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MAINTENANCE AND MANAGEMENT PLAN FOR THE PROPOSED REED REMOVAL AND MAINTENANCE ACTIVITIES IN THE ONRUS RIVER, NEAR HERMANUS, WESTERN CAPE PROVINCE

Prepared for

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EXECUTIVE SUMMARY

FEN Consulting was appointed to compile a Watercourse Rehabilitation and Management Plan (WRMP) as part of the Maintenance Management Plan and Water Use Authorisation (WUA) process for the proposed reed removal and maintenance activities in the Onrus River estuary, located approximately 7 km northwest of Hermanus. The Onrus River estuary was assessed to determine the risk of reed (*Phragmites australis*) removal activities through manual cutting (with follow up treatment with the use of herbicide) and the subsequent removal of its rhizomes and associated sediment.

The reed removal activities by means of mechanical cutting or applying herbicide does not require environmental authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), Environmental Impact Assessment Regulations, 2014 (as amended).

The control measures as set out in this report are deemed sufficient to guide the necessary rehabilitation of all areas affected by the proposed reed removal activities, to a point where the Onrus River estuary will not be impacted any further. The information gathered through monitoring programs such as that defined in this WRMP, will assist in a better understanding of the ecology of the area and ensuring proactive management of risks to the receiving Onrus River estuary.

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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).
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

BGCMA	Breede Gouritz Catchment Management Agency
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
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
MSL	Mean Sea Level
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

Table A: Information required for maintenance and management activities for a single/ multiple owner(s) along a watercourse.

MMP Requirements	Section in Report
Provide a map (at an appropriate scale) of the watercourse or stretch of watercourse being applied for within the stretch where maintenance activities will take place being clearly defined – consideration must be made to mapped features relating to Critical Biodiversity Areas (CBAs) and National Freshwater Ecosystem Priority Areas (NFEPAs).	Section 3 Refer to FEN (2019) report
A map indicating all site(s) at which maintenance activities will take place and included on the map which defines the stretch of watercourse.	Section 2 and Section 5
Specialist assessment to be undertaken to determine (NOTE: information relating to the specifications and Terms of Reference used for the appointment of all specialist inputs must be provided).	Section 3 Refer to FEN (2019) report
Hydrological (incl. flood hydrological data etc.) and geomorphological assessment of watercourse functioning.	
The relevant Present Ecological Status (PES) of the stretch of watercourse in question, if not available an assessment is to be done to determine PES in accordance with the Department of Water and Sanitation (DWS) guidelines.	
What is the reason/cause for the maintenance activities based on an ecological and hydrological assessment of the watercourse within the context of the larger catchment.	Section 2 and Section 3
What are the drivers of system functioning within the watercourse and what is the ecological objective – based on historical condition and PES.	Section 3 Refer to FEN (2019) report
What is the management objective given the ecological status of the watercourse based on historical and PES data; as set out in agreement with the person(s) responsible for undertaking the maintenance activities.	
What is the impact on the watercourse/river system (resource quality characteristics: flow regime, geomorphology, water quality, habitat and biota) for a minimum of 500m both up and downstream of the proposed maintenance activities, with the mitigation measures included;	
An appropriate assessment for risk for each of the proposed types of maintenance activities and linked management actions in terms of the risk matrix for General Authorisations (GA) of Section 21 (c) and (i) by the DWS (GN 509 of 2016) or where applicable.	Section 3.1 Refer to SAS (2019) report
Mapped biodiversity features such as Critical Biodiversity Area, Ecological Support Area, National Freshwater Ecosystem Priority Area (NFEPA), and the National list of Ecosystems that are threatened and in need of protection (2011) gazetted in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), the Western Cape Biodiversity Spatial Plan 2017, as well as relevant provincial specific plans and classifications etc. Please consult the website www.bgis.sanbi.org.za to determine mapped features.	Refer to FEN (2019) report
Include a description of existing or previous protection measures or reinforcements (e.g. gabions or groynes etc.) and infrastructure. Describe any evidence of erosion and/or siltation at the various sites and outlining possible causal factors and maintenance practices.	Section 2 and 3
Provide historical maps and data (images/flow/water quality/land use) of the river channel (if available) in order to assess the natural to changing flow patterns of the watercourse to determine cause of maintenance and possible impact of the maintenance activities, to inform mitigation measures.	Refer to FEN (2019) report
Provide a photographic record for the condition of the riparian habitat around maintenance sites, with the presence of important and/or sensitive habitat/species noted.	Refer to FEN (2019) report
For sites prone to flood damage, a description regarding the history and effect of past floods and include dates of most recent events must be provided. This must inform the process to understand what actions are required along the stretch of the watercourse to reduce such impacts to the resource quality characteristics.	Refer to FEN (2019) report t
Explain the risks associated with the no-go option for the MMP i.e. the risk of not undertaking the maintenance activities as stated in the MMP.	No-go Alternative not considered
Method Statements for activities relating to the Maintenance works proposed	Section 2

1 INTRODUCTION

FEN Consulting (Pty) Ltd was appointed to compile a Watercourse Rehabilitation and Management Plan (WRMP) as part of the Maintenance Management Plan and Water Use Authorisation (WUA) process for the proposed reed removal and maintenance activities in the Onrus River estuary, located approximately 7 km northwest of Hermanus. The extent (footprint) of these maintenance activities is hereafter referred to as the "study area" (please refer to Section 2 for the project description).

This WRMP was compiled to provide mitigation measures to manage the current, perceived and potential impacts on the Onrus River estuary where the reed removal and maintenance activities will occur.

This WRMP follows a system that seeks to achieve a required end state and describes how activities that have, or could have a negative impact on the Onrus River estuary will be controlled and monitored and also identifies the responsible parties and relevant timeframes (where applicable) which will be tasked with implementing these measures. The key aims of the WRMP include:

- Maintenance of the present state of the Onrus River estuary associated with the reed removal and maintenance activities (refer to Section 2 below);
- Prevention of further degradation of the receiving environment; and
- Prudent monitoring to ensure timeous detection of, and response to, damage as a result of the reed removal activities.

This WRMP advocates the use of several environmental management tools and mitigatory measures that are appropriate for the specific reed removal and maintenance activities and fits into the overall planning process of the rehabilitation and management phases and should be implemented by the proponent as soon as it has been approved by all the relevant authorities.

1.1 Structure of this document

This report investigates the need for rehabilitation and maintenance activities in the Onrus River estuary. 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 relevant legislation.

Chapter 2: Project Description
Provides the location of the Onrus River estuary as well as a brief summary of the proposed activities.

Chapter 3: Receiving Freshwater Environment
This section includes a summary of the desktop and site assessment findings undertaken by SAS (2019).

Chapter 4: Legal Framework
This section provides a breakdown of the legal framework relevant to the proposed reed removal and maintenance activities as well as the compilation of this WRMP.

Chapter 5: Watercourse Rehabilitation and Management Plan
This section comprises site specific details pertaining to the reed removal maintenance activities (rehabilitation phase) and management activities (post-rehabilitation phase) that must be implemented. A list of the roles and responsibilities of all individuals involved in the implementation of this WRMP is provided.

Chapter 6: Monitoring Plan
This section provides the required monitoring actions during rehabilitation and post-rehabilitation of the proposed reed removal and maintenance activities.

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 Onrus River estuary affected by the reed removal activities.

1.2 Assumptions and Limitations

- Use must be made of the ecological assessment report undertaken by FEN Consulting (2019), which describes the watercourse ecological aspects of the study area (the lowest reach of the Onrus River);
- It is not the scope of work of this report to assign or decide which parties will undertake or manage the proposed reed removal/maintenance activities. It is the responsibility of the applicant (the Onrus River Estuary Forum (OREF)) to assign the abovementioned roles and to inform the surrounding landowners of any aspects and responsibilities relating to the reed removal/maintenance activities;
- The recommended reed removal/maintenance area as depicted in this report (Figure 5) to be used only as a guideline for the removal/maintenance of reeds and it does not depict that all reeds must be removed from the study area. The scope of this report did not include providing specific volumes of reeds to be removed from the properties facing the Onrus River, as property owners have no obligation to remove reeds in front of their property; this document provides set out measures to those who chooses to do so, under the supervision of OREF.

1.3 Watercourse Rehabilitation and Management Plan Framework

1.3.1 Principles of the Watercourse Rehabilitation and Management Plan

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

Loss of biodiversity puts aspects of the economy, wellbeing 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 reed removal and maintenance activities including project aspects such as site clearing and trampling by personnel.
- **Indirect impacts:** are impacts associated with the reed removal and maintenance activities that may occur within the zone of influence associated with the Onrus River estuary, such as the surrounding terrestrial areas.
- **Induced impacts:** impacts that directly attributable to the project but are expected to occur due to the activities of the project.
- **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.

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 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 mitigation 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 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 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 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 watercourse 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.

A summary of how the above relates specifically to the proposed reed removal and maintenance activities in terms of measures which must be applied in order to ensure the minimisation of negative impacts and maximisation of positive impacts as a result of the reed removal is provided below:

- **Avoiding impacts** by not performing environmentally detrimental actions;
- **Minimising impacts** by limiting aspects of an action, optimising processes, structural elements and other design features; and
- **Rectifying impacts** through rehabilitation, restoration, etc. of the affected environment.

1.3.2 Objectives of the Watercourse Rehabilitation and Management Plan

The objectives of this WRMP 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 the ecological integrity of the Onrus River estuary;
- Maximise the service provision of the Onrus River estuary;
- Maximise the ecological functioning of the Onrus River estuary;
- Detail specific actions deemed necessary to assist in mitigating the potential environmental impact on the watercourse area;
- Ensure as far as is practicable that the measures contained in the report are implemented; and
- Propose mechanisms for monitoring compliance with the WRMP and reporting thereon.

2 PROJECT DESCRIPTION

The study area is situated within the Overstrand Local Municipality in the Western Cape Province and is included in the Breede-Gouritz Catchment Management Area (BGCMA). The Onrus River rises in the Babilonstoring Mountains and flows 16 km through the Hemel en Aarde Valley before crossing the narrow coastal plain to discharge into the sea via the Onrus River estuary, which is situated approximately 7 km northwest of Hermanus (Figure 1 and 2). Residential developments are located along the northern and western boundary and an open space area is situated on the eastern boundary of the study area. The study area stretches from the mouth of the Onrus River to the R43 bridge crossing, this covers an approximate 2 km reach of the Onrus River.

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Figure 1: Digital satellite image depicting the study and investigation areas in relation to its surroundings.

