



**Western Cape
Government**
Environmental Affairs and
Development Planning

Heuningnes River Estuary Draft Estuarine Management Plan

DOCUMENT DESCRIPTION

Document title and version:

Heuningnes River Estuary Draft Estuarine Management Plan

Project Name:

Western Cape Estuary Management Framework and Implementation Strategy

Client:

Western Cape Government, Department of Environmental Affairs & Development Planning

Royal HaskoningDHV reference number:

MD1819

Authority reference:

EADP 1/2015

Compiled by:

Version 1: HillLand (2010)

Version 2: Royal HaskoningDHV (2019)

Version 3: CapeNature (2021)

Acknowledgements:

CapeNature

Western Cape Government Environmental Affairs & Development Planning

Directorate: Biodiversity and Coastal Management

Sub-Directorate: Coastal Management

Email: coastal.enquiries@westerncape.gov.za

Date:

August 2021



DOCUMENT USE

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) (ICMA), via the prescriptions of the 2013 National Estuarine Management Protocol (NEMP), requires Estuarine Management Plans (EMPs) to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management. The NEMP, promulgated in May 2013, sets out the minimum requirements for individual EMPs.

In 2013/2014, a review was conducted by the National Department of Environmental Affairs: Oceans and Coasts (DEA: O&C) (DEA, 2014a) on existing EMPs to ensure, *inter alia*, the alignment of these plans with the NEMP (2013). This revision of the Heuningnes River EMP, including the Situation Assessment Report (SAR) 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 NEMP. In summary, this entailed:

- Updating the terminology as per the NEMP;
- Including a summary of the Situation Assessment, specifically addressing ecological health;
- Include a map of geographical boundaries based on the Estuarine Functional Zone;
- Rewording of objectives linked to the vision;
- Restructuring of the management objectives and activities;
- Refinement of the estuary zonation map;
- Providing performance indicators to gauge progress towards achieving the objectives;
- Extending the monitoring plan to explicitly include a performance monitoring plan to gauge progress towards achieving EMP objectives (i.e. using performance indicators);
- Updating information on institutional capacity and arrangements to reflect requirements of the ICMA and the NEMP.

Significant amendments have been made to bring this document in line with the requirements of the NEMP. Nonetheless, the work of the original authors and input received from stakeholders have been incorporated into this revised EMP.

Historical information and data remain relevant and critically important for estuarine management in the long term and must be supplemented by new information when it 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, and supporting SAR, must not be

considered a once-off compilation but rather a “living document” that should be regularly updated and amended as deemed necessary.

Earlier editions of the SAR and EMP were drafted referring to the government departments in existence at the time. Where feasible, the necessary updates have been made or indicated otherwise.

EXECUTIVE SUMMARY

Introduction

The National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) (ICMA) was developed to facilitate the sustainable use and management of South Africa's coastline and coastal and estuarine resources. The ICMA requires that estuaries within South Africa be managed in a co-ordinated and efficient manner, and in accordance with the National Estuarine Management Protocol (NEMP) and the National Coastal Management Programme (CMP) (DEA, 2014b), which lay out specific objectives for management of the South African coastline, including estuaries.

The Heuningnes River EMP was originally developed by Hilland Associates (2010) under the auspices of the erstwhile Cape Action Plan for the Environment (CAPE) Estuaries Management Programme, and has been revised to fulfil requirements of the ICMA and align with the NEMP (2013) published under the ICMA.

Summary of Situation Assessment

The SAR provides an overview of the current status of the Heuningnes River estuary, identifies areas of deficiency in terms of management and provides a platform for the EMP envisaged.

The Heuningnes River estuary is a low-lying permanently open estuarine system situated on the Cape south coast, approximately 300 km south east of Cape Town, within the cool temperate biogeographic region of South Africa. It covers an appreciable area of 14 123 ha (1 475 ha open water) extending over a length of 19 km. The mouth of the estuary falls within the De Mond Nature Reserve Complex and it has been identified as a Ramsar wetland of international importance as well as a national priority estuary. In addition, a small portion of the Heuningnes River Estuary in the south west corner abutting Soetendalsvlei is located in the Agulhas National Park.

Despite intensive agriculture in the catchment, the overall present ecological health of the Heuningnes River estuary is rated as a C Category, that is, moderately modified. It is highly important in terms of its conservation value; the extensive interconnected wetland habitats incorporating the Soetendalsvlei and high functional importance as a roosting area for coastal birds, fish and crustacean nursery area, and migratory corridor, make the Heuningnes River estuary unique along the southern Cape coast. The Recommended Ecological Category (REC), or desired state, is considered to be a B Category. Attaining this state would require restoring a certain amount of flow to the system as well as addressing some of the existing non-flow related issues affecting the estuary. The system is also highly valued as a recreational and tourism destination for recreational fishing and natural exploration and appreciation through the De Mond Nature Reserve and private properties. With the tourism industry being one of

the fastest growing economic sectors in the Cape Agulhas region, the Agulhas Plain possesses significant economic potential from a biodiversity perspective.

