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The National Estuarine Management Protocol (the Protocol), promulgated in May 2013 under the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008, as amended by Act No. 36 of 2014), sets out the minimum requirements for individual estuarine management plans.

In 2014, a review was conducted by the National Department of Environmental Affairs: Oceans and Coasts (DEA, 2014) on existing estuarine management plans to ensure, *inter alia*, the alignment of these plans with the Protocol.

This revision of the Groot Berg River Estuarine Management Plan, including the Situation Assessment Report and the Management Plan itself, is in response to the comments received during the DEA review process only, to ensure compliance with the minimum requirements for EMPs as per the Protocol. In summary, this entailed:

- Including the outcomes of the Resource Directed Measures and opportunities for socio-economic development in the Situation Assessment Report;
- Including a specific sub-section on conservation/protection legislation and management initiatives;
- Updating the terminology as per the Protocol;
- Including a summary of the Situation Assessment;
- Including a map of geographical boundaries based on Estuarine Functional Zone;
- Updating the management objectives and activities to include those related to management of agriculture;
- Extending the monitoring plan to explicitly include a performance monitoring plan to gauge progress towards achieving EMP objectives (i.e. using performance indicators);
- Including a description of institutional capacity and arrangements to manage elements of EMP provided as per the Protocol.

The work of the original authors and input received from stakeholders remains largely unchanged. Historical information and data remains relevant and critically important for estuarine management in the long term and must be updated when new information becomes available. This revision does not represent, or replace, the full five-year review process required to re-evaluate the applicability of the plan and to provide new information. This full review process is therefore still urgently required and should be part of a future revision. Nonetheless, this EMP must be considered a living document that should be regularly updated and amended as deemed necessary.

EXECUTIVE SUMMARY

Introduction

Estuaries are recognised as particularly sensitive and dynamic ecosystems, and therefore require above-average care in the planning and control of activities related to their use and management. For this reason, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), via the prescriptions of the National Estuarine Management Protocol (the Protocol), require Estuary Management Plans to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management.

The Groot Berg River estuary, more commonly known as the Berg estuary, is one of 279 functional estuaries in South Africa (Turpie 2004) and one of 4 permanently open estuaries on the west coast (Whitfield 2000). It is the one of the largest estuaries in the country, with a total area of 61 km². The estuary is one of the most important in the country in terms of its conservation value. The extensive floodplain that surrounds the middle and upper reaches of the system make it unique in the South-Western Cape. It has been identified as an Important Bird Area (Barnes 1998) and a desired protected area in the conservation planning assessment conducted for C.A.P.E. (Turpie & Clark 2007) as well as in other studies (e.g. Turpie et al. 2002; Turpie 2004). However, mounting pressures could reduce this value, as water abstraction and pollution degrade estuary condition, fish stocks are affected by small-scale fishing, and demand for development increases on the West Coast.

This document is a Management Plan for the Groot Berg River estuary. It was originally developed under the auspices of the Cape Action Plan for the Environment (C.A.P.E.) Estuaries Management Programme. The main aim of this programme was to develop a conservation plan for the estuaries of the Cape Floristic Region (CFR), and to prepare individual management plans for as many estuaries as possible. This current revision of the Draft Groot Berg River Estuarine Management Plan (EMP), including the Situation Assessment and the Management Plan itself, is in response to a review conducted by the National Department of Environmental Affairs: Oceans and Coasts in 2014, to ensure compliance with the minimum requirements for estuary management plans as per the Protocol.

Situation Assessment

The Groot Berg River estuary is located approximately 130 km north of Cape Town on the West Coast of South Africa. Based on the extent of tidal influence, the estuary is estimated to be 65 km long, although seawater does not penetrate this far upstream regularly. The main channel at Veldrif is about 100-200 m wide, becoming progressively narrower and shallower upstream. Depth is about 3-5 m on average, but extends up to 9 m in places. The total volume of the estuary is estimated to be about 12 Mm³. The catchment lies entirely within the Western Cape Province which receives most precipitation during the winter rainfall season. Three major dams have been built in the

catchment, including the Wemmershoek Dam (surface area = 3 km² storage capacity = 66 Mm³/a), the Voëlvlei Dam (surface area = 15 km², storage capacity = 170 Mm³/a), and the recently (2008) completed Groot Berg River Dam (storage capacity = 130 Mm³/a, surface area = 488 ha). Numerous smaller farm dams are also found throughout the east part of the catchment. The present-day annual runoff of the Groot Berg River is estimated to be around 682 Mm³/a, about 35% lower than under natural conditions.

The total population living within the Groot Berg River catchment was estimated at 369 282 in 1995, most of which (79%) is found in urban areas. Agriculture (livestock farming, plantation forestry, grain and fruit farming), commercial industries, residential development and nature conservation are the main land use activities in the catchment. Alien vegetation also occupies a large portion (13%) of the total catchment area, with natural vegetation accounting for only 2% of the total area. Economic activities associated with the estuary have historically been fisheries-based (commercial fishing, fish processing factories and boat repair facilities) but have recently expanded to include tourism and recreation. The estuary is considered a premier bird watching destination and recreational fishing remains a strong draw card. Cerebos and smaller commercial salt works generate further income in the area. In 1997, the Gross Domestic Product for the catchment was R12 billion, equivalent to 2.5% of the national GDP.

The Groot Berg River estuary mouth is stabilized between concrete breakwaters and dredged and therefore remains permanently open. Freshwater flow to the estuary varies from around 1.5 m³.s⁻¹ in summer (Nov-Feb) to 35 m³.s⁻¹ in winter (May-Aug), but reaches between 90 to 600 m³.s⁻¹ when in flood. Saline seawater penetrates the estuary up to at least 40 km from the mouth during the summer low-flow period, but freshwater inflow to the estuary during winter is sufficient to push the salt water back to within 10 km of the mouth. Estuarine waters are well-oxygenated throughout the year, but are slightly more oxygen rich in winter than summer. Temperature is fairly uniform along the estuary during winter, typically 12-15°C, but tends to be warmer in the upper reaches during summer (typically above 20°C). The lower reaches remain cool during summer due to upwelling at sea. Nutrients enter the estuary with both the sea and the river, with sea inputs dominating in summer (low flow season), and river inputs dominating in winter (high flow season). Nutrient inputs from the sea have changed little over time but inputs from the catchment have escalated dramatically in recent decades as a result of agricultural inputs and runoff.

Vegetation of the estuary can broadly be grouped into four types: (1) Macroalgae (*Enteromorpha* sp.) which forms extensive mats that cover sand and mud flats in the lower reaches of the estuary, and is a source of concern owing to the impacts on invertebrate populations and their predators (birds). (2) Submerged macrophytes comprise eelgrass (*Zostera capensis*), which forms dense beds in the lower reaches and provides important habitat for juvenile fishes, and fountain grass (*Potamogeton pectinatus*), which occurs in low densities in the upper reaches. (3) Salt marsh, which is also concentrated in the lower reaches and on the floodplain, and contributes to system productivity and biotic diversity, providing important feeding areas, habitat and shelter for numerous invertebrate and birds. (4) Reeds and sedges, which are not able

to tolerate high salinity, occur in abundance in the middle and upper reaches of the estuary.

The invertebrate community of the Groot Berg River estuary comprises zooplankton species that live in the water column and the benthic species that live in and on the sediments. These invertebrate communities are characterised by high abundance relative to other South African estuaries, and high species richness for the west coast, where diversity is usually fairly low. A total of 35 fish species from 30 families have been recorded in the Groot Berg River estuary, of which 17 (48%) can be regarded as either partially or completely dependent on the estuary for their survival. These include some highly valuable species such as white steenbras and elf, as well as lower value species such as harders. The Groot Berg supports the highest recorded density of shorebirds on the West Coast of Africa, and supports nationally important populations of several species. Some 92 waterbird species have been regularly recorded over the past 10 years, with an average of about 60 species being recorded on the estuary at any one time. An average of 14 000 non-passerine waterbirds are typically recorded in mid-summer counts, this number decreasing to about 12 300 in mid-winter.

The Present Ecological State of the Groot Berg River estuary is a Category C, which infers a moderately modified system, and it is likely that the estuary is on a negative trajectory of change, because of the extremely low flows under the present state.

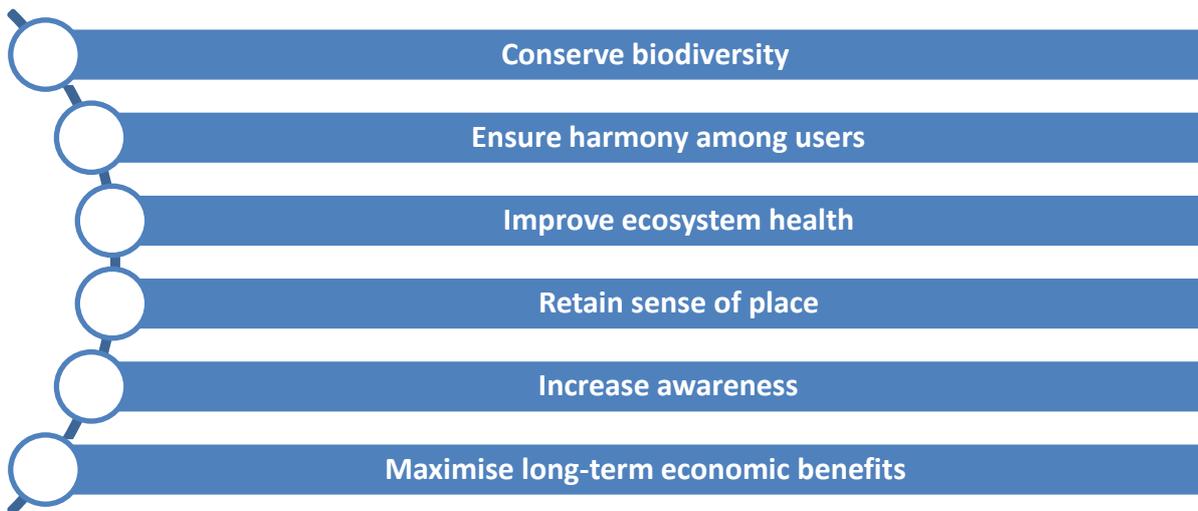
Vision and Objectives

A vision is a high level statement which defines the strategic intent of a management intervention. The following vision was developed and agreed upon at successive stakeholders meeting held in Veldrif in October and November 2008:

“The Groot Berg estuary is a wetland of global conservation significance that provides recreational, social and economic benefits through a balance between sustainable use, conservation and development.”

Key management objectives for the Groot Berg River estuary were identified and agreed upon at a successive stakeholder workshops held in Veldrif in October and November 2008. These objectives are seen to reinforce all other objectives and none are seen as being of greater importance than any other.

The corresponding key objectives have been identified as the corner stones to the achievement of the Vision are:



Spatial Zonation

A process of revising the zonation of the Groot Berg River estuary has commenced, and it has been proposed that portions of the lower estuary be demarcated as a Special Management Area in terms of the ICM Act. This Special Management Area would be zoned in such a way as to satisfy the many conflicting requirements of the different user groups and stakeholders who wish to enjoy the benefits provided by the estuary. Zonation will allow for partitioning of activities within the estuary, thus permitting their co-existence without one activity precluding or conflicting with another. It will also reduce management costs as it will focus activities in particular geographic areas and hence eliminate the need to always deploy management staff across the whole estuary.

The proposed Special Management Area extends from the mouth up to the Kersefontein Bridge (45 km upstream) and includes the banks of the estuary where sensitive and conservation worthy estuarine vegetation occurs. The special management area is divided into four zones as follows:

Zone 1:

Includes the Old Mouth Lagoon. This area harbours large beds of eelgrass (*Zostera*), is an important area for invertebrates (bait species), fish and birds.

Zone 2:

Includes intertidal salt marsh areas adjacent to the Port Owen Marina, the Cerebos salt works and the Riviera Hotel. Salt marsh vegetation is very sensitive to damage from trampling and is an important roosting area for water birds.

Zone 3:

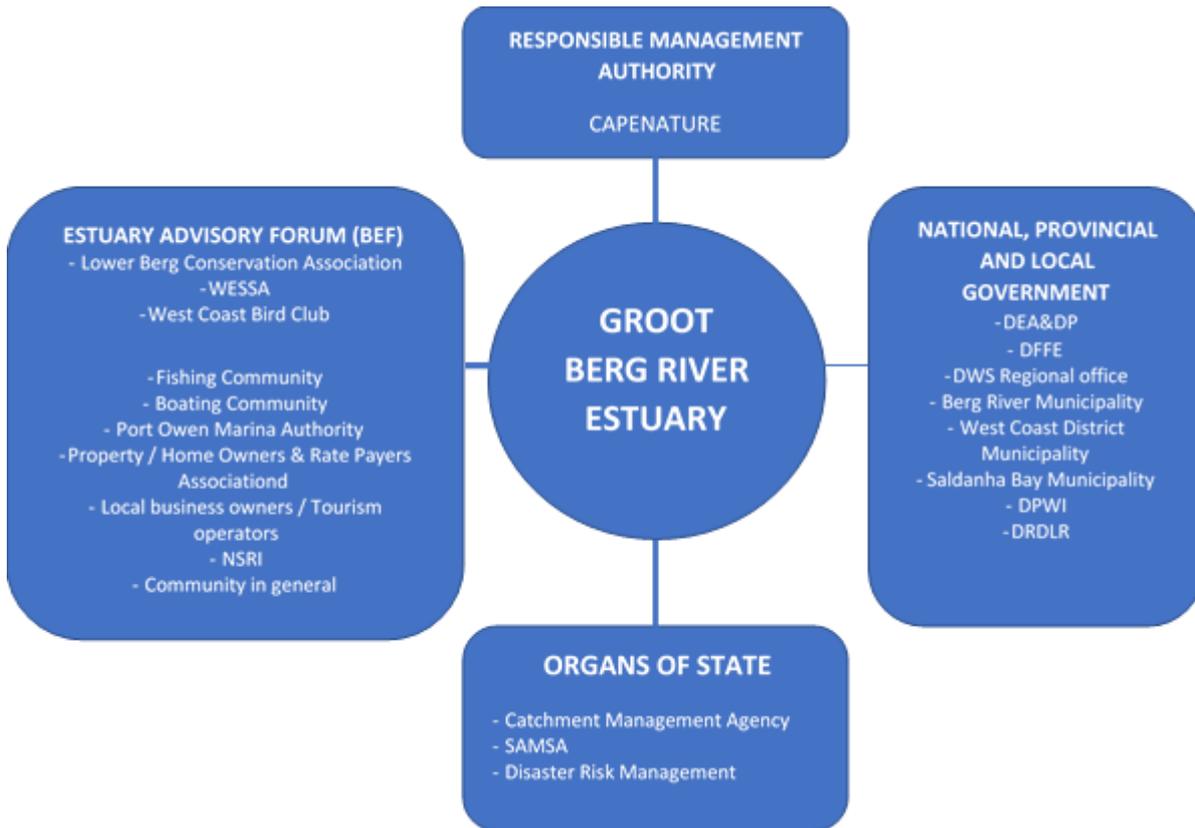
Includes the whole of De Plaet and the adjacent salt marsh and reed marsh habitats. This area harbours large beds of eelgrass (*Zostera*), is an important area for invertebrates

(bait species), and is an extremely important foraging area for water birds and waterfowl.

Zone 4:

Includes supratidal salt marsh, and reed and sedge marsh areas between the railway bridge and the Hopefield road bridge. This vegetation is sensitive to trampling and grazing by livestock and is a very important winter feeding ground for wading birds and waterfowl.

Institutional Arrangements



The Protocol identifies CapeNature as the Responsible Management Authority responsible for the development of the Groot Berg River EMP as well as being responsible for the co-ordination of its implementation (see the above diagram). This implementation function can be effected through a range of different forums and actors.

According to the Protocol, the role of existing Groot Berg River Estuary (Advisory) Forum (BEF) is interpreted as providing an advisory service to the RMA on issues specific to the management and implementation of the EMP, as well as being the hub that links all stakeholders, which serves to foster stakeholder engagement and to facilitate the implementation of the project plans identified. The broader community will be able to voice concerns and raise issues via the BEF. This includes Ratepayers' Associations, NGO's, community groups, conservancies, etc., as well as representatives from

surrounding industry and agriculture. Any representatives are obliged to raise issues identified by their constituents and to provide feedback to the constituents. Importantly, the BEF will not represent or supplant the individual positions of its members unless specifically mandated to do so.

The successful implementation of the EMP may be seen as also dependent on the contribution of a number of governmental role players, including:

- Western Cape Government departments: Responsible for legislative support, including compliance, funding, research and monitoring;
- Municipalities, including Groot Berg Municipality, Saldanha Bay and West Coast District Municipality: Responsible for legislative support and funding;
- Relevant National government departments, especially Department of Environmental Affairs, Department of Water and Sanitation (via the regional office), Department of Environment, Forestry and Fisheries, Department of Agriculture, Land Reform and Rural Development;
- Organs of State (SANparks, CapeNature, BGCMA).

The National Department of Environmental Affairs is generally responsible for national standardisation of estuarine management and approval of provincially-compiled estuarine management plans. Direct involvement in individual estuaries, such as the Groot Berg, will occur via existing forums for intergovernmental coordination. These forums will have the management of the Groot Berg River estuary on their agendas from time to time, and include:

- Western Cape Provincial Coastal Committee: Responsible for facilitating co-management, effective governance and provincial co-ordination of estuarine management;
- West Coast District Municipal Coastal Committee: Responsible for facilitating co-management and effective governance.

Management Objectives

Six project plans have been compiled for the efficient and effective management of the Groot Berg River Estuary. Each plan corresponds to a key objective and contains applicable management actions, supporting regulations, level of priority, responsible institution(s), and required resources if such information is available. These are arranged in general order of priority, but nevertheless recognize that the neglect of any leg will compromise overall success:

- Protect biodiversity and sense of place
- Cooperative and effective governance
- Restoration of estuary health
- Research and monitoring
- Increase public awareness
- Promoting ecotourism and livelihood opportunities

It should be noted that there is some interconnectedness between the plans and some management actions, as they all ultimately contribute to the conservation of ecosystem function and patterns of biodiversity, which in turn leads to the conservation of a sustained supply of ecosystem goods and services delivered by the estuary.