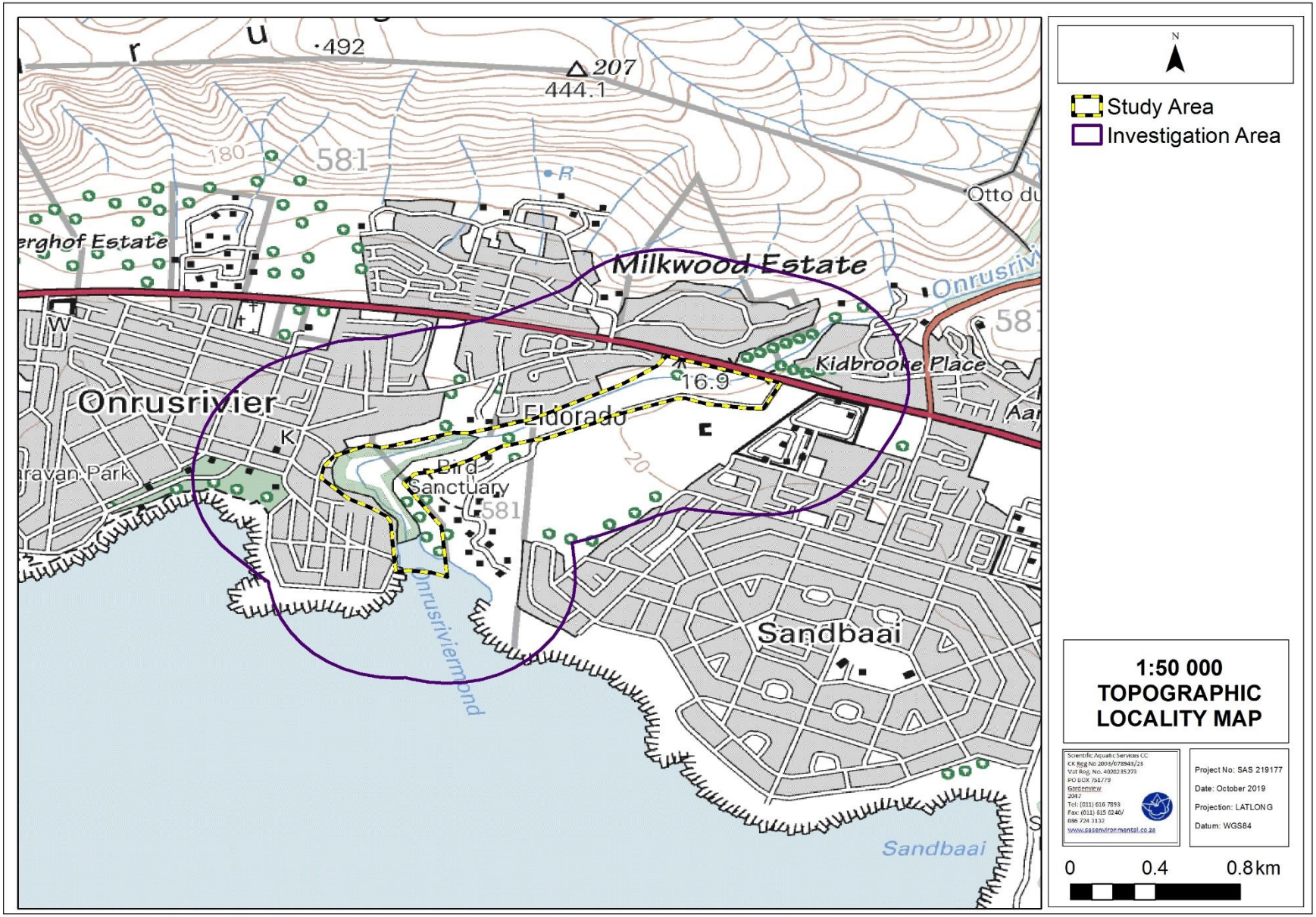


Figure 2: Location of the study and investigation areas depicted on a 1:50 000 topographical map in relation to surrounding areas.

Due to the change in catchment land uses (agricultural activities, vegetation removal, urbanisation, instream impoundments) over the past few decades, the increase of sediment deposition changed the Onrus River estuary from a seasonally closed estuary with a relatively large open water lagoon to a shallow lagoon dominated by robust reed species (Bezuidenhout, 2015)[1]. Building of the instream De Bos dam (approximately 7.2 km north of the study area) resulted in the reduction of flood events that could flush sediment from the river mouth. Consequently, robust reed species, specifically *Phragmites australis*, established in these deposited sediments which are no longer flushed out either by tidal action or by river flow. The monoculture of reed species reduced the overall biodiversity of the estuary and discourages the use of the estuary for recreational purposes. As such, it is required that the reed species be removed in order to improve the ecological integrity of the estuary in the study area. The proposed reed clearing activities will be managed by the holder, the Onrus River Estuary Forum (OREF), of this WRMP.

The management of reeds in the Onrus River estuary has been under investigation since the early 1980s. The DWS Reserve Determination study for the Onrus River (2017)[2] presents a summary of the observation and management of the reed encroachment over the past 80 years.

Table 1: History of management of reed encroachment at Onrus River estuary (DWS, 2017).

Year	Action
1938	61% of the estuary area was open water. Reeds confined to isolated patches on the northern shore.
1961	Reeds have spread along the northern shorelines.
1973	Water body largely covered by reeds.
1989	Open water reduced to only 25% of the total estuary area.
1992-1993	Reed beds comprised 3.8 ha. Dredging of the estuary to remove accumulated sediment and 1.5 ha of reeds.
2002	Rehabilitation report showed no significant sedimentation since dredging except for some sedimentation that occurred during a flood shortly after the dredging.
2012	Residents cleared the *Phragmites australis* stand present on the eastern side of the estuary and planted arum lilies on the reed rhizomes. Some of this habitat was taken over by *Typha capensis* and the remaining cleared areas by *Commelina* sp. supressing reed growth.

Dredging of the Onrus River estuary occurred towards the end of 1992 with reed removal and was completed by mid-1993 (Bezuidenhout, 2015). Dredging and reed removal reduced the reed edge from that which was surveyed in 1989, compared to the 1997 reed edge (Figure 3). Other than the dredging activities in 1992/1993, no large-scale reed removal has occurred since 1993. Small scale reed removal was undertaken by local residents on the eastern side of the estuary in 2012 (DWS, 2017).

It is therefore proposed that the monoculture of reeds in the Onrus River estuary be removed. The removal of the reeds will also contribute to the management objectives as per the draft Onrus Estuary Management Plan compiled by Anchor Environmental (2016), with specific mention of enhancing the recreational utility of the Onrus River and by improving its overall ecological health. Cutting of reeds by means of a mechanical reed cutter and the removal of rhizomes and sediment, with potential follow up treatment using the application of herbicide is the proposed management method, which is described in the section below. Reed cutting entails the stockpiling of reeds after removal, these reeds may not be burned on site due to the surrounding urbanised areas and the seeds may disperse and/or the plants may re-establish in these areas.

[1] Bezuidenhout, L. 2015. Onrus Estuary – Including reassessment of 2002 proposed rehabilitation and draft situation analysis. Prepared for the Lagoon Preservation Trust (LPT). Prepared by Pieter Badenhorst, May 2014. Updated by Liezel Bezuidenhout, May 2015.

[2] Department of Water and Sanitation (DWS). 2017. Determination of Water Resources Classes and Resource Quality Objectives in the Breede-Gouritz Water Management Area: Quantification of the Ecological Water Requirements and changes in Ecosystem Goods, Services and Attributes. Report No: RDM/WMA8/00/CON/CLA/0117

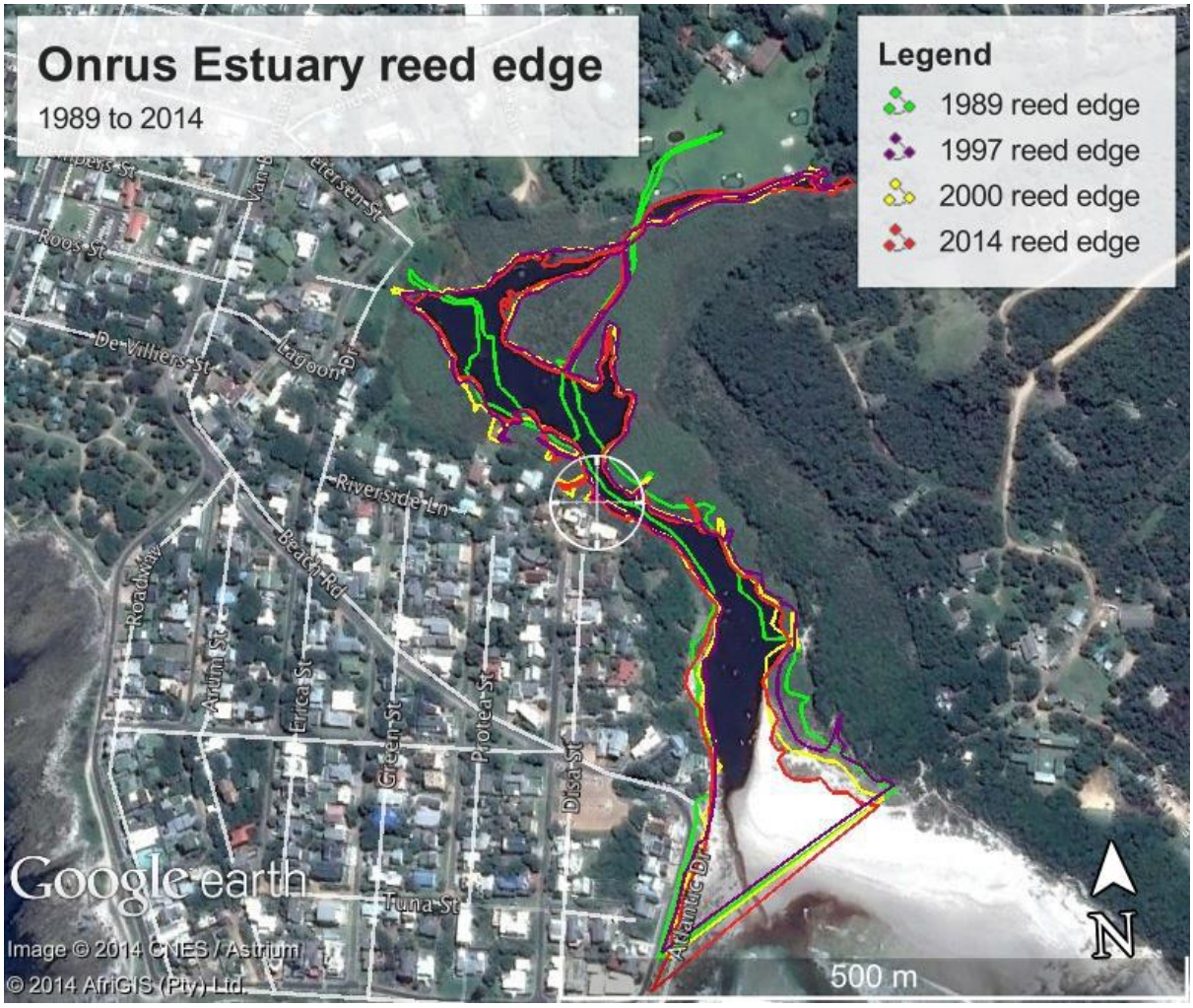


Figure 3: A comparison of the reed edge for the years 1989 (pre dredge), 1997 (3 years post dredge), 2002 (8 years post dredge) and 2014 (20 years post dredge) (Bezuidenhout, 2015).

