagation.	➢ As part of the proposed rehabilitation plans, indigenous wetland species must be re-instated within the wetland habitat and the newly reinstated wetland area. As such, plans should be made for where the species are to be sourced and budgetary allowances made for the purchasing of various species. ➢ One such nursery from which indigenous plant species can be obtained is from the Cape Flats LIFE (plant list available in Appendix B). ➢ Availability of species needs to be secured before rehabilitation activities commence to ensure that plants are ready and available for re-vegetation (Step 3), so as not to leave areas exposed and vulnerable to erosion and incision.

Step 2: AIP Clearing

Alien and Invasive Plants (AIPs) *Acacia saligna* (Port Jackson Willow, Category 1b), *Echium plantagineum* (Patterson's Curse, Category 1b) as well as *Pennisetum Clandestinum (*Kikuyu Grass, Category 2) were identified within the current delineated western wetland flat. Category 1b species require compulsory control and must be removed and destroyed as they have high invasive potential. An AIP control plan was thus developed as part of the offset project. This AIP control plan focuses on mechanisms to control the identified species within the proposed rehabilitation area. It must be noted that Port Jackson (*Acacia saligna)* have been known to have large and resilient seed banks that can germinate for upwards of five (5) decades thus it is imperative that sufficient capacity and funding be provided for follow-up control for a number of years after the initial clearing (please also refer to Appendix D).

AIP control can be divided up into two phases, namely:

1. The initial control phase whereby AIPs are removed from the rehabilitation areas; and
2. The follow-up control whereby AIPs (coppice, saplings, and seedlings) within the rehabilitation must be done once a year during spring (September – November) for a minimum period of seven (7) years to ensure that new AIP infestation does not occur within the rehabilitated areas, after which the follow-up period should be re-assessed based on the need.

The following definitions are applicable to this section relating to AIP control:

Table 6: Definitions for terminology associated with AIP removal.

Hand Pull	Saplings and seedlings must be pulled out by hand. All root material should be removed to avoid re-sprouting of the plant.
Frill	The technique whereby an axe or cane knife is used to chip/cut around the base of a tree (±2mm deep) in order to place herbicide into the cuts (cutting not to be as deep as to ringbark). Herbicide to be applied within 30 minutes from frilling.
Ringbark	Removal of a ring of bark at least 25cm wide and pull down to just below ground level. Ring barking interferes with the circulation of the tree and results in it slowly dying.
Tree Felling	Complete removal of the AIP down to a stump by means of a chainsaw, hand axe or cane knife.
Stumping	The treatment of the remaining stump after felling with an appropriate herbicide (see recommended below).
Soil application	The application of herbicide (see recommended below) to the soil which is taken up by the plants roots.
Foliar Spray	The application of herbicides directly to the leaves. Foliar spraying can be done by using the following: a) A hose and handgun spraying the solution from a herbicide tank; b) A backpack spray unit; or c) Splatter guns which allow for larger droplets at higher concentrations – suitable for regrowth.
Stump Coppice	New shoots that regenerate from the stumps of felled trees.
Root Suckers	New vertical regrowth that arises from the base of the trunk, a new stem arising away from the main, stumped stem.

The table below indicates the recommended control measures to be implemented as part of this rehabilitation plan. All recommended herbicides and active ingredients are listed under species specific control. It is important to note that AIP control (specifically *Acacia saligna* thickets occurring within the rehabilitated areas) must be done from the outer sections inwards in order to contain the existing AIP and prevent further spread.

Table 7: Relevant Objectives and Control Measures to be implemented as part of the AIP clearing

Objectives or requirements	Control Measures
Initial Control	
Chemical Control	• Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle; • Suitable dye must be used to limit over- or under spray of areas; • Chemical control will entail limited usage of registered herbicides for a specific species and one must adhere to the measurements on the product label; and • **Label instructions may not be exceeded due to negative impacts on surrounding flora and fauna for the use of herbicides containing Glyphosate, Diquat and Paraquat within the identified watercourses associated with the rehabilitated area.**
Species Specific Treatment   	The following are species specific treatment for the three main AIPs noted within the rehabilitation areas. Use of these listed chemical treatments should occur after or during the mechanical removal process and may be used on other common weeds, as deemed appropriate by the ECO. **Treatment of Port Jackson** (*Acacia saligna):* • Seedlings must be hand pulled and no herbicide is needed; • Young plants should be lopped/pruned and treated by means of a foliar spray of 50ml of Triclopyr Ester* mixed with 10l of water and applied at a rate of 3 l/ha; and • Adult plants must first be cut down to a stump and frilled before being treated with 300ml of Triclopyr Amine salt* mixed in 10 l of water applied at a rate of 1.5 l/ha. Additionally, a Triclopyr Ester* solution can also be applied to approximately 0.6m length of stump. • All branches that have been mechanically removed must be transported off site to a designated dumping facility. Cut branches should not be left in stockpiles as the seeds will likely germinate. **Treatment of Kikuyu Grass (***Pennisetum clandestinum)* • A herbicide with active ingredient Glyphosate*, dalapon or haloxyfop-P methyl ester should be used. Plants should be sprayed during their active growing season (autumn). It is to be noted that Glyphosate* or haloxyfop herbicides may not be used within the watercourses where water is free flowing as it is known to be toxic to aquatic life. • Haloxyfop-P Methyl Ester is deemed to have a minimal environmental impact (although on an acute basis is toxic to aquatic life) and is not expected to leach into groundwater. Furthermore, it has been identified to degrade in soils under normal environmental conditions[3]. **Treatment of Patterson's Curse** (*Echium Plantagineum)* • Plants can easily be hand pulled and no herbicide is needed, however, chemical control can be used with active ingredients chlorsulfuron, mesulfuron methyl, triasulfuron or Glyphosate* to control seed sets during the flowering season.
Follow-up Control	

Follow-up AIP treatment	• Follow-up control is essential to control alien saplings, seedlings and coppice regrowth to achieve and sustain the progress that was made in the initial phase. If the follow up control phase is neglected, the alien infestation may become worse and denser than before the eradication process started.
	• Follow-up should be quarterly after the initial AIP clearing, thereafter, annually, within the growing season (September – November) for at least seven (7) years.
	• An annual assessment before mobilisation of the clearing crew should be undertaken to determine equipment and personnel requirements in order to secure the necessary funding.
	• After initial control operations dense regrowth may arise as new regrowth will sprout in the form of stump coppice, seedlings and root suckers. The following should therefore be applied:
	  ○ Plants that are less than 1 m in height must be controlled by foliar application.
	  ○ Areas with dense seedlings should not be uprooted or hoed out, as these areas will result in soil disturbance and will in return promote flushes and germination of alien seedling growth.

[3] The DOW Chemical Company. 2011. Product Safety Assessment: haloxyfop-P Methyl Ester

Although not considered an AIP, *Phragmites australis* is known to dominate wetlands associated with deep sandy soils and outcompete other indigenous vegetation. As such, this species needs to be controlled and managed within the rehabilitated and reinstated wetland flat. The following table provides a description of the various mechanisms that should be used to control *P. australis.*

Figure 15: Summary of mechanisms used for the control of *Phragmites australis*.

Control Type	Description
Mechanical Control	
Mowing and Cutting	For a perennial rhizomatous grass, mowing does little to reduce *P. australis* dominance. It was identified that mowing actually stimulates shoot production and resulted in increased density of Phragmites shoots (but decreased shoot height and biomass) in wetlands (Gu¨sewell *2003*; Hazelton *et al.* 2014). On a large scale, hand cutting is noted to be ineffective due to the time and labour requirements, however, is considered an important strategy of rapid response efforts. Overall, simply cutting will be ineffective in eliminating *P. australis*, but with proper timing, cutting may help reduce dominance (through depletion of underground reserves) and control further expansion (Hazelton *et al.* 2014). It is, however, imperative that all cut material be removed and disposed of off-site in order to prevent recolonization of rhizomes.
Burning	Burning has not been effective unless coupled with either hydrological restoration or herbicide application (Marks *et al.* 1994). Burning alone has produced variable results and in some instances was noted to stimulated *Phragmites* growth and stand development (Hazelton *et al.* 2014).
Chemical Control	
Herbicides	Because of the physiology of *P. australis*, well-established stands are difficult to control with only one herbicide treatment. Creating multiple stresses on the plants is the most effective way to control phragmites. There are two broad-spectrum herbicides, Glyphosate and Imazapyr that are commercially available and known to control *P. australis* effectively when used properly. These chemicals are nonselective and will enter any plant species (targeted and non-target plant species) through contact with the leaves or stems and be translocated to the rhizomes. As such, application of glysophate should be done to targeted *P. australis* after senescence of other indigenous species (during the Cape Town dry season) to minimise effects (Hazelton *et al.* 2014). Both herbicides are available in separate formulas for application either on aquatic or terrestrial sites. Improper use of the terrestrial formulations in an aquatic habitat may harm fish and macro invertebrates and therefore **label instructions may not be exceeded due to negative impacts on surrounding flora and fauna**.  Two types of applications are noted to be the most effective for the treatment of *P. australis:* *Foliar Treatment:* Spray should be applied to wet the leaves and, when present, the flower plumes of the target plants. Excessive application, such that the chemicals are dripping off the plants, should be avoided due to injuries to desirable indigenous plants. This application can be undertaken in areas where *P. australis* is dense, with limited other species (NRCS, 2013).  *Cut stem treatment:* This method should be used in isolated or scattered stands of *P. australis*, where impacts to desirable, native plant species must be avoided. Cut plants to waist height and add one drop of herbicide to hollow stems with a squirt bottle or syringe. Be careful to remove seed heads from the site after cutting to prevent seed spread. Due to the pervasiveness of this species and its ability to aggressively recolonize through seed or rhizomes, long-term management and monitoring are necessary. Once areas of phragmites have been controlled (e.g., greater than 85-percent reduction), it is recommended that an annual maintenance control program be implemented (NRCS, 2013).
Biological control	
Once *Phragmites australis* proliferation is within controllable levels, plant competition by other indigenous species will likely assist with the long term restoration trajectory. Areas where *P. australis* have been killed should be replanted/ re seeded with indigenous species as soon as possible (In line with precautionary timeframe after chemical control) in order to allow for establishment so as to competitively exclude *P. australis* samplings. Unmanaged areas where *P. australis* has been controlled effectively, but not replanted with indigenous species, are often reinvaded by *P. australis* immediately either by seeds or regrowth from rhizomes that were not killed (Hazelton *et al.* 2014).	

Step 3: Site- Specific Wetland Rehabilitation

A detailed site-specific rehabilitation plan has been developed for the western wetland flat and the reinstatement thereof. Some aspects are also applicable to the development of the stormwater attenuation facility associated with the eastern wetland flat. Successful rehabilitation depends upon conceptual planning, research and design flexibility. The proposed site-specific mitigation measures for the construction and rehabilitation phases are listed in Table 7 below and the anticipated wetland area to be rehabilitated are visually represented therein.

Table 8: Rehabilitation interventions and control measures proposed for the western wetland flat.

Objective/ Requirement	Control measures
General mitigation	<u>General</u> • It is imperative that no construction equipment or personnel enter the wetland to be rehabilitated, unless authorised as part of the rehabilitation interventions. The extent of the remaining portion of the western wetland flat and the footprint area of the eastern wetland flat must be pegged by a suitably qualified freshwater ecologist (although fencing is preferred). • At no point may vehicles or construction equipment move within the remaining portion of the western wetland flat, nor within the extent of the eastern wetland flat. All vehicles should remain on designated roads within the road reserve. • No equipment may be stored within the delineated wetlands while not in use. Any designated storage and parking bays must be located no closer than 32m of the envisaged extent of the western wetland flat and the Kuils River (associated with the eastern wetland flat). <u>Vegetation Clearing and earthworks</u> • Any rehabilitation works should be undertaken just before the rainy season (between the months of February – May) so that vegetation growth can be quickly re-established. • In order to construct the proposed Erica Drive, vegetation will need to be cleared within and surrounding the western wetland flat. All vegetation removed (especially since many of the current vegetation is identified as AIP) must be disposed of at a suitable disposal facility. • All excess material removed as part of the reinstatement and rehabilitation of the western wetland flat must be utilised as part of the soil profiling activities (preferably to create the small berm south of the extended wetland footprint) or be removed from site. At no point may this material be disposed on site or within any of the other watercourses identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.
Rehabilitation earthworks associated with the western wetland flat	<u>Summary of the findings</u> The wetland is in a largely degraded state as a result of urbanisation and the Bellville South Industrial waste disposal site and surrounding urbanisation. Due to the severe transformation of the topography of the surrounding landscape, the hydrological regime of this wetland has also been impacted. The shallow interflow that recharges this wetland was noted to be contaminated (based on the odour of the soil when soil samples were taken). Infilled areas surrounding the wetland allow for additional contaminated surface runoff to enter this wetland, changing the flow patterns and the inundation period thereof. Furthermore, the vegetation is considered severely modified, due to the high diversity of weeds and AIPs (see Figure 10). <u>Rehabilitation interventions proposed</u> It is the opinion of the freshwater specialist that fairly extensive works need to be undertaken within this wetland and surrounding area, as part of the proposed rehabilitation and reinstatement to ensure the required ecoservice provision is maintained/improved and a PES of at least Category D (as per the requirements of the Wetland Offset) is achieved over the long-term. The following main activities were identified and the following sections provide relevant mitigation and rehabilitation requirements to address the activities: • Removal of vegetation (Please see 'Step 2: AIP clearing' above); • Excavation of the proposed reinstated wetland footprint area (approximating 0,5 hectares); • Construction of a berm along the southern extent of the wetland; and • Revegetation of the reinstated wetland footprint area.

Objective/ Requirement	Control measures
	EXCAVATION OF THE PROPOSED WETLAND FOOTPRINT AREA

- The western wetland flat was noted to have various piles of deposited material (Figure 15). These deposits are dominated by *Pennisetum clandestinum* and litter which have altered the geomorphological and hydrological processes as well as the wetting patterns within the wetland. It is therefore recommended that all deposits be removed from the wetland and the area sloped to maintain the average 2% fall in an easterly direction and ensure that it is free draining and that no concentration of flow occurs. This slope will also ensure that the inflow of stormwater at the forebay of the wetland (western portion) flows through the wetland (in an easterly direction), and hydrologically drives the reinstated wetland.

Figure 16: Infilling (purple arrows) noted within and around the western wetland flat.