Notwithstanding its high ecological and conservation importance, a significant proportion of the estuarine function zone has been transformed by agricultural development, which together with growing pressure for water abstraction, fishing and bait harvesting, and low-lying development, threaten the health of the system. In addition, the low-lying nature of the Agulhas Plain renders the area vulnerable to extensive flooding during prolonged closure of the estuary mouth. This negatively affects farming practices and thus the local economy. Thus, there is ongoing pressure to artificially breach the estuary mouth when water levels are too high. Mouth management and linking the Soetendalsvlei to the ocean forms a critical aspect of the Heuningnes Estuary management.

Only a portion of the expansive Heuningnes system is afforded formal protected area status. The desirability and potential for expanding the protected area is therefore very high in order to preserve the health of the system and ensure appropriate management of this sensitive area. Several opportunities for expansion include stewardship options on private land, proclamation of sections of the Heuningnes River as a protected area; and proclamation of a Marine Protected Area adjacent to the De Mond and Waenhuiskrans properties.

One of the most important restoration actions that was identified was the need for ecological buffer areas on many of the agricultural areas. A 100m buffer is proposed on the estuary and specific priorities within this buffer area will be defined and allocated to specific management objectives within the EMP. The system is also in need of alien vegetation management. In addition, the recent EWR study for the Heuningnes River estuary identified a number of important restorative measures that should be implemented by various role players to improve the health of the system to a "B" class.

Various knowledge gaps were identified during the SAR and EWR processes, leading to the recommendation of specific research opportunities to address these shortfalls. These include an economic assessment of maintaining open mouth conditions, an economic assessment of the ecosystem goods and services provided by the system, and ongoing observation program as well as a fish tagging programme.

Vision and Objectives

The Vision adopted for the Heuningnes River estuary is:

“The sustainable, non-commercial management of this near pristine Ramsar site while preserving and promoting biodiversity, fish recruitment and controlled Eco-Tourism Activities as well as the promotion of sustainable agriculture practices along the estuary banks for the benefit of present and future generations.”

While the Vision is an inspirational, higher-level statement which defines the strategic intent of management intervention, key (strategic or overarching) objectives support the development of the detailed management objectives for the Heuningnes River EMP. These are as follows:

Sector/ Category and Key Objective	Performance Indicators	Priority
1. Biodiversity Conservation		
Targets for ecosystem biodiversity and health (in terms of the long-term persistence of habitats, species, community structure, biomass and functioning) are achieved and the estuary continues to function as a Ramsar site.	<ul style="list-style-type: none"> • Estuarine area under formal protected area status is increased • Biodiversity hotspots/ Sensitive species habitats are documents and protected • Integrity and functionality of estuary and wetlands improved • Spatial zonation plan (revised) is adopted and enforced through appropriate bylaws and regulations • Monitoring programmes are in place, and data is captured by an effective database management system • A rehabilitation programme is developed and implemented, that is backed by adequate funding and sponsorships • Improved law enforcement resulting in a reduction in degrading and illegal activities 	HIGH
2. Water Quantity & Quality		
Estuarine structure and function are preserved and maintained through implementation and monitoring of RQOs/Ecospecs (also taking into account public health).	<ul style="list-style-type: none"> • Ecological reserves for water quantity and quality are secured • Effective catchment management through the active participation of key role players • Mouth Management is not detrimental to the ecological functioning of the estuary 	MEDIUM