The table below provides a summary of the Management Objectives per priority area as part of the Performance Monitoring Plan:

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	TIMING	LEGISLATION	RESPONSIBILITY
1. Protection of biodiversity and sense of place				
a. Establish a Special Management Area (SMA)	Lower Groot Berg River estuary receives formal protection as a SMA	Once a year	ICM Act NEM:PAA	RMA, CapeNature, DEA
b. Integrate into IDP/SDF	EMP is reflected in the local/district and coastal management line is gazetted	Every IDP/SDF review cycle	ICM Act MSA	Groot Berg River LM
c. Zonation plan	Boating and other estuary uses occur only within the designated zones	Every 5 years	ICM Act, Seashore Act, MSA	Groot Berg River LM, West Coast DM
d. Ramsar Status	Groot Berg River estuary receives global recognition as a Ramsar site	Assess progress every year	RAMSAR NEM:PAA	DEA, CapeNature.
e. CWCBR Core area	Groot Berg River estuary redefined as core area within CWCBR	Assess progress every year	NEM:PAA	RMA, CWCBR
f. Ensure sustainable use of estuary resources	Improvements in ecological health indices Number of permits issued Number of infringements reduced Increase in number of patrols and inspections	Ongoing for compliance personnel, daily patrols & inspections	MLRA	DEFF, CapeNature
2. Co-operative and effective governance				
a. Appoint Berg Estuary Forum	Confirmed members & constituted BEF	End of 1st year	ICM Act	CapeNature
b. Define co-operative governance arrangements	Confirmed roles & responsibilities of participating agencies	Assess every 2 years	ICM Act, NEM:PAA	BEAF, CapeNature, Groot Berg River LM, DEA, DWS
c. Secure financing	Funding is secured for next 5 years	Assess twice a year	ICM Act, NWA, CARA, MSA	Berg River LM, Key partners
d. Provide resources and capacity	Office space obtained and adequately equipped, manned by knowledgeable and well-trained permanent staff	Assess twice a year		RMA, DEA&DP, Key partners
3. Restoration of estuary health				
a. Secure freshwater input	Ecological health Category of C is achieved and maintained	Biannual for DWS	NWA	RMA, Berg River LM, DWS, BEAF,
b. Remove obstructions to flow and clear alien vegetation	All obstructions removed Increased number of tons removed/ hectares cleared	Ad hoc visual monitoring during normal daily activities	CARA	RMA, Berg River LM,, BEAF, DEFF

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	TIMING	LEGISLATION	RESPONSIBILITY
c. Eliminate illegal fishing	Increase in fish abundance and nursery function	Ad hoc visual monitoring during normal daily activities	MLRA	DEFF, CapeNature
d. Promote sustainable agriculture	Improvement in estuary nutrient status Degraded areas recovered Cooperative governance with local communities	Twice a year	CARA, NWA	DALRRD, DWS, CapeNature
4. Research and monitoring				
a. Promote scientific research	Increase in number of research projects and monitoring programmes	Once a year		RMA, DEFF, BEAF, CapeNature
b. Monitor estuary health	Ongoing databases and reports produced	Biannual for DWS Monthly for BEF	NWA	RMA, Berg River LM, DWS, CMA, BEAF
c. Monitor human use	Ongoing databases and reports produced	Ad hoc visual monitoring during normal daily activities	MLRA	RMA, Berg River LM,, BEAF,
5. Increasing public awareness				
a. Create mechanisms for communication with stakeholders	Widespread and effective communication to a diversity stakeholders who are well informed through their preferred method of communication	Once a year	ICM Act	RMA, Berg River LM,, BEAF,
b. Develop education and awareness programme	Visitor center open to public Increase in number of newsletters, pamphlets, and posters; Sufficient number of public notice boards; Increase public participation in coastal/estuary/river clean ups and other initiatives. Increase in number of visiting school groups to visitor center	Quarterly	ICM Act	RMA, Berg River LM,, BEAF,
6. Maximising economic benefits & promoting ecotourism				
a. Establish and manage visitor facilities	Increase in number of tourists per year Increase in contribution of tourism to GDP	Once a year		RMA, Berg River LM,, BEAF,
b. Market the Groot Berg River estuary	Increase in number of newsletters, pamphlets, and posters Increase in number of tourists per year Increase in number of employed persons Ongoing provision of employment opportunities	Quarterly		RMA, Berg River LM,, BEAF,

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ABBREVIATIONS & ACRONYMS

amsl	Above mean sea level
BEF	Berg Estuary Forum
C.A.P.E.	Cape Action for People and the Environment
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CFR	Cape Floristic Region
CMP	Coastal Management Programme
CPZ	Coastal Protection Zone
CSIR	Council for Scientific and Industrial Research
DEFF	Department of Environment, Forestry and Fisheries
DEA	Department of Environmental Affairs
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEA: O&C	Department of Environmental Affairs: Oceans & Coasts Branch (formerly MCM)
DEA&DP	Western Cape Government's Department of Environmental Affairs & Development Planning
DM	District Municipality
DWS	Department of Water and Sanitation (formerly DWAF)
EAF	Estuary Advisory Forum
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EMP	Estuarine Management Plan(s)
ERC	Ecological Reserve Category
EZP	Estuary Zonation Plan
ha	hectares
HWM	High-Water Mark
I&AP	Interested and Affected Party
ICM Act	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) as amended
LM	Local Municipality
MCM	Directorate Marine and Coastal Management (
MEC	Member of the Executive Council
MLRA	Marine Living Resources Act (Act No. 18 of 1998) as amended
MSA	Municipal Systems Act (Act No. 32 of 2000)
NBA	National Biodiversity Assessment
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004) as amended
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008) as amended
NEM:PAA	National Environmental Management: Protected Areas Act (Act No.57 of 2003)
NEMA	National Environmental Management Act (Act No. 107 of 1998) as amended
NWA	National Water Act (Act No. 36 of 1998) as amended

RDM	Resource Directed Measures
REC	Recommended Ecological Category
RMA	Responsible Management Authority
SANParks	South African National Parks
The Protocol	National Estuary Management Protocol
TPC	Threshold of Potential Concern

1 INTRODUCTION

1.1 Background

The Groot Berg River estuary is one of 279 functional estuaries in South Africa (Turpie 2004) and one of 4 permanently open estuaries on the west coast (Whitfield 2000). It is the one of the largest estuaries in the country, and one of the most important in the country in terms of its conservation value. It has been identified as an Important Bird Area (Barnes 1998) and a desired protected area in the conservation planning assessment conducted for C.A.P.E. (Turpie & Clark 2007) as well as in other studies (e.g. Turpie et al. 2002; Turpie 2004).

This document is a Management Plan for the Groot Berg River estuary. It was originally developed under the auspices of the Cape Action Plan for the Environment (C.A.P.E.) Estuaries Management Programme. The main aim of this programme was to develop a conservation plan for the estuaries of the Cape Floristic Region (CFR), and to prepare individual management plans for as many estuaries as possible. This Estuarine Management Plan (EMP) has been revised in line with the requirements of the National Estuarine Management Protocol.

1.2 Purpose and scope of the Groot Berg River Estuarine Management Plan

Drawing on the Situation Assessment prepared for the Groot Berg River estuary (Anchor Environmental 2008a), inputs from key stakeholders (Anchor Environmental 2008b – Groot Berg Estuary Management Plan Stakeholder Consultation Report), and other supporting documents prepared for the C.A.P.E. Estuaries Programme (e.g. Turpie & Clark 2007 – Cape Estuaries Classification, Prioritisation, Protection and Rehabilitation report), the Groot Berg River EMP sets out the Vision and Objectives for the Groot Berg River estuary. It also identifies specific Management Objectives needed to meet these objectives, and indicates the main Actions required in the next five years in order to achieve the overall vision. The Groot Berg River EMP focuses on strategic priorities only. While planning for some emergencies, e.g. floods, is part of this plan, it remains possible that unforeseen disasters could disrupt the prioritisation set out here.

A set of management priorities have been identified for the estuary for the next five years, which generally represent sectors of governance (e.g. conservation, water regulation, etc.), and contain management actions to meet the respective objectives. Each management objective will be implemented through a set of management actions and will result in a number of deliverables. A plan of action or implementation is provided for area of priority.

1.3 Legal framework

Chapter 4 of the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), aims to facilitate the efficient and coordinated management of all estuaries, in accordance with:

-
- a) The Protocol (Section 33) approved by the Ministers responsible for the environment and water affairs; and
 - b) Estuarine management plans for individual estuaries (Section 34).

The Protocol, promulgated in 2013, provides a national policy for estuarine management and guides the development of individual EMPs. It must be ensured that the EMPs are aligned with the Protocol and the National Coastal Management Programme (CMP) (DEA, 2014). The Protocol lays out the following:

- a) The strategic vision and objectives for achieving effective integrated management of estuaries in South Africa;
- b) The standards for the management of estuaries;
- c) The procedures regarding how estuaries must be managed and how the management responsibilities are to be exercised by different organs of state and other parties;
- d) The minimum requirements for EMPs;
- e) Who must prepare EMPs and the process to be followed in doing so¹; and
- f) The process for reviewing EMPs to ensure that they comply with the requirements of the ICM Act.

The responsible body contemplated in Section 33(3)(e) who develops an EMP must:

- a) follow a public participation process in accordance with Part 5 of Chapter 6 of the ICM Act; and
- b) ensure that the EMP and the process by which it is developed are consistent with:
 - i) the Protocol; and
 - ii) the National CMP and with the applicable provincial CMP and CMP referred to in Parts 1, 2 and 3 of Chapter 6 of the ICM Act;
- c) If applicable, ensure that relevant legislation is enacted to implement the EMP; and
- d) Submit an annual report to the Minister on the implementation of the EMP, the legislation and any other matter.

One of the pillars of successful integrated coastal (including estuarine) management is the establishment of effective institutional arrangements to underpin both cooperative government and cooperative governance. Cooperative governance is a system that allows government and civil society to communicate and contribute to shared responsibility in respect of coastal management objectives and must be well-organized and widely representative of all coastal stakeholders. The ICM Act details the institutional arrangements that will contribute to cooperative coastal management in South Africa. These arrangements are made at national, provincial and municipal government levels, and the embodiment of cooperative coastal governance is vested in what will be known as coastal committees. The ICM Act provides for the permissive, i.e. if so required, establishment of municipal coastal committees, but at a national and provincial level however, the Minister

¹ The National Estuarine Management Protocol identifies the Groot Berg River Local Municipality as the management authority responsible for developing and co-ordinating implementation of the Groot Berg River Estuarine Management Plan

and MECs of coastal provinces are directed to establish national and provincial coastal committees, respectively. Provincial coastal committees must be established within one year of the commencement of the ICM Act.

The National Coastal Committee (the MINTEC Working Group 7) is established by the Minister, and its powers determined by notice in the Government Gazette. It is supported administratively by the National Department of Environmental Affairs. The Premier of each coastal province must identify a lead agency (organ of state) that is responsible for the coordination, monitoring and implementation of the provincial coastal management programme, monitoring the state of the environment in the coastal zone, and identifying relevant trends and priority issues. The lead agency for coastal management is directly responsible to the MEC. Each metropolitan, district or local municipality which has jurisdiction over the coastal zone may establish a municipal coastal committee. The establishment of Municipal Coastal Committees is discretionary.

The lowest tier of institutional arrangements for estuarine management comprises the RMA and the estuary advisory forums. The role of the estuary advisory forum is to act as the hub or platform which links all stakeholders, including both organs of state and civil society, so as to facilitate cooperative management and effective governance in terms of the EMPs, as well as facilitate and monitor implementation of an EMP. The role of RMA is for developing and co-ordinating implementation of EMPs.

1.4 Mandate and responsibilities of the RMA

In terms of the National Estuary Management Protocol published in terms of the ICM Act the RMA for the Groot Berg River estuary will ultimately be responsible for overall management of the estuary, and will play a co-ordinating role for all other implementing agencies.

The Groot Berg River Estuary stretches from the river mouth at Velddrif to the limit of discernible tidal influence at the Kersefontein bridge (32°54'25.51"S; 18°20'4.10"E) before the Bergrivier station. This is also the point where the body of open water reduces to seasonal wetland which extends into the Saldanha Bay Local Municipality (LM) to the extent of the estuarine functional zone, i.e. the boundary of the estuary as defined by the 5m topographical contour. The one in a hundred-year flood line has been calculated and provides the modelled motivation for this zone. In this instance, the Protocol identifies CapeNature as the management authority responsible for developing and co-ordinating implementation of the Groot Berg River Estuarine Management Plan. The estuary falls within the boundary of two local municipalities (Figure 1) and has been identified as a priority estuary in the Western Cape Protected Areas Expansion Strategy.

However, given the fact that the vast majority of the Groot Berg River estuary falls within the Berg River Local Municipality and for the ease of management planning and co-ordination, it is strongly recommended that the CapeNature co-ordinate with the West Coast DM, the Berg River LM and the Saldanha Bay LM on management of the system. The latter should continue as a strategic partner/key role player in the management of the system.

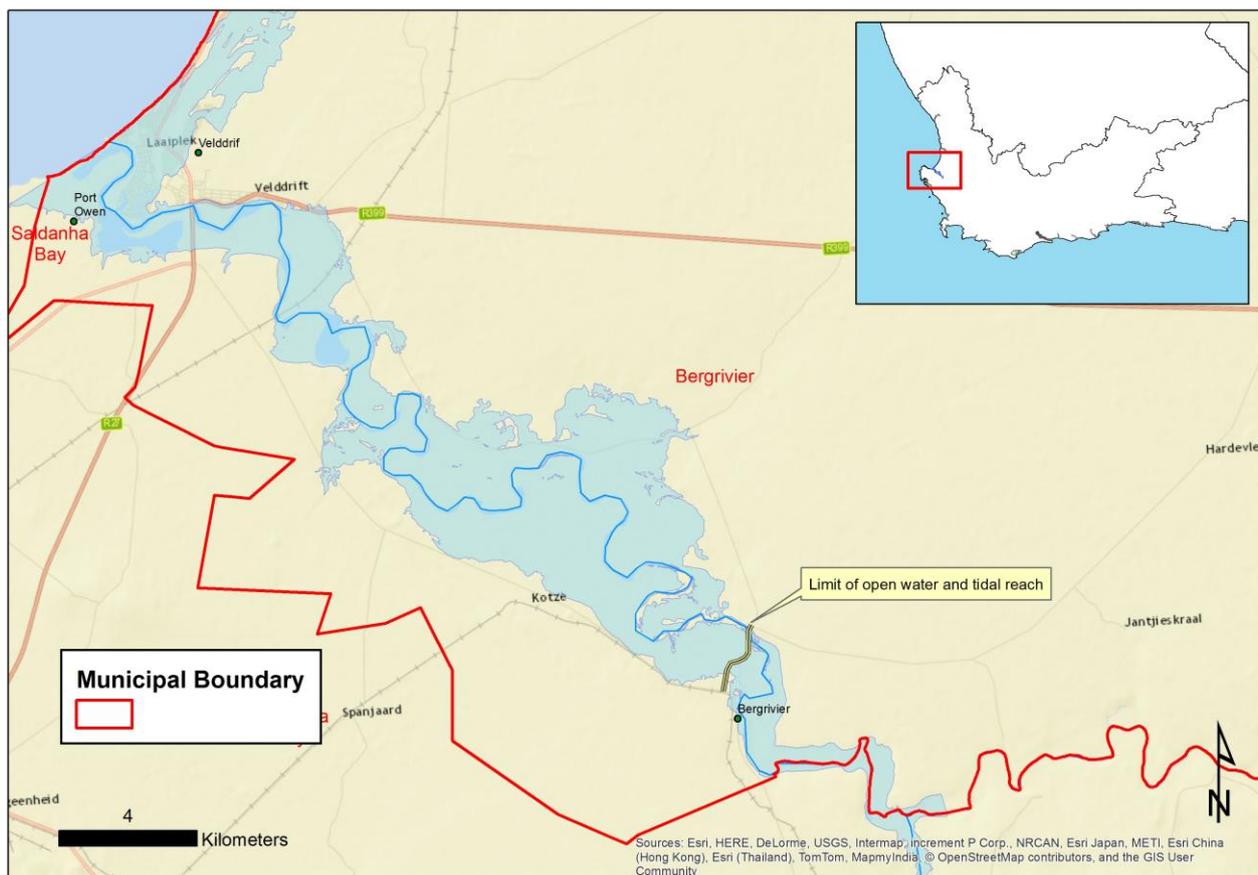


Figure 1: Location of the Groot Berg River estuary within the Berg River Municipality

The RMA is responsible for overall co-ordination of the actions of other implementing agencies, and not the implementation actions themselves. Section 7.3 of the Protocol indicates that:

“...management actions...shall be translated into project plans by the responsible government department that is responsible for certain aspects of estuary management (as per legislative mandates)...”

Specifically, the RMA responsibilities are described by the Protocol as:

Section 5: **“...authorities are responsible for the development of EMPs and coordination of the implementation process...”**

Section 5(e): **“The identified responsible management authority to development the EMP needs to budget accordingly for the development of these plans.”**

Section 8(1): **“The responsible management authority developing an EMP must actively engage all the relevant stakeholders including government departments, non-government organisations and civil society in the development and implementation of the EMP.”**

Section 9.1(1) and 9.2: “...it **must obtain formal approval** for the EMP...” and “Once approved...the EMP shall be... **Integrated..**” and “**incorporated** into into that protected area’s management plan as contemplated in section 39 of NEMPAA.”

The responsible body contemplated in Section 33(3)(e) of the ICM Act who develops an EMP must:

- a) follow a public participation process in accordance with Part 5 of Chapter 6 of the ICM Act; and
- b) ensure that the EMP and the process by which it is developed are consistent with:
 - iii) the Protocol; and
 - iv) the National CMP and with the applicable provincial CMP and CMP referred to in Parts 1, 2 and 3 of Chapter 6 of the ICM Act;
- c) If applicable, ensure that relevant legislation is enacted to implement the EMP; and
- d) Submit an annual report to the Minister on the implementation of the EMP, the legislation and any other matter.

Coordination of the implementation of the actions in this EMP by the RMA, CapeNature, and its strategic partners (Berg River Local Municipality,, Saldanha Bay Local Municipality, Department of Environmental Affairs, West Coast District Municipality, Western Cape Provincial Government, Department of Water and Sanitation, Department of Forestry and Fisheries), will be monitored by a Groot Berg Estuary (Advisory) Forum (BEAF) comprising all key stakeholders on the estuary, using indicators within a set time-frame.

This EMP is a strategic planning document, and as such does not provide detailed, routine planning for the management of the estuary. This detail should be captured by the RMA or assigned representatives, or other responsible agencies, in their annual budget, Plan of Operations, Integrated Development Plan (IDP), Annual Performance Plan (APP) etc. (as applicable) with the management plan forming the platform for more fine-scale planning. CapeNature has developed a Governance Tool to integrate all management objectives, actions, monitoring, and reporting. Furthermore, the NEM: ICM Amendment Act (Act No. 36 of 2014) provides for a report to be submitted to National DEA every two years in respect to implementation once an EMP has been signed off and approved. The EMP should also be recognized as a dynamic document, whereby certain components could be revised as important new information becomes available and management priorities change. Adaptive management should be continually pursued through a process of annually reviewing the progress made in achieving the management objectives. Finally, the management plan should be subject to a comprehensive revision on a five-year cycle, as required by the Protocol.

2 SUMMARY OF SITUATION ASSESSMENT

2.1 Introduction

The Groot Berg River estuary is one of the largest of South Africa's 279 estuaries, with a total area of 61 km². It is one of the most important estuaries in the country from a conservation perspective, particularly in respect of its bird and fish fauna. The extensive floodplain that surrounds the middle and upper reaches of the system make it unique in the South-Western Cape. Mounting pressures are, however, threatening this estuary, including freshwater abstraction and pollution, fishing, housing developments and high intensity recreation. Recognising the importance of the Groot Berg River estuary and estuaries in South Africa more generally, the C.A.P.E. Regional Estuaries Management Programme originally commissioned Anchor Environmental Consultants to prepare a management plan for the Groot Berg River estuary. This appointment included a Situation Assessment as background material for the development of the management plan.

2.2 Geographic and socio-economic context

The Groot Berg River estuary is located approximately 130 km north of Cape Town on the West Coast of South Africa. Based on the extent of tidal influence, the estuary is estimated to be 65-69 km long (approximately to the farm Steenbokfontein at 32°56'34.5"S 18°24'34.5"E), although seawater does not regularly penetrate this far upstream. The main channel at Veldrif is about 100-200 m wide, becoming progressively narrower and shallower upstream. Depth is about 3-5 m on average, but extends up to 9 m in places. The total volume of the estuary is estimated to be about 12 Mm³. The catchment lies entirely within the Western Cape Province which receives most precipitation during the winter rainfall season. Three major dams have been built in the catchment, including the Wemmershoek Dam (surface area = 3 km², storage capacity = 66 Mm³/a), the Voëlvlei Dam (surface area = 15 km², storage capacity = 170 Mm³/a), and the recently (2008) completed Groot Berg River Dam (storage capacity = 130 Mm³/a, surface area = 488 ha). Numerous smaller farm dams are also found throughout the east part of the catchment. The present-day annual runoff of the Groot Berg River is estimated to be around 682 Mm³/a, about 35% lower than under natural conditions.