- In order to ensure that the new wetland footprint area corresponds to geomorphology and hydrological regime of the existing wetland flat, the outer boundary of the wetland footprint should be sloped to create seasonal and temporary wetland zones. This can be achieved by (Figure 16 and 17):
  - Excavating the central to southern portion of the proposed wetland footprint to a maximum depth of 0.5m (creating the permanent wetland zone). At a depth of 0.7m the groundwater table was encountered (see Section 3.2). If the depth of the wetland is to be excavated to 0.5m, it is likely that groundwater will pond at the surface, in certain areas, creating a permanently inundated zone; and
  - Less material should be excavated towards the outer perimeter of the proposed footprint area, creating a gradual slope (having a depth of maximum 0.3m) towards the boundary of the footprint area (creating seasonal and temporary wetland zones).
- The wetland footprint area should not be uniformly levelled/excavated as variable ponding should be encouraged in areas of the wetland flat to increase the presence and diversity of niche habitats (Figure 16 and 17). Oversight from a freshwater specialist is recommended for this component of the rehabilitation phase to ensure the hydrological retention of the system is not adversely altered.

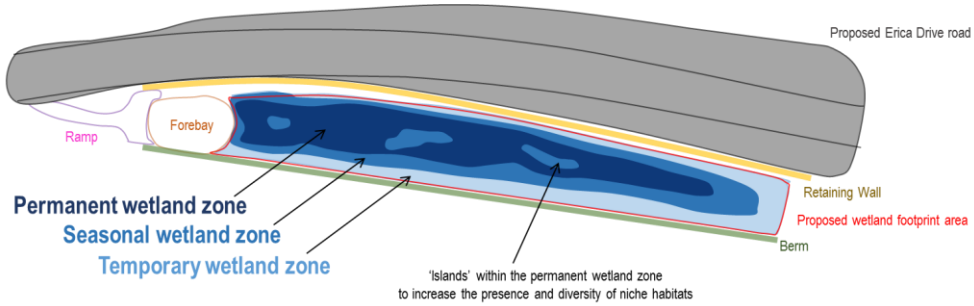
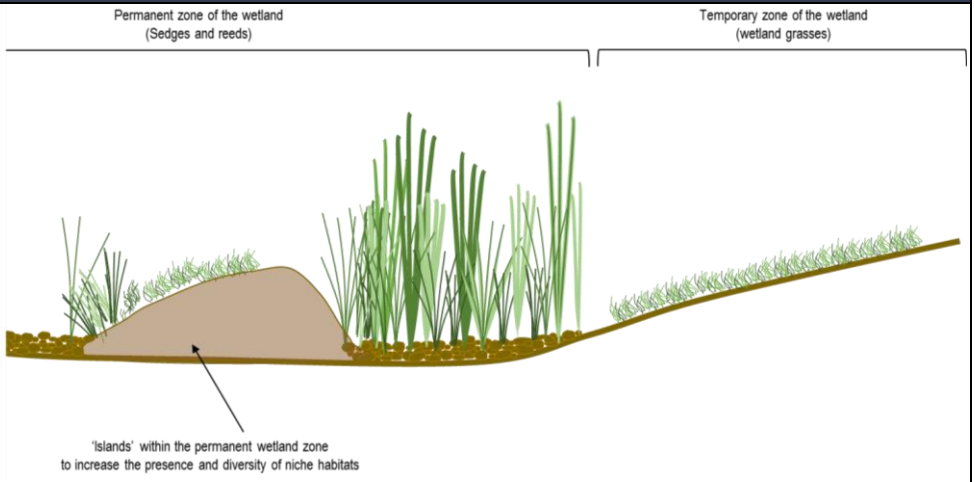


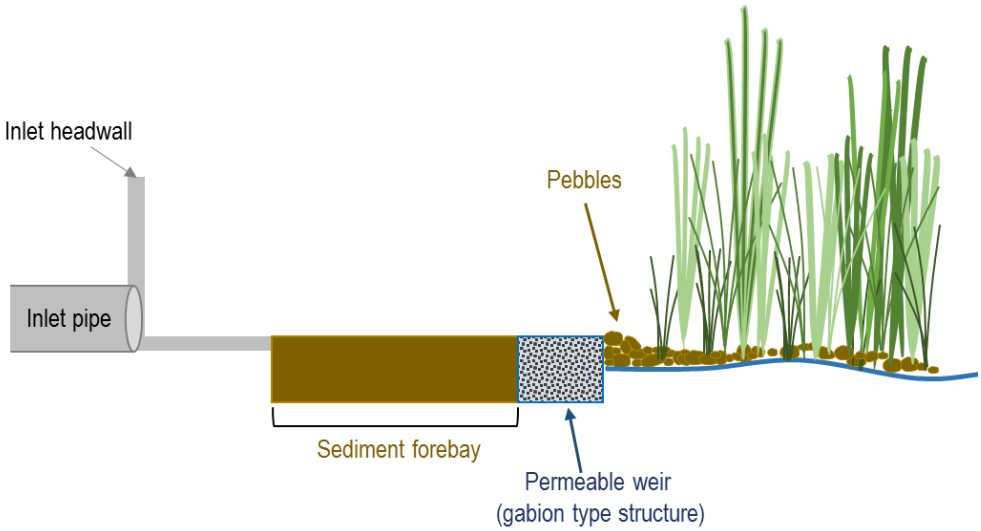
Figure 17: Proposed zonation of the western wetland flat footprint area

Objective/ Requirement	Control measures
	 **Figure 18: Cross section of the footprint area of the wetland, indicating the desired zonation.** Figure 12 and 13 below provides an overview of where the • Litter was also observed to be disposed of in the wetland. All removed material should be disposed of at a registered waste disposal facility. • The base of the wetland should be lined with pebbles and small rocks in selected areas. This will aid with flood attenuation (by increasing the surface roughness) but also aid with the establishment of vegetation and prevent the establishment of a monoculture of reeds. <u>Rehabilitation considerations</u> • The rehabilitation of the remaining extent of the western wetland flat and the reinstatement of wetland habitat should only be undertaken towards the end of the construction of the proposed Erica Drive. Dust generated from the construction works may smother new re-instated vegetation, specifically saplings and smaller species (e.g. *Isopelis* and *Ficinia* spp). • All rehabilitation work must be done during the drier summer months leading up to the rainy season (May – April) to reduce contamination of surface water and ensure maximum survival of new plant species (see section below of re-vegetation). Some watering of plants during the first dry season may be necessary to ensure survival. • Should the ECO not have the relevant expertise, it is recommended that the rehabilitation be overseen by a suitably qualified wetland specialist to ensure maximum service provision is achieved over the long-term in terms of hydrology, geomorphology, water quality and biota.
	CONSTRUCTION OF A BERM ALONG THE SOUTHERN EXTENT OF THE WETLAND

	• The proposed berm should be constructed from material removed from the proposed footprint area (*in-situ* soil). However, it should be ensured that the soil is weed free.
	• The berm should be designed in such a way that it meanders (i.e. mimic a natural dune environment) with undulating slopes. This will assist in the creation of microhabitats. No steep slopes which may limit vegetation growth and result in erosion are allowed and all slopes should not exceed a 3:1 ratio.
	• This berm should be revegetated with appropriate terrestrial indigenous vegetation from the Cape Flats Dune Strandveld vegetation group (as classified by Mucina & Rutherford, 2006) that will aid with the stabilisation of the berm. This vegetation should be agreed upon by the landscape architect and the freshwater specialist and/or a suitably qualified botanist. Recommended species include:
	  ○ Tall shrubs:
	  ○ *Chrysanthemoides monilifera*
	  ○ *Olea exasperata*
	  ○ *Metalasia muricata*
	  ○ *Searsia laevigata*
	  ○ *Searsia glauca*
	  ○ Succulents:
	  ○ *Carpobrotus acinaciformis*

Objective/ Requirement	Control measures
	○ *Carpobrotus edulis)* ○ Larger tree species: ○ *Sideroxylon inerme* ○ *Euclea racemosa* ○ *Tarchonanthus camphoratus* ○ *Pterocelastrus tricuspidatus* ○ *Robsonodendron maritimum*
	RE-VEGETATION OF THE WETLAND FOOTPRINT AREA
	The last stage of the rehabilitation activities should be to re-instate indigenous obligate and facultative wetland vegetation within the reinstated wetland footprint area. Propagation and purchasing of the required species should have been undertaken as part of the Planning (Step 1) and must be ready and available for transplantation as soon as the AIP clearing and re-sloping activities have been completed. This is also applicable to the proposed stormwater attenuation facilities. The following points are of key importance for re-vegetation: • Planting must start as soon as possible after soil profiling so as to reduce the duration of bare ground being exposed, which could lead to erosion and sedimentation of the area, and to establish ecological habitats. Furthermore, all disturbed areas as part of the rehabilitation, as well as where AIP have been removed should also be re-instated with indigenous vegetation. • Re-instatement of indigenous vegetation should be undertaken in early May for the larger specimens (growing season) and early spring (August/September) for the smaller saplings. This will ensure that the hot summer months are avoided, and that species will be planted prior to the onset of winter rainfall, which will maximize growth and early establishment. • Water will need to be made available for irrigation purposes for the first season after indigenous vegetation has been planted. It is recommended that all planted specimens within the seasonal and temporary zone be watered during the first summer. It is anticipated that there will be a loss of some planted saplings. Additional specimens should be planted one year after the rehabilitation works, prior to the rainy season to maximise success for long-term proliferation. • Should the Contractor not have the relevant expertise on planting of specimens, they should appoint a suitably qualified botanist or landscape architect to assist with the re-vegetation. • Saplings must be replanted annually during the winter period for the first 3 years after completion of construction, in order to maximise the success rate of revegetation. Since vegetation loss is common during re-establishing activities, provisioning of additional saplings will ensure a higher success rate. The following criteria is recommended to be used to inform the selection of wetland plant species for the wetland footprint area and the stormwater attenuation facilities: Plants must be hardy, and ideally able to withstand: • Elevated nutrients; • Periodically high hydrocarbons (oils); • Occasional high sediment inflows; • Elevated ammonia concentrations; • Periods of low oxygen, depending on zonation; and • Periodic inundation (it is assumed that inundation is likely during the rainy season). • Plants must be readily available; • Plants must establish rapidly to facilitate prompt onset of wetland function; • Plants should ideally be locally indigenous and no plants that are alien and invasive (e.g. Port Jackson) should be planted or allowed to remain in the area surrounding the Erica Drive development. It is important to note that the Contractor must ensure a variety of plants be used within the wetlands and consideration must be given to the wetland zonation (the wetlands are predominantly seasonal and temporary) when selecting plant species. It is noted that *Pennisetum clandestinum* has already invaded the area, so regular maintenance will be required until the reinstated vegetation is self-sustaining.

Objective/ Requirement	Control measures
	WETLAND SPECIES The below list was compiled through the use of the field guide titled "Easy identification of some South African Wetland plants (Grasses, restios, sedges, rushes, bulrushes, Eriocaulons and Yellow-eyed grasses)" (van Ginkel *et al*. 2011) where plant species were cross referenced with the broader Cape Flats area. Additionally, wetland species as listed for the Southwest Sand Fynbos and Western Strandveld vegetation types in the book titled "Vegetation of South Africa, Lesotho and Swaziland" (Mucina and Rutherford. 2006) were added. Additional plant species can be sourced from the Cape Flats LIFE locally indigenous fynbos exchange list available in Appendix C (plants marked with an asterisk "*" can be sourced from Cape Flats. · *Bolboschoenus maritimus* · *Calopsis paniculata* · *Carex clavata** · *Cyperus congestus* · *Cyperus textillis** · *Elegia asperiflora* · *Elegia capensis* · *Elegia fistulosa* · *Eleocharis dregeana* · *Epischoenus gracilis* · *Ficinia nodosa** · *Isolepis cernua* · *Isolepis diabolica* · *Isolepis hystrix* · *Isolepis marginata* · *Isolepis setacea* · *Juncus dregeanus* · *Juncus effusus** · *Juncus lomatophyllys** · *Pycreus polystachyos* · *Zantedeschisa aethiopica (already present on site)* • Proliferation of any of the following common Western Cape weed and alien plant species should be removed by hand and the use of chemicals be limited to when absolutely necessary, in order to prevent die back of remaining indigenous vegetation and to prevent contamination of the wetlands: · *Acacia saligna (see Table 3)* · *Pennisetum clandestineum (see Table 3)* · *Echium plantagineum (see Table 3)* · *Ricinus communis* · *Plantago lanceolata* • All chemical control must be monitored as per the requirements stipulated in Table 6 of this report.
Stormwater Management	• The stormwater attenuation facilities proposed as part of the Erica Drive development (see Figures 5 - 7) should be designed to be as natural as possible (earthed and unlined) and vegetated to function as a constructed wetland for water quality filtration. • These facilities should be zoned the same as that of the reinstated wetland. It should have a permanently inundated zone (not deeper than 0,5m – as per Figure 5) with seasonal and temporary zones towards the outside perimeter of the stormwater attenuation facility. This will ensure that this facility functions as a typical hydrogeomorphic unit (wetland flat) found within this region. • Storm inlets and outlet points must be designed at ground level so as to prevent erosion and gully formation. Suitable engineering solutions (such as concrete aprons or gabion mattresses) should be utilised at all outlets to reduce the speed at which the water flows into the attenuation facility. • The tie-in of the forebay into the natural wetland (applicable to the western wetland flat) and the stormwater attenuation facilities must be designed and constructed in such a way that turbulent and/or supercritical flows are not created.

Objective/ Requirement	Control measures
	• The tie-in point of the forebay must be at or near the same elevation as the base of the natural wetland/stormwater attenuation facility to minimise the risk of erosion and sedimentation (Figure 18). • An energy dissipating structure should be installed at the toe of the forebay to prevent erosion and scouring where the stormwater will be discharged into the natural wetland/stormwater attenuation facility. This structure should be impermeable and be buried below the base of the natural wetland/stormwater attenuation facility. • Pebbles and stones should be placed between the energy dissipating structure and the base of the natural wetland/stormwater attenuation facility, to prevent the formation of a drop, which could cause erosion to occur. Vegetation must also be established to bind the soil of the bed, and to prevent erosion. This will also diffuse flow and lower the velocity of water into the natural wetland/stormwater attenuation facility (Figure 18).  **Figure 19: As schematic of the energy dissipating structures which must be included as part of the design of the stormwater inlets.** • Litter traps should be installed at all outlets to catch any litter/solid wastes from entering the system (Figure 19). This can be in the form of a stormwater drain net or grates. These traps must be regularly cleaned during the operational phase to prevent blockages.  **Figure 20: Example of litter traps from stormwater outlets.**

Step 4: Operational phase management and Monitoring

Prudent monitoring of the extended footprint of the western wetland flat and the stormwater attenuation facility associated with the eastern wetland flat are of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage the progress of the rehabilitation interventions and any arising issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Site walk through surveys should be applied as the preferred method of monitoring (at specified frequencies) with specific focus on:
  - Erosion monitoring (for the duration of the raining season);
  - Sedimentation (for the duration of the raining season);
  - Alien and invasive vegetation proliferation (at the start and end of the growing season);
  - Spills events (regularly at the direction of the relevant engineer);
  - Surface water monitoring; and
  - Waste and litter problems.
- General habitat unit overviews should also be undertaken;
- Stability and appropriateness of stormwater controls;
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring actions should be repeatable;
- Data should be auditable; and
- Reports should present and interpret the data obtained.