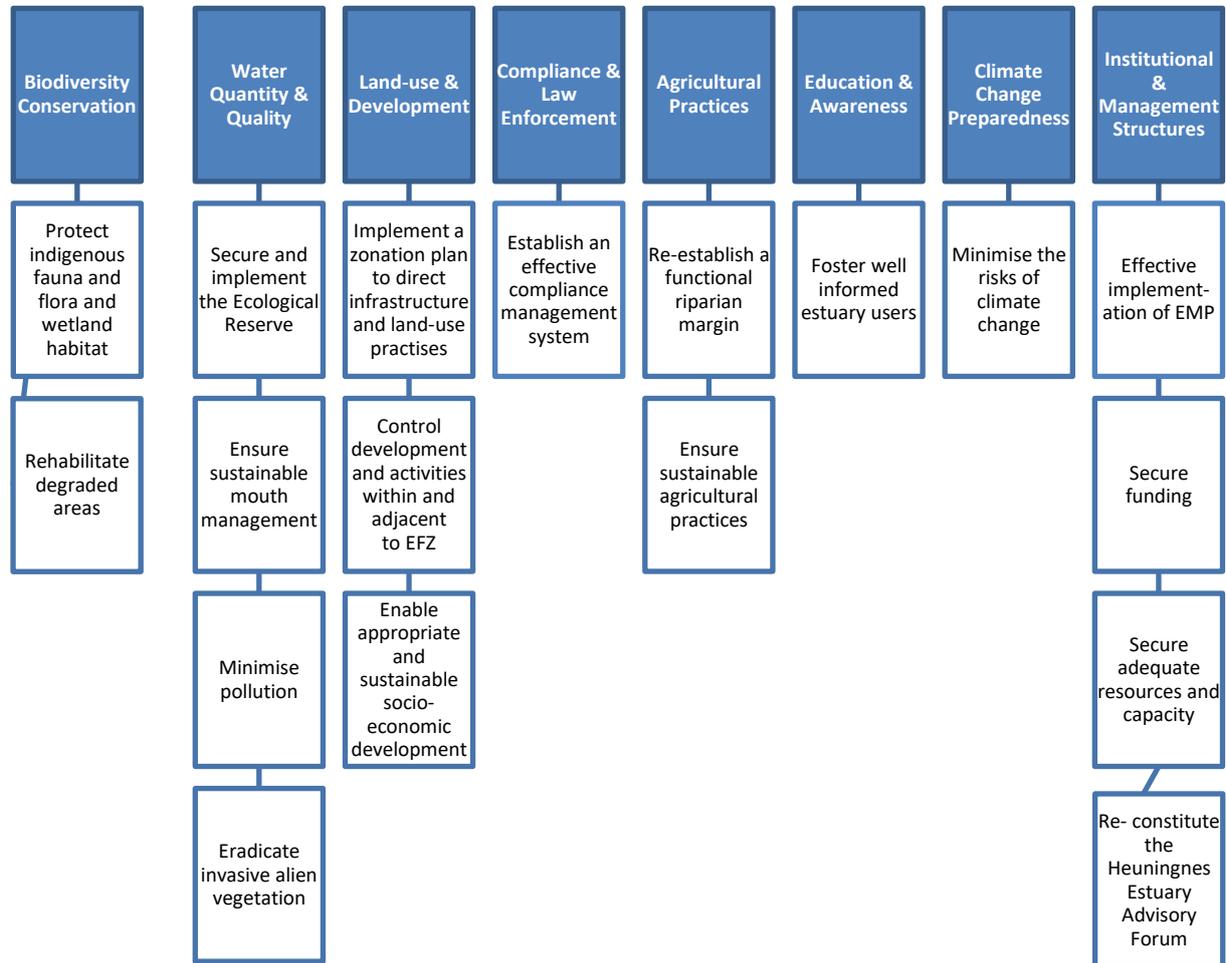
Sector/ Category and Key Objective	Performance Indicators	Priority
	<ul style="list-style-type: none"> Waste water discharge is not detrimental to the ecological functioning of the estuary IAPs eradication programme developed and implemented on an ongoing basis Water quality monitoring programme is in place Ecological health of the estuary is improved 	
3. Land-use & Infrastructure Planning		
<p>The current status and values of the various estuarine areas are established, and implications of future flood levels for the estuarine functional zone (5m contour) determined.</p>	<ul style="list-style-type: none"> Spatial zonation plan(revised) is adopted and enforced through appropriate bylaws and regulations 	MEDIUM
	<ul style="list-style-type: none"> Reduced habitat loss/degradation and disturbance, and inappropriate activities Viable and compatible socio-economic opportunities to uplift local communities or specific target groups are identified and implemented 	
4. Compliance & Law Enforcement		
<p>The estuary and its resources are utilised in sustainable manner through an effective level of compliance management.</p>	<ul style="list-style-type: none"> Monitoring programme is developed and implemented, which is supplemented by additional appointment and deployment of trained and endorsed law enforcement officers/rangers Effective permitting and data monitoring system developed, which regulates the number and type of resource use, and yields useful data that is easy to interpret Preservation of the estuary as a bait sanctuary / bait collection policy is strongly enforced Sustainable use of estuarine and marine living resources throughout the system 	MEDIUM