The lower section of the estuary has been subject to extensive development and anthropogenic impacts. The urban areas of Laaiplek, Port Owen Marina, and Veldrif dominate most of the northern bank of the estuary from the mouth to approximately 9 km upstream. Dredging is periodically undertaken at the Port Owen Marina and the estuary mouth to facilitate the movement of sailing and fishing vessels in and out of the estuary and the marina. The Marina makes a very significant contribution to the total economic value of this area. The history of Port Owen Marina dredging operations spans three decades. In 2000, the Berg River Municipality commissioned Ninham Shand to produce a Scoping Report on the proposed dredging of the Port Owen Marina. This included a Public Participation Process. An authorization was granted by the then Western Cape Department of Environmental and Cultural Affairs and Sport, for a dredging operation that concluded in 2001 and was summarized by Ninham Shand in a final closure report in October 2001 (Mead 2008). During this operation, dredged sediment was pumped to the estuary opposite

the western entrance channel. Most of the dredged material was fine mud that was carried out to sea by the outgoing tide, while the coarser sandy material that remained was re-dredged in the river and transported by pipeline to a disposal site on land (south bank of the estuary opposite the western entrance channel) (Anchor Environmental Consultants, 2019). Appropriate mitigation measures need to be put in place in order to limit the impact of dredging on the Groot Berg estuary.

The total population living within the Groot Berg River catchment was estimated at 369 282 in 1995, most of which (79%) is found in urban areas. Agriculture (livestock farming, plantation forestry, grain and fruit farming), commercial industries, residential development and nature conservation are the main land use activities in the catchment. Alien vegetation also occupies a large portion (13%) of the total catchment area, with natural vegetation accounting for only 2% of the total area. Economic activities associated with the estuary have historically been fisheries-based (commercial fishing, fish processing factories and boat repair facilities) but have recently expanded to include tourism and recreation. The estuary is considered a premier bird watching destination and recreational fishing remains a strong draw card. Cerebos and smaller commercial salt works generate further income in the area. In 1997, the Gross Domestic Product for the catchment was R12 billion, equivalent to 2.5% of the national GDP.

2.3 Ecological characteristics and functioning of the estuary

The Groot Berg River estuary mouth is stabilized between concrete breakwaters and dredged and therefore remains permanently open. Freshwater flow to the estuary varies from around $1.5 \text{ m}^3\cdot\text{s}^{-1}$ in summer (Nov-Feb) to $35 \text{ m}^3\cdot\text{s}^{-1}$ in winter (May-Aug), but reaches between 90 to $600 \text{ m}^3\cdot\text{s}^{-1}$ when in flood. Saline seawater penetrates the estuary up to at least 40 km from the mouth during the summer low-flow period, but freshwater inflow to the estuary during winter is sufficient to push the salt water back to within 10 km of the mouth. Estuarine waters are well-oxygenated throughout the year, but are slightly more oxygen rich in winter than summer. Temperature is fairly uniform along the estuary during winter, typically $12\text{-}15^\circ\text{C}$, but tends to be warmer in the upper reaches during summer (typically above 20°C). The lower reaches remain cool during summer due to upwelling at sea. Nutrients enter the estuary with both the sea and the river, with sea inputs dominating in summer (low flow season), and river inputs dominating in winter (high flow season). Nutrient inputs from the sea have changed little over time but inputs from the catchment have escalated dramatically in recent decades as a result of agricultural inputs and runoff. Total nitrogen concentration at the head of the estuary for example, has increased from less than $300 \mu\text{g/l}$ prior to 1980 (which was roughly equal to the input from the sea) up to almost $2\,000 \mu\text{g/l}$ in 2005.

Phytoplankton communities in the Groot Berg River estuary are typically estuarine, and reflect the prevailing physical conditions. Abundance is highest in winter owing to higher nutrient concentrations at this time of year, and has escalated dramatically in response to increases in nutrient input from the catchment. Average biomass of phytoplankton (measured as Chlorophyll a concentration) has increased from around $1.8 \mu\text{g/l}$ in winter and $0.2 \mu\text{g/l}$ in summer in the 1980s to around $8.2 \mu\text{g/l}$ in winter and $1.2 \mu\text{g/l}$ in summer at present.

Vegetation of the estuary can broadly be grouped into four types: (1) Macroalgae (*Enteromorpha* sp.) which forms extensive mats that cover sand and mud flats in the lower reaches of the estuary, and is a source of concern owing to the impacts on invertebrate populations and their predators (birds). (2) Submerged macrophytes comprise eelgrass (*Zostera capensis*), which forms dense beds in the lower reaches and provides important habitat for juvenile fishes, and fountain grass (*Potamogeton pectinatus*), which occurs in low densities in the upper reaches. (3) Salt marsh, which is also concentrated in the lower reaches and on the floodplain, and contributes to system productivity and biotic diversity, providing important feeding areas, habitat and shelter for numerous invertebrate and birds. (4) Reeds and sedges, which are not able to tolerate high salinity, occur in abundance in the middle and upper reaches of the estuary.

The invertebrate community of the Groot Berg River estuary comprises zooplankton species that live in the water column and the benthic species that live in and on the sediments. These invertebrate communities are characterised by high abundance relative to other South African estuaries, and high species richness for the west coast, where diversity is usually fairly low. The dominant invertebrate species are calanoid copepods *Pseudodiaptomus hessei*, the crown-crab *Hymenosoma orbiculare*, mysids (mainly *Mesopodopsis wooldridgei*) and fish larvae (hyperbenthos), amphipods (mainly *Grandidierella lutosa* and *Corophium triaenonyx*) and polychaetes (mainly *Capitella capitata*) (subtidal benthos), and polychaetes (mainly *Ceratonereis erythraensis*), amphipods and isopods (inter-tidal benthos). These invertebrates are important in the diets of fish and birds.

Fish are particularly reliant on estuaries for sheltered habitat in southern Africa, and different species depend on them to different extents. A total of 35 fish species from 30 families have been recorded in the Groot Berg River estuary, of which 17 (48%) can be regarded as either partially or completely dependent on the estuary for their survival. These include some highly valuable species such as white steenbras and elf, as well as lower value species such as harders. The estuaries on the west coast, particularly the Groot Berg, are crucial in maintaining the range and stock integrity of estuarine and estuarine dependent species along the entire west coast. A decline in the harder stock and marine gill net fishery catches on the west coast in the late 1990s has been attributed to recruitment over-fishing in the Groot Berg and Olifants estuary gill net fisheries. However, strong recoveries in fish abundance in the Groot Berg River estuary have been observed since gill netting in this estuary was banned in 2003. Harder and estuarine round herring are the dominant fish species in the estuary, while elf also make up a significant proportion of fish numbers. Estuary- dependent species are most abundant from 10-30 km from the mouth, and the area from 12-22 km upstream is considered to be the best core area to conserve for these species (i.e. from the railway bridge upstream to Kruispad). Adequate protection needs to be applied to the entire estuary, however, to ensure the survival of these species as they are highly mobile moving from the mouth right up to the top of the estuary.

Birds are one of the most important components of the Groot Berg River estuary's biodiversity. The Groot Berg supports the highest recorded density of shorebirds on the West Coast of Africa, and supports nationally important populations of several species. Some 92 waterbird species have been regularly recorded over the past 10 years, with an average of

about 60 species being recorded on the estuary at any one time. An average of 14 000 non-passerine waterbirds are typically recorded in mid-summer counts, this number decreasing to about 12 300 in mid-winter. These figures represent average numbers present on any one day, and with birds arriving and leaving, the numbers using the estuary would be far higher than this. Murison & Hockey (2004) estimated that at least 55 000 birds used the whole estuary and floodplain in 2001, and 2015 winter night roost counts at the river mouth exceed 50 000.

Charadriiformes (waders, gulls and terns) account for 41% of the species recorded, with most of these being wader species. Many species are associated with particular habitats or micro-habitats, and some are more sensitive to salinity than others. Distinct communities occur at the mouth (dominated by cormorants, gulls and terns), the lower estuary (dominated by waders and flamingos in summer and flamingos, coots and waders in winter), and the upper estuary (dominated by ducks and waders and wading birds in summer and ducks, flamingos, coots and resident waders in winter). In recent years, a large cormorant roost has developed near the mouth, probably a result of loss of suitable areas elsewhere.

2.4 Ecosystem services

Estuaries provide a range of services that have economic or welfare value. In the case of the Groot Berg River estuary, the most important of these are the commercial fishing harbour, the recreational value and the nursery value of the estuary, recreation and tourism, and salt production. There may be additional values, such as carbon sequestration, but these are not well understood and are probably fairly minor.

The Groot Berg River estuary provides a nursery area for numerous fish species that are caught in the commercial and recreational inshore fisheries along the west coast, including harders, white steenbras, elf and leervis. Estuarine fish make up about 25% of the value of the gill- and seine-net fisheries and 0.3% of the value of the commercial boat fisheries on the west coast, or about 8% of the overall value of West Coast inshore marine fisheries. The Groot Berg River estuary contributes about 60% of the estuarine habitat on the west coast and is thus extremely important in this respect. Taking into account the degree to which these fish are dependent on estuaries, the nursery value of the Groot Berg River estuary is estimated to be some R9 million per year.

The Groot Berg River estuary is a popular tourist destination for South Africans and overseas tourists. The north bank of the lower estuary is almost completely urbanized, while the middle and upper reaches have a strong natural or rural feel. Holiday cottages have been erected along both banks of the estuary, while hotels, guest houses, the Stywelyne Caravan Park and other accommodation establishments in the area cater for visiting tourists. These establishments are all generally full during the major holiday periods. Several farms on the banks of the estuary offer tourist accommodation and eco-tourism and/ adventure sports (including water-skiing) activities. Recreational fishing opportunities represent an important draw card for visitors to the estuary, where above average catch-rates can be expected. There is also an important subsistence line fish fishery on the estuary. The recreational value of the estuary, including all forms of estuary recreation and turnover in the real estate sector

attributable to the estuary premium on property prices, is estimated to be in the order of R10 – 20 million per annum.

2.5 Regulatory context and related management issues

Water quality and quantity are mainly controlled under the National Water Act 36 of 1998. This makes provision for an Environmental Reserve which stipulates the quantity and quality of water flow required to protect the natural functioning of each water resource, including estuaries. The extent to which an estuary's functioning is catered for is determined by the designated future management "class" (where classes A – F describe state of health), called the Ecological Reserve Category (ERC). In the case of the Berg River System, a Reserve Determination Study has been completed (DWS, 2012). However, the ecological reserve itself is yet to be signed off by the Minister. The study revealed that the Present Ecological State of the Groot Berg River estuary is a Category C, which infers a moderately modified system, and it is likely that the estuary is on a negative trajectory of change, because of the extremely low flows under the present state. Maintaining the status quo is therefore likely to result in continued decline in condition. Although the system is rated as highly important, and should thus obtain Recommended Ecological Category of B, it would be impractical to improve the condition of the Groot Berg River estuary this level due to the extent of the existing water resources infrastructure in the catchment and the and the extent of transformation. Further studies include a preliminary assessment of the water requirements of the Groot Berg River estuary was completed as part of the Western Cape Systems Analysis at the time when the Groot Berg River was identified as a viable source of freshwater for the Greater Cape Town area (1993). A detailed baseline assessment of the Berg River System and all hydraulically linked systems (i.e. estuary and groundwater systems) was completed in the period 2002-2007, as a requirement in terms of the Environmental Impact Assessment completed for the Berg River Dam.

Exploitation of living resources in the estuary is governed by the Marine Fisheries Policy for South Africa (1997) and the Marine Living Resources Act (1998). The policy supports sustainable use of resource and use of these resources for economic growth and development as well as ecosystem and biodiversity protection. There are currently no commercial fisheries on the Groot Berg River estuary, with all gill net fishery permits having been rescinding in 2003. Subsequent recovery of fish stocks (mainly mullet and various line fish species) in the Groot Berg River estuary has borne out the wisdom of this decision. There remains a growing recreational line fishery on the estuary which is largely uncontrolled at present.

Under the Seashore Act of 1935, the estuary up to the high-water mark belongs to the state and all structures in this zone need to be supported by a Lease Agreement (CapeNature). The Integrated Coastal Management Act (ICM Act) provides guidance on the sustainable development of the coastal zone. The ICM Act provides for the determination of a Coastal Protection Zone (CPZ) of 1km from the high tide mark (including in estuaries) for undeveloped land and land zoned for agricultural use, which is narrowed to 100m in areas zoned for other 'urban' land uses (e.g. residential, industrial or commercial). In the case of the Groot Berg River estuary, most of the land surrounding the estuary is zoned as rural, and thus in terms of ICM Act a default coastal protection zone of 1km would apply around the

much of the estuary. However, the boundaries of this zone may be adjusted by the MEC, and, in the Western Cape, the 10 m topographical contour is the proposed maximum width of the CPZ around estuaries, as per the Overberg District Setbacks Project (DEA&DP 2012). There is also provision to create a larger CPZ where necessary. Coastal management lines may also be designated for all coastal property, by agreement between local and provincial authorities. Within the CPZ and coastal management lines, no new land transformation or development may take place without a permit issued by the MEC. There is a strong argument to establish corresponding CPZ and coastal management lines for all estuaries in the country.

The Municipal Systems Act (2000) requires the identification of development priorities for each province, district and local municipality, and the expression of development plans in a spatial layout. The latter in turn, has to be formalised in a detailed land use and management plan. Thus the key land- use decision-making is taking place by the local municipalities, in this case the Berg River Municipality. Their plans have to fit in with broader scale plans of the district and province. The Western Cape Province Spatial Development Framework (SDF) highlights the conservation importance of the Groot Berg River estuary at a national level but offers little of specific relevance to the management of the Groot Berg River estuary. The district Integrated Development Plan (IDP) and SDF lists the Groot Berg River riparian zone (northern and southern sections) as ecologically sensitive and recommends severe restrictions on development (e.g. setback lines from the 1:50 year flood line and conservation of the salt march area to the south of the river). The Berg River LM SDF has recently been revised, with the latest draft having been approved by the Municipal Council and is currently under consideration at the provincial level. There are, however, outstanding appeals against this document.

The draft SDF prepared for the Municipality recognizes the limited potential for natural resources of the estuary (agriculture, fishing etc.) to support further economic development but supports the notion that natural attributes of the area (specifically including the Groot Berg River estuary and its navigable portion) have a regional value for development opportunities e.g. ecotourism. It acknowledges that earlier spatial planning documents (Berg River SDF 2002, Lower Berg River Sub-Regional Structure Plan 2001) and district level SDF documents do not support urban development along the ecologically sensitive southern banks of the estuary and define the urban edge as the northern river bank. Surprisingly though, it makes provision for extending the urban edge of Velddrif to beyond the southern side of the Groot Berg River, citing the increasing demand for river frontage as the reason; suggesting that a "soft urban edge" is adopted in respect of a proposed development in this area and another at the Plaats (also designated as ecologically sensitive in other planning documents).

The State of Rivers Report for the Groot Berg River (2004) prepared by the then DWAF (now DWS), recommends that the Groot Berg River estuary be registered as a wetland of international importance under the Ramsar Convention to ensure a high level of bird habitat protection.

2.6 Potential for and need of protection for the Groot Berg River estuary

The Groot Berg River estuary is rated as the third most important estuary in South Africa from a conservation perspective, scoring in the top 10% for size, habitats, type rarity within its biogeographical zone, and biodiversity. The Groot Berg River estuary is also included within a minimum set of 50 estuaries in the country identified as requiring protection in order to achieve national biodiversity protection targets. The establishment of a protected area on the Groot Berg River estuary is highly recommended and is considered highly feasible. Specific recommendations, to be further developed in consultation with stakeholders, are as follows:

- Establish a conservancy encompassing most of the estuary including supratidal estuarine habitats;
- Develop a Zonation plan which includes a no-take Marine Protected Area that incorporates the some of the more important bird habitats and fish nursery areas as well as a representative sections of other important habitat types present in the estuary (mudflat, salt marsh, submerged and emergent vegetation); and
- The whole estuary to be managed by the provincial (CapeNature), district (West Coast DM) or local (Berg River Municipality) authority, with strict control over boating and development.

The Groot Berg River estuary has also been identified as one in which there is a need for rehabilitation. Key management intervention identified in this respect include (in order of priority):

- Restoration of water quality;
- Restoration of the quantity of freshwater inflows;
- Removing significant obstructions to flow, and
- Rehabilitation of banks that are currently being eroded

The degree to which these factors should be managed to restore the health of the system depends largely on the vision that is developed for the estuary, and on its future protection status.

2.7 Opportunities for socio-economic development

The biophysical characteristics as well as the aesthetic appeal of the Groot Berg River estuary denote potential opportunities for further socio-economic development. These are discussed in further detail below.

The system provides a sheltered harbour which supports the commercial fisheries offshore but considering the depletion of commercial fishery stocks, the recreational importance of the estuary provides the principle opportunity for socio-economic development. The promotion of protection of the Groot Berg River estuary including no-go/no-take ecologically sensitive areas will improve the overall ecological functioning and aesthetics of the estuary and therefore, the recreational value of the estuary will be enhanced, particularly for tourists seeking nature and/or birding destinations.

The recreational and eco-tourism activities occurring within the area typically requires suitable tourist development such as accommodation, retail businesses and possibly guides for birdwatching activities. This requirement for tourism development provides opportunity for increasing local employment. This is particularly crucial in rural areas of the estuary, considering the low increase in employment rate due to decline in agriculture expansion. However, it is important to manage the recreational activities occurring within the Groot Berg River estuary as it may lead to large-scale disturbance of the environment and overfishing by recreational fisherman.

Environmental awareness and education programmes will aid the local communities to better understand the importance of the estuary to their livelihoods and ensure a bottom-up sustainable approach to estuary management. Furthermore, appropriately trained members of the local population, using their local as well as “new-found” knowledge, could possibly provide tours to and/or within the estuary and thereby creating employment by tour companies and/or self-employment. These opportunities need to be thoroughly explored.

3 VISION & OBJECTIVES

A vision is a high-level statement which defines the strategic intent of a management intervention. The following vision was developed and agreed upon at successive stakeholders meeting held in Veldrif in October and November 2008:

“The Groot Berg estuary is a wetland of global conservation significance that provides recreational, social and economic benefits through a balance between sustainable use, conservation and development.”

Key management objectives for the Groot Berg River estuary were identified and agreed upon at a successive stakeholder workshops held in Veldrif in October and November 2008. These are all set out in Figure 2. These objectives are seen to reinforce all other objectives and none are seen as being of greater importance than any other.

3.1 Conserve biodiversity

Adequate protection must be provided for estuarine biota to ensure persistence of populations, species, habitats and ecosystem processes, living resources must be protected from over-exploitation and excessive disturbance. Development around the estuary should be planned to maximize aesthetic and tourism value without compromising the existing sense of place, cultural or archaeological heritage or conservation objectives.

3.2 Ensure harmony and co-operative governance

Appropriate zonation of the estuary and effective control over recreational, subsistence and commercial users of the estuary will minimise the potential for conflicts between user groups and will ensure all groups are adequately catered for.

3.3 Improve ecosystem health

The estuary should be maintained in a condition which is largely natural. This will require that it is improved from its current status as a moderately modified to a largely natural system through improvements in water quality, restoration of freshwater supply and other measures.

3.4 Promote research and monitoring

Research and monitoring must be undertaken to produce appropriate and reliable quantitative data toward sustainable management of the estuary in respect to conservation, development, resource use and other activities.

3.5 Increase awareness

Residents and visitors should be aware of the importance and economic value of the estuary, know the regulations, and understand the rationale for management measures and interventions.