2.1 Mechanical cutting of reeds

Cutting of the reeds is recommended as a mechanical control measure and is also the preferred method of reed removal. Russel and Kraaij[3] (2008) studied the cutting of *Phragmites australis* along an inundation gradient in the Wilderness estuarine lakes, near Knysna, Western Cape Province. This study demonstrated that cutting of reeds during the late summer season in conjunction with inundation with moderately saline water can supress reed growth and survivorship. This method entails the cutting of all surface biomass at ground level, when the reeds have the highest concentration of nutrients in the shoots towards the end of the productive (growing) period in the late summer period, i.e. during February (Russel and Kraaij, 2008). The timing of cutting in relation to plant phenology is important for cutting of reeds to be successful. Cutting must be undertaken to maximise nutrient depletion by removal of above-ground biomass prior to the translocation of nutrients from shoots to rhizomes, which occurs in late summer (February). This (method and timing) is also recommended by the 'Problem riparian and aquatic vegetation management guide for estuarine systems in the Western Cape' (Anchor Environmental, 2012). It is noted that the recommended reed removal period may impact on the breeding season of some bird species in the local area (*Pers comm* Dr. Anton Odendal). As such, the initial cut treatment can accommodate the breeding season of the birds, in that the reed cutting must

[3] Russell, I.A. and Kraaij, T., 2008. Effects of cutting *Phragmites australis* along an inundation gradient, with implications for managing reed encroachment in a South African estuarine lake system. *Wetlands Ecology and Management*, *16*(5), pp.383-393.

take place during May to July (with the limitation that the cut treatment may not be successful). Please refer to Annexure C for a breeding schedule of the birds breeding in the reeds in the Onrus River estuary, as provided by OREF. Follow up cut treatments is thereafter recommended to occur in the late summer season.

This method involves the classification of three different management zones associated with the watercourse (Figure 4):

- The 'dry zone', located furthest from the estuary edge and with surface soil (top 20 cm) not waterlogged;
- The 'moist zone', situated between the dry zone and estuary edge with waterlogged surface soil but no free-standing water, and
- The 'wet zone', within the estuary with soils covered in free standing water. It must be noted that the wet zone is not always static due to fluctuations of the water level in the estuary (due to seasonality, estuary breaching etc.).

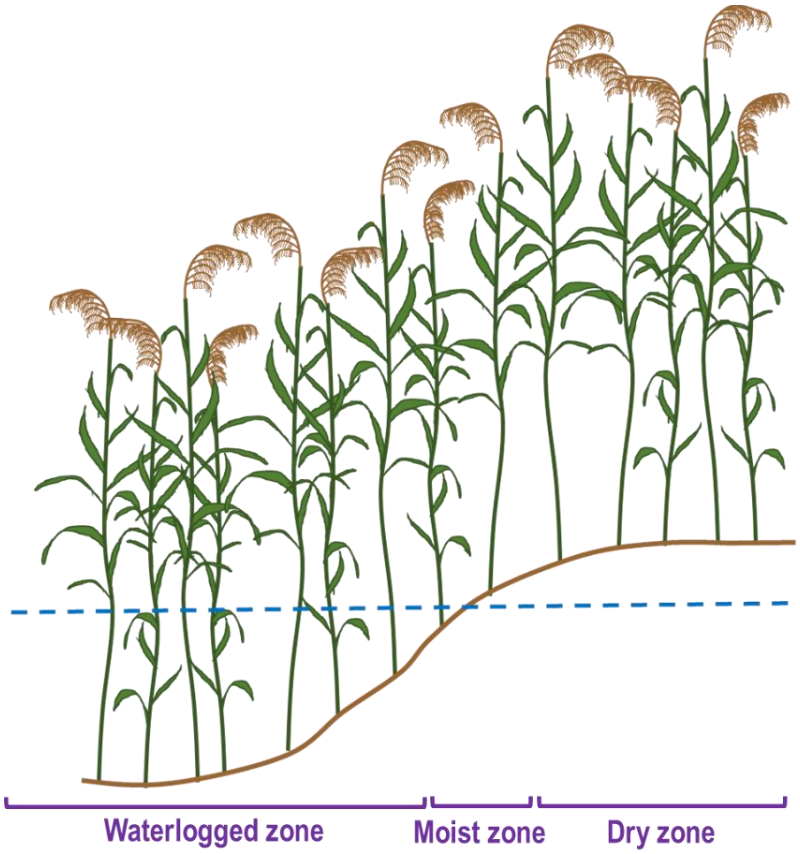


Figure 4: Different management zones identified within a watercourse.

This cut treatment must also be implemented at the Onrus River estuary. OREF suggested specified areas in the study area which are to be cleared of reeds, and reed areas to be retained, existing access paths to be utilised and potential stockpiling areas (Figure 5). The method statement for mechanical reed cutting is described below:

- Dedicated access paths must be marked (the entrance to these access paths indicated by a flag and pole or something similar) to allow workers to access the reed beds at specific points only and to avoid trampling of other (indigenous) riparian vegetation species (Figure 5);
- Reed shoots must be cut at ground level across the three zones identified (Figure 4), and thus below water in the wet zone. This can either be done with the use of:
    - Rotary brush cutter, mechanical reed cutter or chainsaws or sickles must be used, as no heavy machinery within the delineated boundary of the river may be permitted (small

four stroke motorised boats may be permitted, with authorisation from the regulating authority); or

- An aquatic mower[4], which is an underwater reciprocating mower that mounts to a small boat or a hand saw can be used to cut reeds below the water level.

- A barge (shoal-draft flat-bottomed boat) can be made use of to transport the cut reeds from the waterlogged zone to the shore or a wheelbarrow can be used (in the dry zone);
- Cut reeds must be stockpiled in a designated area to allow the reeds to dry out and be compacted for eventual transport, outside the delineated boundary of the river.

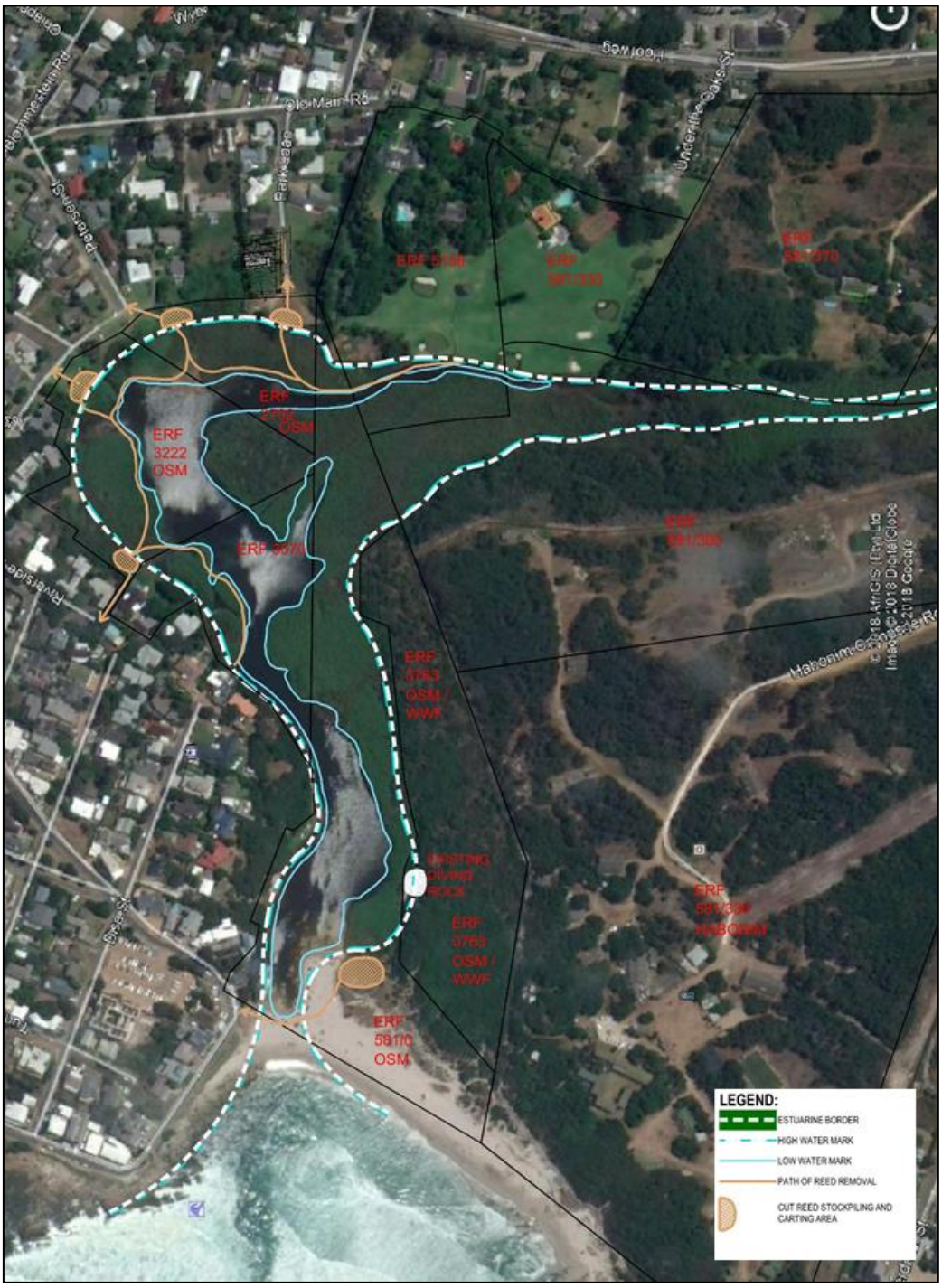


Figure 5: Recommended reed cutting areas and sizes, and access paths to be utilized as part of the reed maintenance activities (OREF, 2020).

[4] Available for purchase online at https://weedrazers.com/product/aquatic-mower-2695-00/

Cutting of the reeds will remove a large volume of surface biomass, but regeneration of the reeds may occur immediately thereafter. The outcome of the cut treatment over a two year period, as described by Russel and Kraaij (2008) is summarised in the table below.