Sector/ Category and Key Objective	Performance Indicators	Priority
5. Agricultural Activities		
<p>Viable agricultural activities within the estuarine functional zone are maintained and promoted. All agricultural activities in the catchment area are not detrimental to the functioning of the estuary.</p>	<ul style="list-style-type: none"> • Riparian buffer is re-established and functional, and damaging activities are reduced • Implementation of the mouth management plan that protects sustainable and legal agricultural activities • Effective cooperative catchment management • Adoption of environmental best practices, specifically toward reducing the use of fertilizers and remediating damaging activities 	HIGH
6. Education & Awareness		
<p>The importance of Heuningnes River estuary as a Ramsar site and a fish nursery is realised through effective awareness raising and education</p>	<ul style="list-style-type: none"> • Awareness programme developed and successfully implemented on an on-going basis • Informative signage erected at strategic points and information disseminated 	MEDIUM
7. Climate Change Preparedness		
<p>The detrimental impacts of predicted climate change are minimised by:</p> <ol style="list-style-type: none"> 1. taking a long-term precautionary approach to infrastructure development and water-resource planning*; 2. influencing land management in upper and middle catchments to reduce impacts on estuary; and 3. promoting long-term sustainable livelihoods through estuarine management that minimises risks. 	<ul style="list-style-type: none"> • Impacts of climate change on the Heuningnes River estuary determined and documented • The options of planned retreat out of high risk areas are investigated • An estuary-specific climate change adaption strategy is developed • New development excluded from sensitive areas and high risk areas • Applicable building controls applied to risk areas 	HIGH
8. Institutional & Management Structures		
<p>The estuary is managed in a cooperative and integrated manner between appropriate spheres of government, relevant management institutions and civil society.</p>	<ul style="list-style-type: none"> • Appropriate regulations and bylaws are developed and gazetted to give effect to the EMP and zonation plan 	MEDIUM

Sector/ Category and Key Objective	Performance Indicators	Priority
	<ul style="list-style-type: none"> • Effective co-operative governance through a committed management committee • Roles and responsibilities defined and accepted via signed MOUs • Mandated authorities and participating agencies are well capacitated, actions are fulfilled • Functional HEAF with representatives of all relevant spheres of government and civil society that meets regularly • Integration and active collaboration with HROA and ABI • Effective communication between responsible authorities and stakeholders 	

Management Objectives

An illustrative overview of the management objectives is provided below. Detailed action plans were developed for each of these objectives.



Proposed Spatial Zonation

At the time of drafting the initial EMP, the Heuningnes estuarine management area was delineated from the Bredasdorp / Struisbaai road (R319) to the mouth of the estuary. However, there is a realisation that the estuarine functional zone (EFZ), according to the 5 m contour, incorporates a significantly larger area including extensive wetland habitat including Soetendalsvlei associated with the Heuningnes River estuary.

The proposed spatial zonation incorporates the coastal protection zone, coastal management line, 100 m buffer from the HWM, 5 m contour EFZ, 32m river and wetland buffer and the 1:50 year and 1:100 year flood lines. It identifies the existing development areas, and proposes the following zones:

- Development zone;

- Limited Activity Zones (incorporating all sensitive estuarine habitats and ecological corridors);
- Recreational Use Zones; and
- Marine Living Resource Use Zones.

However, in its current form, the spatial zonation of the Heuningnes River estuary is very restrictive, with 75% being no-go for any form of use. This is both impractical and undesirable. It is therefore imperative that future revisions of the Heuningnes EMP incorporate the full extent of the EFZ as delineated by the 5 m topographical contour (or future refinements of the EFZ) and consider broader permissible uses.

Institutional Capacity and Arrangements

This EMP should be regarded as a strategic plan that can guide the detailing of management actions and identification of implementing agents. It does not specify the required resources (human and financial) required for effective management of the estuary. Co-management and effective governance is a vital aspect to the efficient and effective estuarine management and key role players in the management of the Heuningnes River estuary are identified.

Although the Heuningnes River estuary falls wholly within the Cape Agulhas municipal area, thus inferring the responsibility of management authority and co-ordination of the implementation of the EMP on the Cape Agulhas LM according to the NEMP (2013); CapeNature is already responsible for the management of the De Mond NR, and SANParks manages the south western section of the EFZ in the Agulhas NP. Designation of the RMA will thus need to be through agreement via a signed Memorandum of Understanding, between these entities, whilst the formation of a management committee is recommended for de facto implementation of the various actions identified in the plan. The functions of the RMA are described including the position and role of the Heuningnes Estuary Advisory Forum, which must embrace, inter alia, the Heuningnes Riparian Owners Association.

Finally, key government departments and organs of state that fulfil a supporting role to the RMA are identified.

Integrated monitoring plan

Monitoring is a crucial aspect of the adaptive estuarine management planning process as the generated data will be used to inform and update management decisions. Three broad categories of monitoring are incorporated into an integrated monitoring plan, namely resource monitoring, compliance monitoring and performance monitoring.

There are various forms of monitoring taking place, such as the tidal measuring station (and a pending permanent water quality probe) at De Mond, bi-weekly water quality monitoring by CapeNature at De Mond, and six-monthly by DWS, as well as seasonal

coordinated water bird counts and regular inspections of fish catches at De Mond. A set of recommended minimum monitoring requirements to ascertain the current state, future pressures on the estuary, and detect any trends is provided from the EWR study. These include details on the ecological component, monitoring action, temporal scale, as well as spatial scale of monitoring proposed. These are accompanied by Ecological Specifications and Thresholds of Potential Concern.