3.6 Maximise long-term economic benefits

The estuary must be managed to maximize the value of ecosystem goods and services, deliver in the long term, ensuring an equitable balance among local, regional and national benefits, whilst respecting and protecting the human rights and livelihood needs of the local community.

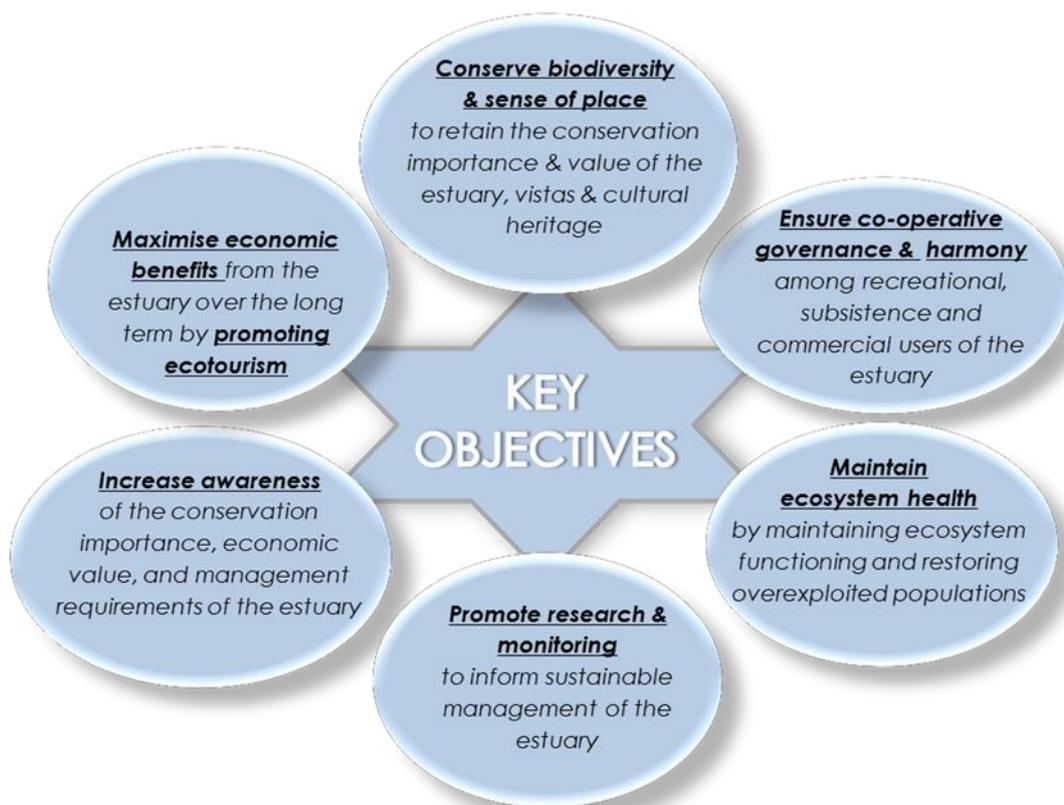


Figure 2: Key objectives to achieve the Vision for the Groot Berg River Estuary

4 MANAGEMENT OBJECTIVES

Detailed management objectives required to achieve the key objectives are summarized in Figure 3. Note that some of the detailed management objectives are cross cutting and form part of the strategy for other key objectives.

Maximising economic benefits, promoting ecotourism and improving local livelihoods will require the conservation of biodiversity and maintaining the sense of place as well as development and marketing initiatives. Targets established for conservation of estuarine biodiversity in South Africa require the establishment of a protected area that provides a sanctuary for at least 50% of all biota in the Groot Berg River estuary (Turpie & Clark 2007). It also requires that use of the remaining stocks is sustainable. Zonation of the estuary will support biodiversity conservation objectives as well as assisting in maintaining harmony amongst users.

Economic objectives require development and opportunities for ecotourism growth, but this will have to be subject to coastal management lines and development guidelines that safeguard the sense of place of the estuary. These features will need to be integrated into regional and local development plans. Ecotourism growth will require marketing and attractive visitor facilities that draw people to the area and will also depend on future developments being sensitive to biodiversity and the sense of place.

Conservation of biodiversity will also require restoration and maintenance of ecosystem health through the provision of environmental flows, as well as rehabilitation of habitats that have been damaged, e.g. by invasive alien trees. Improving ecosystem health will also require sustainable agriculture to alleviate poor water quality, habitat destruction and other disturbance to the riparian edge of the estuary. This in turn will require public awareness and harmony amongst farmers and managers of the estuary. Ensuring sustainable resource use is critical to preserving the biodiversity of the estuary. Biodiversity conservation will also be facilitated if public awareness is improved, which in turn will require the provision of educational material and signage.

The management and monitoring of the estuary area, the freshwater inflows and development in the surrounding area will require cooperative governance among the estuary management agency, catchment management agency, conservation agencies, and local and national government. This in turn will require an estuary advisory forum that has representation amongst all relevant organisations and stakeholder groups.

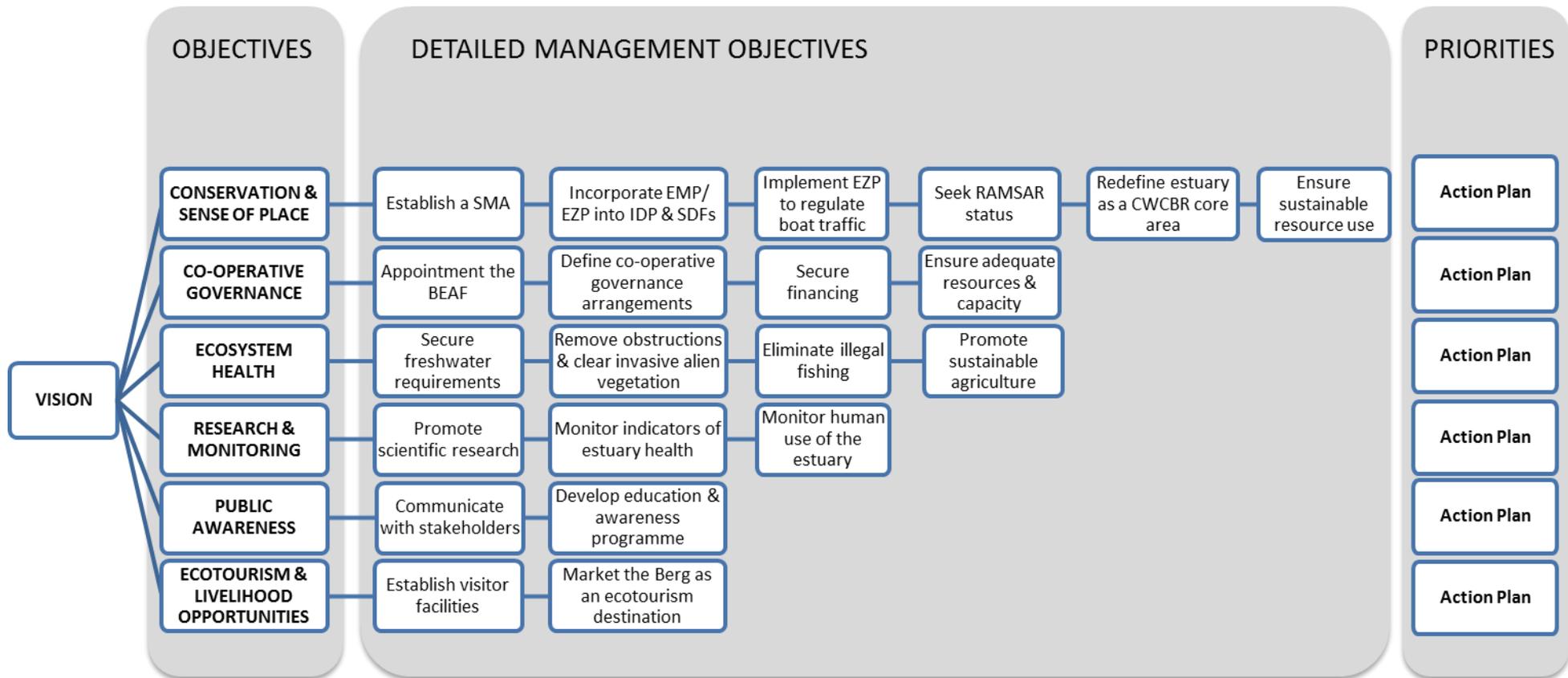


Figure 3: Structure of the Groot Berg River EMP indicating detailed Management Objectives to achieve key Objectives and the Vision

Table 1: Indicators for management objectives and associated actions

MANAGEMENT OBJECTIVE	INDICATORS
1. Conservation of estuarine biodiversity, estuary's unique sense of place and heritage resources	<ul style="list-style-type: none"> • Estuarine protected area established that provides protection for at least 50% of all biota in the estuary, including invertebrates (bait), fish, vegetation and birds • Zonation plan for the estuary approved and implemented • Groot Berg River EMP integrated within local, district and provincial level planning documents (IDPs and SDFs) • Groot Berg River estuary is assigned Ramsar status • Groot Berg River estuary incorporated as a core area within the West Coast Biosphere Reserve • Illegal fishing activities reduced • Exploitation of living resources is regulated • Future development around the estuary is constrained to ensure that it does not compromise estuary health, ecosystem functioning and/or sensitive species • Future development around the estuary is constrained to ensure that it does not compromise the existing rural atmosphere and cultural heritage resources associated with the Groot Berg River estuary
2. Harmonious and effective governance	<ul style="list-style-type: none"> • Groot Berg estuary advisory forum convened and meets regularly • Responsible Management Authority for the Groot Berg River estuary is well capacitated • Arrangements for co-operative governance of the Groot Berg River estuary defined and agreed to by all Government department with a mandate to act • Adequate capacity and resources secured and available for implementation of the EMP amongst participating entities
3. Restoration of estuary health	<ul style="list-style-type: none"> • Freshwater environmental reserve for the Groot Berg River estuary quantified, signed off by relevant minister • Quantity and quality of freshwater reaching the estuary adequate to restore and maintain estuary health • Reduction and removal of obstructions to flow in the estuary channel, including invasive alien vegetation • Nutrient status of the Groot Berg River estuary is reduced • Best practice agriculture methods are adopted
4. Research and monitoring	<ul style="list-style-type: none"> • Adequate research and monitoring is being conducted that allows for quantification of utilisation patterns, changes in abiotic and biotic health, and benefits accruing to local communities and national economy
5. Enhanced public awareness and appreciation for the Groot Berg River estuary	<ul style="list-style-type: none"> • Functional and effective stakeholder communication, education and awareness programmes are in place • Stakeholders are sensitized to and made aware of activities affecting health and functioning of the estuary, and management regulations governing use of the estuary • Stakeholders are sensitized to and made aware of new regulations such as are being developed for watercraft
6. Maximising economic benefits delivered by the estuary & promoting ecotourism	<ul style="list-style-type: none"> • Groot Berg River estuary recognised as a nationally important ecotourism destination • Quality and quantity of visitor facilities (ablutions, parking, etc.) sufficient to meet visitor standards and requirements • A tangible and measurable improvement in benefits accruing to local communities surrounding the estuary (such as increased level of employment and household income)

5 SPATIAL ZONATION

5.1 Introduction

The Groot Berg River estuary is among the top five estuaries in the country in terms of conservation importance, and is under consideration for being assigned Ramsar status as a wetland of international importance. Protection of the biodiversity and ecological functioning of the Groot Berg River estuary is fundamental to meeting the country's biodiversity conservation targets (Turpie & Clark 2007) as well as meeting policy decisions enshrined in the National Protected Area Expansion Strategy for South Africa (DEA 2010), to increase the area under formal protection.

Currently, conservation in estuaries is achieved through a number of different legislative Acts including the Marine Living Resources Act (MLRA 1998), the Integrated Coastal Management Act (Act No. 24 of 2008, as amended) (ICM Act), the Protected Areas Act (PAA 2003), the Biodiversity Act (BA 2004), the Environment Conservation Act – Terrestrial and Marine Protected Areas (ECA 1994), and the National Parks Act (NPA 1976). With the exception of the ICM Act, these acts are able to provide explicit protection for living and non-living resources either below the high water mark only (viz. MLRA 1998) or above the high water mark only (the rest).

The ICM Act, however, provides for various levels of protection for both aquatic and terrestrial habitats in the coastal zone both above and below the high water mark. The following are of importance and can be effectively used in the development of a zonation plan and protection of habitats and resources in the Groot Berg River estuary:

1. The **Coastal Protection Zone** which comprises all land 1 000m inland from the high water mark zoned for agricultural or undetermined use and the wetlands, lakes, lagoons or dams situated on this land; any land within 100 m inland of the high water mark in areas zoned for residential or commercial use; the seashore and admiralty reserves which are not coastal public property; and land inundated by 1:50 year floods or storm events.
2. **Coastal Management Lines** are designed to protect the integrity of the Coastal Protection Zone. These lines are designed to control development in ecologically sensitive or vulnerable areas and can be used to prohibit or restrict development seawards of a particular point.
3. **Special Management Areas** are designed to provide additional protection for particularly special coastal ecosystems and biodiversity, and for control over exploitation of living and non-living resources in a particular area.

A **zonation plan** has previously been prepared for the Groot Berg River estuary in accordance with the ICM Act taking consideration of discussions with and submissions received from stakeholders engaged in the development of the Groot Berg River EMP. The primary aim of this plan is to **enhance protection for key habitats and biota on the estuary**. There is strong support for improved control over recreational activities (particularly boating) on the estuary and also for proclamation of formal conservation areas. The zonation plan represents the best possible means of satisfying the many conflicting requirements of the

different user groups and stakeholders who wish to enjoy the benefits provided by the Groot Berg River estuary. On-going stakeholder engagement is, however, reviewing the zonation in order to incorporate new information and rising concerns into the plan.

Zonation will allow for partitioning of activities within the estuary thus permitting their co-existence without one activity precluding or conflicting with another. It will also reduce management costs as it will focus activities in particular geographic areas and hence eliminate the need to deploy all types of management staff across the whole estuary at all times. Requirements, for which the greatest scope for conflict exists, most likely include exploitative resource use, high intensity recreation and biodiversity conservation.

5.2 Estuarine boundaries

In terms of protection specifically afforded to each estuarine system through Resource Directed Measures, the Department of Water & Sanitation stipulates that the downstream boundary of an estuary is the estuary mouth; the upstream boundary is the full extent of tidal influence, saline intrusion, or back flooding; and the 5m above mean sea level (amsl) contour defines the lateral boundaries, where they have not been defined by scientific methods (DWA, 2010).

The ICM Act further defines an estuary as "*a body of surface water -*

- a) *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 body of surface water is open to the sea; or*
- c) *in respect of which the salinity is higher than fresh water as a result of the influence of the sea, and where there is a salinity gradient between the tidal reach and the mouth of the body of surface water".*

The 5m topographic contour encapsulates the Estuarine Functional Zone (EFZ), which in turn is defined by 2014 EIA Regulations (GNR 985) under the National Environmental Management Act (NEMA 1998) as "*the area in and around an estuary which includes the open water area, estuarine habitat (such as sand and mudflats, rock and plant communities) and the surrounding floodplain area...*". In this way, certain activities are not permitted within an estuary without prior Environmental Authorisation.

Figure 4 and Figure 5 illustrate the original SANBI estuarine boundary and refined 5m contour around the Groot Berg River estuary. However, the body of open water, and hence tidal influence and salt intrusion from the sea does not reach past the Kersefontein Bridge bridge (32°54'25.51"S; 18°20'4.10"E). This point is located within the Bergrivier municipal boundary (Figure 6).



Figure 4: Geographical boundaries of the Groot Berg River estuary, showing the estuarine functional zone (5m contour) and the coastal protection zone (lower estuary)

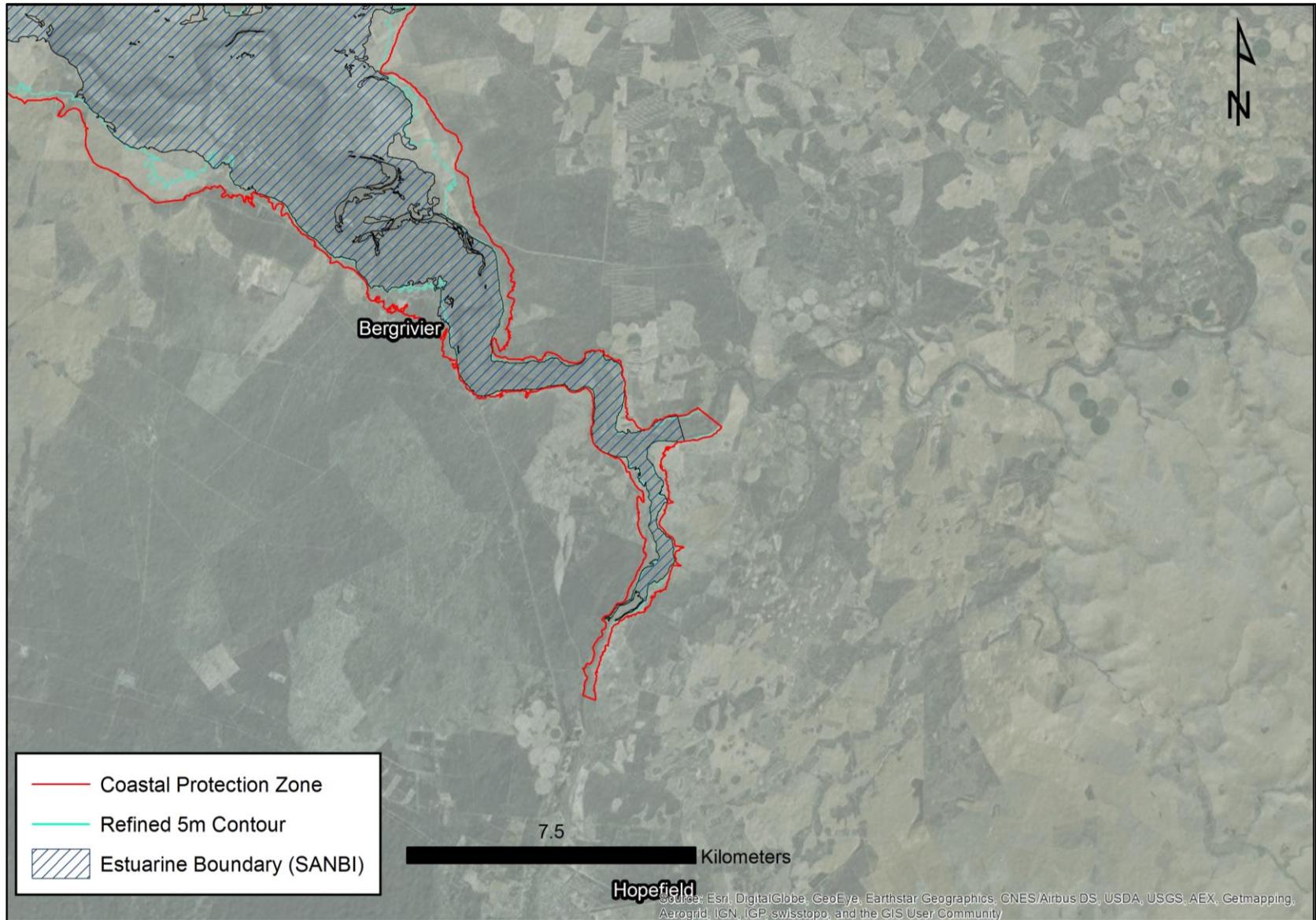


Figure 5: Geographical boundaries of the Groot Berg River estuary, showing the estuarine functional zone (5m contour) and the coastal protection zone (upper estuary)