Table 2: Summary of the outcome of the removal of reeds from the Wilderness estuarine lakes (Russel and Kraaij, 2008)

		Year 1	Year 2
Method		Effects of once-off cut	Effects of double cut
Management Zone	Waterlogged Zone	Decrease in reed abundance. Decrease in reed diameter and length. Thus, reeds were almost eliminated, due to prolonged inundation periods.	The once-off cut treatment virtually eliminated reeds, which negated the need for a second annual cut
	Moist Zone	Increase in reed abundance. Decrease in reed diameter and length. Thus, this resulted in increased abundance, but shorter and thinner, reeds.	Increase in reed abundance, but reductions in reed size. Second annual cut treatment did not result in cumulative/amplified effects on reeds, when compared with the effects of a single cut treatment.
	Dry zone		

Based on the outcome of the Russel and Kraaij (2008) study, it is apparent that once-off cutting without inundation (moist zone and dry zone) may be largely ineffective as a means to control reed encroachment, whereas the extent of inundation (wet zone) significantly influences reed regrowth in cut areas. Despite double cutting in the dry and moist zones causing a reduction in shoot size and increase in shoot density, when compared to once-off cutting, it was observed that the effects of cutting were not amplified with successive cuts. Thus, reed coppicing is likely to be very limited in inundated areas, but will occur along the embankments, in the moist and dry zones. It is recognised that cutting may only be a short-term solution which will need to be implemented every year to achieve long-term success, or the cut treatment can be followed by the application of an authorised herbicide.

2.1.1 Herbicide application as follow up treatment

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 the reeds. There are two herbicides, Glyphosate and Triclopyr that are commercially available and known to control *P. australis* effectively when used properly. Commercially available herbicides containing glyphosate includes Roundup and Mamba 360 SL which are systemic foliar applied herbicides. Glyphosate is 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 glyphosate should be done to targeted *P. australis* after senescence of other indigenous species (during the Western Cape dry season) to minimise effects (Hazelton *et al.* 2014). Commercial herbicides containing Triclopyr includes Confront 360 and Garlon 3A. The abovementioned 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**.

The chosen herbicide must be registered for use in aquatic environments, as an unregistered product may have detrimental impacts to the aquatic environment. No application of herbicide may occur during amphibian breeding season[5], or when eggs and tadpoles are present. During the application process, herbicide may only be mixed in the contractor laydown area and spray drift and herbicide run-off must

[5] An amphibian specialist can be consulted to confirm the breeding season of amphibian species found in the Onrus River estuary.

be kept to a minimum. Additionally, herbicide application should take place within the context of LandCare recommendations and other best management practices as stipulated by the municipality and/or regulating authority.

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). 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

- *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.

2.2 Removal of rhizomes

Once the reeds have been cut, it is recommended that the reed rhizomes also be removed (should the relevant party choose to do so). The following is recommended:

- Rhizome removal must be undertaken from the river embankment (dry zone) towards the moist zone. This will allow any rhizome material removed from the dry zone to settle in the moist zone, avoiding it from being dispersed;
- Cut the rhizome 'mat'[6] using a sickle, hedge shears or an aquatic mower to break up the biomass into manageable sizes to remove from site;
- Remove all cut material from the cut site with the use of a shovel and wheelbarrow (pending on the wetness zone), including any short/small pieces of rhizome material which may potentially disperse from the cut site and propagate in other areas;
- Removed rhizomes must be stockpiled in the same designated area as the cut reeds to allow for the material to dry out and be compacted for eventual transport, outside the delineated boundary of the river (Figure 5).

2.3 Sediment removal as part of the rhizome removal activities

Should sediment below the cut sites require removal, the following is recommended:

- Only sediment from the specific cut site and that in the dry and moist zones (Figure 4) may be removed up to a depth of 30 cm. This is to avoid sediment plumes from occurring in the water column and prevent the smothering of biota (including macrophytes, invertebrates and fish). In this regard the following must be adhered to:
  - Minimise the number of people operating within the cut site and the number of trips to and from the cut site – this will limit the concentrations of suspended sediment in the water column;
  - Minimise collateral suspension by using selected entry and exit points to the cut sites (use only those originally earmarked for use during reed cutting);

[6] *Phragmites australis* rhizomes create a dense network of underground biomass.

- A 'Mud and muck shovel[7]' can be used to dig out the sediment. This specific shovel allows for water to drain out of the collected sediment before it being placed in a wheelbarrow for transportation. Additionally, this shovel also collects any cut reed and rhizome debris. Alternatively, a normal shovel can be used to dig out the sediment. For removing saturated sediments, a normal shovel can be used to remove the sediment, where after the sediment can be placed over perforated material (such as shade cloth) which may act as a sieve to allow water to pass through and sediment to remain, the it can be transported to the designated stockpiling area via a wheelbarrow (Figure 5).

The removed materials (cut reeds, rhizomes and sediment) may not be left to decompose within the Onrus River estuary, within close proximity to its embankment or within any nearby open public spaces, as this may cause a nuisance to the surrounding residential developments. Nor may it be left in the river as the decomposing thereof may result in eutrophication of the system. The cut reeds, rhizomes and seeds may not be composted on site (within the Onrus River estuary or within 32 m thereof) as seeds and rhizomes can survive and grow in a compost heap, creating a new stand or dispersing to other areas. As such, the material must be disposed of at a registered disposal facility within seven (7) days of being cut/removed. The cut reeds and rhizomes may be composted off site.

The above prescribed reed removal method (including Section 2.1, 2.2 and 2.3) is subject to variability pending on the equipment used and persons/contractor undertaking the reed removal activities. This method can be followed by a landowner wanting to clear reeds in front of their property (small clearing area) or by a contractor with more personnel and equipment (larger clearing area). However, the control measures as provided in this report (see Section 7) must be adhered to, to ensure that the removal of reeds are conducted in a systematic and ecologically accepted manner. Additionally, the 'Problem riparian and aquatic vegetation management guide for estuarine systems in the Western Cape' (Anchor Environmental, 2012) must also be consulted, to ensure that the best practice guidelines are followed. However, the party undertaking to reed removal/maintenance activities must adhere to the control measures as provided in this report and must inform the holder/OREF of this report of the proposed activities.

3 RECEIVING ENVIRONMENT

The following information on the ecological characteristics of the Onrus River is taken from the report titled: "Ecological assessment of the Onrus River for the proposed reed maintenance activities, near Hermanus, Western Cape Province" (SAS, 2019), which also provides further information if required. During the site assessment undertaken by SAS in September 2019, the downstream reach of the Onrus River was identified in the study area (Figure 6). On review of historical photographs (circa 1927), the Onrus River estuary primarily hosted vegetation representative of the Overberg Sandstone Fynbos biome (Musina and Rutherford, 2006) (Figure 7). The reach of the Onrus River associated with the study area is currently dominated by the reed species *Phragmites australis* (Figure 7 and 8).

[7] A 'Mud and Muck shovel' is a shovel are specifically designed to facilitate the removal of sediment from a body of water in a simple and non-technical way. This shovel has a perforated shovel head (small holes punched through the shovel's bowl). These holes are small enough that they allow water and air to pass through, leaving nothing but the sediment behind in the shovel and allowing the user to scoop the shovel through the sediment without having to deal with the suction that would ordinarily be created by mud and deep sediments. Available for purchase online at https://jonesfish.com/products/muck-shovel-1

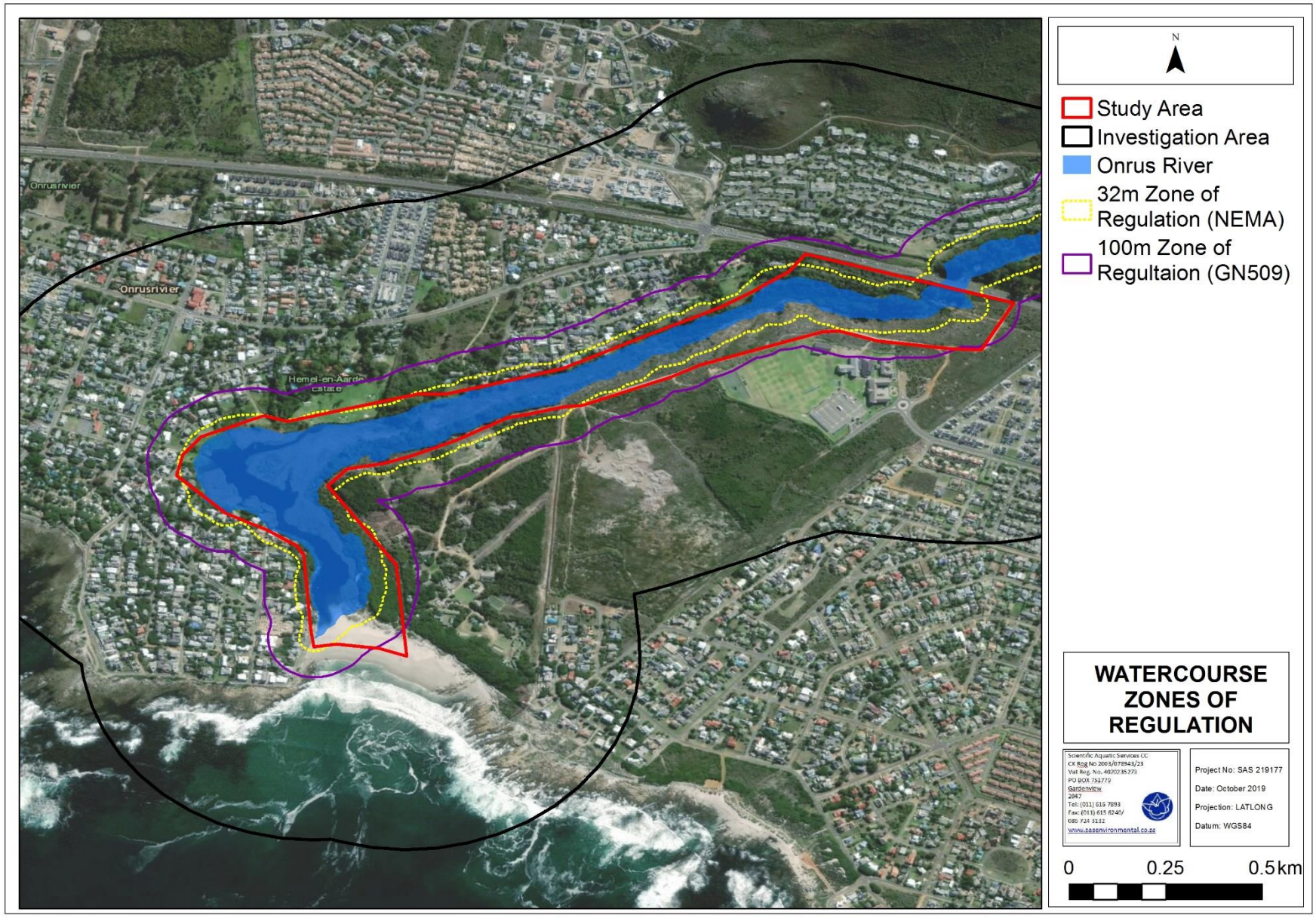


Figure 6: Delineation of the Onrus River estuary associated with the study area, including the 100m GN509 regulation zone and associated 32m NEMA regulation zone.

Figure 7: Photographs taken of the Onrus River circa 1927 (top) and 2019 (bottom), depicting the extent of reed encroachment and diminishing of the endemic vegetation distribution.

Figure 8: Photographs representative of the Onrus River estuary. (Left) Photograph taken at the mouth of the river. (Right) photograph taken of the downstream reach of the river. The purple arrow indicates the mouth of the river.