Law enforcement in the Heuningnes River estuary is currently insufficient due to lack of capacity. By and large, compliance monitoring within the De Mond Nature Reserve and Agulhas National Park is the responsibility of CapeNature and SANParks, respectively, and is undertaken according to applicable legislation and policies and by means of internal law enforcement and compliance monitoring protocols. Through the RMA, all authorities, including CapeNature and SANParks, will need to increase their law enforcement personnel.

The performance monitoring plan is proposed to be used by the RMA to assess the effectiveness with which planned management activities contained in the EMP are being performed and ultimately to gauge progress in achieving the vision and objectives. A monitoring plan relative to the proposed management priorities is included. It is also anticipated that CapeNature and SANParks will employ the Management Effectiveness Tracking Tool – South Africa (METT-SA) to assess the implementation of the EMP and effectiveness of the management of the estuary in their areas of jurisdiction.

Ultimately, this EMP should be reviewed by the RMA and updated on a five-yearly basis to ensure that objectives and targets are being achieved.

Research

Research is an integral part of any management approach. With management actions and monitoring, existing and new questions will arise that needs to be addressed through proper research. A prioritised list of the basic research requirements for effective monitoring of the Heuningnes River estuary is provided.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	BACKGROUND	1
1.2	PURPOSE AND SCOPE OF THE HEUNINGNES RIVER ESTUARINE MANAGEMENT PLAN	2
1.3	SUMMARY OF LEGAL FRAMEWORK	3
1.4	MANDATE AND RESPONSIBILITIES OF THE RESPONSIBLE MANAGEMENT AUTHORITY	5
2	SUMMARY OF SITUATION ASSESSMENT	8
3	VISION & OBJECTIVES	16
3.1	VISION 16	
3.2	OBJECTIVES	16
4	MANAGEMENT OBJECTIVES	21
4.1	BIODIVERSITY CONSERVATION	21
4.2	WATER QUANTITY & QUALITY	21
4.3	LAND-USE & INFRASTRUCTURE PLANNING	21
4.4	COMPLIANCE & LAW ENFORCEMENT	21
4.5	AGRICULTURAL PRACTICES	21
4.6	EDUCATION & AWARENESS	22
4.7	CLIMATE CHANGE PREPAREDNESS	22
4.8	INSTITUTIONAL & MANAGEMENT STRUCTURES	22
5	MANAGEMENT PRIORITIES	24
5.1	BIODIVERSITY CONSERVATION	24
5.2	WATER QUANTITY & QUALITY	27
5.3	LAND-USE & INFRASTRUCTURE PLANNING	31
5.4	COMPLIANCE & LAW ENFORCEMENT	35
5.5	AGRICULTURAL PRACTICES	37
5.6	EDUCATION & AWARENESS	39
5.7	CLIMATE CHANGE PREPAREDNESS	40
5.8	INSTITUTIONAL & MANAGEMENT STRUCTURES	41
6	SPATIAL ZONATION	44
6.1	GEOGRAPHICAL BOUNDARIES	44
6.2	BIOREGIONAL PLANNING	45
6.3	COASTAL & RIVER POLICY BUFFER ZONES AND MANAGEMENT LINES	47
6.3.1	Coastal Protection Zone	47
6.3.2	Coastal Management Line	47
6.3.3	100m buffer from the High Water Mark	47
6.3.4	32m river and wetland buffer	48
6.3.5	5m contour (Estuarine Functional Zone and Floodplain)	48
6.3.6	1:50 and 1:100 year Flood lines	48
6.4	DE MOND NATURE RESERVE ZONATION	49
6.5	HABITAT SENSITIVITY	49

6.6	ZONATION OF ACTIVITIES	51
6.6.1	Development Areas	51
6.6.2	Conservation (Ecologically sensitive areas)	52
6.6.3	Recreational Use Zones	53
6.6.4	Marine Living Resource Use	54
7	INSTITUTIONAL ARRANGEMENTS	57
7.1	KEY ROLE PLAYERS	57
7.1.1	Estuary Management Authority	58
7.1.2	Heuningnes River Estuary Advisory Forum	59
7.1.3	Government Departments and organs of state	60
7.1.4	Estuarine Experts	61
8	MONITORING AND EVALUATION	63
8.1	ECOLOGICAL MONITORING	63
8.1.1	Current Monitoring	63
8.1.2	Recommended Ecological Monitoring	63
8.2	COMPLIANCE MONITORING / LAW ENFORCEMENT	64
8.3	PERFORMANCE MONITORING (REVIEW AND EVALUATION)	64
9	RESEARCH	66
10	RECOMMENDATIONS	68
11	REFERENCES	69
	APPENDIX 1: SPATIAL ZONATION MAPS	71
	APPENDIX 2: RECOMMENDED ECOLOGICAL MONITORING PROGRAMME	86
	APPENDIX 3: ECOLOGICAL SPECIFICATIONS AND THRESHOLDS OF POTENTIAL CONCERN	92
	APPENDIX 4 RECOMMENDED COMPLIANCE MONITORING	97
	APPENDIX 5: RECOMMENDED PERFORMANCE MONITORING PLAN	98
	APPENDIX 6: HEUNINGNES ESTUARY MOUTH MANAGEMENT PLAN	103