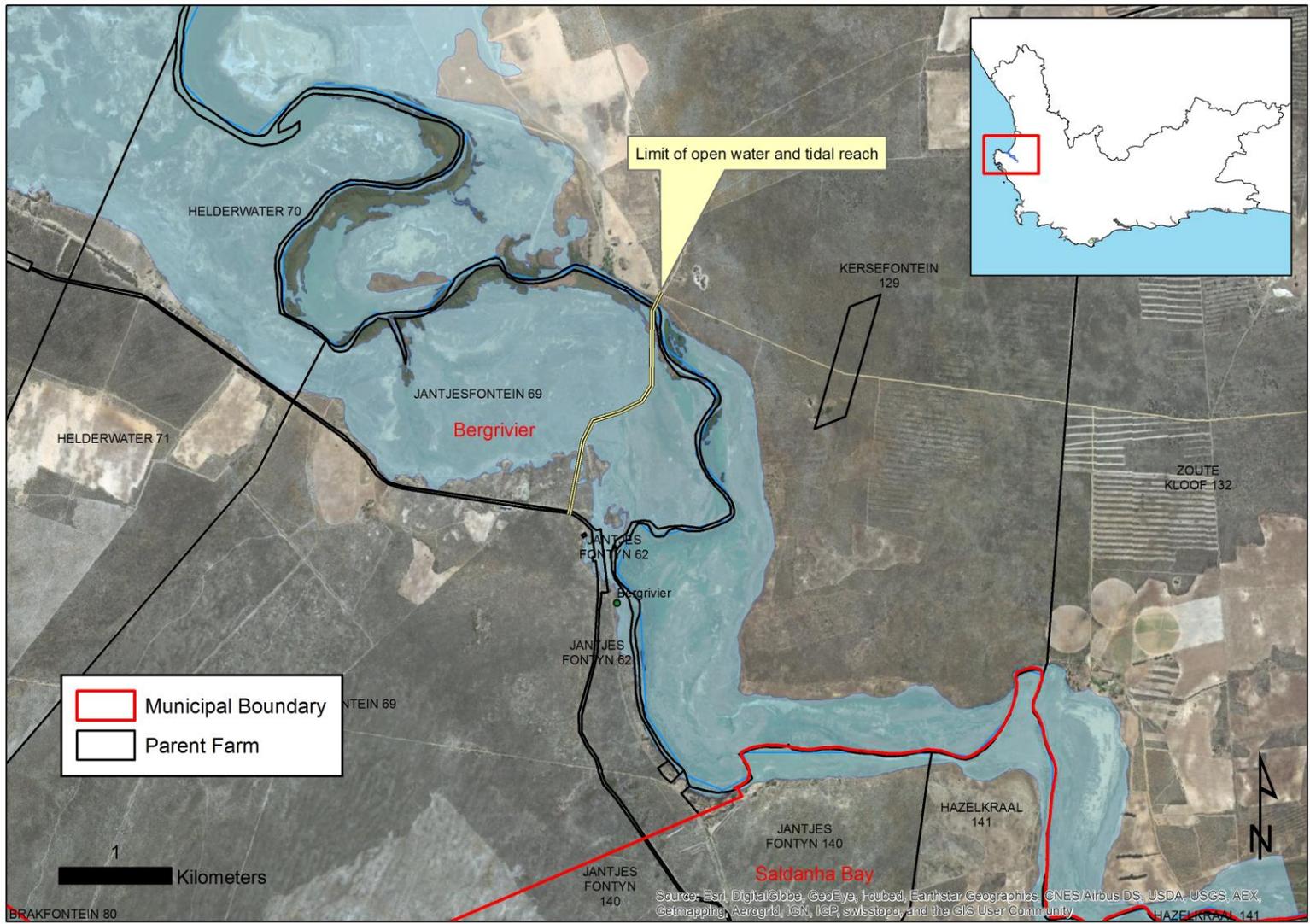


Figure 6: Location of the upper estuarine limit

5.3 Coastal Protection Zone and Coastal Management Lines

Under the ICM Act, the Provincial MEC in consultation with the Local Municipalities may define a **Coastal Protection Zone (CPZ)** of at least 1000m from the coastal and estuarine high tide mark for all areas surrounding the Groot Berg River estuary zoned agricultural or undetermined use and that are not part of a lawfully-established township, urban area or other human settlement, and a corresponding zone of 100m for all other land. However, the boundaries of the CPZ can be adjusted by the MEC, and in the Western Cape, the 10m topographical contour surrounding an estuary has been adopted (DEA&DP, 2014). The approximate position of this line is shown in Figure 4 and Figure 5. Note that the Berg River Local Municipality is seeking to extend the urban edge of Veldrif to include a portion of the south bank of the Groot Berg River estuary but this has yet to be ratified by the provincial government.

The ICM Act also provides for the establishment of a **coastal management line(s)**, designed to protect the coastal protection zone. Any future development seawards of the coastal management line is automatically subject to an Environmental Impact Assessment (EIA) and would have to be compatible with the vision and objectives defined within this estuarine management plan for the Groot Berg River Estuary. Establishment of a coastal management line around the Groot Berg River estuary will assist in preventing development from encroaching onto the estuary. It is recommended that a coastal management line for the Groot Berg River estuary corresponding with the coastal protection zone as indicated in Figure 4 and Figure 5 be established.

The coastal management area should be incorporated in its entirety within a newly designated core area of the Cape West Coast Biosphere Reserve (CWCBR). The establishment of a formal conservancy should also be considered for all privately owned riparian lands adjoining the Groot Berg River estuary. The coastal management zone will serve to protect ecological functioning and integrity of the estuary, limit disturbance to estuarine flora and fauna, and will assist in retaining the wilderness character of the estuary and enhance its ecotourism appeal.

The National Water Act (1998) also places some restrictions on development adjacent to water courses, which includes estuaries. This Act requires that authorization (a water use licence) be obtained for any alterations to the bed, banks, course or characteristics of a water course (which includes changes in land use, vegetation cover, topography, soil, etc.) or the adjacent riparian habitat (defined as any flooded area adjacent to the river channel) from the Department of Water & Sanitation. The riparian habitat is considered to include everything within the 1:100 year flood line of a water course.

Flood line modelling of the Groot Berg River estuary was recently updated during the establishment of coastal set-back lines for the West Coast District (DEA&DP, 2014) which also included the 1:20 year flood and covered the entire estuarine area (Figure 8 and Figure 7). The steep nature of the topography in certain areas dictates that 1m vertical difference between the 1:20 year and 1:100 year flood is contained within the same floodplain. The 1:100 year flood line clearly encompasses an extensive area in the lower estuary (Figure 8), including large portions of the town of Veldrif/Laaipelek, the whole of Port Owen and the

whole of the salt works on the south bank of the estuary. In the middle to upper reaches of the system, it is mostly farmland that is affected. The onus is on the developer to delineate the extent of the riparian area and the 1:100 year flood line in accordance with guidelines published by DWAF (2005). It is recommended that no further development be permitted within the 1:100 year flood line surrounding the Groot Berg River estuary.

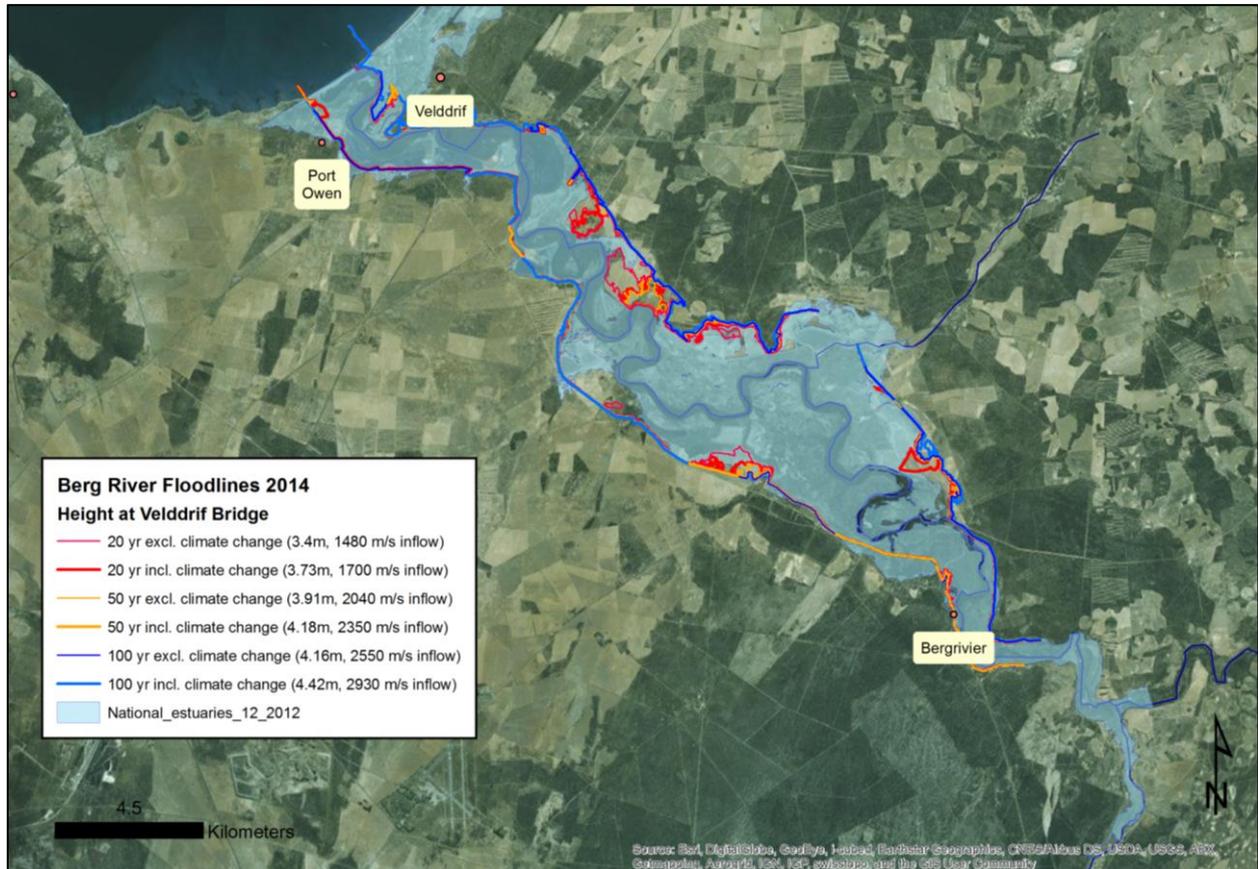


Figure 7: Flood line modelling for the Groot Berg River estuary, showing 1:20 year, 1:50 year and 1:100 year flood scenarios with and without climate change impacts (DEA&DP, 2014)

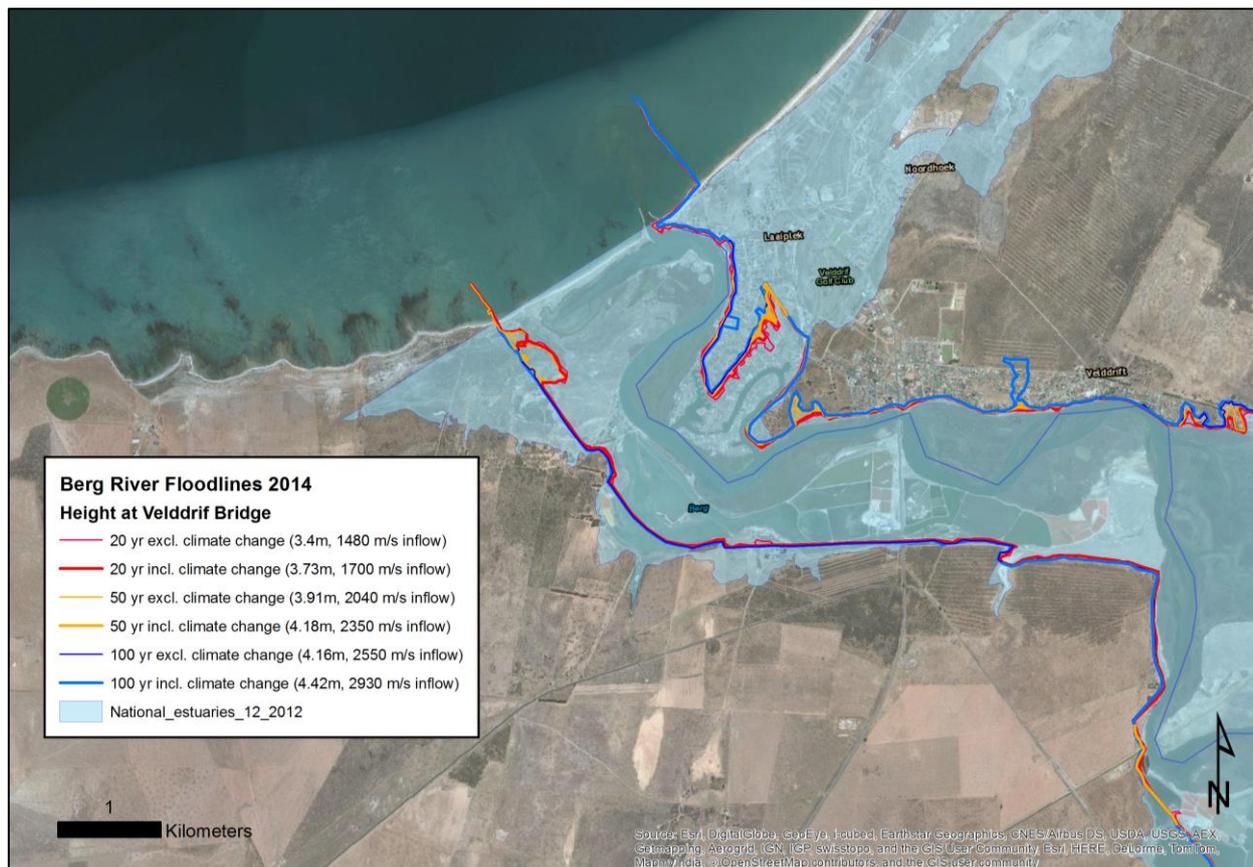


Figure 8: Positions of the 1:20, 1:50 and 1:100 year flood lines on the lower Groot Berg River estuary (DEA&DP, 2014)

5.4 Zonation of activities

In addition to formally demarcating the geographical boundaries, the extent of the Coastal Protection Zone and Coastal Management Line around the Groot Berg River estuary, it has been proposed that portions of the lower estuary be demarcated as a **Special Management Area** in terms of the ICM Act. This Special Management Area would be zoned in such a way as to satisfy the many conflicting requirements of the different user groups and stakeholders who wish to enjoy the benefits provided by the estuary.

The existing zonation as contained in this EMP is constantly being reviewed by management entities and stakeholders, with the intention to generate a fully updated zonation at the time of the next formal complete review of the EMP. Revised zonation must allow for partitioning of activities within the estuary, thus permitting their co-existence without one activity precluding or conflicting with another. It will also reduce management costs as it will focus activities in particular geographic areas and hence eliminate the need to deploy management staff across the whole estuary at all times. For now, however, the draft zonation remains as is.

The proposed Special Management Area extends from the mouth up to the Kersefontein Bridge (45 km upstream) and includes the banks of the estuary where sensitive and conservation-worthy estuarine vegetation occurs (Figure 9 - Figure 12). The Special Management Area is divided into four zones as follows:

Table 2: Zonation of the Groot Berg Special Management Area, related controls, authorities and legislation

ZONE	CONTROLS	RELEVANT LEGISLATION	CONSULT	ENFORCE
Zone 1				
Includes the Old Mouth Lagoon. This area harbours large beds of eelgrass (<i>Zostera</i>), is an important area for invertebrates (bait species), fish and birds.	<ul style="list-style-type: none"> All forms of exploitation should be prohibited in this area and entry should be restricted to non-motorised vessels only. 	<ul style="list-style-type: none"> MLRA Regulations Municipal By-laws National, provincial and municipal CMP's 	<ul style="list-style-type: none"> DEFF West Coast District Local Municipality 	<ul style="list-style-type: none"> DEFF compliance officers CapeNature officers DEA:O&C
Zone 2				
Includes intertidal salt marsh areas adjacent to the Port Owen Marina, the Cerebos salt works and the Riviera Hotel. Salt marsh vegetation is very sensitive to damage from trampling and is an important roosting area for water birds.	<ul style="list-style-type: none"> Use of motorised vehicles should be strictly prohibited in this area. Pedestrian traffic should be restricted to established paths and board walks only. 	<ul style="list-style-type: none"> Municipal By-laws National, provincial and municipal CMP's 	<ul style="list-style-type: none"> West Coast District Local Municipality 	<ul style="list-style-type: none"> CapeNature officers DEA:O&C
Zone 3				
Includes the whole of De Plaat and the adjacent salt marsh and reed marsh habitats. This area harbours large beds of eelgrass (<i>Zostera</i>), is an important area for invertebrates (bait species), and is an extremely important foraging area for water birds and waterfowl.	<ul style="list-style-type: none"> All forms of exploitation should be prohibited in this area and entry should be restricted to non-motorised vessels only. Pedestrian access is to be restricted to established paths and board walks only. Access to motorised vehicles should be strictly prohibited. 	<ul style="list-style-type: none"> MLRA Regulations Municipal By-laws National, provincial and municipal CMP's 	<ul style="list-style-type: none"> DEFF West Coast District Local Municipality 	<ul style="list-style-type: none"> DEFF compliance officers CapeNature officers DEA:O&C
Zone 4				
Includes supratidal salt marsh, and reed and sedge marsh areas between the railway bridge and the Hopefield road bridge. This vegetation is sensitive to trampling and grazing by livestock and is a very important winter feeding ground for wading birds and waterfowl.	<ul style="list-style-type: none"> Use of motorised vehicles should be restricted to existing roads and tracks only. No grazing of livestock should be permitted between the months of April and October of each year. 	<ul style="list-style-type: none"> Municipal By-laws National, provincial and municipal CMP's 	<ul style="list-style-type: none"> DEFF West Coast District Local Municipality 	<ul style="list-style-type: none"> DEFF compliance officers CapeNature officers DEA:O&C



Figure 9: Special features and habitats on the Groot Berg River estuary for which additional protection is required. 1. Old Mouth Lagoon, 2. Intertidal salt marshes.