The table below provides a summary of the ecological assessment of the Onrus River estuary:

Table 3: Summary of results of the assessment of the Onrus River located within the study area

Present Ecological State (PES)	**PES Category: D (Largely Modified)** Modifiers include urbanisation, linear infrastructure crossings, upstream instream impoundments (De Bos Dam) and degradation of the river due to sewage spills. Reduction of the diversity of habitat due to the encroachment of reed species (specifically *Phragmites australis*) and contamination of surface water resulted in a decline of biodiversity and habitat provisioning of the Onrus River estuary.	**Ecological Importance and Sensitivity (EIS)**	**Moderate** The system is considered of moderate ecological importance on a landscape scale, mainly as a result of the wetland vegetation types (according to NFEPA, 2011) associated with the study area. The estuary is also classified as a CBA 1 for both terrestrial and aquatic (estuarine) importance by the Western Cape Biodiversity Spatial Plan (WCBSP, 2017).
Ecoservice provision	**Intermediate (1,4)** The Onrus River estuary plays only a minor role in providing services such as flood attenuation, streamflow regulation and erosion control, since there is little in way of downstream habitat that depends on this system. Nevertheless, the dense reed stands in the estuary aids in protecting the lowest reach of the river (river mouth) from erosion. The Onrus River is granted of high importance and functionality for recreational purposes. It also lends a high aesthetic value to the surrounding residential developments. Despite the dense reed species in the river, resulting in a lower diversity of habitat, it does still provide habitat to a variety of avifaunal species.	**REC Category and RMO**	**REC: Category D** **BAS: Category: D** As the assessed reach of the Onrus River is considered ecologically degraded, it is recommended that the current PES of the system be maintained, or if possible, improved. No further degradation to this system is allowed and, where possible, small scale rehabilitation (e.g. reed removal) should be undertaken. **RMO: Maintain** Since the Onrus River is located within a CBA, considered of moderate Ecological Importance and Sensitivity and the Recommended Management Objective (RMO) is to maintain the system, it is recommended that the reach of the Onrus River be rehabilitated (initially by means of reed removal) to increase hydraulic functioning and overall ecological state. This will also promote its aesthetic value and provide a more open recreational area (since less reeds wll dominate the mouth area), which is likely to maintain and potentially increase the PES of the system. However, it should be noted that in order to improve the PES of the river and associated estuary, a catchment-wide approach is essential.

Catchment runoff from the upgradient mountainous areas enters the Onrus River and is considered its main hydrological driver. Due to the instream De Bos dam (approximately 9 km upstream of the study area) and abstraction of water for agricultural usage, the volume of water entering the system at present differs significantly to that prior to the construction of the dam in 1976. Due to the lack of frequent and significant flooding of the river, the estuary is classified as a temporarily open/closed system and is more often in a closed state with a large sandbar between the river outlet and the ocean. The lack of breaching of the sea and opening of the mouth and frequent flooding of the Onrus River deposits sediment in the mouth of the river, where it acts as a shallow substrate for reeds (*Phragmites australis*) to grow in. *Phragmites australis* dominates the active channel of the river and has encroached on the marginal and non-marginal zones, specifically along the western embankment. Rapid encroachment of this reed resulted in an almost complete reduction of open water area in 1989 (Figure 3 – comparison of reed edge), which lead to dredging of the estuary in 1993.

3.1 DWS Risk Assessment outcome

Based on the outcome of the DWS risk assessment (SAS, 2019), the proposed reed removal activities are expected to have a Moderate risk significance on the Onrus River. This can primarily be attributed to the activities that will occur directly within the river, causing disturbance to habitat of the river.

Manual cutting of the reed species will reduce the surface biomass of the reeds after one cut but coppicing of the reeds will occur after a year (specifically in the moist zone and dry zone – Figure 4) where prolonged soil saturation and inundation is not expected. Annual cutting of reeds, for at least three years, is recommended to ensure that the extent of reeds is reduced in the Onrus River. Follow up control using approved herbicides and application methods may be used in small areas.

4 LEGAL FRAMEWORK FOR THIS WATERCOURSE REHABILITATION AND MANAGEMENT PLAN

The following legislative documents were considered and the aspects which are pertinent to watercourse management including the rehabilitation of disturbed areas were utilized.

- The Constitution of the Republic of South Africa, 1996[8];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- 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); and
- National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)(ICMA).

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

Watercourse means-

(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 of the Gazette, declare a watercourse.

Riparian habitat includes the physical structure and associated vegetation of areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas**.**

An **estuary** is defined as a partially or fully enclosed body of water –

(a) Which is open to the sea permanently or periodically; and
(b) Within which the sea water can be diluted, to an extent that is measurable, with fresh water drained from the land.

[8]Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

The above definition is further refined in the National Environmental Management: Integrated Coastal Management Act, 2008 (ICMA) (Act No. 24 of 2008), in which an **estuary** is defined as a body of surface water:

(a) That is part of a watercourse that is permanently or periodically open to the sea;
(b) In which a rise and fall of the water level as a result of the tides is measurable at spring tides when the watercourse is open to the sea; or
(c) In respect of which the salinity is measurably higher as a result of the influence of the sea.

In the Department of Water and Sanitation Training Manual on the National Water Act, 1998 (Act No. 36 of 1998) Section 21 (c) and (i) water uses first published in 2009 and more recently considered in the training on Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) the following are considered **water resources** but not watercourses and hence do not enjoy Protection under the National Water Act, 1998 (Act No. 36 of 1998):

(a) Canals;
(b) Estuaries; and
(c) Groundwater/aquifers

Based on the above definitions and the classification of the Onrus River and associated estuary (see FEN 2019) the Onrus River (from its origin) can be defined as a riverine system with an associated riparian zone and thus also as a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) and does enjoy protection under this act. However, the Onrus River is periodically open to the sea via the Onrus River estuary (the lowest reach of the river), which is defined as a water resource as per the National Water Act, 1998 (Act No. 36 of 1998) and does not enjoy protection under the National Water Act, 1998 (Act No. 36 of 1998) but is protected under the ICMA (Act No. 24 of 2008).

It is very difficult to discern the physical boundary between a river and an estuary (specifically the Onrus River since it is largely freshwater driven), implying it is difficult to determine the position where the 'protection under the National Water Act, 1998 (Act No. 36 of 1998)' is located. It is the responsibility of the Environmental Assessment Practitioner (EAP) to present the findings of this report to the relevant regulating authorities of both watercourses and water resources, to ensure the correct environmental authorisation process going forward. Thus, the Onrus River estuary was assessed as per the assessment requirements for watercourses as per Appendix 6 of Government Notice 326 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998), promulgated in Government Notice 40772 of 2017.

This report is meant to function as a Watercourse Rehabilitation and Management Plan (WRMP) in accordance with Activity 19(b) of Listing Notice 3 of the 2017 NEMA Environmental Impact Assessment (EIA) Regulations. It must be noted that the reed removal activities by means of mechanical cutting or applying herbicide does not require environmental authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), Environmental Impact Assessment Regulations, 2014 (as amended).

However, should dredging be used as a method of maintaining the reeds, a Maintenance Management Plan (MMP) (this report is referred to as a Watercourse Rehabilitation and Management Plan (WRMP)) is required in terms of Activity 19A of Listing Notice 1 (Government Notice No. R.983 of 2014 (as amended 07 April 2017)) – and not Environmental Authorisation (EA) in the form of a Basic Assessment Process. The reason for the WRMP and not the EA is as a result of subsection (b) as seen below from Activity 19A of Listing Notice 1:

The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from -
(i) the seashore;

(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the highwater mark of the sea or an estuary, whichever distance is the greater; or

(iii) the sea; -

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;
(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or
(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.

Additionally, reed removal and maintenance activities via dredging are instream activities that will occur in the Onrus River estuary (hereafter referred to as a watercourse). The following activities in terms of Section 21 of the National Water Act (Act No. 36 of 1998) will be triggered:

- 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.

The reed removal and maintenance activities trigger a Section 21 (c) and (i) water use as it refers to the National Water Act, 1998 (Act No. 36 of 1998) as well as activity 19 of the Environmental Impact Assessment Regulations Listing Notice 1 of 2014 (as amended) as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998). The conditions for Section 21(c) and (i) activities, in terms of Government Notice 509 of 2016 require that a WRMP be developed and must address the following:

1. Identify a WRMP domain, preferably from a whole-catchment perspective;
2. Identify an accountable, representative body that should take unbiased custodianship of the WRMP and drive its implementation;
3. Identify key stakeholders;
4. Divide the Onrus River estuary into useful management units;
5. Identify major drivers of watercourse disturbance and instability - human and natural and their primary and secondary effects;
6. Complete a risk assessment as per the Department of Water and Sanitation (DWS) Risk Assessment Matrix (see SAS, 2019) for identified impacts and their mitigation activities;
7. Solicit input from stakeholders on their priorities and objectives;
8. Define best practice measures for rehabilitation and maintenance implementation;
9. Design a plan for ecological monitoring which is specifically linked to the stated objectives; and
10. Develop an implementation programme and review mechanism.

The report should contain supporting technical information used to ensure low risk to the resource quality such as:

a) An impact assessment and mitigation report (see FEN, 2019) completed by an independent consultant as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the National Water Act, 1998 (Act No. 36 of 1998);
b) All the relevant specialist reports supporting the proposed mitigation measures;

i. Specialists Reports must address the level of modification /risk posed to resource quality, i.e.: flow regime, water quality, geomorphological processes, habitat and biota of the Onrus River estuary and contain Present Ecological state (PES) and Ecological Importance and Sensitivity (EIS) data for relevant Onrus River estuary (see FEN, 2019).

c) Environmental Management Plan (EMP) giving effect to all actions required to mitigate impacts (What, When, Who, Where and How);
d) Best practices applicable to these activities, where applicable;
e) Generic designs and method statements, where applicable;
f) Norms and standards, where available;
g) A monitoring programme that must include "present day" conditions to be used as baseline values;
h) Monitoring, auditing and reporting programme (reports must be sent on request to the region or Catchment Management Agency (CMA)); and;
i) Internalized controls and auditing, where applicable.

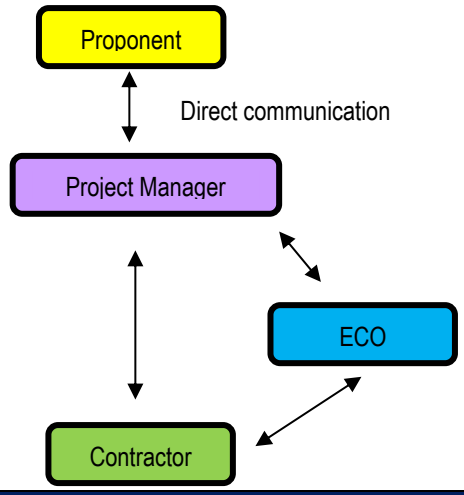
Please refer to **Annexure A** for additional legislative requirements.