The monitoring plan comprises but is not limited to the following:

- Identification of areas of concern. These are areas that are affected by disturbances such as:
  - Erosion;
  - Waste dumping;
  - Alien vegetation species encroachment;
  - Soil compaction; and
- Ensuring that the management/rehabilitation measures as stipulated in Section 6 of this report are adhered to;
- A list of all alien vegetation species must be compiled as well as possible control methods such as manual, chemical or mechanical.
- Gathering all equipment required for the monitoring process; and
- Compiling a monitoring report.

Table 9: Monitoring actions for the eastern and western wetland flats.

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting
AIP control	1. Screening of the entire rehabilitation area(s); 2. Logging locations of any newly coppiced species to be treated/removed.	1. Before the initial AIP clearing a baseline assessment should be taken to indicate densities and species; 2. After the initial AIP clearing densities should be re-recorded, including all methods and chemicals used; 3. Quarterly assessment during the first year post rehabilitation. Densities and locations of newly coppiced AIPs to be recorded; and 4. Annually during the growing season for the second and third year, post rehabilitation to ensure long-term maintenance measures are effective.	1. Before and after AIP clearing report should be compiled; 2. Quarterly report during the first year post AIP clearing; and 3. Annually during each growing season, for at least 3 years post rehabilitation – report should include information from before and after mobilisation of follow-up clearing teams.

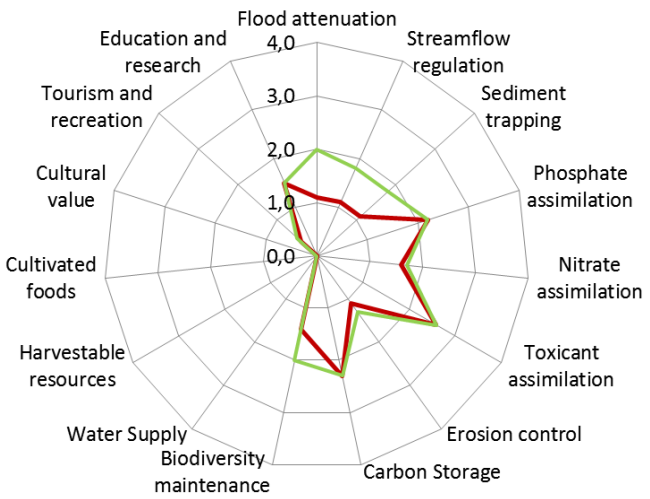
Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting
Waste and litter problems	1. All areas which are frequently traversed by personnel during the rehabilitation phase. 2. Stormwater inlets and outlets	Monitoring of waste or litter problems should occur daily where rehabilitation and AIP clearing is taking place. The Contractor is to ensure that no staff litter on site.	Monthly monitoring report compiled by the appointed ECO.
Erosion	1. All rehabilitated areas; and 2. All areas disturbed by construction activities.	1. Weekly during rehabilitation activities; 2. After every major rainstorm and / flood for the first wet season post rehabilitation.	Monthly monitoring report compiled by the appointed ECO.
Re-vegetation	The western wetland flat and the stormwater attenuation facility associated with the eastern wetland flat.	1. Monthly for 6 months after re-instatement of vegetation; 2. Annually during the growing season for at least three (3) years post rehabilitation to ensure plant survival and to ensure that no AIPs are outcompeting indigenous species.	1. Before commencement of rehabilitation activities, a report should be compiled listing existing species as well as any endangered species that may need to be rescued. Should the Contractor not have the expertise to undertake this list, they are to appoint a suitable botanist to assist; 2. Monthly for 6 months after the re-instatement; and 3. Annually during each growing season, for at least 3 years post rehabilitation.

This monitoring plan must be implemented by a competent person and submit the findings to the responsible authority for evaluation.

6 PROJECTED ENVIRONMENTAL CONDITIONS POST REHABILITATION

Based on the rehabilitation interventions indicated in Table 4 above, the predicted Ecoservice provision and wetland health calculations were revisited for the western wetland flat in order to project the post rehabilitation improvements, as required as part of the offset initiative.

Table 10: Ecoservice and Ecological Health of the western wetland flat post rehabilitation.

<table>
<tr><th colspan="4">WESTERN WETLAND FLAT</th></tr>
<tr><td rowspan="3">PES discussion</td><td colspan="3">PES Category: C (Moderately Modified)
The overall ecological functioning will likely be improved, from a Category D (previous impact score of 4,8) to a high Category C (impact score 3,9). This score indicates that the proposed ecological health of the reinstated wetland will be just above a largely modified (Category D) wetland ecological condition. The overall hydrological regime will improve (from a previous impact score of 5 to 4) as controlled release from the stormwater management infrastructure from Erica Drive will enter the reinstated wetland area. It should be noted that the groundwater which recharges this wetland is potentially contaminated (based on the smell of groundwater encountered during the site assessment by SAS in April 2019), thus the water quality of the wetland is not expected to improve. Provided the recommended soil profiling and removal of infilled material are implemented, the overall geomorphological functioning of the wetland will be improved from a Category D (previous impact score of 5) to a Category C (impact score of 3,9). This can also be attributed to the sediment control devices (forebay) and regular maintenance of the wetland (removal of silt utilising the ramps) which would limit the deposition of sediment and erosion from occurring in the wetland. Through the removal of alien and invasive species and follow-up control, as stipulated in Table 3 of this report, and re-instatement of wetland species, the vegetation composition of the wetland can be improved (from a Category D (4,5 impact score) to a Category C (3,8 impact score)). Careful control and monitoring will be required for Pennsietum clandestinum as complete eradication is extremely difficult and unlikely once established.</td></tr>
<tr><td>Hydrology</td><td>Geomorphology</td><td>Vegetation</td></tr>
<tr><td>Category D - Largely Modified
Impact score: 4</td><td>Category C - Moderately Modified
Impact score: 3,9</td><td>Category C - Moderately Modified
Impact score: 3,8</td></tr>
<tr><td>Ecoservice provision</td><td colspan="2">Ecoservice: Moderate
The increased footprint area and surface roughness of the wetland will allow for increased flood attenuation and stormwater attenuation abilities. Trapping of nutrients will also increase with reintroduction of a diversity of indigenous wetland species. The niche habits created within the wetland will likely provide a diversity of habitat types to a variety of biota.</td><td> 
</td></tr>
<tr><td>EIS discussion</td><td colspan="3">EIS Category: Moderate
This wetland is considered to be of moderate ecological importance and sensitivity, primarily due to its status as a Critical Ecological Support Area (Western Cape Biodiversity Spatial Plan, 2017) as well as its location within the Endangered Western Strandveld Wetland Vegetation Type. The establishment of vegetation associated with the Western Strandveld vegetation group will likely increase the ecological importance of this wetland.</td></tr>
</table>

7 CONCLUSION AND RECOMMENDATIONS

Scientific Aquatic Services (SAS) was appointed to compile a Wetland Rehabilitation, Implementation and Management Plan (RWICP) as per the offset guidelines for the wetland that will be impacted by the proposed extension of Erica Drive. As part of the freshwater resource verification undertaken by SAS in September 2018, two natural wetland flats (known as the western wetland flat and the eastern wetland flat) were identified along the proposed route of Erica Drive.

In accordance with the rehabilitation interventions and offset initiative proposed within this document, most aspects will require mechanical inputs and cannot be done by hand. Although the initial impact is significant it must be noted that these activities are only for a short period so as to restore the ecoservice provision and wetland health. These measures stipulated within this report will allow for the recharge of a reinstated wetland footprint area and improve the remaining original extent of wetland habitat, leading to an overall betterment of the wetland and the general environment.

The following table is a summary of the ecoservice provision and ecological health of the western wetland flat prior to rehabilitation and the predicted values post rehabilitation.

Table 11: Summary table of wetland health and ecosystem service provision prior to and post rehabilitation

	Prior to Rehabilitation	Post Rehabilitation
Wet-health	Category D (Largely Modified)	Category C/D (Moderately Modified)*
Ecoservice Provision	Moderately low	Moderate
Extent of wetland footprint area	0.48 hectares	0,5 hectares**

*Although the ecological condition is in a higher category, it should be noted that it is a borderline case and will be dependent on long-term management of the wetland. Nevertheless, an improved from a score of 4,8 to 3,9 was identified.

**The extent of the western wetland reduced due to the Erica Drive traversing the wetland, however, the reinstatement of the wetland footprint allows for relatively the same wetland area post rehabilitation. Furthermore, the stormwater attenuation facility north of the proposed Erica Drive will contribute an additional 0.63ha of wetland habitat through the careful planning and design that it functions as a constructed wetland.

Although loss of wetland habitat is not considered favourable and should be avoided based on the mitigation hierarchy prescribed by the DEA *et al.* (2013) based on the above provided information, the loss of wetland habitat cannot be avoided and as such the initiative to reinstate the wetland habitat alongside the Erica Drive Road is deemed a feasible rehabilitation/offset, provided all rehabilitation interventions and construction mitigation measures are implemented.

It should be noted that this document will form part of the Environmental Authorisation as well as the Water Use Authorisation, and on approval, this document becomes binding and all aspects of the proposed rehabilitation and mitigation recommendations made herein must be adhered to by the proponent and appointed Contractor.

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ANNEXURE A – PROJECT TEAM

Contact detail of the responsible people who will implement the MMP.

Table A1: Contact details of the responsible person who will implement the RWICP

Engineer	ITS Global	Tel: 012 349 1664 Email: johan@itsglobal.co.za
EAP Practitioner	Eco Impact Legal Consulting	Tel: 0 72 240 3092 Email: johmandie@ecoimpact.co.za
ECO	Still to be appointed	Still to be appointed
Contractor	Still to be appointed	Still to be appointed
Consult who compiled RWICP	Scientific Aquatic Services Environmental CC	Phone: 011 616 7893 Email: christel@sasenvgroup.co.za Email: kim@sasenvgroup.co.za

Scientific Aquatic Services Team
Stephen van Staden
SACNASP Pr. Sci. Nat. Reg No: 400134/05

Stephen van Staden completed an undergraduate degree in Zoology, Geography and Environmental Management. He then undertook an honours course in Aquatic health. In 2002 he began a Master's degree in environmental management, including his dissertation in aquatic resource management. Stephen built a career at a firm specialising in town planning development, after which he moved to a larger firm in late 2002 where he managed the monitoring division and acted as a specialist freshwater resource consultant and other environmental processes and applications. In 2003, Stephen started consulting independently specialising in water resource management. In addition to freshwater assessments, clients enquired about terrestrial ecological assessments. Stephen started working in the wetland consulting arena and has become recognised as a national expert combining science, engineering principles and an in-depth understanding of the legislative framework to provide turnkey advisory services. Stephen launched soil and land capability assessment and visual impact assessment services with other specifically qualified specialists. Stephen is registered by the SA RHP as an accredited biomonitoring specialist and is SACNASP registered in ecology. Stephen is a member of the Gauteng Wetland Forum, SASSO, LARSA and IAIA. Stephen has also attended the DWS training courses on the various Ecostatus models, as well as the implementation of Regulation 509 of 2016 and has attended the course Tools for Wetland Delineation and Assessment by Rhodes University and presented by Prof. F. Ellery, whom was instrumental in the development of the various wetland Ecostatus tools.

Kim Marais
SACNASP Pr. Sci. Nat. Reg No: 117137/17
Kim obtained her undergraduate BSc. at Wits University in Ecology, Environmental Science and Conservation (EEC). During the course of her undergraduate degree she was involved in microbiological and water quality assessments of several urban rivers as well as the Bruma lake in Johannesburg. In 2012 she obtained her BSc. Honours degree, at Wits University in Zoology and published her Honours thesis titled "A Comparative analysis of the diets of *Varanus albigularis* and *Varanus niloticus* in South Africa*"* in African Zoology, April 2014.

Upon graduation Kim worked as a Junior Environmental Assessment Practitioner for 2,5 years, working throughout South Africa and Uganda before joining the SAS team in 2015 as the lead Environmental Scientist and Manager of the Cape Town branch. Kim has extensive knowledge of the environmental legislation as well as faunal and freshwater ecology, undertaking various freshwater and faunal assessments as well as Water Use Licence Applications in the Western Cape and having completed the short course on tools for wetland assessment held by Prof. Fred Ellery at Rhodes University and a wetland and aquatic plant identification course by Dr. G van Grinkel. Kim is registered as a Professional Natural Scientist with SACNASP in the field of Environmental Science, is a member of the South African Wetland Society.

Christel du Preez

Christel completed an undergraduate degree in Environmental and Biological Sciences (2009-2011) at North West University, from where she continued with her Honours degree (2012) in Environmental Sciences focussing on urban ecology. Christel joined SAS as a junior wetland ecologist in January 2016, whilst completing her Master's degree (in urban wetland ecology). Christel achieved her Master's degree in May 2017. Her Master's degree thesis comprised of an in-depth study of the floral composition and ecosystem service delivery of wetlands along an urban-rural gradient. At SAS she has been involved with various projects focussing mainly on the assessment of wetland and riparian systems within various provinces of South Africa, as well as providing rehabilitation and management plans for a variety of freshwater systems.

ANNEXURE B – LEGAL REQUIREMENTS

The sections below present each legislative document and the aspects, which are pertinent to water resource management including the rehabilitation of disturbed areas.