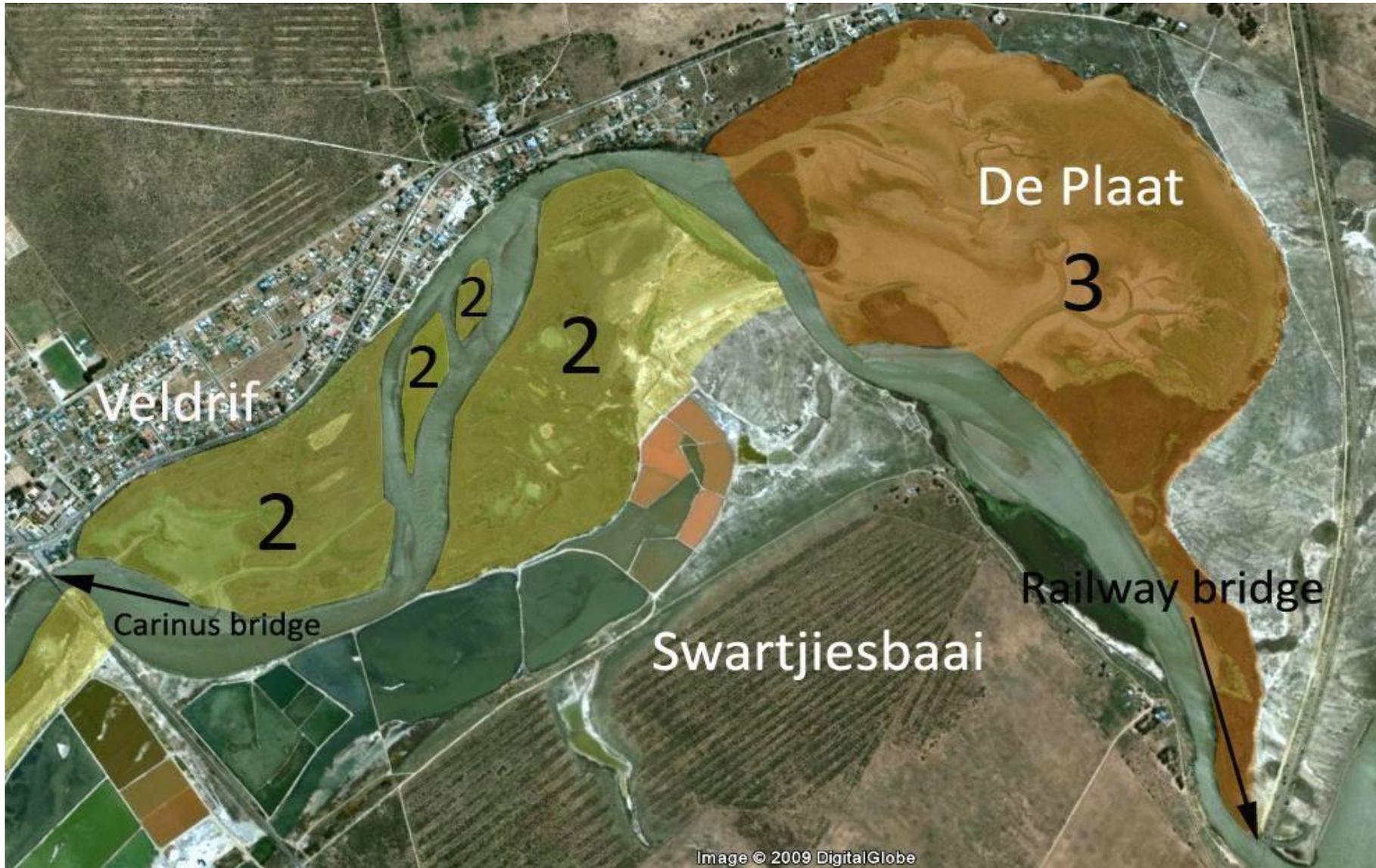


Figure 10: Special features and habitats on the Groot Berg River estuary for which additional protection is required: 2. Intertidal salt marshes, 3. De Laat mudflats

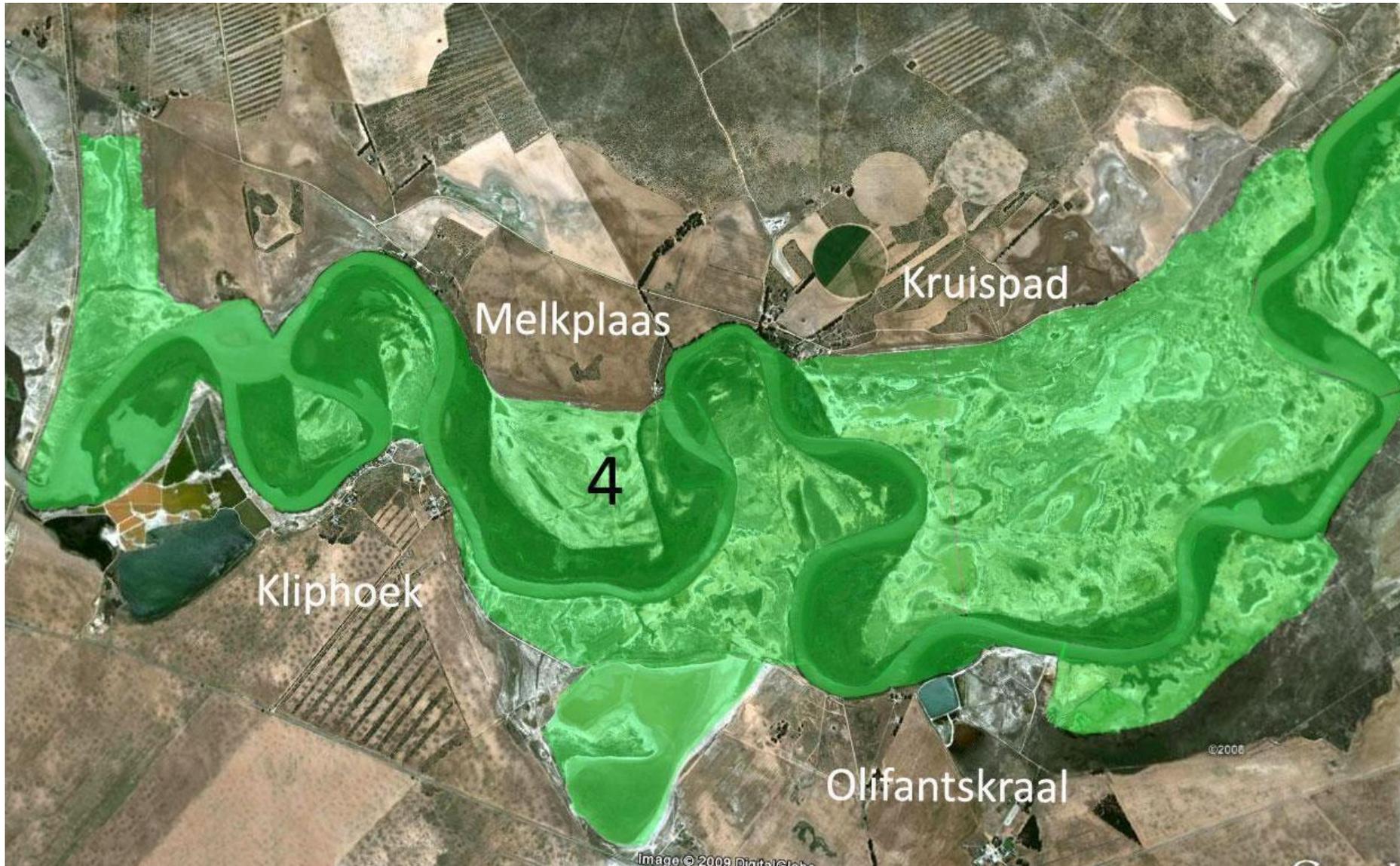


Figure 11: Special features and habitats on the Groot Berg River estuary for which additional protection is required: 4. Reed and Sedge marsh, and Supratidal salt marsh



Figure 12: Special features and habitats on the Groot Berg River estuary for which additional protection is required: 4. Reed and Sedge marsh and Supratidal salt marsh

6 MANAGEMENT PRIORITIES

6.1 Conservation of biodiversity and wilderness character

The Groot Berg River estuary is widely acknowledged as being one of the most important estuaries in South Africa from a conservation perspective. It provides habitat and food resources for the largest population of resident and migrants water birds on the East Atlantic seaboard. It is also the most important nursery habitat for juvenile fish species on the South African West Coast. The expansive floodplain marshes surrounding the estuary are unique in the south-western Cape. For these reasons alone, it is strongly recommended that a significant portion of the estuary be set aside for biodiversity conservation through the enactment of appropriate legislation. The Groot Berg River estuary is identified as a core estuary in the CAPE estuary conservation plan (Turpie & Clark 2007) and the subsequent National Estuarine Biodiversity Conservation Plan (Turpie et al., 2012) (and the Western Cape Protected Area Expansion strategy), which recommends that 50% of its biota is protected and 50% of its margin remains undeveloped. Sustainable utilisation of living resources is therefore imperative and legislation relating to fish and bait harvesting must be enforced as well as compliance of the no-take areas within the system (i.e. Zone 1). The hosting of fishing competitions must not be in conflict with the conservation objectives and will need to be strictly controlled.

It is also recommended that necessary steps be taken to ensure that the estuary in its entirety receive the international recognition it warrants by being awarded Ramsar status and being incorporated as a core area within the Cape West Coast Biosphere Reserve.

It is also important that these ideals and others contained in the vision and management objectives of this EMP be embraced by national, provincial and municipal authorities responsible for management of the Groot Berg River estuary, though the incorporation of these ideals and objectives into relevant planning documents (SDFs and IDPs). Positive steps in this respect would be the inclusion of the proposed coastal management line in planning documents and ensuring that the style and density of development around the estuary does not compromise biodiversity conservation, existing natural vistas, and the wilderness feel or sense of place of the estuary.

Table 3: Management Actions for conservation of biodiversity and wilderness character

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
a. Fully revise the zonation plan	i. The RMA, responsible authorities and stakeholders must collaboratively revise the zonation plan to accommodate updated information and new concerns over activity conflicts.	ICM Act 2008	Revised zonation plan	2019	RMA, BEF, DEA&DP	
b. Formally demarcate the extent of the Coastal Protection Zone (CPZ) and Coastal Management Line (CML) around the Groot Berg River estuary and establish a Special Management Area (SMA) that incorporates the lower reaches of estuary upstream to the Hopfield Bridge, zoned in accordance with the scheme presented in Figure 6- Figure 9 above.	i. Berg River Municipality with assistance from Berg Estuary Advisory Forum (BEAF) and DEFF to formally demarcate the CPZ and CML around the Groot Berg River estuary and to evaluate the establishment of a SMA on the lower estuary that includes appropriate levels of protection for key habitats, fauna	ICM Act 2008 NEM: Protected Areas Act 2003	Joint memorandum from RMA (CapeNature) and DEA:O&C to Minister DEA requesting proclamation of a new SMA on the Groot Berg	2016-17	RMA CapeNature DEA:O&C BEAF	
	ii. With endorsement from DEFF, enlist legal support to prepare notice of intent to proclaim the SMA to be published in the government gazette		Notice of intent in government gazette		DEA:O&C	
	iii. DEA:O&C to consider comments on gazette notice and to and prepare responses to I&APs and Minister		Response letters			
	iv. Preparation of final gazette notice		Proclamation notice in government gazette			
c. Integrate Groot Berg River Estuarine Management Plan into development planning	i. Ensure that the coastal management line and other developmental needs and restrictions are integrated into IDPs and SDFs	ICM Act 2008 Municipal Systems Act 2000	SDFs reflect requirements of EMP	2016	Berg River Local Municipality	

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
	ii. Apply for legal status of the coastal management line under the Integrated Coastal Management Act (when gazetted)	ICM Act 2008	Coastal Management Line gazetted			
c. Regulate boat traffic by implementing an Estuary Zonation Plan (EZP) to minimise impacts on biodiversity and sense of place	i. Berg River Local Municipality or West Coast District Municipality to publish regulations requiring permits for using motorised vessels on the Groot Berg River estuary and restriction their use to specified zones as per the EZP in this EMP	ICM Act 2008 Sea Shore Act 1935 Municipal Systems Act 2000	Regulations/Bylaws	2016	West Coast District and/or Groot Berg River Municipality, RMA	
d. Seek Ramsar status for the Groot Berg River estuary	i. CapeNature and other stakeholders to renew application for Ramsar status on the Groot Berg River estuary	NEM: Protected Areas Act 2003	Ramsar Status	2016	RMA, DEFF BEAF	
e. Redefine the Groot Berg River estuary as a core area within the Cape West Coast Biosphere Reserve (CWCBR)	i. RMA to motivate with CWCBR for change in status of Groot Berg River estuary to a core area within the Biosphere Reserve	Biodiversity Act	Groot Berg River estuary redefined as core area within CWCBR	2016	RMA, CWCBR	
f. Ensure sustainable use of estuary resources	i. Enforce legislation for fishing and bait harvesting	MLRA 1998 ICM Act 2008 Municipal By-laws	Increase in number of patrols and inspections Number of infringements reduced Improvements in ecological health indices Illegal activities and non-compliance reported through SMS hotline	2016-	RMA DEFF Berg River LM Phakisa	
	ii. Enforce no take zonations within EFZ					
	iii. Maintain a limited and predetermined number of well structured, regulated fishing competitions					

6.2 Co-management and effective governance

Owing to their position on the boundary between freshwater, terrestrial and marine environments, management of estuaries requires cooperation from a large number of separate national, provincial and local government agencies, each acting under a different legislative mandate. As a minimum, the following national government agencies are implicated in management of the Groot Berg River estuary: Department of Environmental Affairs Fisheries and Forestry (DEFF), Department of Water & Sanitation (DWS), Department of Public Works (DPW), Department of Tourism (DOT). Provincial and local government agencies implicated in management of the estuary include Berg River Local Municipality (LM), Cape Nature, West Coast District Municipality (WCDM) and the Department of Environmental Affairs & Development Planning (DEA&DP), as well as the Berg-Olifants Catchment Management Agency. However, the Responsible Management Authority (RMA) for the Groot Berg River estuary, as provided for and stipulated in the National Estuarine Management Protocol, is the Berg River LM.

The difficulties of ensuring a sufficiently high level of integration and cooperation amongst all of these different agencies, however, extend beyond the mandate and capacity of a single local authority or agency. For this reason, the Protocol provides for an advisory forum to be established that includes representatives from the principal national, provincial and local government agencies as well as key stakeholder groupings. Currently, the Berg Estuary Advisory Forum (BEAF) fulfils this role. The purpose of the Forum is to provide a body for stakeholders with an interest in the future of the Groot Berg River estuary to exchange information and ideas, and to advise on action for the effective management of the estuary.

One of the first tasks for the RMA and BEAF will be to confirm the mandates, roles and responsibilities of various institutions. For example, DEFF has jurisdiction over living resources in the estuary, DWS has jurisdiction of freshwater flows to the estuary, and the WCDM and Matzikama municipalities has jurisdiction over land-use around the estuary and recreational use of the estuary. At the same time, CapeNature is responsible for enforcing the MLRA and management of any conservation areas. Irrespective of the role of CapeNature as the RMA, it is essential that all these agencies and institutions work cooperatively to ensure the vision and defined management objectives can be realised despite capacity constraints (human, infrastructure and financial resources). CapeNature as the provincial conservation agency, will need to work seamlessly with the Berg River LM in terms of managing the proposed Protected Area, with assistance from DEFF.

Table 4: Management Actions for co-management and effective governance

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
a. Sustain the operation of the Berg Estuary (Advisory) Forum (BEAF)	i. Invite representative members of stakeholders and government to be members of the BEF.	ICM Act 2008	A list of members of the forum and their contact details	2016	RMA, DEA / DEA&DP	
b. Define co-operative governance arrangements for management of the proposed Groot Berg River estuary	i. Estuary Forum to meet the designated Responsible Management Authority, CapeNature, and to define clear roles and responsibility for the authority, the BEF and other participating agencies.	ICM Act 2008 NEM:PAA 2003	Proceedings	2016	RMA BEAF DEA / DEA&DP Berg River LM DWS WCDM	
	ii. Conclude implementation protocols with respective departments and institutions.		Signed letters from all agencies to be involved with the management of the Groot Berg River estuary Protected Area and the BEF clearly outlining respective roles and responsibilities	2016		
c. Secure financing	i. Secure start-up financing for estuary management, capacity building and research and monitoring programmes	ICM Act 2008 NWA 1998 CARA 1983 MSA 2000	Funds secured for 5 years	2016-17	RMA Berg River LM DEA&DP DWS DEFF Key partners	
	ii. Lobby respective agencies to allocate resources, create and fill posts, and acquire necessary infrastructure and resources		An action plan for securing future funding			
	iii. Develop a long-term financing plan					

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
d. Adequate resources and capacity	i. Establish an office at the estuary, preferably at Veldrif		Office building	2016	RMA Berg River LM DEA&DP WCDM Key partners	
	ii. Acquire necessary equipment (office equip, water quality meter, boat, vehicle)		Office is adequately equipped			
	iii. Recruit estuary manager and two field rangers as permanent staff.		Staff & resources deployed for management of Groot Berg River estuary Protected			
	iv. Identify and address training needs among management staff and staff (involved in estuary) of CapeNature, Berg River Municipality DWS, CMA, and DEFF (e.g. for monitoring, visitor regulation and assistance)		Training records			
	v. Evaluate performance of staff, contractors and volunteers		Performance evaluations	2018 +		

6.3 Restoring estuary health

Four focal areas have been identified for restoration or rehabilitation on the Groot Berg River estuary:

1. Restoration of water quality;
2. Restoration of the quantity of freshwater inflows;
3. Removing significant obstructions to flow; and
4. Elimination of illegal fishing activity (gill netting)

The Groot Berg River estuary currently receives some 65% of the natural mean annual runoff (MAR). While this does not affect mouth condition, since the mouth of the estuary has been stabilised between concrete promontories, reduction in flow has had a considerable impact on water quality, both due to reduced ability to dilute pollution and due to the increase in polluted return flows as a result of use of the water in agricultural irrigation. The reduced flows have probably also altered the physical habitat of the estuary in that the depth and profile may have changed, and may also have affected the extent of flooding on the floodplain areas surrounding the estuary.

The reduction in flows will also most likely have resulted in considerable changes to the biota of the estuary. Primary productivity by microalgae has, for example, increased considerably over the last few decades owing to increased nutrient inputs and a reduction in flushing of the estuary. Plants have also most likely been significantly affected. The distribution of brackish reeds and sedges has probably diminished as a result of increased salinity. The biomass of zooplankton and bottom-living invertebrates such as amphipods and prawns is also likely to have increased as a result of the increase in salinity. Abundance and composition of fish and bird communities on the estuary are also likely to have changed as a result of changes in freshwater flow, salinity, habitat and food supplies. A reserve determination study designed to assess freshwater requirements of the estuary (as required in terms of the National Water Act, 2003) has not yet been approved for the estuary in spite of the fact that a new dam has recently been constructed within the Groot Berg catchment. DWS have however, indicated that this is a priority and hopefully this will be commissioned soon and will provided clarity on many of these issues.

A policy decision was taken by then DEAT: MCM to phase out estuarine gill net fisheries throughout the country, with the result that all gill net permits on the Groot Berg River estuary were withdrawn in 2003. While a measurable recovery in the abundance of certain fish species (principally harders elf) in the Groot Berg River estuary has been observed subsequent to the ban, it is likely that continued illegal gill net activity is hampering further recovery. It is thus imperative that this illegal activity is eliminated given the importance of the Groot Berg River estuary as a nursery area for juvenile fish and the severe impact this form of fishing has on juvenile linefish species in particular. However, the reliance of local subsistence fishermen on the Groot Berg River estuary must also be taken into consideration, thus the feasibility of establishing a permitting system for such communities must be investigated. This subsistence permitting system as well as recreational activities must not be in conflict with sustainable use of estuarine living resources.

As a means to promoted sustainable agriculture and reduce damage caused by cattle grazing, an agriculture best practice guideline and grazing protocol specific to the Groot Berg River estuary should be developed. The former would provide detail on how to ensure that agriculture runoff to the estuary is reduced, thereby lowering the nutrient status of the system; while the latter should determine the permissible area for grazing, seasonality and duration of grazing activities.

Table 5: Management Actions for restoring estuary health

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)
a. Secure adequate quantity and quality of freshwater input to restore and maintain ecosystem health and functioning	i. Lobby minister DWS to sign off the recommended freshwater reserve required to prevent further degradation of the Groot Berg River estuary and loss of key fauna and flora in the system.	NWA 1998	Improvements in ecological health indices	2016	RMA BEAF Berg River LM DWS
b. Remove obstructions to flow in the estuary channel and invasive alien vegetation	i. Promote alien clearing activities in and around the upper estuary focusing particularly on removing debris from the estuary channel	CARA 1983	Improvements in ecological health and aesthetic indices	2016	RMA BEAF Berg River LM DEFF WfW DoA
c. Eliminate illegal fishing activities on the Groot Berg River estuary	i. Lobby DEFF to appoint additional staff and to undertake additional patrols on the Groot Berg River estuary with a view to eliminating illegal gill net activity	MLRA 1998	Improvements in fish abundance and nursery value of the estuary	2016-	RMA BEAF DEFF Berg River LM
	ii. Investigate the feasibility of a netfishing permitting system for local subsistence fishermen		Increase in number of patrols and inspections		
d. Promote sustainable agriculture	i. Develop and implement agricultural best practice guideline specifically to reduce nutrient enriched return flow.	CARA 1983 NWA 1998	High nutrient status is alleviated	2016	DALRRD DWS RMA
	ii. Develop, implement and enforce a livestock grazing protocol together with local farmers to control grazing in saltmarsh habitat		Cooperative governance with local communities		

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)
			Improvements in ecological health indices		

6.4 Research and monitoring

This management plan has been devised based on current understanding of the functioning of the estuary and its economic value. There are gaps in this understanding, and there will be an ongoing need to improve understanding through research.