5 WATERCOURSE REHABILITATION AND MANAGEMENT PLAN

5.1 Roles and Responsibilities

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

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



Party (Where applicable)	Responsibility
Proponent	• The Proponent will be responsible for the appointment of a suitably qualified independent Environmental Control Officer (ECO) for the rehabilitation and post rehabilitation phases; • A management body (I.e. Project Manager) must be appointed to ensure compliance with the WRMP; • 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 WRMP; 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 WRMP 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 are sufficient funding and resources for an ECO to adequately perform their role and • The lead project manager must ensure that this WRMP is implemented and that suitable penalties are in place for non-conformance to this WRMP by contractors (as indicated by the ECO).
Environmental Control Officer (ECO)	The ECO is the person responsible for the monitoring of the implementation of this WRMP (only applicable should dredging be implemented – on a weekly basis) during the implementation of the activities and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of reed removal 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 (weekly) to ensure that there is minimal environmental impact due to the proposed maintenance 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 this WRMP 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 officer within the BGCMA, 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 removal/maintenance operations; • Conduct a final environmental audit and a review of management and rehabilitation measures; and • The ECO must be competent and suitably qualified.
Contractor	• The Contractor/s, in this case, refers to any contractor/s on site, • 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 WRMP or the RoD cannot be complied with; • It is the responsibility of the Contractor/s to ensure that the measures stipulated within this WRMP are adhered to; and. • Should the Contractor require clarity on any aspect of the WRMP the Contractor must contact the ECO for advice.

5.2 Site Specific Rehabilitation and Management Plan

A detailed site specific WRMP has been developed for the proposed reed removal and maintenance activities, as described in Section 2 of this report. Successful rehabilitation depends upon cogent conceptual planning, research and design flexibility. The proposed site-specific mitigation measures for the reed removal phase and post-removal phase (post-rehabilitation phase) are listed in Tables 5 and 6.

Table 5: General mitigation measures applicable to the rehabilitation and post-rehabilitation phases associated with the reed removal activities.

General – applicable to all activities associated with the reed removal activities				
Timeframes / Project Phase	**Planning Phase**	**Rehabilitation Phase**		
Parties Responsible (where applicable):	**Proponent**	**Project Manager**	**ECO**	**Contractor**

Site preparation and contactor laydown area

- A contractor laydown area must be established outside of the delineated boundary of the Onrus River estuary and its NEMA 32 m zone of regulation. All equipment utilised as part of the rehabilitation activities must be stored in this area during the rehabilitation phase;
- Dedicated parking area for all vehicles forming part of the rehabilitation phase (specifically those that will transport the removed reed, rhizome and sediment materials) must be located inside the contractor laydown area, and drip trays must be located beneath any parked and leaking equipment along with lubricant/fuel absorbing media (e.g. sawdust or moss type products) within the drip trays to contain spilled material. This must be undertaken to prevent compaction of the soil and potential contaminated runoff from entering the Onrus River estuary;
- No vehicles may be moved indiscriminately in the Onrus River estuary or its 32 m NEMA zone of regulation. During the rehabilitation phase, the footprint areas of the vehicles and trampling in the river must be kept to a minimum. All vehicles must use a single designated track and turn-around areas should be located outside of the Onrus River estuary. Due to the relative accessibility of the site, no unnecessary crossing of the Onrus River estuary or beach may be permitted.
- All walkways/access paths (as per Figure 5) planned into the river to access the cut sites must be marked with a pole and flag (which can be easily removed), and only these paths may be used as part of the rehabilitation phase activities. No indiscriminate movement of personnel may be permitted;
- Cutting and rhizome/sediment removal activities may only be undertaken via manual labour and no heavy machinery or vehicles may enter the delineated boundary of the river. Rotary brush cutters, mechanical reed cutters or chainsaws can be used to cut the reeds. Additionally, canoes or a small motorised boat, preferably only motorised boats with a four stroke motor (if authorised by the regulating authority to enter the estuary) may be utilised;
- If these hand tools require fuel for generation, refuelling must be undertaken outside of the delineated boundary of the river (i.e. in the contractor laydown area). All fuel must be stored in the contractor's laydown area on bunded surfaces to prevent any contamination of soil.

Stockpiling of removed materials

- The cut reeds must be removed from the cut site and may temporarily be stockpiled (for no longer than 7 days – only to allow the cut material to dry before being transported to the main stockpiling area – see Figure 5 for temporary stockpile areas at the lower reach of the river) on the embankment of the river or the beach, whereafter it must be stockpiled in a dedicated stockpile area (main stockpile) outside of the 32m NEMA zone of regulation of the river, preferably in close proximity to the contractors camp. Permission to stockpile the material in these areas must be granted by the applicable private landowner or municipality;
- The reeds may only be stockpiled for a maximum of 7 days at the main stockpile area as it will start to decompose after a longer period of time, whereafter it must be disposed of;
- The stockpiled material may be utilised by the local residents for craft products or used as building material. The removed materials (cut reeds, rhizomes and sediment) may not be left to decompose within the Onrus River estuary, within close proximity to its embankment or within any nearby open public spaces, as this may cause a nuisance to the surrounding residential developments. Nor may it be left in the river as the decomposing thereof may result in eutrophication of the system. The cut reeds, rhizomes and seeds may not be composted as seeds and rhizomes can survive and grow in a compost heap, creating a new stand or dispersing to other areas. The reeds may not be burned

<table>
<tr><th colspan="5">General – applicable to all activities associated with the reed removal activities</th></tr>
<tr><td colspan="5">on site due to the surrounding urbanised areas and the seeds may disperse and/or re-establish in these areas if burning takes place. As such, if the cut reeds are not utilised by the local community, the material must be disposed of at a registered refuse disposal site. It must be transported in a closed truck to avoid dispersal of the seeds to any other areas and/or spilling of the organic material in the roads;
• Only sediment from the specific cut site and that in the dry and moist zones (Figure 4) may be removed up to a depth of 30 cm. This is to avoid sediment plumes from occurring in the water column and prevent the smothering of biota (including macrophytes, invertebrates and fish);
• Persons undertaking the rhizome and sediment removal activities and the number of trips to and from the cut site must be limited – this will limit the concentrations of suspended sediment in the water column;
• Minimise collateral suspension by using selected entry and exit points to the cut sites (use only those originally earmarked for use during reed cutting);
• A hand shovel must be used to dig out the sediment (no mechanical equipment may be permitted) where after the saturated sediment it must be placed on perforated material to drain the water out (water may be allowed to drain into the river). The sediment must be transported from the removal site via a wheelbarrow to the dedicated stockpiling area, which must be the same at the cut reed stockpiling area;
• All sediment must be removed from site and may not be used as fill material or for gardening purposes as it may contain reed seeds that can re-establish. As such, the material must be disposed of at a registered disposal facility within seven (7) days of being removed.

<u>Rehabilitation of access sites to the Onrus River estuary</u>
• All walk paths in the Onrus River estuary used to access the cut sites must be rehabilitated. This includes ripping of compacted areas (applicable to the moist and dry zones), removal of any alien and invasive vegetation and the revegetation of these areas with indigenous vegetation species;
• Temporary stockpile areas (within the 32 m NEMA zone of regulation) and a minimum of 3 m buffer surrounding the footprint area must be ripped (where applicable) and revegetated with indigenous vegetation species. It must be ensured that these areas are free draining and that no preferential flow paths will establish due to the altered topography of these areas.</td></tr>
<tr><td>Timeframes / Project Phase</td><td colspan="2">Planning Phase</td><td>Rehabilitation Phase</td><td>Post Rehabilitation</td></tr>
<tr><td>Parties Responsible (where applicable):</td><td>Proponent</td><td>Project Manager</td><td>ECO</td><td>Contractor</td></tr>
<tr><td colspan="5">• All areas impacted upon during the rehabilitation activities must be monitored post-rehabilitation until basal vegetation cover has been re-established; and
• The area surrounding the rehabilitated footprint areas and the riparian edge of the river must be managed for all alien vegetation. This will prevent any opportunistic alien vegetation species from proliferating in the rehabilitated areas.</td></tr>
</table>

Table 6: Specific mitigation measures applicable to the rehabilitation and post-rehabilitation phases associated with the reed removal activities.

<table>
<tr><th colspan="5">Reed removal and maintenance activities</th></tr>
<tr><td>Timeframes / Project Phase</td><td colspan="2">Planning & reed cutting phase</td><td>Rehabilitation Phase</td><td>Post Reha+6bilitation</td></tr>
<tr><td>Parties Responsible (where applicable):</td><td>Proponent</td><td colspan="2">Project Manager</td><td>ECO</td><td>Contractor</td></tr>
<tr><td colspan="5"><u>Mechanical cutting of reeds</u>

• Reed cutting must consider the proposed methodology for reed removal via mechanical cutting in Section 2.1 to 2.3 of this report and the ‘Problem riparian and aquatic vegetation management guide for estuarine systems in the Western Cape’ (Anchor Environmental, 2012) must also be consulted, to ensure that the best practice guidelines are followed;
• All reed cutting activities (including rhizome and sediment removal) must be undertaken when the least surface area of reeds is inundated. This will allow easier access to cut sites with less surface area inundated. The removed materials will then be drier (due to less inundation) and easier to transport/stockpile. This can either be during the</td></tr>
</table>

Reed removal and maintenance activities

winter period (during high flows when the sandbar is breached and water flows into the sea, reducing the water level in the estuary) or the reed cutting activities can be synchronised with other management requirements when the sandbar is artificially breached (with authorisation from the regulating authorities). This can be correlated with the late summer season when the reeds are at the end of their productive (growing) period. By cutting the surface biomass of the reed, when all carbohydrate reserves are in the upper portion of the plant (i.e., during seed production or flowering) (OMNR, 2011)[9], photosynthesis would be reduced, thus reducing the nutrient transport to the rhizomes and decreasing the risk of coppicing;