The National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, refer specifically to biodiversity management in the following Clause: (4)(a) *Sustainable* development requires the consideration of all relevant factors including, (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (as amended) (No. R. 327) where a "maintenance management plan" is defined as a management plan maintenance purposes defined or adopted by the competent authority. The following EIA Regulation triggers the need for this MMP: Activity 19, Listing Notice 1: The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (N.B. Points (d) and (e) does not apply as these activities fall within the coastal zone).
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a

	permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. ***National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Alien and Invasive Species Regulations, 2014)*** NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2014): ➢ **Category 1a**: Invasive species that require compulsory control. ➢ **Category 1b**: Invasive species that require control by means of an invasive species management programme. ➢ **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➢ **Category 3**: Ornamentally used plants that may no longer be planted. See **Appendix C** for further details pertaining to Alien and Invasive Vegetation control.
The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	Amendments to regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) ensures that landowners are legally responsible for the control of invasive alien plants on their properties. The CARA legislation divides alien plants into weeds and invader plants, with *weeds* regarded as alien plants with no known useful economic purpose, while *invader plants* may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature.
The National Water Act, 1998 (Act No. 36 of 1998)	The purpose of the National Water Act, 1998 (Act 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled. The NWA, 1998 also provides for water use licenses which an operation will have to apply for, before commencing with any Section 21 water use activity. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use licenses will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues. Accordingly, and in terms of the *Guide to the National Water Act*, "water use" refers to doing something that has an impact on the water resource, for example: ➢ The amount of water in the resource; ➢ The quality of water in the resource; and ➢ The environment surrounding the resource. Section 4 governs the entitlement to use water and states that water may only be used if it is a Schedule 1 use, a continuance of an existing lawful use (ELU), or authorised in terms of a

	general authorisation (GA) or license. A water use may therefore not be implemented unless it is properly authorised through one of these types of authorisations. The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA.

ANNEXURE C – CAPE FLATS FYNBOS NURSEY STOCKLIST

FynbosLIFE
Locally Indigenous Flora Education

Tel: 082 378 9445
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URBAN REVEGETATION PROJECTS FOR PEOPLE AND WILDLIFE

fynboslife.com fynboslife @fynboslife

Cape Town lowland waterwise and wetland plants supplied by our **Cape Flats Fynbos Nursery**

CAPE TOWN VELD TYPE PLANT LISTS & LANDSCAPING GUIDELINES AUG 2018

Available quantities shown after price, i.e. R8.90 (price) | 10 (quantity available)
Multipot plug size: 7.5cm diameter x 10cm depth (cavities slightly larger than ecotrays)
Minumum 50 plants per order. We do not charge VAT.
Species not currently available can be grown to order. Lead times are species-specific and vary between 3 months and 3 years.
Delivery: 10% for 30km radius and 15% for 60km radius. Minimum delivery fee R150.00.
NURSERY OPEN BY APPOINTMENT ONLY

This species catalogue is alphabetical, with reference to suitable veld types in Cape Town. Veld type landscaping conserves water and wildlife, and supports Cape Town's irreplaceable, highly threatened biodiversity. 19 nationally-recognised vegetation types and 10 of SA's 21 Critically Endangered vegetation types occur within Cape Town's boundaries. 6 are endemic to the City, occuring nowhere else in the world, and 9 are critically under-conserved. Locally indigenous urban biodiversity gardens (LIFE gardens) are thus ecological and educational assets, showcasing our rich natural heritage and promoting stewardship of the broader Fynbos Biome/Cape Floral Kingdom. Every LIFE garden, irrespective of size, counts towards conservation if local forms of species are planted in their original veld type. The horticulturally-viable species listed here represent a fraction of all species in Cape Town. The list is continually expanding as we trial new local plants in cultivation.

Landscapes for LIFE:
L Locally indigenous plants
I Innovation, Infiltration & Interest
F Forage/Food for people & wildlife; frog-friendly (incl. ponds & permeable fencing)
E Education & Ecosystem services

A QUICK GUIDE TO LANDSCAPING BY VELD TYPE IN CAPE TOWN:

1. Planning & Waterscaping
a. Note suburb/location of garden and refer to veld type key (pg 2) and vegetation map in Appendix A to determine the relevant veld type. This will give you an indication of the soil type and original vegetation of the site. Test soil pH and note topsoil consistency/texture (sand, clay, loam) as these may have been altered through disturbance.
b. Consider rainfall, slope/aspect, wind direction and microclimates of the site prior to plant species selection. Waterscape to capture rainfall and slow water loss.

2. Plant Selection
a. Select plants using the veld type key below or the species lists provided in Appendix B.
b. Mimic succession in nature by starting with pioneers and introducing specialist species like ericas and proteas after 3-5 years.
c. Source only forms of species grown from local Cape Town lowland genetic stock. This ensures hyperlocal adaptation and avoids genetic contamination of locally adapted forms. Locally indigenous plants should be re-established within 10km of their source and narrow endemics within 5km. Use pure, naturally-evolved species, avoiding hybrids and cultivars. For part-local part-exotic gardens, rather include non-invasive water-wise exotics than domestic exotics. Domestic exotics pose a threat of hybridisation and invasive spread e.g. Virgilia oroboides subsp. ferruginea (from George) and Virgilia divaricata (George to Port Elizabeth) introduced to Cape Town and threatening the local Virgilia oroboides subsp. oroboides.
d. Choose a variety of flower shapes, sizes, colours and scents to sustain a diversity of pollinators.
e. Look for drought-adapted leaves, e.g. succulence, hairy/grey/cobwebby, small, linear, divided, leathery/lignified, waxy.
f. Add edible and aromatic species to supplement or replace thirsty exotic veggie and herb gardens.
g. Avoid tall trees on the Cape Town lowlands, as they would not naturally occur here and require excess water to thrive.
h. For more information on species selection and terminology please consult @fynboslife on Facebook or Instagram for weekly posts on locally indigenous species and how to use them in Cape Town gardens.

3. Ground Preparation & Planting
a. Timing: Plant after the first flush of rains, i.e. early winter (May/June/July) in Cape Town.
b. Keep root disturbance to a minimum during and after planting.
c. Avoid fertilisers and dug-in mulch. Add a thick 10cm surface layer of wood chips around the base of plants. Use very well-decomposed compost if necessary, and apply sparingly on the surface only. Plant a living mulch.

4. Irrigation & Maintenance
a. Drip irrigate every second day for two weeks, then twice a week or as needed until plants are established, and over the first 2-3 summers as required. Restrict greywater to less sensitive species like Helichrysums, Pelargoniums & Salvias.
b. Replenish wood chip mulch in late spring and summer.
c. Prune lightly and regularly to prolong life of plants. Most shrubs listed live for 5-15 years; bulbs and trees are longer-lived.

Prepared by Caitlin von Witt 2018/08/13

VELD TYPE KEY (note this list is not exhaustive and only includes the veld types currently represented by our Cape Flats Fynbos Nursery):	
CFDS	**CAPE FLATS DUNE STRANDVELD** Endangered (coastal, neutral-alkaline sands; mostly water-wise, wind-resistant plants)
CFSF	**CAPE FLATS SAND FYNBOS** Critically Endangered (sandy, nutrient-poor, acidic soils on the Cape Flats; mostly water-wise and wind-resistant plants)
SPGF	**SOUTH PENINSULA GRANITE FYNBOS** Critically Endangered (clay soils on lower S & E slopes of Table Mountain; plants have relatively high water/nutrient needs)
CLFW	**CAPE LOWLAND FRESHWATER WETLAND** Critically Endangered (plants for irrigated applications, retention ponds, eco-pools, wetlands, river beds/banks)
PSR	**PENINSULA SHALE RENOSTERVELD** Critically Endangered (fertile clay soils; mostly water-wise, wind-resistant plants)
SSR	**SWARTLAND SHALE RENOSTERVELD** Critically Endangered (fertile clay soils; mostly water-wise, wind-resistant plants)
PSF	**PENINSULA SANDSTONE FYNBOS** Endangered (nutrient-poor acidic soil; mostly water-wise, wind-resistant plants)
HSF	**HANGKLIP SAND FYNBOS** Vulnerable (acid to neutral sand near the coast; mostly water-wise, wind-resistant plants)
LAF	**LOURENSFORD ALLUVIUM FYNBOS** Critically Endangered (seasonally wet flats near Strand)
ASF	**ATLANTIS SAND FYNBOS** Critically Endangered (sandy, nutrient-poor, acidic soils on the West Coast; mostly water-wise and wind-resistant plants)

SPECIES LISTED ALPHABETICALLY:

Species name (A-Z)	SIZE: 4L/21cm and 2L/15cm	SIZE: Multipot plugs (311ml)	SIZE: 6-pack plugs (90ml)	Description	Veld Type	Image
	PRICE | QUANTITY AVAILABLE					
Agathosma capensis	R23.40 (15cm) | 50			Steenbokbuchu. Evergreen, rounded shrub to 1m. Aromatic leaves and mauve flowers. Good bee forage. Flowering time mainly July-Nov. Suitable for lower clay slopes and sandy coastal flats as a border plant.	SPGF	
Agathosma glabrata **(Endangered)**	R23.40 (15cm) | 1			Lemon-scented buchu. Compact shrub to 50cm with bright purple flowers from July-Dec. Attracts bee and butterfly pollinators. For damp sandy flats and dune slacks.	CFDS, CFSF	
Anthospermum aethiopicum	R18.90 (4L) | 5			Dioecious shrub to 2m; attractive filler shrub for moist areas. Flowering trime: Aug-Jan. Suitable for clay or seasonally wet sandy soils.	ASF, PSR, CFSF, SSR, SPGF, LAF	
Arctotheca populifolia	R16.95 (4L) | 5			Creeping, mat-forming perennial groundcover to 20cm. Grey heart-shaped leaves and yellow daisy flowers. Good bee forage. Excellent dune stabiliser for dry, sandy conditons.	HSF, CFDS	
Arctotis incisa	R15.75 (4L) | 25	R8.90 | 0	R4.10 | 24	Sprawling grey-leaved perennial daisy to 40cm. Suitable for dry, sandy conditions.	CFDS, CFSF	
Arctotis stoechadifolia	R15.75 (4L) | 0	R8.90 | 0	R4.00 | 72	Fast-growing groundcover, for dry sandy conditions.	CFDS	
Athanasia crithmifolia	R18.65 (4L) | 40	R8.90 | 0		1.5mx1.5m seasonal wetland shrub. Fast-growing, large yellow flowerheads attract many insect pollinators.	CFSF, PSR, SPGF, SSR, CLFW	

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Athanasia dentata	R18.15 (4L) | 20	R9.00 | 0		1mx1m shrub for dry, sandy and windy conditions. Large yellow daisy flowers and fresh-green toothed leaves.	CFDS CFSF	
Athanasia trifurcata	R16.95 (4L) | 30	R8.90 | 0		1mx1m shrub for dry, sand or clay. Extremely wind- and water-wise. Bee forage.	CFDS PSR CFSF SSR SPGF LAF	
Carex clavata	R15.25 (2L) | 10	R9.00 | 20		50cm tall seasonal wetland sedge with attractive chestnut brown flower spikes	CLFW CFSF SSR	
Carpobrotus edulis		R7.40 | 60	R3.80 | 48	Sour fig, popular edible plant. Fast-growing succulent groundcover to 50cm for coastal conditions. A useful sand stabiliser. Pale yellow flowers.	CFDS HSF CFSF	
Carpobrotus acinaciformis		R7.40 | 20	R3.80 | 24	Sour fig - popular edible plant. Fast-growing succulent groundcover to 50cm for coastal conditions. A useful sand stabiliser. Bright pink flowers.	CFDS	
Chasmanthe aethiopica	R17.60 (4L) | 5			Winter-flowering bulb to 0.5m. Orange tubular flowers pollinated by sunbirds. Sun or semi-shade. Hardy. Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season (May/June/July).	CFDS HSF CFSF PSR SPGF SSR	
Chasmanthe floribunda	R17.60 (4L) | 10			Winter-flowering bulb to 1m. Orange tubular flowers pollinated by sunbirds. Sun or semi-shade. Hardy. Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season (May/June). More robust and floriferous than *C. aethiopica*.	CFSF SPGF	
Chironia baccifera	R19.80 (4L) | 1			Ornamental shrub with starry pink flowers, 40cm-1m. Withstands dry, sandy, windy conditions once established.	CFDS SPGF PSR	
Chrysocoma coma-aurea	R16.95 (4L) | 15	R8.90 | 20		0.6mx0.6m shrub with a mass of yellow button-shaped flowers in spring. For sand or clay in dry, windy conditions. Attracts bees.	CFDS CFSF PSR	
Cliffortia ericifolia **(Endangered)**	R18.15 (4L) | 0	R9.40 | 20		50cm tall shrub with small ericoid glossy green leaves. Suitable as a filler for seasonally wet sands over clays, or acid sands.	CFSF ASF CLFW CFDS	
Cliffortia ferruginea	R16.95 (4L) | 0	R8.90 | 0	R4.15 | 6	Groundcover to 40cm with glossy green leaves for seasonally wet sands. Full sun or semi-shade.	CFSF CLFW ASF	
Cliffortia juniperina var. *juniperina*		R9.50 | 5		Warty caperose. Fine-leaved filler species to 1m for full sun.	CFSF SPGF	

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Cliffortia obcordata	R15.75 (4L) | 20	R8.90 | 0		1.2mx1.5m shrub for dry, sandy and windy conditions.	CFSF SPGF	
Cliffortia strobilifera	R15.75 (4L) | 80	R8.90 | 20	R4.00 | 0	3mx3m fast-growing wetland shrub with lush green foliage	CFSF CLFW	
Coleonema album	R19.95 (4L) | 2			White confetti bush. 2m tall buchu with small honey-scented flowers. Withstands coastal (dry, sandy, windy) conditions.	CFDS HSF	
Commelina africana	R15.75 (12cm) | 5			Common yellow commelina. Spreading groundcover to 50cm for sandy soil in semi-shade to full sun. Yellow flowers from Oct-Mar.	PSF	
Cotyledon orbiculata	R23.40 (4L) | 10	R9.20 | 0		Pig's ear. 1m tall succulent with silvery grey leaves with a red margin. Orange tubular flowers attract bees and birds. For well-drained soils in semi-shade to full sun. Ideal for rockeries.	CFDS HSF	
Cynodon dactylon			R1.45 (200-plug tray) | 100	Couch grass/kweek. Perennial, water-wise mat forming grass. Full sun to semi-shade.	LAF HSF CFSF PSR SPGF SSR	
Cyperus textilis	R16.95 (4L) | 60	R8.90 | 20	R4.15 | 528	1-3m tall wetland sedge. Provides nesting material for birds. May be used to clean polluted water.	CLFW	
Dasispermum suffruticosum		R9.20 | 0		Dune celery. Sprawling coastal perennial with slightly fleshy stems and leaves. Small white/cream flowers.	CFDS	
Delosperma litorale	R16.95 (4L) | 10		R4.15 | 24	Trailing vygie groundcover with white flowers. Hardy; suited to coastal conditions.	CFDS	
Ehrharta calycina		R8.90 | 0		Perennial grass to 0.7m with rose pink flowerheads. For acidic sandy soils.	ASF CFDS	
Ehrharta villosa var. villosa	R17.60 (4L) | 5			Tall (1-1.5m) perennial grass for alkaline sands. Florets softly silvery hairy.	CFDS HSF ASF	
Elegia nuda	R19.40 (4L) | 0			1m tall upright wetland restio, compact growth. For seasonally wet acid sands.	HSF CFSF ASF	
Elegia tectorum (Fish Hoek)	R19.40 (4L) | 50	R9.30 | 40	R4.35 | 0	1.5m tall seasonal wetland restio. Dwarf form of Elegia tectorum. For seasonally wet neutral sands.	CFDS HSF	