Increasing use by visitors, surrounding development, changes in freshwater supply from the catchment, and climate and sea-level change can impact on the health and ecological functioning of the estuary, as well as its value at different spatial scales.

Monitoring and research are essential to enable the respective agencies responsible for management of the Groot Berg River estuary to adapt management plans, operational plans and activities to changing circumstances. Three key focal areas for monitoring and research associated with the Groot Berg River estuary include visitor numbers and behaviour, water quantity and quality, physical characteristics, nutrients, biodiversity, and populations of exploited species.

A detailed baseline assessment of the abiotic and biotic characteristics of the estuary was undertaken prior to the construction of the Groot Berg River dam. There are also detailed operating rules governing flow releases from the dam, designed to protect ecosystem health of the estuary and riverine biota downstream of the dam. Post implementation monitoring is critical however to ascertain whether the measures that have been put in place are adequate to ensure that there is no further deterioration in the health of the estuary from pre-implementation conditions. The responsibility for this monitoring resides with the Department of Water & Sanitation (DWS) but may be delegated to another agency.

All monitoring must be undertaken according to the Reserve Determination methodologies and taking Resource Quality Objectives into account, as provided for in this EMP. Recommended protocols for monitoring the health of the Groot Berg River estuary are included in Appendix 1. These have been adapted from monitoring protocols designed for monitoring the freshwater reserve for the Olifants estuary prepared by Taljaard et al. (2006). These protocols serve to monitor the health of the estuary. Related to this, the "Ecological Specifications" and "Thresholds of Potential Concern" (TPC) for the Groot Berg River estuary are included as Appendix 2.

In addition to monitoring the biotic and abiotic health of the Groot Berg River estuary, it is also strongly recommended that visitor numbers, profiles, behaviour and opinions are monitored on a regular basis to gauge management effectiveness and user responses to management. Monitoring protocols for these aspects are also included in Appendix 1.

Table 6: Management Actions for research and monitoring

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
a. Promote scientific research	i. Identify information gaps and develop research programme(s) aimed at gathering/ consolidating data on biodiversity and exploited species		Research projects Scientific reports, paper and publications	2016-19	RMA Berg River LM BEAF DWS DEFF DST DEA&DP	
	ii. Engage local research institutes and universities to collaborate on priority research projects					
	iii. Solicit research funding support					
b. Monitor biophysical indicators of estuary health	i. Carry out monitoring programme as outlined in Appendix 1 and assess results in terms of thresholds of potential concern (Appendix 2)	NWA 1998	Monitoring data and reports	2016-20	RMA, Berg River LM BEAF, DWS, DEFF	
c. Monitor human use of the estuary	i. Carry out monitoring programme as outlined in Appendix 1	NWA 1998	Monitoring data and reports	2016-20	RMA, Berg River LM BEAF	

6.5 Public awareness

Effective management of the Groot Berg River estuary will be dependent on stakeholder buy-in (through adequate consultation and communication) and visitors' appreciation of the management regulations. Education is also considered to be among the most important functions provided by a protected area along with biodiversity conservation, maintenance of population of exploited species. Protected areas provide opportunities where the public are able to view species in their natural environments, and to experience ecosystems in a largely undisturbed state.

Provision of interpretive and educational material at these sites can greatly enhance this experience as it focuses attention of visitors on goods and services provided by the environment of which they may not have been aware, highlights key aspects of the environment that are special or unique to the area, and can be used to highlight the impact of human activities on the environment. Furthermore, the better people understand the issues surrounding the management of a protected area, the more they are likely to respect the management requirements and regulations. Thus, the management agencies for the Groot Berg River Estuary Protected Area will need to provide state of the art service in this field.

6.6 Economic benefits and ecotourism

The Groot Berg River estuary is one of the most scenic of the large permanently- open estuaries in South Africa. The primary challenge facing the future management agency of the estuary is to provide a quality experience for visitors to the estuary while at the same time managing visitors in a manner that ensures that they do not compromise the resource that attracted them in the first place.

Table 7: Management Actions for increasing public awareness

Management Objectives	Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)	Estimated budget
a. Create effective mechanisms for on- going communication with stakeholders	i. Develop an effective communication strategy	ICM Act 2008	Communication strategy	2016-17	RMA, Berg River LM BEAF DEA WCDM DEA&DP	
	ii. Maintain stakeholder database		Stakeholder database			
	iii. Explore alternative communications mechanisms (workshops, signage, radio etc.)		Record of Communications			
b. Develop an effective education and awareness programme for the protected area that enhances visitor experiences	i. Establish a visitor center within the estuary protected area which acts as a focal point where visitors can go to learn more about the estuary, its conservation importance, the ecology of the system, the cultural and archaeological significance of the area, and the need for rationale behind existing management interventions	ICM Act 2008	Visitor center open to public	2016-17	RMA, Berg River LM BEAF Public /private partnerships Donor funding (e.g. WWF, WESSA, etc.)	
	ii. Source and/ or commission educational and informative material including signage, posters, pamphlets, and relevant literature to be housed in the visitor center and other appropriate localities that will enhance visitor experiences.		Posters, pamphlets, signage, literature compiled and disseminated	2016+		
	iii. Encourage field excursions to the estuary by local schools, community groups, and other stakeholder groupings			2016+		

Table 8: Management Actions for maximising economic benefits & promoting ecotourism

Management Objectives	Management Actions	Deliverables / Indicators	Timing	Responsible Agent(s)
a. Establish and manage visitor facilities	i. Develop appropriate nature friendly infrastructure for visitors to the estuary including accommodation (e.g. camping facilities, lodges, guest houses) as well as other facilities (roads, boat launching facilities, bird hides, walking paths, nature trails, mountain bike trails) in collaboration with local communities and independent contractors that does not detract from sense of place of the area or impact on the environment	Visitor infrastructure and facilities	2016-18	Berg River LM, RMA
	ii. Facilitate opportunities for commercial operators and local communities to develop around visitor facilities, provide services on the estuary and find employment opportunities through selling of crafts, as tour guides and staff at visitor facilities and commercial enterprises	Number of tourism businesses increases Increase in number of employed persons Ongoing provision of employment opportunities		
	iii Ensure that visitor facilities are maintained in good condition at all times to maximise visitor experiences	Facilities receive good reviews		
b. Market the Groot Berg River estuary as a wilderness and nature based ecotourism destination	i. Develop and distribute promotional material for the Groot Berg River Estuary Protected Area to key national, provincial and local tourism agencies and info centers	Brochures, pamphlets, magazine articles produced and disseminate, website created and road signage erected	2016-18	RMA, Berg River LM
	ii. Develop a website			
	iii. Lobby relevant agencies to ensure the estuary is featured in local, regional and national tourism marketing and included on tourism routes			
	iv. Petition national road agencies to erect appropriate road signage informing passing visitors and tourists of the existence of the estuary			

7 INSTITUTIONAL ARRANGEMENTS

7.1 Key role players

It is essential that this EMP is regarded as a strategic plan that can guide the detailing of implementation actions and identification of implementing agents. Therefore, it does not specify the required resources (human and financial) required for proper management of the estuary. However, it does offer a schedule or phased planning approach that incorporates capacity building and implementation at the local level over a five-year period. It is crucial that champions/project leaders/teams are identified who will be responsible for the formulation of detailed action plans and the implementation thereof. Ways of empowering historically disadvantaged individuals with regards to the local management of the Groot Berg River Estuary must be explored and implemented.

Co-management and effective governance has already been identified as the keystone to the efficient and effective management of the Groot Berg River Estuary. Key role players are indicated in Figure 13 below.

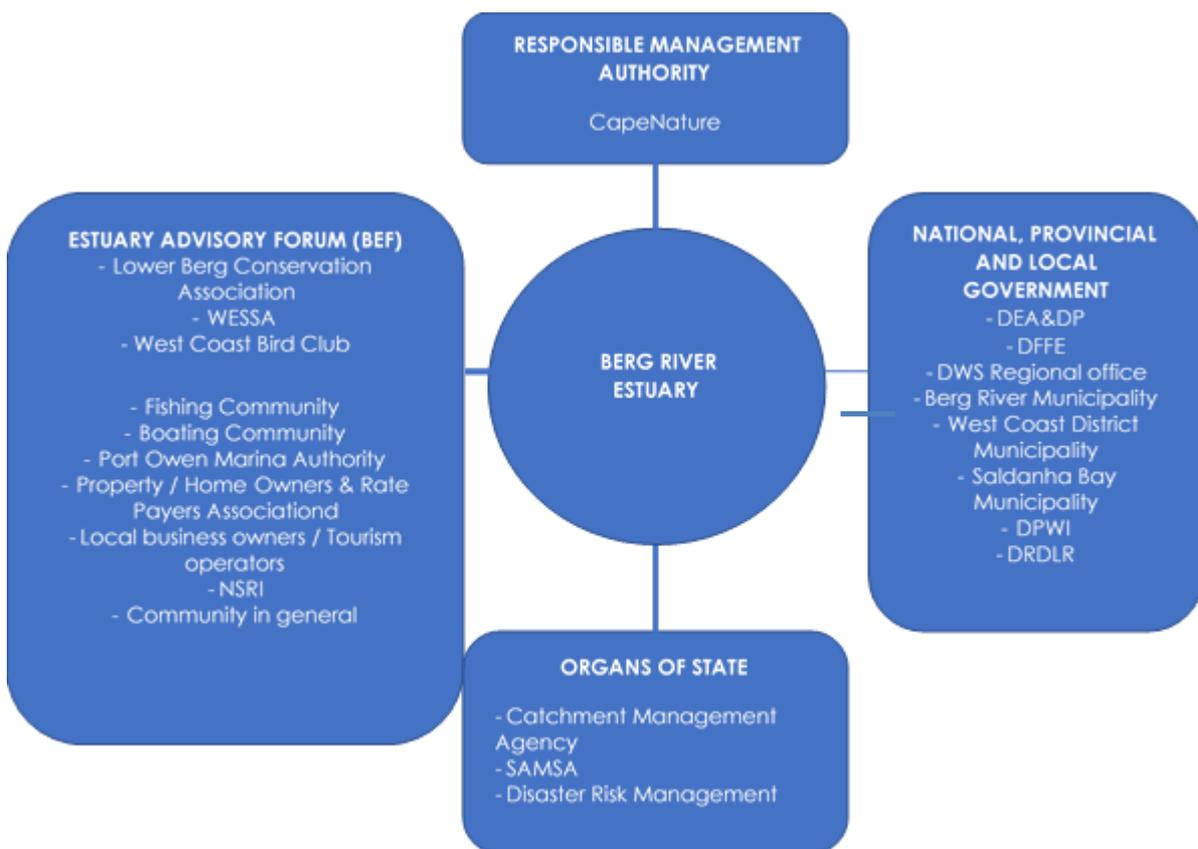


Figure 13: Key role players for the management of the Groot Berg River Estuary

7.1.1 Estuary Management Authority

The Protocol identifies the **CapeNature**, or its assigned representative, as the **Responsible Management Authority** responsible for the development of the Groot Berg River EMP as well as being responsible for the co-ordination of its implementation². This implementation function can be affected through a range of different forums and actors, and if necessary, delegated. Most of the estuary falls within the Berg River LM with Saldanha Bay LM involved with the far upper reaches of the system. Thus, a mutual agreement should be reached between the RMA, the District and the two local municipalities, whereby the responsibility of managing Municipal related activities in this portion of the estuary is formally ceded over to the Berg River Local Municipality, as provided for in the Protocol. The Saldanha Bay municipality must continue to play an important role in monitoring the management of the estuary.

7.1.2 Berg Estuary Forum

According to the Protocol, the **role of BEAF** is interpreted as providing an advisory service to the RMA on issues specific to the management and implementation of the EMP, as well as being the hub that links all stakeholders, which serves to foster stakeholder engagement and to facilitate the implementation of the project plans identified. The broader **community** will be able to voice concerns and raise issues via the BEAF. This includes Ratepayers' Associations, NGO's, community groups, conservancies, etc., as well as representatives from surrounding industry and agriculture. Any representatives are obliged to raise issues identified by their constituents and to provide feedback to the constituents. Importantly, the BEF will not represent or supplant the individual positions of its members unless specifically mandated to do so.

7.1.3 Government Departments and organs of state

The successful implementation of the EMP may be seen as also dependent on the contribution of a number of governmental role players, including:

- **Western Cape Government Departments:** Responsible for legislative support, including compliance, funding, research and monitoring;
- **Municipalities, including West Coast District Municipality, Saldanha Bay Local Municipality and Berg River Local Municipality:** Responsible for operational management and coordination of Municipal issues;
- Relevant **National Government Departments**, especially Department of Environmental Affairs, Department of Water and Sanitation (via the regional office), Department of Forestry and Fisheries, Department of Rural Development and Land Reform; Department of Agriculture, Land Reform and Rural Development

² Although the open water body and tidal reach fall within the Groot Berg River LM, the full estuarine functional zone extends into the Saldanha Bay LM. This necessitates an oversight role for the West Coast DM

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- Organs of State (SANparks, CapeNature [RMA], BGCMA).

The National Department of Environmental Affairs is generally responsible for national standardisation of estuarine management and approval of provincially-compiled estuarine management plans. Direct involvement in individual estuaries, such as the Groot Berg, will occur via existing forums for intergovernmental coordination. These forums will have the management of the Groot Berg River estuary on their agendas from time to time, and include:

- **Western Cape Provincial Coastal Committee:** Responsible for facilitating co-management, effective governance and provincial co-ordination of estuarine management;
- **West Coast District Municipal Coastal Committee:** Responsible for facilitating co-management and effective governance.

7.2 Recommend priority actions

It is recommended that the aspects of the EMP listed below be implemented as a matter of priority within the first year (i.e. **HIGH PRIORITY**). All other aspects listed in the management action plans are by default then considered MEDIUM or LOW priority.

- Improving conservation status in terms of Ramsar and the Cape West Coast Biosphere Reserve;
- Appointment of dedicated officials to oversee the management and administration task for the Groot Berg Estuary;
- Support and assist the Berg Estuary Advisory Forum and securing funding in support of its responsibilities and to facilitate the implementation of the action plans;
- Ensure the proper designation and appointment of the RMA and identify the appropriate implementing vehicle/agent for the EMP, e.g. Governance Tool;
- Establish and conclude implementation protocols with various government and other institutions;
- Finalise and promulgate the Coastal Management Line in and around the estuary;
- Provide adequate coastal access (vehicular and pedestrian) points;
- Provide adequate signage (Interpretive and informative boards at strategic places);
- Ensure that the EMP is endorsed by the RMA, signed/approved by MEC and incorporated into other appropriate legislative tools, e.g. IDP, SDF, etc.;
- Determine the value of goods and services derived from the estuarine environment and its contribution to the local economy;
- Engaging the Minister of DWS to approve the freshwater reserve and RQOs for Groot Berg estuary;
- Implement a monitoring system for the estuary (ecological, economic and social)
- Removing obstruction from the estuary channel;
- Promulgate “boating regulations”
- Monitoring pollutants and outflows;
- Prevent encroachment into CPZ;
- Secured funding for implementation;

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- Ensure compliance and prosecution of transgressors;
 - Identify and promote alternative sustainable livelihoods options and projects;
 - Empowerment of the public on the ecological processes and management objectives through awareness raising campaigns (eg. Coastal clean-ups, marine week and other celebratory events; Eliminating illegal fishing through the deployment of additional staff; and
 - Promoting sustainable agriculture to alleviate high nutrient return flows and damage to marginal habitat by livestock.

8 MONITORING AND EVALUATION

8.1 Resource monitoring

Basic water quality monitoring is currently undertaken on a monthly basis by the West Coast District Municipality on behalf of DWS. Monitoring is limited to the EFZ and the results reported to DWS. DEA&DP (Berg River Improvement Plan) and DEFF (fisheries monitoring programme) also monitor water quality in the estuary. The Saldanha Water Quality Trust monitors bacterial loads in the estuary. These data contribute are important as they contribute to a long-term data repository for the system to detect long term trends and to assist in decision making. The existing estuary forum has also played a valuable role in monitoring activities in and around the estuary and the facilitating the appointment of a monitoring officer.

Appendix 1 provides an expanded list of recommended abiotic and biotic parameters to be monitored on the Groot Berg River estuary, in line with Reserve Determination methodologies, to assess changes in health of the system over time, particularly in relation to the construction of the Berg River Dam. Additional recommendations have been included for monitoring of visitor numbers, profiles and opinions, and angler catch and effort required in terms of the management plan.

8.2 Review and evaluation

This EMP should be reviewed and updated on a five-yearly basis to ensure that objectives and targets are being achieved. An audit should be undertaken alongside the review and evaluation to determine and grade the success and failures with the implementation of the management plan according to the specified performance indicators (Appendix). The audit should ultimately be the responsibility of Berg River Local Municipality, supported by the BEF and CapeNature.

The review will involve revisiting the Situation Assessment to determine the progress or changes that have come about as a result of the EMP in terms of the objectives that were originally set as well as any changes in legislation or policies, and followed by revisions or refinement of the objectives and where necessary, aspects of the management actions plans or monitoring protocol.

9 RECOMMENDATIONS

The following recommendations are made to assist/ improve management of the Groot Berg River estuary:

- The role of RMA shall be performed by CapeNature with strong partnership with the West Coast District Municipality, Berg River Local Municipality and Saldanha Bay Local municipality.

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- Management of the upper portion of the Groot Berg River estuary should be ceded over to the Berg River LM through a formal agreement with the Saldanha Bay LM.
 - The strong links to DEFF must be retained with regards to fishing activities, namely the use of the system as a fishing harbour, gillnetting and line fishing.
 - Given the biodiversity value of the Groot Berg River estuary and its status as one of the national priority estuarine systems and part of the Western Cape Provincial Protected Area Strategy, formal protected area status under Ramsar and as part of the Cape West Coast Biosphere Reserve should be urgently investigated and adopted for the entire estuarine area, or part thereof.
 - Despite on-going lobbying for fishing to continue, fishing activities should not be permitted in the system.
 - Spatial zonation of the system should be revisited in the next review by the RMA, in consultation with the EAF, the respective municipalities and other relevant authorities (e.g. DEFF), and amended if necessary.
 - Future revisions of the zonation plan should also consider flexible recreational use areas as well as peak user days regulations.
 - Current water quality monitoring programme undertaken by West Coast DM must continue, in order to contribute to the broader programme for monitoring the health of the system.
 - Similarly, it is strongly recommended that DWS continue with the ecological monitoring (including fish) previously undertaken by the Council for Scientific and Industrial Research (CSIR) to monitor the ecological health of the system.