- The Council for Scientific and Industrial Research (CSIR) (1993) (as obtained from Bezuidenhout (2015)) proposed that the Onrus River estuary be divided in management units/zones after the initial dredging activities in 1993. These zones are presented in Figure 9 below. Based on this zonation, approximate reed cutting zones in the lowest part of the river were determined to be implemented as part of the proposed reed removal and maintenance activities (Figure 10). The depicted area is for illustrative purposes only and depicts the areas where reed removal activities must be undertaken, and not all of the reeds needs to be removed.
- Some patches of *Phragmites australis* must still be maintained in order to provide habitat for the biota that has established in the reed beds. It is acknowledged that the majority of the reeds along the western and northern boundary of the lowest reach of the river will be removed, as there are residential developments along this embankment and the reed removal will be aesthetically pleasing for these residents (Figure 10). Should a landowner wish to remove the reeds associated with their property, they must take cognisance of the existing reeds and that which they wish to remove, so as to not remove reeds that contribute to the ecological functioning of the estuary (Anchor Environmental, 2012). The landowner must inform the regulating authority/organisation of the area they which to remove the reeds from. Thus, some patches of the reeds must be maintained along the eastern embankment of the estuary. Additionally, some *Phragmites australis* reeds in the upstream reach of the river must be maintained to act as a sediment trap and to remove excess nutrients from the river, with relevance to the below explanation;
    - As per the 'Problem riparian and aquatic vegetation management guide for estuarine systems in the Western Cape' (Anchor Environmental, 2012) the Onrus River estuary must be classified into two broad categories 'Open areas' (including the riparian edge/embankments) and 'delivery channels' (the main trunk of the river below the R43 bridge). Coverage by reeds in open areas and the riparian zone of an estuary could be removed in line with the vision for the estuary (in the case of the Onrus River, what will contribute to the management objectives as per the draft Onrus Estuary Management Plan compiled by Anchor Environmental (2016)). Those reeds in the middle of delivery channel (portion of the river below the R43 road – see Figure 10) should be removed. Those reeds growing on the side of channels should rather be left to prevent erosion and act as nutrient traps. Reeds growing around amenity structures such as jetties, launch sites and boardwalks can also be targeted, should access to these facilities also be a management objective and part of the overall vision of the estuarine system (Anchor Environmental, 2012).
    - Areas where reeds should not be removed include those lining the sides of delivery channels as they perform a valuable function in reducing erosion, siltation and nutrient concentrations. In addition, those stands that harbour large colonies of breeding birds or species of special conservation concern should also be avoided, or their removal be guided by the relevant watercourse/estuarine/ avifaunal specialists. Stands of reeds that comprise a mixture of other indigenous species that exceed 50% should rather be left (Anchor Environmental, 2012).
- For *Phragmites australis* reeds, cover of such species in open areas and the riparian zone of an estuary could be restored to levels equal to their historical cover or the agreed upon limit in line with the vision of the estuary (Anchor Environmental, 2012). Thus, use can be made of historical aerial imagery/photographs (see Figure 3) to aid in setting a specific target of reed cover deemed appropriate for the estuary or section of estuary (see different zones as per Figure 19);
- As per Figure 5, large areas of reeds are proposed to be removed from the western and northern embankments. Where proportionally large amounts of vegetation are to be removed from watercourses, it is very important that the removal of the reeds is staggered and done in stages. This reduces the chances of the system being "shocked" by the sudden reduction in the ability of the estuary to assimilate dissolved nutrients. The amount that should be removed at any one time, and the time interval between removals, should be estuary specific and guided by the regulating authority/organisation with guidance from a watercourse specialist (Anchor Environmental, 2012). This WRMP recommends the removal of the reeds from the downstream reach of the Onrus River at the R43 bridge crossing towards the mouth of the river, however Figure 5 propose the priority areas to be cleared which will correspond to the management objectives as per the draft Onrus Estuary Management Plan compiled by Anchor Environmental (2016). Figure 5 (as provided by OREF, 2020) is provided to only be used as a guideline for the removal of reeds and it does not depict that all reeds must be removed from the depicted area. It must be noted that

[9] Ontario Ministry of Natural Resources (OMNR). 2011. Invasive Phragmites – Best Management Practices, Ontario Ministry of Natural Resources, Peterborough, Ontario. Version 2011.

Reed removal and maintenance activities

property owners have no obligation to remove reeds in front of their property; this document provides set out measures to those who chooses to do so;

- It is recommended that reed cutting activities (including rhizome and sediment removal) must start in the most upstream site of the study area (from the R43 bridge crossing) and must be focussed toward the downstream reach. This is to avoid unnecessary disturbance to the downgradient reach of the river. Starting at the most upstream reach and working downstream, would allow for disturbances to occur only once upstream and continuing downstream. This phasing of reed cutting activities is preferred (as mentioned above), however it is acknowledged that the programme of removal of reeds is dependant on available funding and assistance from the applicable landowners along the river embankment;
- Walk paths or access ways into the river from the embankment must be established as close as possible to the demarcated cut zone in the river or those already existing must be utilised (Figure 5). Only one access point into a cut zone is recommended, but pending the depth of the water, more access points may be allowed. No additional riparian vegetation on the embankments may be cleared for these walk paths/access ways, and existing trail paths (specifically along the eastern embankment of the river) must be used
- Additionally, should any small boats (barge) and/or canoes be used to gain access to the reed cut zones, they must launch at the existing launch area on the north western embankment of the river or from the beach.

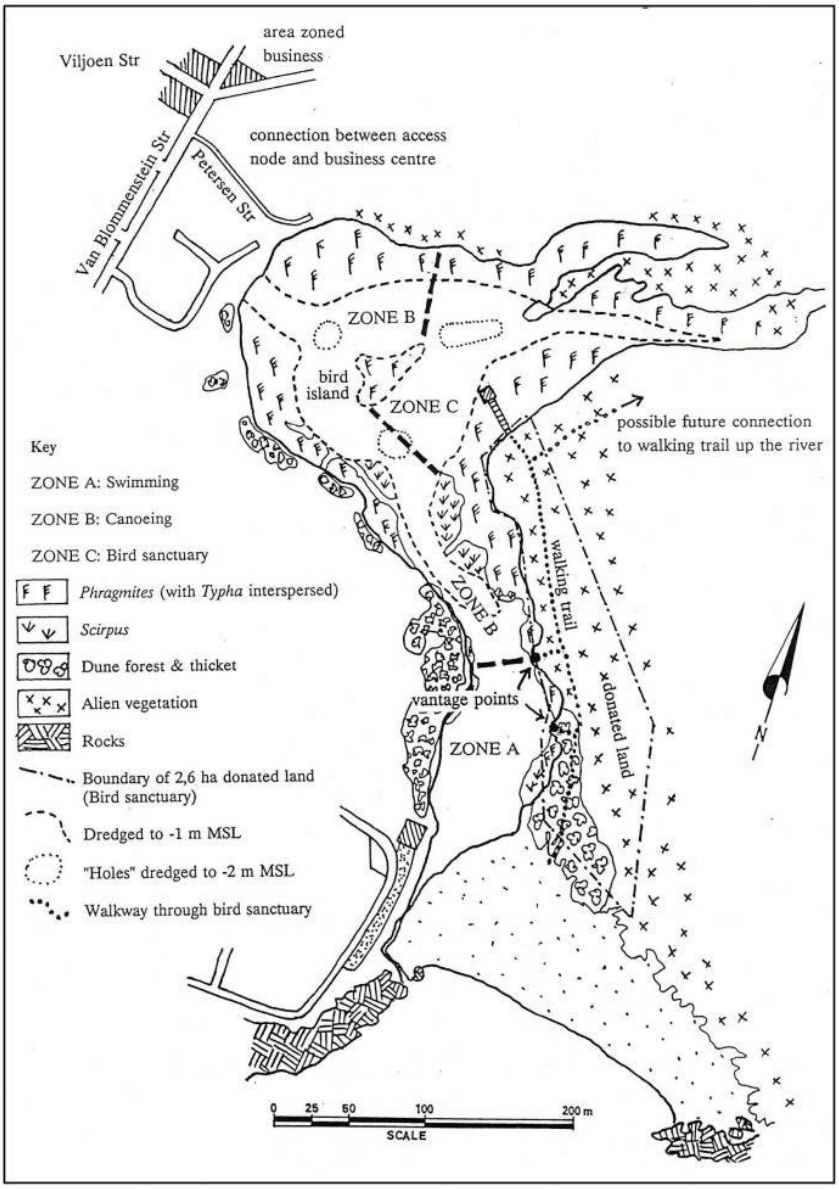


Figure 9: Zonation plan proposed by the CSIR for the implementation after dredging of the Onrus River estuary in 1993 (CSIR, 1993).

Reed removal and maintenance activities

Application of herbicide as a follow up treatment

- There are two herbicides are recommended: Glyphosate (Roundup and Mamba 360 SL) and Triclopyr (Confront 360 and Garlon 3A) which are commercially available and known to control *P. australis* effectively when used properly (see Section 2.1.1 for more detail);
- Additional to the abovementioned herbicides, the 'Problem riparian and aquatic vegetation management guide for estuarine systems in the Western Cape' (Anchor Environmental, 2012) provides the Department of Water Affairs recommended herbicides and the application thereof to control *P. australis* in watercourses, which can also be used should the above mentioned herbicides not be available;
- Improper use of the herbicides may harm fish and macro invertebrates and therefore **label instructions may not be exceeded due to negative impacts on surrounding flora and fauna;**
- The chosen herbicide must be registered for use in aquatic environments, as an unregistered product may have detrimental impacts to the aquatic environment;
- No application of herbicide may occur during amphibian breeding season, or when eggs and tadpoles are present;
- During the application process, herbicide may only be mixed in the contractor laydown area and spray drift and herbicide run-off must be kept to a minimum;

Two types of applications are noted to be the most effective for the treatment of *P. australis (*the ideal application method must be prescribed by the packaging of the chosen herbicide*):*

(1) 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).

(2) 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)

Timeframes / Project Phase	Planning Phase	**Rehabilitation Phase**	Post Rehabilitation	
Parties Responsible (where applicable):	**Proponent**	**Project Manager**	**ECO**	**Contractor**

- Reed cutting, and rhizome and sediment removal activities must be undertaken via manual labour only (as described in Section 2.1 and in the above table);
- Reed shoots must be cut at ground level across the three zones identified in Figure 4, thus below the water surface in the waterlogged zone;
- Preferably only *Phragmites australis* and *Typha capensis* reed species may be cut. All though *Typha capensis* is not as prevalent as *Phragmites australis* in the Onrus River, it can become equally invasive. Considering the difficulty to single out *Phragmites australis* when *Typha capensis* is in a reed stand, both these species may be cut. It is also acknowledged that other species such as *Schoenoplectus* species is also prevalent in between *Phragmites australis* stands, thus total avoidance of other indigenous reeds or sedges is not possible, however effort should be made to avoid cutting other species as much as possible;
- The cut reeds, removed rhizomes and sediment must be stockpiled and disposed of as described in Section 2 taking the recommended stockpile areas as per Figure 5 into consideration; and
- Should it be required that the reeds be removed on an annual basis, this plan and control measures as mentioned above need to be applied. This method must be repeated preferably during the same period as the first cut treatment, and the same areas must be cut. The access ways/walk paths (as per Figure 5) used to access the cut sites must be used to prevent any disturbance to other riparian areas.

Reed removal and maintenance activities				
Timeframes / Project Phase	**Planning and Construction Phase**		**Rehabilitation**	**Post Rehabilitation**
Parties Responsible (where applicable):	**Proponent**		**ECO**	
• All reed cut sites must be inspected quarterly, to monitor any alien or invasive species establishment in the cut sites. If such species are identified, they must be manually removed from site and disposed of at a registered disposal facility. These species may not be stockpiled or burned on site, or in the area surrounding the river; • One year after the cutting of the reeds, upon visual inspection of the reeds, their abundance and coppicing post initial cut activities, it can be decided if a second cut cycle will be implemented. It is highly recommended that the cut activities be repeated as per the method and control measures above. This will promote a higher success rate to reduce the abundance and surface area of the reeds in the estuary in the long term; • If erosion is noted in the estuary after the reed cutting activities, specifically where the access paths are in close proximity to the river embankment, suitable riparian vegetation must be established in these areas to prevent any further erosion and sedimentation of the estuary; • During a flood event, the flood regime of the river and estuary must be visually monitored to ensure ongoing hydrological functioning of the river and estuary, and that sufficient scouring occurs to periodically open the mouth (which would be a natural occurrence during high flood events).				