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Eragrostis curvula		R9.00 | 140		Weeping love grass. Perennial tufted grass to 1 (to 1.5)m. Good forage, erosion control and an attractive ornamental grass that provides food for seed-eating birds. For full sun/semi-shade on sandy or clay slopes. Not suitable for seasonally wet flats or near nature reserves as can be invasive.	SPGF	
Erica annectens **(Vulnerable, Cape Peninsula Endemic)**	R21.80 (15cm) | 5			Approx. 60cm-1m tall, erect to spreading dwarf shrub. Orange to red 2cm-long corolla tube attracts nectar-feeding birds. Flowering time: Dec-Feb. Grows on acidic moist rock ledges from Noordhoek to Simonstown.	PSF	
Erica cerinthoides	R21.80 (15cm) | 5			Fire erica. Shrub to 1m for full sun in well-drained acidic sand. Red tubular flowers attract sunbirds.	CFSF PSF SPGF	
Erica curviflora	R21.80 (15cm) | 5			Water heath. Streamside/seepage shrub to 1.6m with showy, curved, tubular orange-red flowers which attract sunbirds. For full sun.	CLFW	
Erica ericoides	R40.00 (15cm) | 2			Compact shrub to 80cm. Small pale pink honey-scented flowers from Jan-Apr. Suitable for acid sand or clay on slopes and flats.	SPGF PSF	
Erica mammosa (white-flowered 'gilva' form)	R40.00 (15cm) | 2			Nine-pin heath. Tall, branching shrub to 2m. 2cm-long tubular white flowers attract bird pollinators. Flowering time: Dec-Apr. For full sun in well-drained acid sands, thrives in sandy seepage areas.	PSF SPGF	
Erica margaritacea **(Critically Endangered Cape Flats Endemic)**	R38.50 (15cm) | 5			Pearl heath. Compact shrub to 50cm. Pearly white-pink flowers in summer attract insect pollinators. Suitable for seasonally wet acid sands in full sun.	CFSF	
Erica subdivaricata	R38.50 (15cm) | 4			Shrub to 1m with small bell-shaped, white flowers that attract insect pollinators. Suitable for damp, partially shady spots.	CFSF	
Erica verticillata **(Extinct in the Wild)**	R40.00 (15cm) | 4			Whorled heath. Tall shrub to 1.5m with mauve-pink flowers from late summer to autumn. Suitable for seasonally wet acid sands in full sun. Attracts nectar-feeding birds.	CFSF	
Eriocephalus africanus	R16.40 (4L) | 60	R8.90 | 0		Wild rosemary, edible herb. 1.2mx1.2m shrub for dry, sandy and windy conditions.	CFDS SSR CFSF HSF PSR	

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Eriocephalus racemosus	R17.40 (4L) | 25			Wild rosemary, edible herb. 1.2m hardy erect shrub for dry, sandy conditions. Less robust than *E. africanus*.	HSF ASF	
Euclea racemosa	R65.00 (10L) | 0			Sea guarrie. Small to medium-sized tree, ideal for hedges. Edible fruit, attracts birds. Dry, sandy and windy conditions.	CFDS ASF SSR HSF	
Euryops pectinatus	R17.40 (4L) | 20	R8.90 | 20		Golden daisy bush. Shrub to 1.5m with divided grey-green leaves and large yellow daisy flowers, free flowering. For sull sun on sandy or clay slopes.	PSF	
Falkia repens	R14.60 (2L) | 10	R8.90 | 40	R4.15 | 48	Fast-growing groundcover for moist areas in sun or shade. Pink trumpet-shaped flowers.	CFDS CFSF	
Felicia filifolia	R16.40 (4L) | 20	R8.90 | 0		1mx1m shrub for dry, sandy and windy conditions. Showy purple daisy flowers in spring.	CFDS PSR SSR	
Ficinia bulbosa	R18.80 (4L) | 80			Sedge with delicate, fresh green culms to 50cm. For irrigated areas.	CFDS ASF CFSF	
Ficinia capitella	R18.80 (4L) | 5			Sedge with fine, pendulous lime-green culms to 30cm. For irrigated areas.	CFDS CFSF	
Ficinia indica	R18.80 (4L) | 0			0.4m tall sedge for seepage areas. Rich chestnut-coloured spikes.	LAF PSF CFSF SPGF	
Ficinia lateralis	R18.80 (4L) | 50			0.6m tall tufted sedge for seasonally wet coastal sands. Wind tolerant.	CFDS	
Ficinia nodosa (Scirpus nodosus)	R16.95 (4L) | 20	R8.90 | 300		1m tall sedge with fresh green stems. For seasonally wet areas. Withstands summer drying. Excellent wetland filtration and soil stabilisation.	CFDS CFSF CLFW	
Freylinia lanceolata	R19.40 (4L) | 50			Small tree to 4m with cream-coloured, honey-scented tubular flowers. Attracts pollinators. For irrigated applications.	CLFW	
Fuirena coerulescens		R9.50 | 0		Delicate sedge to 50cm for damp areas.	CFDS	
Geranium incanum	R14.60 (2L) | 20	R8.90 | 20	R4.10 | 24	Groundcover for damp sandy soils. Delicate pale pink/white flowers.	CFDS CLFW CFSF SSR HSF	

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Gladiolus angustus	R18.20 (15cm) | 0		R4.25 | 72	Marsh painted lady. Bulbous plant, spring flowering. Sold as clump of approx. 3 shooting bulbs in 15cm pot during growing season.	CFDS CLFW	
Gnidia pinifolia	R16.95 (15cm) | 5			Pine-leaf saffron bush. Shrub to 1m with long tubular flowers which are fragrant at night, attracting moth pollinators. Flowers all year round. For full sun on lower slopes and sheltered sandy flats.	SPGF ASF	
Gnidia squarrosa	R16.40 (15cm) | 5			Aandbossie. Lax shrub, 1-2m. Cream flowers from June-Oct, scented at night. For full sun on sandy slopes and flats.	SPGF CFDS	
Gomphostigma virgatum	R16.95 (4L) | 2	R8.90 | 2		Shrub to 2.6m with scented white flowers. For damp soils in wetlands or along freshwater streams.	CLFW	
Gymnosporia buxifolia	R21.80 (4L) | 10			Spikethorn. Large shrub/ small tree, 3-7m, excellent spiny security hedge. Showy flowers attract insect pollinators, which in turn attract birds.	CFSF SPGF ASF	
Helichrysum crispum		R8.90 | 80		Small rounded shrub to 50cm, woolly grey leaves, creamy white flowers. For dry, sandy, windy conditions.	CFDS HSF LAF	
Helichrysum cymosum	R16.95 (4L) | 2	R8.90 | 40	R4.15 | 24	Gold carpet. Low shrub with grey foliage and yellow flowerheads. For sun or semi-shade in seasonally wet sand. Water well to establish.	CFDS CFSF SPGF	
Helichrysum dasyanthum	R17.60 (4L) | 20	R8.90 | 0		1mx1m shrub with yellow flowers. For dry, sandy and windy conditions.	CFDS CFSF SPGF SSR	
Helichrysum niveum	R16.95 (4L) | 1			Dwarf twiggy, ericoid shrublet to 20cm. Adapted to dry, sandy and windy conditions.	HSF CFDS	
Helichrysum patulum	R15.75 (4L) | 10	R8.90 | 40	R4.05 | 24	1mx1.5m sprawling shrub for dry, sandy and windy conditions.	CFDS PSR SSR	
Helichrysum petiolare	R16.95 (4L) | 15	R8.90 | 0		1mx1m shrub with soft grey foliage. For semi-shade to full sun in a sheltered position.	SPGF	
Helichrysum teretifolium	R18.20 (4L) | 10	R9.00 | 20		Compact groundcover to 30cm with dark green foliage and cream flowers. For semi-shade to full sun on sandy flats and slopes.	CFDS HSF	

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VELD TYPE KEY (note this list is not exhaustive and only includes the veld types currently represented by our Cape Flats Fynbos Nursery):	
CFDS	**CAPE FLATS DUNE STRANDVELD** Endangered (coastal, neutral-alkaline sands; mostly water-wise, wind-resistant plants)
CFSF	**CAPE FLATS SAND FYNBOS** Critically Endangered (sandy, nutrient-poor, acidic soils on the Cape Flats; mostly water-wise and wind-resistant plants)
SPGF	**SOUTH PENINSULA GRANITE FYNBOS** Critically Endangered (clay soils on lower S & E slopes of Table Mountain; plants have relatively high water/nutrient needs)
CLFW	**CAPE LOWLAND FRESHWATER WETLAND** Critically Endangered (plants for irrigated applications, retention ponds, eco-pools, wetlands, river beds/banks)
PSR	**PENINSULA SHALE RENOSTERVELD** Critically Endangered (fertile clay soils; mostly water-wise, wind-resistant plants)
SSR	**SWARTLAND SHALE RENOSTERVELD** Critically Endangered (fertile clay soils; mostly water-wise, wind-resistant plants)
PSF	**PENINSULA SANDSTONE FYNBOS** Endangered (nutrient-poor acidic soil; mostly water-wise, wind-resistant plants)
HSF	**HANGKLIP SAND FYNBOS** Vulnerable (acid to neutral sand near the coast; mostly water-wise, wind-resistant plants)
LAF	**LOURENSFORD ALLUVIUM FYNBOS** Critically Endangered (seasonally wet flats near Strand)
ASF	**ATLANTIS SAND FYNBOS** Critically Endangered (sandy, nutrient-poor, acidic soils on the West Coast; mostly water-wise and wind-resistant plants)

SPECIES LISTED ALPHABETICALLY:

Species name (A-Z)	SIZE: 4L/21cm and 2L/15cm	SIZE: Multipot plugs (311ml)	SIZE: 6-pack plugs (90ml)	Description	Veld Type	Image
	PRICE | QUANTITY AVAILABLE					
Agathosma capensis	R23.40 (15cm) | 50			Steenbokbuchu. Evergreen, rounded shrub to 1m. Aromatic leaves and mauve flowers. Good bee forage. Flowering time mainly July-Nov. Suitable for lower clay slopes and sandy coastal flats as a border plant.	SPGF	
Agathosma glabrata **(Endangered)**	R23.40 (15cm) | 1			Lemon-scented buchu. Compact shrub to 50cm with bright purple flowers from July-Dec. Attracts bee and butterfly pollinators. For damp sandy flats and dune slacks.	CFDS, CFSF	
Anthospermum aethiopicum	R18.90 (4L) | 5			Dioecious shrub to 2m; attractive filler shrub for moist areas. Flowering trime: Aug-Jan. Suitable for clay or seasonally wet sandy soils.	ASF, PSR, CFSF, SSR, SPGF, LAF	
Arctotheca populifolia	R16.95 (4L) | 5			Creeping, mat-forming perennial groundcover to 20cm. Grey heart-shaped leaves and yellow daisy flowers. Good bee forage. Excellent dune stabiliser for dry, sandy conditons.	HSF, CFDS	
Arctotis incisa	R15.75 (4L) | 25	R8.90 | 0	R4.10 | 24	Sprawling grey-leaved perennial daisy to 40cm. Suitable for dry, sandy conditions.	CFDS, CFSF	
Arctotis stoechadifolia	R15.75 (4L) | 0	R8.90 | 0	R4.00 | 72	Fast-growing groundcover, for dry sandy conditions.	CFDS	
Athanasia crithmifolia	R18.65 (4L) | 40	R8.90 | 0		1.5mx1.5m seasonal wetland shrub. Fast-growing, large yellow flowerheads attract many insect pollinators.	CFSF, PSR, SPGF, SSR, CLFW	

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Athanasia dentata	R18.15 (4L) | 20	R9.00 | 0		1mx1m shrub for dry, sandy and windy conditions. Large yellow daisy flowers and fresh-green toothed leaves.	CFDS CFSF	
Athanasia trifurcata	R16.95 (4L) | 30	R8.90 | 0		1mx1m shrub for dry, sand or clay. Extremely wind- and water-wise. Bee forage.	CFDS PSR CFSF SSR SPGF LAF	
Carex clavata	R15.25 (2L) | 10	R9.00 | 20		50cm tall seasonal wetland sedge with attractive chestnut brown flower spikes	CLFW CFSF SSR	
Carpobrotus edulis		R7.40 | 60	R3.80 | 48	Sour fig, popular edible plant. Fast-growing succulent groundcover to 50cm for coastal conditions. A useful sand stabiliser. Pale yellow flowers.	CFDS HSF CFSF	
Carpobrotus acinaciformis		R7.40 | 20	R3.80 | 24	Sour fig - popular edible plant. Fast-growing succulent groundcover to 50cm for coastal conditions. A useful sand stabiliser. Bright pink flowers.	CFDS	
Chasmanthe aethiopica	R17.60 (4L) | 5			Winter-flowering bulb to 0.5m. Orange tubular flowers pollinated by sunbirds. Sun or semi-shade. Hardy. Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season (May/June/July).	CFDS HSF CFSF PSR SPGF SSR	
Chasmanthe floribunda	R17.60 (4L) | 10			Winter-flowering bulb to 1m. Orange tubular flowers pollinated by sunbirds. Sun or semi-shade. Hardy. Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season (May/June). More robust and floriferous than *C. aethiopica*.	CFSF SPGF	
Chironia baccifera	R19.80 (4L) | 1			Ornamental shrub with starry pink flowers, 40cm-1m. Withstands dry, sandy, windy conditions once established.	CFDS SPGF PSR	
Chrysocoma coma-aurea	R16.95 (4L) | 15	R8.90 | 20		0.6mx0.6m shrub with a mass of yellow button-shaped flowers in spring. For sand or clay in dry, windy conditions. Attracts bees.	CFDS CFSF PSR	
Cliffortia ericifolia **(Endangered)**	R18.15 (4L) | 0	R9.40 | 20		50cm tall shrub with small ericoid glossy green leaves. Suitable as a filler for seasonally wet sands over clays, or acid sands.	CFSF ASF CLFW CFDS	
Cliffortia ferruginea	R16.95 (4L) | 0	R8.90 | 0	R4.15 | 6	Groundcover to 40cm with glossy green leaves for seasonally wet sands. Full sun or semi-shade.	CFSF CLFW ASF	
Cliffortia juniperina var. *juniperina*		R9.50 | 5		Warty caperose. Fine-leaved filler species to 1m for full sun.	CFSF SPGF	