TABLE OF FIGURES

Table 1: Key Objectives for the Heuningnes River estuary	17
Table 2: Management Actions for Biodiversity Conservation	24
Table 3: Management Actions for Water Quantity and Quality	28
Table 4: Management Actions for Land-use & Infrastructure Planning	31
Table 5: Management Actions for Compliance & Law Enforcement	35
Table 6: Management Actions for Agricultural Practices	37
Table 7: Management Actions for Education & Awareness	39
Table 8: Management Actions for Climate Change Preparedness	40
Table 9: Management Actions for Institutional & Management Structures	41
Table 10: The Heuningnes River estuary management area (HilLand, 2010)	44
Table 11: Bioregional Planning Categories relevant to the Heuningnes spatial zonation (HilLand, 2010)	46
Table 12: Description of sensitive habitat areas	50
Table 13: Zonation specifications for the Heuningnes River estuary	54
Table 14: Recommended minimum requirements for long term monitoring (HilLand, 2010; Anchor, 2017)	86
Table 15: Recommended additional resource monitoring (HilLand, 2010)	89
Table 16: Ecological specifications and thresholds of potential concern for abiotic components (Anchor, 2017)	92
Table 17: Ecological specifications and thresholds of potential concern for biotic components (Anchor, 2017)	94
Table 18: Recommended estuary use and compliance monitoring (HilLand, 2010)	97
Table 19: Recommended performance monitoring plan	98

LIST OF TABLES

Table 1: Key Objectives for the Heuningnes River estuary	17
Table 2: Management Actions for Biodiversity Conservation	24
Table 3: Management Actions for Water Quantity and Quality	28
Table 4: Management Actions for Land-use & Infrastructure Planning	31
Table 5: Management Actions for Compliance & Law Enforcement	35
Table 6: Management Actions for Agricultural Practices	37
Table 7: Management Actions for Education & Awareness	39

Table 8: Management Actions for Climate Change Preparedness	40
Table 9: Management Actions for Institutional & Management Structures	41
Table 10: The Heuningnes River estuary management area (HilLand, 2010)	44
Table 11: Bioregional Planning Categories relevant to the Heuningnes spatial zonation (HilLand, 2010)	46
Table 12: Description of sensitive habitat areas	50
Table 13: Zonation specifications for the Heuningnes River estuary	54
Table 14: Recommended minimum requirements for long term monitoring (HilLand, 2010; Anchor, 2017)	86
Table 15: Recommended additional resource monitoring (HilLand, 2010)	89
Table 16: Ecological specifications and thresholds of potential concern for abiotic components (Anchor, 2017)	92
Table 17: Ecological specifications and thresholds of potential concern for biotic components (Anchor, 2017)	94
Table 18: Recommended estuary use and compliance monitoring (HilLand, 2010)	97
Table 19: Recommended performance monitoring plan	98

ABBREVIATIONS

ABI	Agulhas Biodiversity Initiative
amsl	Above mean sea level
BAS	Best Attainable State
BGCMA	Breede-Gouritz Catchment Management Agency
CAPE	Cape Action Plan for People and the Environment
CapeNature	Western Cape Nature Conservation Board
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CFR	Cape Floristic Region
CLEO	Continual Low-level Environmental Observation
CMA	Catchment Management Agency
CML	Coastal Management Line
CMP	Coastal Management Programme
CPZ	Coastal Protection Zone
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Water Bird Counts
DAFF	National Department of Agriculture, Forestry and Fisheries
DEFF	Department of Environment, Forestry and Fisheries
DEA	Department of Environmental Affairs (national)
DEA&DP	Department of Environmental Affairs and Development Planning
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphate
DMNRC	De Mond Nature Reserve Complex
DRDLR	Department of Rural Development and Land Reform
DWS	Department of Water and Sanitation
EDR	Estuarine Dominated Reach
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EIS	Estuarine Importance Score
EMP	Estuarine Management Plan
ESA	Ecological Support Areas
EWR	Ecological Water Requirement
FDR	Freshwater Dominated Reach
GDP	Gross Domestic Product
HEAF	Heuningnes Estuary Advisory Forum
HROA	Heuningnes Riparian Owners Association
HWM	High-water Mark
IAP	Invasive Alien Plants
ICMA	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)
IDP	Integrated Development Planning
LAZ	Limited Activity Zone
LM	Local Municipality
MA	Local Government: Municipal Systems Act (Act No. 32 of 2000)
MaintMP	Maintenance Management Plan
MDR	Marine Dominated Reach
MEC	Member of provincial Executive Council
MLRA	Marine Living Resources Act (Act No. 18 of 1998)
MMP	Mouth Management Plan
MOU	Memorandum of Understanding