6 MONITORING PLAN

Prudent monitoring of the Onrus River estuary and its buffer zones is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage water resource related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed. It is important to note that this report considers the aspects associated with the reed removal activities only. The recommended monitoring actions can be combined with surveys of the reed-edge changes if and when it's undertaken by the responsible party, however the frequency of monitoring recommended must be adhered to.

Table 7 below illustrates data capturing for the monitoring plan. This monitoring plan must be implemented by a competent authority/person and the findings are to be submitted to the responsible authority for evaluation.

Table 7: Monitoring actions for the reed removal activities in the Onrus River estuary.

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting	Report Content	Equipment
***Phragmites australis* density and abundance**	All cut sites	Every three months after the initial cut activities, for a year utilising fixed point photography.	Outcome of the monitoring must be reported in that months monitoring report compiled by the appointed ECO (if applicable) or reed-clearing coordinator after the first reed cut activities. Should follow up reed cutting commence in the following year, the above reporting frequency must be repeated.	1. Discuss the density of reed species; 2. Fixed point photo (Taking a photo at specific point within priority area to show effect of regrowth); and 3. Map indicating where regrowth occurred.	1. GPS 2. Field Form 3. Camera
Erosion Control	Walk paths/access ways	Monitoring of erosion and sedimentation should occur during the rehabilitation phase, after every rainstorm and / flood, and for the post rehabilitation phase, after each significant rainfall event.	1. After every major rainstorm and / flood. 2. Monthly monitoring report compiled by the appointed ECO (if applicable) or reed-clearing coordinator after during the rehabilitation phase. Biannually for 3 years post-rehabilitation activities.	1. Brief indication of the method of assessment; 2. Assumptions and Limitations must be listed; 3. Photos and GPS point locations taken of existing erosion in the estuary and buffer zones prior to and post rehabilitation must be incorporated into the report. 4. Any erosion observed must be discussed in detail; 5. Map indicating where erosion is present; and 6. Recommended mitigation and remediation actions should be presented.	1. GPS 2. Camera 3. Field Form 4. Measuring tape
Alien Vegetation Control	Any footprint areas established as part of the reed removal activities.	1. Monitoring will be done during and after growing season; 2. Regrowth of alien vegetation should be monitored monthly during the rehabilitation phase; and 3. Monitoring must be done annually post-rehabilitation until indigenous basal cover has re-established.	1 Monthly monitoring report must be compiled by the appointed ECO (if applicable) or reed-clearing coordinator after during the rehabilitation phase and alien vegetation reported on at least quarterly. 2. Post-rehabilitation an annual report must be developed for three years following the completion of the reed removal activities or until indigenous basal cover has re-established.	4. Provide a list of species occurring within and within close proximity to the Onrus River estuary; 5. Discuss the density of species; 6. Fixed point photo (Taking a photo at specific point within priority area to show effect of alien vegetation control.); and 7. Map indicating where alien vegetation is present.	1. GPS 2. Field Form 3. Camera

7 CONCLUSION AND RECOMMENDATIONS

This WRMP includes suitable management and monitoring measures to effectively manage, maintain and improve the ecological characteristics of the Onrus River estuary where the removal of the *Phragmites australis* reed is recommended. Rehabilitation impacts are applicable to areas where impact avoidance is 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 ecological state.

The measures as set out in this report are deemed sufficient to guide the necessary rehabilitation of all areas affected by the proposed reed removal activities, to a point where the Onrus River estuary will not be impacted any further.

The information gathered through monitoring programs such as that defined in this plan, will assist in a better understanding of the ecology of the area and ensuring proactive management of risks to the receiving environment. All measures as stipulated in this report are considered to be in compliance with the conditions and aspects as stipulated in Government Notice 509 of 2016, as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as well as the National Environmental Management Act, 1998 (Act No. 107 of 1998).

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ANNEXURE A – 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 Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
The National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA)	The National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act, 1998 (Act No. 36 of 1998) (NWA)	The National Water Act, 1998 (Act No. 36 of 1998) (NWA) 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).
National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)(ICMA)	Coastal set-back lines or coastal management lines are prescribed boundaries that indicate the limit of development along ecologically sensitive or vulnerable areas, or an area where dynamic natural processes pose a hazard or risk to humans. The 'National Guideline Towards the Establishment of Coastal Management Lines' document as provided by the Department of Environmental Affairs (2017) provide guidance to Lead Agencies of Coastal Provinces on the establishment of Coastal Management Lines by the Members of Executive Council (MECs). In accordance with National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)(ICMA), Section 25 of the ICMA states: **25. Establishment of coastal management lines** (1)An MEC must by notice in the Gazette establish or change coastal management lines- (a) to protect coastal public property, private property and public safety; (b) to protect the coastal protection zone; (c) to preserve the aesthetic values of the coastal zone; or (d) for any other reason consistent with the objectives of this Act. (1A) An MEC may, in regulations published in the Gazette, prohibit or restrict the building, erection, alteration or extension of structures that are wholly or partially seaward of a coastal management line. (1B) When establishing coastal management lines in terms of subsection (1), the MEC must consider the location of immovable property and the ownership and zonation of vacant land. (2) Before making or amending a notice referred to in subsection (1), or making the regulations referred to in subsection (1A), the MEC must-

	(a) consult with any local municipality within whose area of jurisdiction the coastal management line is, or will be, situated; and (b) give interested and affected parties an opportunity to make representations in accordance with Part 5 of Chapter 6. (3) A local municipality within whose area of jurisdiction a coastal management line has been established must delineate the coastal management line on a map or maps that form part of its zoning scheme in order to enable the public to determine the position of the coastal management line in relation to existing cadastral boundaries. (4) A coastal management line may be situated wholly or partially outside the coastal zone. (5) The Minister, after consultation with the relevant MEC, must exercise the powers and perform the functions granted to the MEC in this section, if such power relates to any part of an area that- (a) is a national protected area as defined in the Protected Areas Act; (b) straddles a coastal boundary between two provinces; or (c) extends up to, or straddles, the borders of the Republic.
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.
National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA)	The objectives of this act are (within the framework of NEMA) 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 the benefits arising from bio prospecting involving indigenous biological resources; ➢ To give effect to ratify international agreements relating to biodiversity which are binding to the Republic; ➢ To provide for cooperative 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 the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the 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) Specimens of an alien species; or c) A specimen of a listed invasive species without a permit.
National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (Alien and Invasive Species Regulations, Notice number 864 of 29 July 2017 in Government Gazette 40166)	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 aims 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, 2017): ➢ **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; and ➢ **Category 3**: Ornamentally used plants that may no longer be planted.

ANNEXURE B – 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.

ANNEXURE C – BIRD BREEDING SCHEDULE

A bird breeding schedule listing the local, reed nesting bird species in the Onrus River estuary is provided. Cognisance of bird breeding times must be taken when scheduling reed clearing activities.

Please note that the list as provided in this section was provided by OREF, and is not the scope of work to verify this data nor the speciality of the writer of this report to do so.

OREF: BIRD BREEDING SCHEDULE

ONRUS RIVER ESTUARY: WATER BIRDS - TAKEN FROM OLM EMP SRA

ALL BREEDING WATER BIRDS THAT NEST IN REEDS

None of these birds appear on the Endangered Species List of BirdLife Africa

SPECIES - Common Name	BREEDING STATUS	BREEDING SEASON	REED NESTING	J	F	M	A	M	J	J	A	S	O	N	D
Bishop, Southern Red	RESIDENT	JULY-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Bishop, Yellow or Cape	RESIDENT	AUG-NOV	YES	J	F	M	A	M	J	J	A	S	O	N	D
Bittern, Little	RESIDENT	JUNE-FEB	YES	J	F	M	A	M	J	J	A	S	O	N	D
Coot, Red Knobbed	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Cormorant, Reed	RESIDENT	JULY-APRIL	YES	J	F	M	A	M	J	J	A	S	O	N	D
Crake, Black	RESIDENT	OCT-MARCH	YES	J	F	M	A	M	J	J	A	S	O	N	D
Darter, African	RESIDENT	SEPT-JAN	YES	J	F	M	A	M	J	J	A	S	O	N	D
Duck, Maccoa	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Duck, White-faced	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Duck, Whitebacked	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Duck, Yellow-billed	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Egret, Cattle	RESIDENT	AUG-FEB	YES	J	F	M	A	M	J	J	A	S	O	N	D
Egret, Little	RESIDENT	AUG-JAN	YES	J	F	M	A	M	J	J	A	S	O	N	D
Egret, Yellow-billed	RESIDENT	SEPT-FEB	YES	J	F	M	A	M	J	J	A	S	O	N	D
Goose, Spur-winged	RESIDENT	AUG-OCT	YES	J	F	M	A	M	J	J	A	S	O	N	D
Grebe, Little	RESIDENT	AUG-FEB	YES	J	F	M	A	M	J	J	A	S	O	N	D
Harrier, African Marsh	RESIDENT	JUNE-NOV	YES	J	F	M	A	M	J	J	A	S	O	N	D
Heron, Purple	RESIDENT	OCT-MARCH	YES	J	F	M	A	M	J	J	A	S	O	N	D
Moorhen	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Night-Heron, Black-crowned	RESIDENT	AUG-MARCH	YES	J	F	M	A	M	J	J	A	S	O	N	D
Rail, African	RESIDENT	JAN-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Swallow, Barn	MIGRANT(NON-Breed)	SEPT-APRIL	ROOSTS	J	F	M	A	M	J	J	A	S	O	N	D
Swamphen, African Purple	RESIDENT	SEPT-JAN	YES	J	F	M	A	M	J	J	A	S	O	N	D
Teal, Cape	RESIDENT	JAN-OCT	YES	J	F	M	A	M	J	J	A	S	O	N	D
Teal, Red-billed	RESIDENT	JUNE-NOV	YES	J	F	M	A	M	J	J	A	S	O	N	D
Warbler, African reed (marsh)	MIGRANT (Breeding)	SEPT-NOV	YES	J	F	M	A	M	J	J	A	S	O	N	D

SPECIES - Common Name	BREEDING STATUS	BREEDING SEASON	REED NESTING	J	F	M	A	M	J	J	A	S	O	N	D
Warbler, Cape Reed	RESIDENT	SEPT-DEC	YES	J	F	M	A	M	J	J	A	S	O	N	D
Warbler, African sedge	RESIDENT	SEPT-NOV	YES	J	F	M	A	M	J	J	A	S	O	N	D