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Cliffortia obcordata	R15.75 (4L) | 20	R8.90 | 0		1.2mx1.5m shrub for dry, sandy and windy conditions.	CFSF SPGF	
Cliffortia strobilifera	R15.75 (4L) | 80	R8.90 | 20	R4.00 | 0	3mx3m fast-growing wetland shrub with lush green foliage	CFSF CLFW	
Coleonema album	R19.95 (4L) | 2			White confetti bush. 2m tall buchu with small honey-scented flowers. Withstands coastal (dry, sandy, windy) conditions.	CFDS HSF	
Commelina africana	R15.75 (12cm) | 5			Common yellow commelina. Spreading groundcover to 50cm for sandy soil in semi-shade to full sun. Yellow flowers from Oct-Mar.	PSF	
Cotyledon orbiculata	R23.40 (4L) | 10	R9.20 | 0		Pig's ear. 1m tall succulent with silvery grey leaves with a red margin. Orange tubular flowers attract bees and birds. For well-drained soils in semi-shade to full sun. Ideal for rockeries.	CFDS HSF	
Cynodon dactylon			R1.45 (200-plug tray) | 100	Couch grass/kweek. Perennial, water-wise mat forming grass. Full sun to semi-shade.	LAF HSF CFSF PSR SPGF SSR	
Cyperus textilis	R16.95 (4L) | 60	R8.90 | 20	R4.15 | 528	1-3m tall wetland sedge. Provides nesting material for birds. May be used to clean polluted water.	CLFW	
Dasispermum suffruticosum		R9.20 | 0		Dune celery. Sprawling coastal perennial with slightly fleshy stems and leaves. Small white/cream flowers.	CFDS	
Delosperma litorale	R16.95 (4L) | 10		R4.15 | 24	Trailing vygie groundcover with white flowers. Hardy, suited to coastal conditions.	CFDS	
Ehrharta calycina		R8.90 | 0		Perennial grass to 0.7m with rose pink flowerheads. For acidic sandy soils.	ASF CFDS	
Ehrharta villosa var. villosa	R17.60 (4L) | 5			Tall (1-1.5m) perennial grass for alkaline sands. Florets softly silvery hairy.	CFDS HSF ASF	
Elegia nuda	R19.40 (4L) | 0			1m tall upright wetland restio, compact growth. For seasonally wet acid sands.	HSF CFSF ASF	
Elegia tectorum (Fish Hoek)	R19.40 (4L) | 50	R9.30 | 40	R4.35 | 0	1.5m tall seasonal wetland restio. Dwarf form of Elegia tectorum. For seasonally wet neutral sands.	CFDS HSF	

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Eragrostis curvula		R9.00 | 140		Weeping love grass. Perennial tufted grass to 1 (to 1.5)m. Good forage, erosion control and an attractive ornamental grass that provides food for seed-eating birds. For full sun/semi-shade on sandy or clay slopes. Not suitable for seasonally wet flats or near nature reserves as can be invasive.	SPGF	
Erica annectens **(Vulnerable, Cape Peninsula Endemic)**	R21.80 (15cm) | 5			Approx. 60cm-1m tall, erect to spreading dwarf shrub. Orange to red 2cm-long corolla tube attracts nectar-feeding birds. Flowering time: Dec-Feb. Grows on acidic moist rock ledges from Noordhoek to Simonstown.	PSF	
Erica cerinthoides	R21.80 (15cm) | 5			Fire erica. Shrub to 1m for full sun in well-drained acidic sand. Red tubular flowers attract sunbirds.	CFSF PSF SPGF	
Erica curviflora	R21.80 (15cm) | 5			Water heath. Streamside/seepage shrub to 1.6m with showy, curved, tubular orange-red flowers which attract sunbirds. For full sun.	CLFW	
Erica ericoides	R40.00 (15cm) | 2			Compact shrub to 80cm. Small pale pink honey-scented flowers from Jan-Apr. Suitable for acid sand or clay on slopes and flats.	SPGF PSF	
Erica mammosa (white-flowered 'gilva' form)	R40.00 (15cm) | 2			Nine-pin heath. Tall, branching shrub to 2m. 2cm-long tubular white flowers attract bird pollinators. Flowering time: Dec-Apr. For full sun in well-drained acid sands, thrives in sandy seepage areas.	PSF SPGF	
Erica margaritacea **(Critically Endangered Cape Flats Endemic)**	R38.50 (15cm) | 5			Pearl heath. Compact shrub to 50cm. Pearly white-pink flowers in summer attract insect pollinators. Suitable for seasonally wet acid sands in full sun.	CFSF	
Erica subdivaricata	R38.50 (15cm) | 4			Shrub to 1m with small bell-shaped, white flowers that attract insect pollinators. Suitable for damp, partially shady spots.	CFSF	
Erica verticillata **(Extinct in the Wild)**	R40.00 (15cm) | 4			Whorled heath. Tall shrub to 1.5m with mauve-pink flowers from late summer to autumn. Suitable for seasonally wet acid sands in full sun. Attracts nectar-feeding birds.	CFSF	
Eriocephalus africanus	R16.40 (4L) | 60	R8.90 | 0		Wild rosemary, edible herb. 1.2mx1.2m shrub for dry, sandy and windy conditions.	CFDS SSR CFSF HSF PSR	

Eriocephalus racemosus	R17.40 (4L) | 25			Wild rosemary, edible herb. 1.2m hardy erect shrub for dry, sandy conditions. Less robust than *E. africanus*.	HSF ASF	
Euclea racemosa	R65.00 (10L) | 0			Sea guarrie. Small to medium-sized tree, ideal for hedges. Edible fruit, attracts birds. Dry, sandy and windy conditions.	CFDS ASF SSR HSF	
Euryops pectinatus	R17.40 (4L) | 20	R8.90 | 20		Golden daisy bush. Shrub to 1.5m with divided grey-green leaves and large yellow daisy flowers, free flowering. For sull sun on sandy or clay slopes.	PSF	
Falkia repens	R14.60 (2L) | 10	R8.90 | 40	R4.15 | 48	Fast-growing groundcover for moist areas in sun or shade. Pink trumpet-shaped flowers.	CFDS CFSF	
Felicia filifolia	R16.40 (4L) | 20	R8.90 | 0		1mx1m shrub for dry, sandy and windy conditions. Showy purple daisy flowers in spring.	CFDS PSR SSR	
Ficinia bulbosa	R18.80 (4L) | 80			Sedge with delicate, fresh green culms to 50cm. For irrigated areas.	CFDS ASF CFSF	
Ficinia capitella	R18.80 (4L) | 5			Sedge with fine, pendulous lime-green culms to 30cm. For irrigated areas.	CFDS CFSF	
Ficinia indica	R18.80 (4L) | 0			0.4m tall sedge for seepage areas. Rich chestnut-coloured spikes.	LAF PSF CFSF SPGF	
Ficinia lateralis	R18.80 (4L) | 50			0.6m tall tufted sedge for seasonally wet coastal sands. Wind tolerant.	CFDS	
Ficinia nodosa (Scirpus nodosus)	R16.95 (4L) | 20	R8.90 | 300		1m tall sedge with fresh green stems. For seasonally wet areas. Withstands summer drying. Excellent wetland filtration and soil stabilisation.	CFDS CFSF CLFW	
Freylinia lanceolata	R19.40 (4L) | 50			Small tree to 4m with cream-coloured, honey-scented tubular flowers. Attracts pollinators. For irrigated applications.	CLFW	
Fuirena coerulescens		R9.50 | 0		Delicate sedge to 50cm for damp areas.	CFDS	
Geranium incanum	R14.60 (2L) | 20	R8.90 | 20	R4.10 | 24	Groundcover for damp sandy soils. Delicate pale pink/white flowers.	CFDS CLFW CFSF SSR HSF	

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Gladiolus angustus	R18.20 (15cm) | 0		R4.25 | 72	Marsh painted lady. Bulbous plant, spring flowering. Sold as clump of approx. 3 shooting bulbs in 15cm pot during growing season.	CFDS CLFW	
Gnidia pinifolia	R16.95 (15cm) | 5			Pine-leaf saffron bush. Shrub to 1m with long tubular flowers which are fragrant at night, attracting moth pollinators. Flowers all year round. For full sun on lower slopes and sheltered sandy flats.	SPGF ASF	
Gnidia squarrosa	R16.40 (15cm) | 5			Aandbossie. Lax shrub, 1-2m. Cream flowers from June-Oct, scented at night. For full sun on sandy slopes and flats.	SPGF CFDS	
Gomphostigma virgatum	R16.95 (4L) | 2	R8.90 | 2		Shrub to 2.6m with scented white flowers. For damp soils in wetlands or along freshwater streams.	CLFW	
Gymnosporia buxifolia	R21.80 (4L) | 10			Spikethorn. Large shrub/ small tree, 3-7m, excellent spiny security hedge. Showy flowers attract insect pollinators, which in turn attract birds.	CFSF SPGF ASF	
Helichrysum crispum		R8.90 | 80		Small rounded shrub to 50cm, woolly grey leaves, creamy white flowers. For dry, sandy, windy conditions.	CFDS HSF LAF	
Helichrysum cymosum	R16.95 (4L) | 2	R8.90 | 40	R4.15 | 24	Gold carpet. Low shrub with grey foliage and yellow flowerheads. For sun or semi-shade in seasonally wet sand. Water well to establish.	CFDS CFSF SPGF	
Helichrysum dasyanthum	R17.60 (4L) | 20	R8.90 | 0		1mx1m shrub with yellow flowers. For dry, sandy and windy conditions.	CFDS CFSF SPGF SSR	
Helichrysum niveum	R16.95 (4L) | 1			Dwarf twiggy, ericoid shrublet to 20cm. Adapted to dry, sandy and windy conditions.	HSF CFDS	
Helichrysum patulum	R15.75 (4L) | 10	R8.90 | 40	R4.05 | 24	1mx1.5m sprawling shrub for dry, sandy and windy conditions.	CFDS PSR SSR	
Helichrysum petiolare	R16.95 (4L) | 15	R8.90 | 0		1mx1m shrub with soft grey foliage. For semi-shade to full sun in a sheltered position.	SPGF	
Helichrysum teretifolium	R18.20 (4L) | 10	R9.00 | 20		Compact groundcover to 30cm with dark green foliage and cream flowers. For semi-shade to full sun on sandy flats and slopes.	CFDS HSF	

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Hellmuthia membranacea	R18.20 (4L) | 5			50cm-1m tall sedge with large attractive flowerheads. Drought tolerant. Excellent soil stabiliser.	CFDS	
Hermannia pinnata	R18.20 (4L) | 0			Fast growing, mat-forming shrublet to 0.15m with creeping stems. Pale orange, nodding bell-shaped flowers. Suitable for sandy, well-drained soil.	HSF	
Imperata cylindrica		R9.20 | 40		Sword grass. Perennial rhizomatous grass to 50cm for seasonally wet areas. Host plant for the Critically Endangered Barber's ranger butterfly (*Kedestes barberae bunta*) in False Bay Nature Reserve.	CFDS HSF CFSF CLFW	
Isolepis prolifera	R14.75 (2L) | 10	R8.90 | 100		Low trailing sedge, rooting at the nodes. Grows in marshy conditions or 5-10cm deep water.	CLFW	
Jordaaniella dubia	R16.95 (4L) | 35		R4.15 | 600	Hardy creeping vygie with large yellow flowers. For dry, sandy, windy conditions.	CFDS HSF	
Juncus capensis	R18.20 (4L) | 20	R9.10 | 0		50cm tall seasonal wetland rush. Excellent wetland filtration and soil stabilisation.	CLFW SPGF	
Juncus effusus	R18.20 (4L) | 0	R9.10 | 10		Soft rush - 50cm-1m tall seasonal wetland rush.	SPGF CLFW	
Juncus kraussii	R16.95 (4L) | 50	R8.90 | 100	R4.15 | 0	1m tall wetland rush. Host plant for damselflies.	CFDS CLFW	
Juncus lomatophyllus	R18.80 (4L) | 10	R9.20 | 10		40cm tall wetland rush. Filtration for ecopools and grey water wetlands.	CLFW	
Kiggelaria africana	R105.00 (20L, 1.5m) | 0			Wild peach. Fast-growing tree to 20m for sheltered slopes or ravines in clay or loamy soil. Symbiotic relationship with *Acraea horta* butterfly, with the caterpillars attracting birds.	SPGF CLFW	
Lampranthus emarginatus		R9.40 | 0		Clusterleaf brightfig. Vygie to 30cm with narrow grey leaves and a show of purple flowers in spring/summer. For sandy flats and slopes in full sun.	SPGF PSR	
Lampranthus filicaulis **(Vulnerable)**		R9.40 | 0		Threadleaf brightfig. Prostrate perennial vygie with pink flowers in spring. For sandy irrigated areas.	CFSF SPGF	

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Lampranthus reptans **(Near Threatened)**		R9.00 | 20	R4.20 | 24	Creeping perennial vygie with showy yellow flowers for irrigated areas (grows naturally in seasonal wetlands).	CFSF	
Lampranthus stenus **(Critically Endangered)**		R9.40 | 20		Narrowleaf brightfig. Vygie to 30cm with narrow grey leaves and pink flowers in late spring/summer. For sandy flats and slopes in full sun.	CFSF	
Leonotis leonurus	R15.80 (4L) | 50	R8.90 | 120		2mx2m shrub for dry, sandy and windy conditions. Rewarding orange tubular flowers. Prune hard after flowering.	CFDS CFSF SPGF CLFW ASF	
Lessertia frutescens	R17.20 (4L) | 50			Cancer bush. Shrub to 1,5m tall with silvery grey compound leaves and nectar-rich orange-red flowers in spring, attracting sunbirds. For coastal sands and stony slopes. Water well to establish, water-wise thereafter. Short-lived but readily seeds itself.	CFDS ASF	
Leucadendron argenteum **(Rare and Endangered)**	R24.00 (2L) | 4			Silver tree. 7-10m tall tree with silvery-hairy leaves and separate male and female plants. Flowers attract beetle pollinators. Females produce cones. For full sun in sandy granite-derived soils only. No compost or fertiliser.	SPGF	
Leucadendron coniferum **(Vulnerable)**	R20.60 (4L) | 0	R9.60 | 20		Dune conebush. Coastal shrub or small tree, 2-4m. Attractive silvery green foilage. Withstands dry, sandy, windy conditions. No compost or fertiliser.	CFDS HSF	
Leucadendron floridum **(Critically Endangered Cape Peninsula Endemic)**	R24.00 (15cm) | 0			Flats conebush. Dioecious shrub to 2m. Attractive silvery green foliage. Wind- and beetle-pollinated. For permanently moist sands adjacent rivers/wetlands. No compost or fertiliser.	CFSF SPGF HSF CLFW PSF	
Leucadendron lanigerum var. lanigerum **(Endangered)**	R20.60 (4L) | 0	R9.60 | 0		Common shale conebush. Shrub to 1.5m. Flowering time: July-Sep. No compost or fertiliser.	ASF SSR LAF	
Leucadendron laureolum	R28.50 (4L) | 40			Laurel-leaf conebush. Large protea to 2.5m. Flowering time: June-Aug. For acid sands, wind tolerant. No compost or fertiliser.	HSF CFSF PSF	
Leucadendron levisanus **(Critically Endangered Cape Flats Endemic)**	R20.60 (4L) | 50	R9.60 | 0		Cape Flats conebush. 1-2m tall protea for seasonally wet acid sands. Tolerant of windy conditions. No compost or fertiliser.	CFSF	
Leucadendron salignum	R28.50 (4L) | 0			Common sunshine conebush. Large shrub to 2m. Flowering time: May-Dec. Full sun. For acid sands, wind tolerant. No compost or fertiliser.	HSF ASF LAF	