MPA	Marine Protected Area
NBA	National Biodiversity Assessment
NEM:PAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMP	National Estuarine Management Protocol (2013)
NFA	National Forest Act
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
nMAR	Natural Mean Annual Runoff
NMLS	National Marine Linefish System
NWA	National Water Act (Act No. 36 of 1998)
ODM	Overberg District Municipality
PAMP	Protected Area Management Plan
PES	Present Ecological Status
REC	Recommended Ecological Category
REI	River-Estuary Interface
RMA	Responsible Management Authority
RQO	Resource Quality Objectives
SAHRA	South African Heritage Resource Agency
SANParks	South African National Parks
SAR	Situation Assessment Report
SDF	Spatial Development Framework
SMA	Special Management Area
TPC	Thresholds of Potential Concern
WHS	World Heritage Site

1 INTRODUCTION

1.1 Background

The Heuningnes River estuary is a low-lying permanently open estuarine system situated on the Cape south coast, approximately 300 km south east of Cape Town, within the cool temperate biogeographic region of South Africa. It covers an appreciable area of 14 123 ha (1 475 ha open water) extending over a length of 19 km, and is highly important in terms of its conservation value (Figure 1).

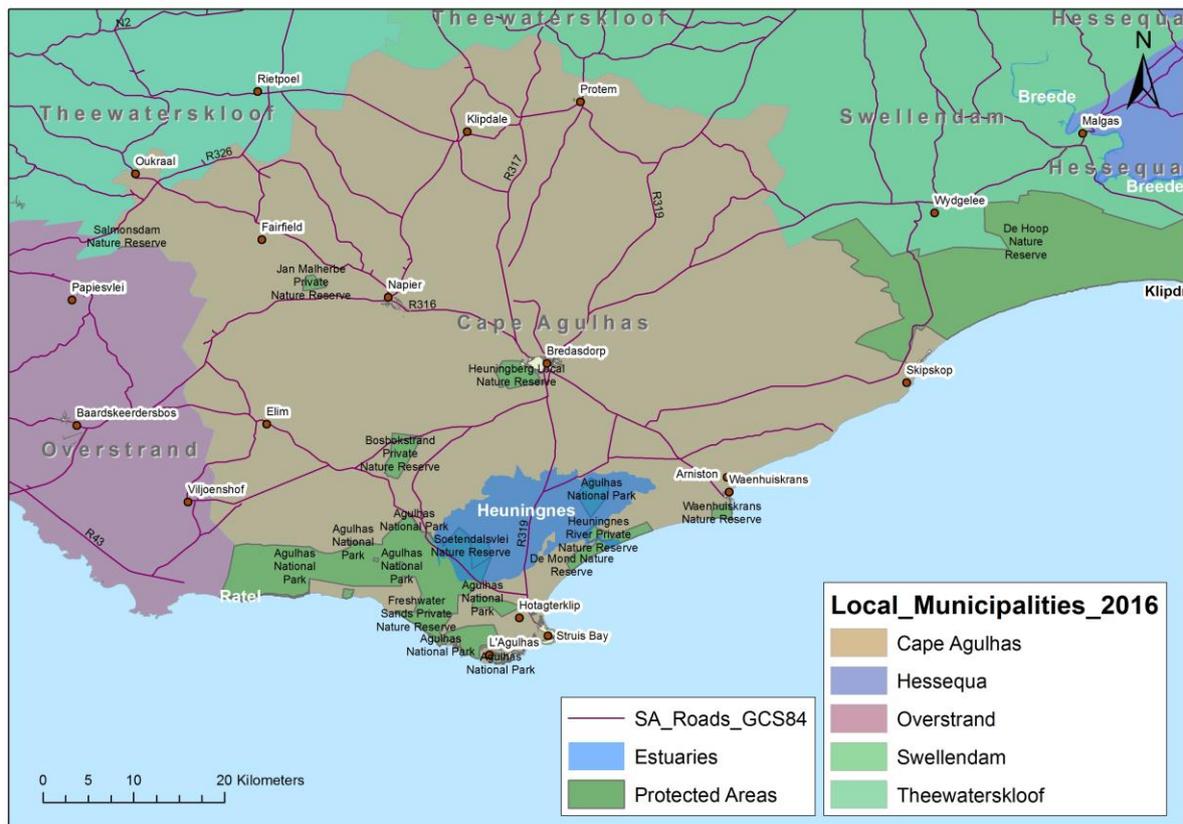


Figure 1: Location of the Heuningnes River Estuary

The extensive interconnected wetland habitats incorporating the Soetendalsvlei and high functional importance as a roosting area for coastal birds, its fish and crustacean nursery area, and migratory corridor, make the Heuningnes River estuary unique along the southern Cape coast. The mouth of the estuary falls within the De Mond Nature Reserve Complex and it has been identified as Ramsar wetland of international importance as well as a national priority estuary. However, a significant proportion of the estuarine function zone has been transformed by agricultural development, which together with growing pressure for water abstraction, mouth manipulation, fishing and bait harvesting, and low-lying development, threaten the health of the system (Figure 2).