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APPENDIX 1: RECOMMENDED MONITORING PROTOCOLS

ECOLOGICAL COMPONENT	MONITORING ACTION	RELATED TPC (see Appendix 2)	TEMPORAL SCALE (frequency and when)	SPATIAL SCALE (No. Stations)
1. BIRDS	Undertake counts of all water-associated birds. All birds should be identified to species level and total number of each counted.	1.1 – 1.2	Winter and summer survey, yearly	Entire estuary
2. FISH	Conduct fish surveys using both seine and gill nets as primary gear.	2.1 – 2.6	Winter and summer survey every 3 years starting 2009	Entire estuary (30 stns)
3. INVERTEBRATES	Zooplankton: Collect quantitative samples using a flow meter after dark, preferably during neap tides (mid to high tide). Sampling to be done at mid- water level, i.e. not surface. (Include chlorophyll a measurements on benthic microalgae and water column chlorophyll as to establish feeding links)	3.1	Same as for fish	Entire estuary (12 stns)
	Benthic invertebrates: Collect (subtidal) samples using a Zabalocki-type Eckman grab sampler with 5-9 randomly placed grabs (replicates) at each station. Collect intertidal samples at spring low tide using core sampling.	3.2	Same as for fish	Entire estuary (12 stns)
	Macrocrustaceans: Collected quantitative samples during neap tides (mid to high tide), at the same stations used for zooplankton, using a benthic sled with flow meter.	3.3	Same as for fish	Entire estuary (12 stns)
4. MACROPHYTES	Map main macrophyte communities using aerial photos or GPS	4.1 – 4.5	Every 3 years	Entire estuary
5. MICROALGAE	Phytoplankton: Conduct water column chlorophyll a measurements and counts of dominant phytoplankton group.	5.1 – 5.3, 5.5	Same as for fish	Entire estuary (12 stns)
	Benthic microalgae: Conduct benthic chlorophyll a measurements	5.4	Same as for fish	Entire estuary (12 stns)
	Collect data on conductivity, temperature, suspended matter/turbidity, dissolved oxygen, pH, inorganic nutrients and organic content in river inflow	6.6, 6.7 & 6.8	At least monthly	At Jantjiesfontein or Steenboksfontein

ECOLOGICAL COMPONENT	MONITORING ACTION	RELATED TPC (see Appendix 2)	TEMPORAL SCALE (frequency and when)	SPATIAL SCALE (No. Stations)
6. WATER QUALITY	Monitor inorganic nutrient inflow from agricultural return flow in upper reaches (e.g. bore hole sampling)	6.6, 6.7 & 6.8	At least monthly	4 stns along upper estuary
	Collected longitudinal salinity & temperature profiles (in situ)	6.1 – 6.5	To be measured when biotic surveys require information for interpretation	Entire estuary (22 stns)
	Water quality measurements taken along the length of the estuary (surface and bottom samples) for pH, dissolved oxygen, suspended solids/turbidity and inorganic nutrients.	6.7 – 6.9		Entire estuary (22 stns)
	Baseline data set for pesticides/herbicides accumulation in sediments	6.13	Every 3 years	Focus on depositional areas
7. HYDRODYNAMICS	Water level recordings	8.6	Continuous	3 stations
	Flow gauging	7.1 – 7.3 & 8.1	Continuous	Head of the estuary (Steenbokfontein)
	Aerial photographs of estuary (spring low tide)	4.1 – 4.4 & 8.5	Annually	Entire estuary
8. SEDIMENT DYNAMICS	Bathymetric survey: Series of cross-section profiles and a longitudinal profile collected at fixed 500 m intervals, but more detailed in the mouth (vertical accuracy better than 300 mm)	8.5	Every 3 years	Entire estuary
	Set sediment grab samples (at cross section profiles) for analysis of particle size distribution (PSD) and origin (i.e. using microscopic observations)	8.3 - 8.4		Entire estuary
	Daily sampling of suspended sediment (and organic matter)	8.2	Daily	Steenbokfontein
9. HUMAN USE	Collect statistics on the profile (origin, sex, age, income category) and activities of visitors to the Groot Berg River estuary using self-fill in questionnaires		Continuous	or entry points and key sites of interest
	Conduct regular counts of users and boats, separated by type.		Twice per week	Entire estuary
	Survey visitor opinions on impacts of key management interventions.		Every two years	Entire estuary
	Creel surveys of Catch, Effort and C.P.U.E. for shore and boat-based anglers		Intensively (3x/week) every 5th year	Entire estuary

APPENDIX 2: ECOLOGICAL SPECIFICATIONS AND THRESHOLDS OF POTENTIAL CONCERN (TPC) FOR MONITORING PARAMETERS LISTED IN APPENDIX 1

The following table provides “Ecological Specifications/Resource Quality Objectives” and “Thresholds of Potential Concern” (TPC) for the Groot Berg River estuary adapted from those prepared for ecological freshwater requirements study completed for the Olifants estuary (Taljaard et al. 2006). In this context, “Ecological Specifications/Resource Quality Objectives” are defined as being clear and measurable specifications of ecological attributes (in the case of estuaries - hydrodynamics, sediment dynamics, water quality and different biotic components) that define a specific ecological reserve category, in this case a Category B, while “Thresholds of Potential Concern” are defined as measurable end points related to specific abiotic or biotic indicators that if reached (or when modelling predicts that such points will be reached) should prompt management action. Note that thresholds of potential concern endpoints are generally defined such that they provide early warning signals of potential non-compliance to ecological specification (i.e. not the point of “no return”). Thus, indicators (or monitoring activities) included here incorporate biotic and abiotic components that are considered particularly sensitive to ecological changes associated with changes in river inflow and should be interpreted as such.

ECOLOGICAL SPECIFICATIONS/RESOURCE QUALITY OBJECTIVES		THRESHOLD OF POTENTIAL CONCERN	POTENTIAL CAUSES
1. BIRDS	Retain the species richness, abundance and diversity of the bird community, representative of resident and migrant waders, wading birds and water fowl as under the Present State as assessed during the Berg River Baseline Monitoring Programme (Clark 2007).	<p>1.1 Community composition or bird numbers deviates by more than 50% of average seasonal baseline counts for two consecutive summer or winter seasons, focusing on waders, wading birds, terns & water fowl (summer and winter), and specifically red data species which are supported by the system (e.g. Pelican, Oyster catchers, Chestnut banded plover)</p> <p>1.2 In the case of water fowl densities decline by 20% of average seasonal baseline counts for two consecutive summer or winter seasons</p>	<p>Changes in:</p> <ul style="list-style-type: none"> Salinity Invertebrate biomass/abundance Fish biomass/abundance in smaller size classes Vegetation habitats (e.g. reed beds, submerged macrophytes, salt marsh) Mud flats Human disturbance (not at moment)

ECOLOGICAL SPECIFICATIONS/RESOURCE QUALITY OBJECTIVES		THRESHOLD OF POTENTIAL CONCERN	POTENTIAL CAUSES
2. FISH	Retain the following fish assemblages in the estuary: estuarine species (25-75%), partially estuarine dependent species (40-80%), and obligate estuarine dependent (e.g. white steenbras) (>1%). Exotic freshwater species (<0.5%)	<p>2.1 Level of estuarine species drop below 25% of total abundance</p> <p>2.2 Levels of obligate estuarine dependent species drop below 0.5% of total abundance</p> <p>2.3 Levels of partially estuarine dependent species drop below 40% or rise above 80% of total abundance</p> <p>2.4 Levels of exotic freshwater species above 0.5% (e.g. Mozambique tilapia out-competing resident species)</p> <p>2.5 Benthic dwellers species drop below 2% of total abundance in estuary above 18 km from the mouth</p>	<p>Changes in:</p> <ul style="list-style-type: none"> Insufficient spawn biomass (national stock – marine) Spawning failure due to environmental conditions (marine) Recruitment failure (e.g. no cues reaching the sea from the estuary) Habitat (macrophytes) Water column (temperature, salinity, turbidity, dissolved oxygen) Toxic substances (?) Food availability (Invertebrate & fish) Exploitation Introduction in aliens
	Maintain recruitment of adult and juvenile fish at Reference Condition levels. This requires maintaining sufficient flow for freshwater plume (temperature, salinity and olfactory gradient) entering the sea. This implies that there should be a significant number of 0 - 1 year old fish and no missing year classes.	2.6 There are a missing year classes within a species	Blockage of eel migrations due to sand bar at mouth, Bad catchment practices/destruction of habitat, Blockage of migration due to dams.
3. INVERTEBRATES	Retain Present State species richness and mix (low species abundance, high dominance). However, under the present state one or two species are always present at high densities compared to others (e.g. <i>Pseudodiaptomus hessei</i>). For a B Category the higher densities need to be more variable in abundance during the year.	3.1 Species richness is greater than 30 for zooplankton and macroinvertebrates respectively (50% increase)	<p>Changes in:</p> <ul style="list-style-type: none"> Variability in intra-annual flow, e.g. loss of high flow pulses (>20 m3/s) in autumn/spring (salinity) Sediment grain size distribution and organic content
	Indicator species such as <i>Capitella capitata</i> , should not dominate benthic species at any site	3.2 <i>Capitella capitata</i> exceeds 50% abundance of benthic species at any site	Increase in pollution (low oxygen high organic loading)
	<i>Callianassa</i> and <i>Upogebia</i> distribution patterns as under Present State	3.3 Abundance levels or areas of distribution decreases by more than 50% (mainly lower sandy reaches)	Changes in sediment characteristics along the estuary

ECOLOGICAL SPECIFICATIONS/RESOURCE QUALITY OBJECTIVES		THRESHOLD OF POTENTIAL CONCERN	POTENTIAL CAUSES
4. MACROPHYTES	Maintain the present distribution and abundance of the different plant community types	4.1 Greater than 20% change in the area covered by different plant community types	Increase in salinity and reduced flooding influencing depth to groundwater and groundwater salinity. Increase in turbidity would reduce submerged macrophyte cover.
	Reduce the areas covered by macroalgae (<i>Enteromorpha</i> sp.) in the upper reaches by 50% compared to the Present State (summer 2004).	4.2 Lower 15 km of estuary with greater than 50% of estuary mudflats covered by <i>Enteromorpha</i> sp.	Low flow, lack of flushing and reduced current speeds. Reduced flooding that resets the estuary. High nutrient input from agricultural activities and return flow.
	Control the spread of invasive aliens in the riparian zone (e.g. <i>Sesbania punicea</i> and <i>Eucalyptus</i> spp.).	4.3 Greater than 20% increase in area covered by invasive plants.	Disturbance of riparian zone due to human impacts such as bulldozing and clearing of natural vegetation
	Maintain reed and sedge areas and brackish salt marsh as for the Present State (by preventing upstream encroachment of saline water).	4.4 Dieback of reeds and brackish salt marsh in middle and upper reaches of estuary.	Reduced flow and an increase in saline intrusion.
	Prevent an increase in bare ground in the floodplain salt marsh by maintaining groundwater salinity at <70 ppt and depth to the water table at < 1.5 m	4.5 Greater than 20% increase in bare ground in salt marsh.	Reduced flow and flooding, increase in groundwater salinity and depth to groundwater.
5. MICROALGAE	Maintain a low phytoplankton biomass with a small REI (i.e. 10 ppt to river +1 ppt) zone	5.1 Phytoplankton biomass exceeds 10 µg/l chlorophyll a in summer or winter 5.2 Blue-green algae exceeds 10% of phytoplankton cell	Water flow rates falling too low in winter or summer.
	Maintain microalgal group diversity as measured under Present State	5.3 5.3 Flagellates cease to be the dominant group and diatoms become less diverse (<10 taxa per site)	Reduced freshwater inflow rates and high salinity near the upper areas of the estuary.
	Maintain intertidal and subtidal microphytobenthic biomass as measured under Present State (2004).	5.4 Benthic microphytobenthic biomass exceed 40 mg/m ² chlorophyll a	Elevated nutrient in the inflowing freshwater.
	Maintain a low frequency of dinoflagellates	5.5 The frequency of dinoflagellates exceeds 5% of the total phytoplankton counts	Eutrophication of inflowing river water.

ECOLOGICAL SPECIFICATIONS/RESOURCE QUALITY OBJECTIVES		THRESHOLD OF POTENTIAL CONCERN	POTENTIAL CAUSES
6. WATER QUALITY	Salinity intrusion should not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae (see above)	<p>6.1 Salinity greater than 20 ppt for long than 3 months at 7 km upstream from the mouth (brackish saltmarsh, reeds and sedges & invertebrates)</p> <p>6.2 Salinity of groundwater increases to 50 ppt and depth to water table to 1 m. (flood plain salt marsh)</p> <p>6.3 Total dissolved solids (measure of 'salinity') of river inflow exceeds 3500 mg/l (phytoplankton)</p> <p>6.4 Salinity in estuary exceeds 35 ppt (prevent hyper-salinity) (phytoplankton)</p> <p>6.5 Salinity greater than 10 ppt occurs above 16 km upstream of the mouth (fish)</p>	Modification of volume of river inflow Quality of agricultural return flow
	System variables (Temperature, pH, turbidity, dissolved oxygen, suspended solids and turbidity) not to cause exceedance of TPCs for biota (see above)	6.6 River inflow: Summer temp < 20°C pH < 6.5 'Turbid' river inflow (to be determined) Dissolved oxygen < 4	Changes in water quality of river inflow at head of estuary and as a result of agricultural return flow along the banks of the upper estuary.
		6.7 Secchi disc reading above 8 km from the mouth is greater than 1 m (proxy for turbidity in estuary)	
		6.8 pH > 8.5 or < 6.5 in river inflow or in estuary	Excessive macroalgal/microalgal growth in the estuary
		6.9 Water column DO drops below 4 mg/l (1 m above bottom except in deep holes) (need to investigate DO level at night in dense macrophyte beds)	
	Inorganic nutrient concentrations not to cause exceedance of TPCs for macrophytes and microalgae (see above).	6.10 When average river inflow is less than 5 m ³ /s and average DIN concentrations exceed 100 µg/l in river inflow and DIN concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 100 µg/l	Changes in water quality of river inflow at head of estuary and as a result of agricultural return flow along the banks of the upper estuary.
		6.11 During high flow season (flows > 20 m ³ /s) average DIN concentrations exceed 500 µg/l in river inflow and average DIN concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 500 µg/l	
		6.12 Average DRP concentration exceed 100 µg/l in river inflow and average DRP concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 100 µg/l	

ECOLOGICAL SPECIFICATIONS/RESOURCE QUALITY OBJECTIVES		THRESHOLD OF POTENTIAL CONCERN	POTENTIAL CAUSES
	Presence of toxic substances not to cause exceedance of TPCs for biota (see above).	6.13 For pesticides/herbicides baseline studies still need to be undertaken before TPCs can be set (special concern in upper reaches with extensive agricultural activities along banks of estuary)	Inputs from agricultural activities in the catchment and along the banks of the estuary in upper reaches
7. HYDRO-DYNAMICS	Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality	7.1 River inflow distribution patterns differ by more than 5% from present 7.2 River inflow decreases to below 1.5 m ³ /s at any time 7.3 River inflow below 2 m ³ /s persist for longer than 4 months	Modification to inflow at head of estuary
8. SEDIMENT DYNAMICS	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see above)	8.1 River inflow distribution patterns (flood components) differ by more than 10% (in terms of magnitude, timing and variability) from that of the Present State 8.2 Suspended sediment concentration from river inflow deviates by more than 10% of the sediment load discharge relationship to be determine as part of baseline studies	Modification to inflow at head of estuary
	Changes in sediment grain size distribution patterns not to cause exceedance of TPCs in benthic invertebrates (see above).	8.3 The median bed sediment diameter deviates by more than a factor of two from levels to be determined as part of baseline studies (Present State). 8.4 Sand/mud distribution in middle reaches (8-20 km) change by more than 20% from Present State 8.5 Changes in the channel bathymetry in the upper reaches (above 20 km upstream of the mouth) change by more than 20% from Present State 8.6 Changes in tidal amplitude below the Steenbokfontein of more than 20% from Present State	Modification to inflow at head of estuary; Catchment activities

APPENDIX 3: RECOMMENDED PERFORMANCE MONITORING PLAN

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	TIMING	LEGISLATION	RESPONSIBILITY
1. Protection of biodiversity and sense of place				
a. Establish a Special Management Area (SMA)	Lower Groot Berg River estuary receives formal protection as a SMA	Once a year	ICM Act NEM:PAA	BEF, CapeNature, DEA
b. Integrate into IDP/SDF	EMP is reflected in the local/district and coastal management line is gazetted	Every IDP/SDF review cycle	ICM Act MSA	Berg River LM
c. Zonation plan	Boating and other estuary uses occur only within the designated zones	Every 5 years	ICM Act, Seashore Act, MSA	Berg River LM, West Coast DM
d. Ramsar Status	Groot Berg River estuary receives formal protection as a Ramsar site	Assess progress every year	NEM:PAA	DEA, BEF, CapeNature
e. CWCBR Core area	Groot Berg River estuary redefined as core area within CWCBR	Assess progress every year	NEM:PAA	BEF, C.A.P.E., CWCBR
f. Ensure sustainable use of estuary resources	Improvements in ecological health indices Number of permits issued Number of infringements reduced Increase in number of patrols and inspections	Ongoing for compliance personnel, daily patrols & inspections	MLRA	DEFF, CapeNature
2. Co-operative and effective governance				
a. Appoint Berg Estuary Forum	Confirmed members & constituted BEF	End of 1st year	ICM Act	CapeNature
b. Define co-operative governance arrangements	Confirmed roles & responsibilities of participating agencies	Assess every 2 years	ICM Act, NEM:PAA	BEF, C.A.P.E., CapeNature. Berg River LM, DEA, DWS
c. Secure financing	Funding is secured for next 5 years	Assess twice a year	ICM Act, NWA, CARA, MSA	Berg River LM, Key partners

d. Provide resources and capacity	Office space obtained and adequately equipped, manned by knowledgeable and well-trained permanent staff	Assess twice a year		RMA, DEA&DP, Key partners
3. Restoration of estuary health				
a. Secure freshwater input	Ecological health Category of C is achieved and maintained	Biannual for DWS	NWA	Berg River LM, DWS, BEF, C.A.P.E.
b. Remove obstructions to flow and clear alien vegetation	All obstructions removed Increased number of tons of alien vegetation removed/ hectares cleared	Ad hoc visual monitoring during normal daily activities	CARA	Berg River LM,, BEF, DEA&DP.
c. Eliminate illegal fishing	Increase in fish abundance and nursery function	Ad hoc visual monitoring during normal daily activities	MLRA	Berg River LM, BEF, C.A.P.E.
d. Promote sustainable agriculture	Improvement in estuary nutrient status Degraded areas recovered Cooperative governance with local communities	Twice a year	CARA, NWA	DALRRD, DWS, BEF, CapeNature
4. Research and monitoring				
a. Promote scientific research	Increase in number of research projects and monitoring programmes	Once a year		Berg River LM, BEF, CapeNature
b. Monitor estuary health	Ongoing databases and reports produced	Biannual for DWS Monthly for BEF	NWA	Berg River LM, BEF, DWS
c. Monitor human use	Ongoing databases and reports produced	Ad hoc visual monitoring during normal daily activities	MLRA	Berg River LM,, BEF, CapeNature
5. Increasing public awareness				
a. Create mechanisms for communication with stakeholders	Widespread and effective communication to a diversity stakeholders who are well informed through their preferred method of communication	Once a year	ICM Act	Berg River LM,, BEF,
b. Develop education and	Visitor center open to public	Once a year	ICM Act	Berg River LM,, BEF,

awareness programme	Increase in number of newsletters, pamphlets, and posters; Sufficient number of public notice boards; Increase public participation in coastal/estuary/river clean ups and other initiatives. Increase in number of visiting school groups to visitor center			
6. Maximising economic benefits & promoting ecotourism				
a. Establish and manage visitor facilities	Increase in number of tourists per year Increase in contribution of tourism to GDP	Once a year		Berg River LM,, BEF,
b. Market the Groot Berg River estuary	Increase in number of newsletters, pamphlets, and posters Increase in number of tourists per year Increase in number of employed persons Ongoing provision of employment opportunities	Once a year		Berg River LM,, BEF,