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Leucadendron strobilinum **(Cape Peninsula Endemic)**	R24.00 (2L) | 10			Peninsula conebush. Large shrub to 2.6m. Flowering time: Sep-Oct. For damp, rocky slopes in neutral-acid sand. Full sun. No compost or fertiliser.	PSF	
Leysera gnaphalodes	R16.40 (2L) | 4		R4.20 | 24	Shrublet to 0.4m with pale grey foliage. Suitable for windswept clay slopes. Flowering time: Sep-Nov.	ASF SSR	
Linum africanum	R16.40 (15cm) | 5			Wild flax. Compact shrub to 30cm with copious yellow flowers in summer. For semi-shade. Variable habitat from clay slopes to coastal sands.	SPGF	
Lobelia anceps (Lobelia alata)	R14.75 (2L) | 0	R8.90 | 0	R4.15 | 24	Groundcover with pretty blue flowers for irrigated areas.	CFSF SPGF CLFW	
Maurocenia frangula	R82.50 (10L) | 4			Bittersweet cherry. Small rounded tree to 3m with large leathery dark green leaves. Small white flowers from May to June followed by showy, edible cerise fruit. Occurs in coastal forest and rocky slopes. Plant in full sun in sandy soil.	CFDS	
Melianthus major	R18.80 (4L) | 2			Kruidjie-roer-my-nie. Large streamside shrub to 3m. Rusty-red, nectar-rich flower spikes attract birds. Prefers rich, moist, well-drained soils in full sun to semi-shade. Prune heavily in summer.	SPGF CLFW	
Mentha longifolia subsp. capensis	R15.75 (4L) | 40	R8.90 | 20		Edible wild mint. For seasonal wetlands.	SPGF CLFW	
Metalasia densa	R20.60 (4L) | 0			Erect shrub to 2m with green to white-woolly foliage. For sandy, windy conditions. Flowering time: June-Oct.	HSF PSR ASF PSF CFSF	
Metalasia muricata	R16.95 (4L) | 80	R8.90 | 40		2mx2m silvery-grey shrub with cream honey-scented flowerheads. For dry, sandy and windy conditions along the coast.	CFDS HSF ASF	
Mimetes fimbrifolius **(Rare Cape Peninsula Endemic)**	R24.00 (2L) | 10			Tree pagoda. 4x5m tree with flowerheads clasped by reddish-yellow leaves at branch tips. Flowering time: Jul-Dec. Attracts bird pollinators. For full sun on moist rocky slopes and sandy flats. May live for up to 100 years!	PSF	
Monopsis lutea	R16.35 (4L) | 30	R8.90 | 60	R4.10 | 24	Marsh groundcover with pretty yellow flowers and bright green trailing stems. Damp sands.	CLFW SSR	

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Morella cordifolia	R18.80 (4L) | 80	R9.30 | 0		Waxberry. 2-3m tall spreading shrub for dry, sandy and windy conditions.	CFDS CFSF HSF	
Muraltia mitior **(Endangered)**	R19.60 (4L) | 70	R9.40 | 0		Beautiful purple-flowered shrub with finger-like branches to 1m. For sandy, seasonally wet areas.	CFDS	
Muraltia (Nylandtia) spinosa	R20.00 (4L) | 0			Tortoise berry; 1.5x1m shrub with masses of purple flowers in winter and edible fruit. For dry, sandy and windy conditions.	CFDS CFSF HSF	
Olea europaea subsp. africana	R105.00 (20L) | 10			Wild olive. 9mx12m tree with glossy green foliage. Drought-, frost- and wind-resistant. Fruit attracts birds.	CFDS CFSF SPGF PSR SSR	
Orphium frutescens (pink)	R16.95 (4L) | 120	R8.90 | 0		80cm tall upright wetland shrub with showy pink flowers. Buzz-pollinated by carpenter bees.	CFDS CFSF CLFW	
Orphium frutescens (white)	R16.95 (4L) | 120	R8.90 | 0		80cm tall upright wetland shrub with showy white flowers. Buzz-pollinated by carpenter bees.	CFDS SPGF CLFW	
Osteospermum fruticosum	R16.40 (4L) | 0	R8.90 | 0	R4.10 | 24	Trailing African daisy. Semi-succulent groundcover to 40cm with white flowers, ray florets mauve on underside. Attracts butterflies. Full sun. Wind- and drought- resistant.	CFDS	
Osteospermum incanum	R16.95 (4L) | 0			Spreading, fast-growing shrub to 1.5m. Leaves softly hairy, grey. For dry, sandy and windy conditions.	CFDS CFSF	
Osteospermum moniliferum	R16.40 (4L) | 20	R8.90 | 40		Large, spreading, fast-growing shrub to 3m. Edible berries attract birds. For dry, sandy and windy conditions.	CFDS HSF CFSF SSR SPGF PSF	
Otholobium bracteolatum	R16.40 (4L) | 120	R8.90 | 0	R4.10 | 24	1mx1.5m shrub with purple and white pea flowers. Adapted to dry, sandy, windy conditions.	CFDS	
Otholobium decumbens		R8.90 | 20		Prostrate mat-forming forb with mauve flowers. For full sun in sandy soil.	CFSF SPGF	
Otholobium fruticans (**Rare Peninsula Endemic**)	R16.40 (2L) | 30			40cmx1m trailing semi-shrub with purple flowers. For sandy acidic soil on the slopes of Table Mountain.	SPGF PSF	

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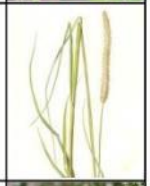
Passerina paleacea	R19.60 (4L) | 20	R9.50 | 20		Rare gonnabos. Shrub to 1m with ericoid leaves. For neutral to alkaline sands in full sun.	CFDS	
Pelargonium betulinum	R16.95 (4L) | 0	R8.90 | 10		Camphor-scented pelargonium. 1mx1m shrub for dry, sandy and windy conditions. Showy pink flowers.	CFDS CFSF HSF	
Pelargonium capitatum	R15.80 (4L) | 40	R8.90 | 20		Rose-scented pelargonium. Fast-growing groundcover with pink flowers on long stalks. Water- and wind-wise.	CFDS CFSF SPGF HSF	
Pelargonium cucullatum subsp. *tabulare*	R16.90 (12cm) | 4			Tree pelargonium. Shrub to over 2m with showy pink flowers in late spring/summer. Full sun, drought tolerant.	CFSF SPGF PSR HSF	
Pennisetum macrourum	R18,80 (4L) | 0			African feather grass. Beautifully backlit tall wetland grass to 2,5m. Suitable for full sun to semi-shade in marginal or well-irrigated applications.	CFSF CLFW	
Phylica ericoides	R18.80 (4L) | 80	R9.20 | 20		1m tall spreading shrub with white button-like flowers. For dry, sandy and windy conditions.	CFDS HSF CFSF SPGF	
Plecostachys serpyllifolia	R15.80 (4L) | 5	R8.90 | 40	R4.00 | 24	1mx1m seasonal wetland shrub with cobwebby grey foliage.	SPGF CLFW HSF	
Podalyria calyptrata	R38.50 (15cm) | 2			Sweetpea bush. Large shrub to 3m with glossy silvery-green foliage. Showy pink flowers in spring attract carpenter bees, honeybees, hoverflies, butterflies and birds. For damp acid sand or clay in full sun.	SPGF PSF	
Podalyria sericea **(Vulnerable)**	R38.50 (15cm) | 0			Small rounded shrub 1mx1m. Silvery-shiny leaves and pink flowers in spring/summer. Attracts carpenter bees, honeybees, butterflies and other insects, which in turn attract birds. For full sun on acid-neutral sand or clay slopes.	SPGF PSF	
Polygala myrtifolia	R19.40 (4L) | 0			September bush. Evergreen, water-wise shrub/small tree of 1-4m, for use as a windbreak or hedge. Striking purple flowers mainly in autumn and spring. Provides forage for bees.	CFDS CFSF SPGF	

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Prionium serratum	R20.00 (4L) | 2			Palmiet. Large wetland graminoid to 2m or more. Excellent water purifier. Flowerheads eaten as a vegetable when in bud.	CLFW	
Pseudoselago spuria **(rare Cape Flats form)**	R18.20 (4L) | 5	R9.00 | 20		Powderpuff plant. Upright perennial shrub to 60cm, white flowerheads. Prefers moist, sandy soils. Full sun.	CFSF	
Psoralea aphylla	R18.80 (4L) | 20			Seasonal wetland shrub to 2m, leaves reduced, shoots silvery hairy, stems weeping, masses of mauve/white flowers in summer. Now rare on the Cape Flats. Plant in full sun under irrigation.	CFSF CLFW	
Psoralea glaucina **(Critically Endangered Cape Flats Endemic)**	R18.20 (4L) | 0	R9.00 | 40		Groundcover for seasonally damp neutral-alkaline sands. Purple pea flowers.	CFDS	
Psoralea pinnata	R18.20 (4L) | 200	R9.00 | 20		3-4mx2m fast-growing seasonal wetland plant/small tree with masses of mauve and white flowers in late spring/summer.	CFSF SPGF CLFW HSF	
Psoralea repens	R15.80 (4L) | 2	R8.90 | 80	R4.00 | 24	Groundcover for alkaline sands. Drought- and wind- resistant. Purple pea flowers.	CFDS	
Ruschia macowanii	R15.80 (4L) | 60	R8.90 | 40		1mx1m sprawling vygie for dry, sandy and windy conditions	CFDS	
Salvia africana-caerulea		R9.60 | 5		Blue sage. 1.5mx1.5m aromatic shrub for clay slopes and flats.	SPGF SSR PSR ASF	
Salvia africana-lutea	R16.95 (4L) | 100	R8.90 | 20		1.5mx1.5m shrub for dry, sandy and windy conditions. Orange, tubular, bird-pollinated flowers.	CFDS HSF PSR SSR	
Salvia chamelaeagnea	R16.95 (4L) | 10	R8.90 | 20		Rough blue sage. Dense shrub to 2m for irrigated areas/seasonal wetlands in clay soils. Lime green foliage and large blue and white flowers in summer.	SPGF CLFW	
Salvia lanceolata	R17.60 (4L) | 0			1.5mx1.5m shrub for dry, sandy and windy conditions. Peach-orange, tubular, bird-pollinated flowers.	CFDS ASF	
Scabiosa incisa	R17.60 (4L) | 2			Fast-growing perennial groundcover with beautiful mauve, long-stemmed flowerheads from spring to summer. For coastal sands in full sun. Attracts butterflies.	CFDS	

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Schoenoplectus scirpoides	R18.20 (4L) | 30	R9.00 | 0	Ex open R6.00 | 0	2m tall attractive wetland reed. Requires permanent water, 50cm deep.	CLFW	
Scirpoides thunbergii	R18.20 (4L) | 2	R9.00 | 0		0.7m tall rhizomatous sedge. Suitable for sandy damp areas.	ASF CFSF	
Searsia crenata	R19.80 (4L) | 10	R9.50 | 0		Shrub/small tree to 4m. Ideal coastal or inland hedging plant. Drought and wind tolerant. Host plant for butterflies; berries attract birds. Full sun.	CFDS CFSF SPGF	
Searsia lucida	R19.80 (4L) | 0	R9.60 | 0		Shrub/small tree (3-5mx4m) with attractive glossy green leaves. Excellent hedging plant. Drought and wind tolerant. Berries attract birds. Full sun.	CFDS HSF CFSF SPGF	
Selago canescens	R16.40 (2L) | 0			Bitterbush. Evergreen shrub to 1.5m with attractive mauve flowers. Flowering time: July-Sep. Host plant for butterflies. For loamy soil in full sun.	SPGF	
Selago corymbosa	R16.40 (2L) | 0			Perennnial densely leafy shrublet to 0.6m. Creamy white flowerheads. Host plant for butterflies. Suitable for sun or semi-shade.	SPGF	
Senecio halimifolius	R15.80 (4L) | 50	R8.90 | 360		2mx1.5m seasonal wetland shrub with yellow daisy flowers which attract insect pollinators. Tolerates summer drying.	CFDS CFSF SPGF CLFW SSR	
Seriphium plumosum (Stoebe cinerea)	R18.90 (2L) | 40			Many branched grey-woolly, shrub to 1.5m for clay slopes in semi-shade to full sun.	SPGF	
Seriphium plumosum (Stoebe plumosa)	R21.40 (4L) | 0	R9.50 | 0		1mx1m shrub with woolly grey foliage for dry, sandy and windy conditions. Water-wise contrast filler.	CFDS CFSF LAF	
Serruria aemula **(Endangered Cape Flats Endemic)**	R24.00 (2L) | 0	R9.60 | 20		Shrublet to 0.5m with finely divided leaves. Silvery-pink flowers appear from July-October. For irrigated or seasonally wet sands in full sun. No compost or fertiliser.	CFSF	

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Serruria foeniculacea **(Critically Endangered Cape Flats Endemic)**	R21.40 (4L) | 10	R9.50 | 10		1mx1m protea with silvery pink flowers. For seasonally wet acid sands. No compost or fertiliser.	CFSF	
Serruria glomerata **(Vulnerable Cape Peninsula Endemic)**	R24.00 (2L) | 0			Compact shrublet to 0.5mx0.5m. Flowering time: Aug-Oct. Suitable for seasonally wet acid sands. No compost or fertiliser.	HSF CFSF	
Sideroxylon inerme **(Protected tree)**	R180.00 (20L, 3m) | 2			Milkwood. 10-15m tall tree with glossy green leaves, small white flowers and purple/black fruit which attracts birds. Suitable for coastal conditions.	CFDS	
Solanum africanum	R16.95 (4L)| 2	R8.90 | 40		Dronkbessie. Creeping succulent shrub with stems to 3m. Groups of pendulous mauve flowers with yellow stamens followed by black berries.	CFDS	
Stachys aethiopica	R16.40 (15cm) | 5		R4.10 | 24	Kattekruie. Hardy spreading groundcover with delicate white-pink flowers. For semi-shade.	CFDS SSR SPGF PSR	
Struthiola dodecandra	R19.40 (4L) | 2	R9.30 | 0		1-1.5m tall shrub with sweet-smelling white flowers. For seasonally wet flats and slopes.	CFSF SPGF CLFW	
Struthiola striata	R19.80 (4L) | 30			Shrub to 1m with small tubular flowers, scented at night, moth-pollinated. For damp sandy flats.	ASF CFSF	
Tarchonanthus littoralis	R33.00 (4L) | 10; R105.00 (20L, 1.5m) | 40			Camphor tree. 2-9m semi-deciduous, hardy, water-wise tree with grey leaves for coastal conditions. Excellent windbreak/tall hedge.	CFDS	
Tetragonia decumbens	R15.80 (4L) | 40	R8.90 | 60	R4.00 | 144	Dune spinach - popular edible plant. Fast-growing groundcover to 50cm for coastal conditions. A useful sand stabiliser.	CFDS HSF	
Tetragonia fruticosa	R15.80 (4L) | 2	R8.90 | 0		Slaaibos - popular edible plant. Fast-growing groundcover to 50cm for coastal conditions. A useful sand stabiliser.	CFDS HSF	
Thamnochortus punctatus	R21.80 (4L) | 0			Steenbok reed. Dwarf perennial restio to 1m, spreading to 0.5m at the base. For full sun in well-drained soil. Water well to establish.	ASF CFSF	
Thamnochortus spicigerus	R21.80 (4L) | 40	R9.50 | 200		Tall thatching reed. Large tussock-forming reed to 2.5m, spreading to 1.5m at the base. For well-drained, neutral-alkaline sand in full sun.	CFDS HSF	

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Trachyandra ciliata	R16.40 (4L) | 5			Veldkool. Perennial to 50cm for coastal sands. Edible flower buds can be steamed or boiled in the same way as asparagus, or cooked in a stew.	CFDS	
Trachyandra divaricata	R16.40 (4L) | 20	R8.90 | 20		Sandkool. Perennial to 50cm for coastal sands. The branched edible flower buds can be steamed or boiled.	CFDS HSF	
Tribolium uniolae	R18.90 (2L) | 0			Tufted perennial grass to 0.6m with compact golden flowerheads. For sandy or clay slopes and flats.	ASF PSF LAF SPGF CFSF	
Wachendorfia thyrsiflora	R19.40 (4L) | 10			Marsh butterfly lily. Tall evergreen geophyte with spikes of yellow flowers reaching 2.5m (Sep-Dec). For permanently marshy areas in full sun.	SPGF CFSF CLFW PSF HSF	
Watsonia meriana	R17.60 (4L) | 0			Cormous plant, leaves to 0.6m, flowers to 2m. Tubular red flowers attract sunbirds. For seasonally inundated areas. Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season (winter/spring).	CFDS CFSF SPGF CLFW	
Watsonia tabularis **(Cape Peninsula Endemic)**	R18.20 (4L) | 0			Cormous plant, sword-shaped leaves to 1m, orange flowers from Nov-Jan, bird-pollinated. Water-wise, suited to sunny rockeries. Prefers neutral to acid soils (occurs naturally on sandstone from sea level to Table Mt summit). Sold as clump of approx. 3 shooting bulbs in 4L bag during growing season.	CFSF SPGF PSF	
Zantedeschia aethiopica				Arum lily. Geophytic species to 1m with fresh green foliage and elegant large white spathes; these support a microcosm of wildlife from beetles to bees to frogs and spiders. For full sun or semi-shade in marshy conditions. Evergreen with permanent moisture availability, deciduous with seasonal moisture. Rhizomes attract porcupines.	CLFW SPGF CFSF	

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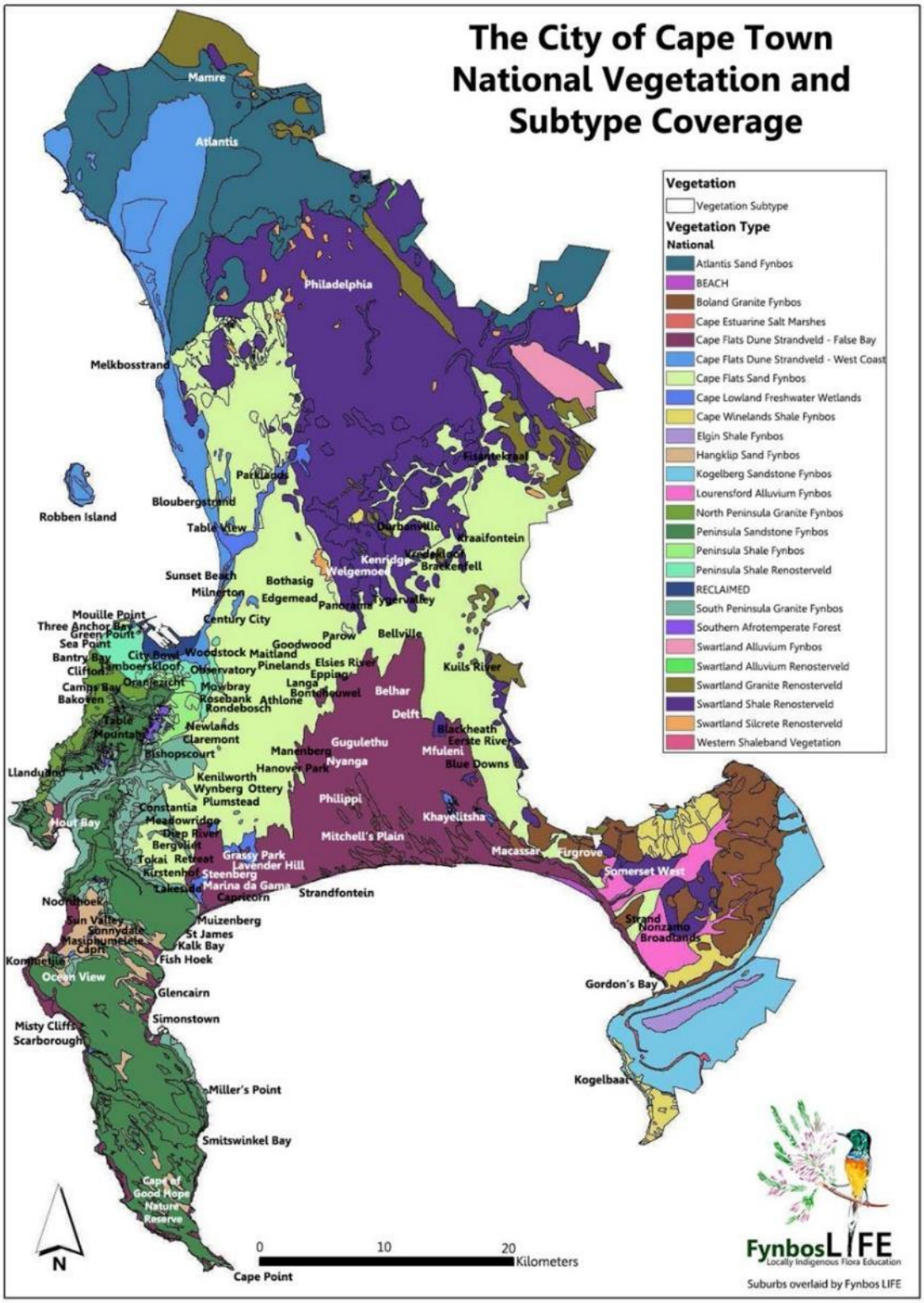
APPENDIX A. CITY OF CAPE TOWN VEGETATION MAP WITH SUBURBS OVERLAID



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ANNEXURE D – ALIEN FLORAL SPECIES CONTROL

The dominant alien floral species are predominantly associated with agricultural activities and should be identified by the ECO prior to the commencement of construction. An Alien and Invasive Plant (AIP) species control program should be developed for control of these species. The basic principles of a control program are presented below.

AIP control programs must include the following three phases (Campbell, 2000):

- Initial Control Phase: The existing population must be drastically reduced.
- Follow-up Control Phase: Control of coppice regrowth, root suckers and seedlings.
- Maintenance Phase: Low AIP density and numbers with a low annual control cost. During this phase, AIP is no longer considered a problem. It is important to monitor the situation of infestation during the growing season of the plants as to avoid re-infestation and to keep the control cost at a minimum.

Control Methods

To control AIP successfully, one must use a number of control methods. When using herbicides, the recommendations that are stated on the label of the specific product must be adhered to (Campbell, 2000).

Integrated Control Strategies

A combination of the most suitable and effective methods should be used to control a specific species in a particular situation. The following selection of appropriate control methods should take into account the following (Campbell, 2000):

- Species of alien and invasive weeds;
- The type of growth form (i.e. seedling, sapling, shrub or tree);
- The density of infestation;
- The terrain where the infestation is present;
- Rehabilitation requirements
- What resources are available;
- Speed or urgency that the control of the infestation requires – physical removal and biological control will take longer than chemical control.

- **Initial control phase**
  - **Hand pull:** saplings and seedlings must be pulled out by hand and regrowth must be controlled with herbicide (Campbell, 2000). All guidelines for the application of herbicide listed in this Rehabilitation Plan must be adhered to;
  - **Frill:** a cane knife is used to cut frills into the stem. Herbicide must be applied (1-2 mm per frill) and must be done in 30min after frilling;
  - **Soil application:** herbicide is applied to the soil and taken up by the plants roots

Methods for controlling Coppice, saplings and seedlings:

AIP infestation can comprise different growth forms, and some of the growth forms cannot be utilised. These plants need to be cut with a brush cutter and the stumps treated with herbicide that was mixed with a dye to show where treatment was done (however stumps must not be removed as they significantly contribute to soil stability).

Integrated strategies to control alien shrubs	**Alien shrubs that are less than 1 m in height**: • A foliar application must be used in the general control of alien shrubs that are less than 1 m in height. • Registered herbicide must be used and where grass is present, selective broadleaf herbicide that will not impact on the grass. When grass is not present, a selective or non-selective registered herbicide must be used. • For dense seedling growth that is of uniform height a flat fan nozzle with knapsack must be used. • For seedling growth that is of uneven height, root suckers, short saplings, and coppice growth a cone nozzle must be used. **Alien shrubs that are taller than 1 m (Campbell, 2000):** • Shrubs that are taller than 1 m must be reduced cutting using brush cutter or cane knives. • When large areas with dense growth are present a tractor mounted gyro-motor must be used. • For low – medium density infestation a cut stump treatment must be used. Stumps that are must be treated immediately. The best time to treat is during the active growing season. • Medium – High-density infestations must be slashed to knee height so that the plants can coppice. The best time to do this is during the winter months as the plants are dormant and the coppice will come out during the active growing period after good rain. The coppice must be sprayed when enough leaves are present to absorb the herbicide, and a dye must also be used to indicate treated areas. • Pathways must be cut to increase exposed areas so that a foliar spray treatment is more effective without compromising the indigenous vegetation. • Mechanical uprooting of shrubs is not always a preferred method because the soil is disturbed and this increases the risk of alien vegetation infestation. This activity also promotes erosion, and soil loss will occur. Mechanical uprooting can be done in areas that have a dense grass cover, as the roots of the grass will keep the soil intact. After uprooting the soil must be levelled and if grass seeds are present, some grass seeds must be placed on these areas to promote grass regrowth.
Integrated strategies to control alien herbs (Campbell, 2000)	**Chemical Control:** ➢ Alien herbs are soft non-woody species. ➢ Some of the alien herbs have registered herbicides to control them and are either pre- or post-emergent herbicides. ➢ When alien herbs are associated with woody alien plant, herbicides that are registered to control woody alien species are often used to control alien herbs. Alternatively, glyphosate can be used as it is often registered for both alien herb and alien woody species.

Follow up control (Campbell, 2000)

Introduction

Follow-up control is essential to control alien saplings, seedlings and coppice regrowth to achieve and sustain the progress that was made with the initial control work in the initial phase. If the follow-up control phase is neglected, the alien infestation will become worse and denser than before the eradication process started. It is essential to sustain the follow-up phase because it will prevent the suppression of alien seedlings on planted grasses.

Follow up treatment control must use the following methods:

- Chemical control methods: Only use registered herbicides to control any alien species. Instruction on the herbicide labels must be followed carefully.
- Mechanical control methods
- Biological control methods that are available.

Control methods for dense regrowth: After initial control operations dense regrowth may arise as new regrowth will sprout in the form of stump coppice, seedlings and root suckers.	
Chemical control / foliar application:	• Plants that are less than 1 m in height must be controlled by foliar application. • Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle. • If grass is present, the use of a registered selective herbicide must be used so as not to harm the grass, and if grass is not present a registered non-selective or selective herbicide can be used. • Suitable dye must be used at all times to limit over- or under spray of areas.
Mechanical control:	• Areas with dense seedlings should not be uprooted or hoed out, as these areas will result in soil disturbance and will in return promote flushes and germination of alien seedling growth. • When stump density is high, plants should not be cut. This is impractical, and there will be many untreated stumps. Instead cut the stumps in dense areas with brush cutters and remove the top growth. Stumps will start to coppice, and foliar spay must be used to control the coppice regrowth.
Control methods for low-medium density regrowth: Neglecting to control low-medium density regrowth will result in densification and spreading as well as additional control costs.	
Chemical control:	• Cut stump method must be used and stumps must be cut up to a height of 15 cm and must be sprayed within an hour of cutting the plant with a registered herbicide. Herbicide must be applied with knapsack sprayers set to low pressure, using cone nozzles, e.g. TG1 or CE1. Hand sprayers can also be used to apply herbicide. A suitable dye must be used to ensure all stumps are treated. Only the cut surface must be treated with herbicide, and the side of the stumps must not be treated. • Foliar spray can be applied to regrowth that is up to the height of 1m. Herbicide must be applied using knapsacks with solid cone nozzle and must be mixed with a suitable dye to prevent over- or under spraying of treated areas.
Mechanical control:	• Seedlings can be removed from wet soil by hand pulling. Gloves can be used for hand protection during the operation.