Figure 2: Location and boundaries of the Heuningnes River estuary according to the 5 m topographical contour

The National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) (ICMA) was developed to facilitate the sustainable use and management of South Africa's coastline and coastal and estuarine resources. The ICMA requires that estuaries within South Africa be managed in a co-ordinated and efficient manner, and in accordance with the 2013 National Estuarine Management Protocol (NEMP) and the National Coastal Management Programme (CMP) (DEA, 2014b), which lay out specific objectives for management of the South African coastline, including estuaries.

The Heuningnes River EMP was originally developed by Hilland Associates (2010) under the auspices of the erstwhile Cape Action Plan for the Environment (CAPE) Estuaries Management Programme, and has been revised to fulfil requirements of the ICMA and align with NEMP (2013), published under the ICMA.

1.2 Purpose and Scope of the Heuningnes River Estuarine Management Plan

There are certain key components which have been addressed as part of this EMP, namely:

- Situation Assessment;
- The setting of a Vision and Objectives;

- The evaluation of key Management Objectives to achieve the vision and objectives;
- The identification of Management Priorities;
- Spatial Zonation of the estuary and conditions of use;
- Institutional Arrangements;
- Monitoring and Evaluation; and
- Research needs.

Apart from the key requirements of achieving the vision and strategic objectives, the management strategies determined in this management plan are prioritised for the next five years to ensure that limited financial and human resources are utilised as effectively as possible.

It is important to remember that the EMP is a living document that will and must change with time to be able to face management issues effectively.

No plan will be effective if the people who are involved do not believe in its merits. Therefore, the authorities and land owners in the system should form part of the team facilitating and monitoring the implementation of the plan (i.e. an Estuary Advisory Forum).

Figure 2 shows the full extent of the Heuningnes River estuary as per the 5 m topographical contour, which delineates the estuarine functional zone (EFZ). It is critical to note, that the management area of this EMP (See Figure 5) does not include the various important inland water bodies that occur within the functional zone (See details in section 6.1). The importance of these water bodies to the continued functioning of the estuary and the importance of the estuary to these water bodies is an aspect that will require further research and which stresses the importance of integrated catchment management.

1.3 Summary of Legal Framework

Chapter 4 of ICMA, aims to facilitate the efficient and coordinated management of all estuaries, in accordance with:

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

The NEMP, 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 NEMP (2013) and the National CMP (DEA, 2014b). The NEMP (2013) 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 ICMA.

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 ICMA 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 ICMA provides for the permissive, i.e. if so required, establishment of municipal coastal committees, but at a national and provincial level however, the Minister and Members of the provincial Executive Council (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 ICMA.

The National Coastal Committee (the MINTEC Working Group 8) 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, Forestry and Fisheries (DEFF). 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. In the Western Cape, this is the Department of Environmental Affairs and Development Planning (DEA&DP). 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 Responsible Management Authority (RMA) and the estuary advisory forum. The role of the estuary advisory forum is to act as the hub which links all stakeholders, including both organs of state and civil society, so as to facilitate cooperative management

¹ The National Estuarine Management Protocol (2013) identifies CapeNature as the management authority responsible for developing and co-ordinating implementation of the Heuningnes River Estuarine Management Plan, with the support of the different authorities for their areas of jurisdiction.

and effective governance in terms of the EMPs, as well as facilitate and monitor implementation of an EMP. The role of RMA is for co-ordinating implementation of EMPs.

A review of all the legislation that can potentially inform the management actions has been undertaken and is included in the preceding Situation Assessment Report. It is important to note the legislative background is constantly changing and will need to be updated from time to time.

1.4 Mandate and responsibilities of the Responsible Management Authority

In terms of the NEMP (2013), the RMA for the Heuningnes River estuary, is CapeNature (i.e. the Western Cape Nature Conservation Board) given that parts of the estuary fall within the De Mond Provincial Nature Reserve (Figure 1) and the estuary is listed in Western Cape Province's Protected Area Expansion Strategy.

However, there is a shared responsibility with South African National Parks (SANParks) that administers the Agulhas National Park to the West and the Cape Agulhas Local Municipality (LM) (Figure 3).

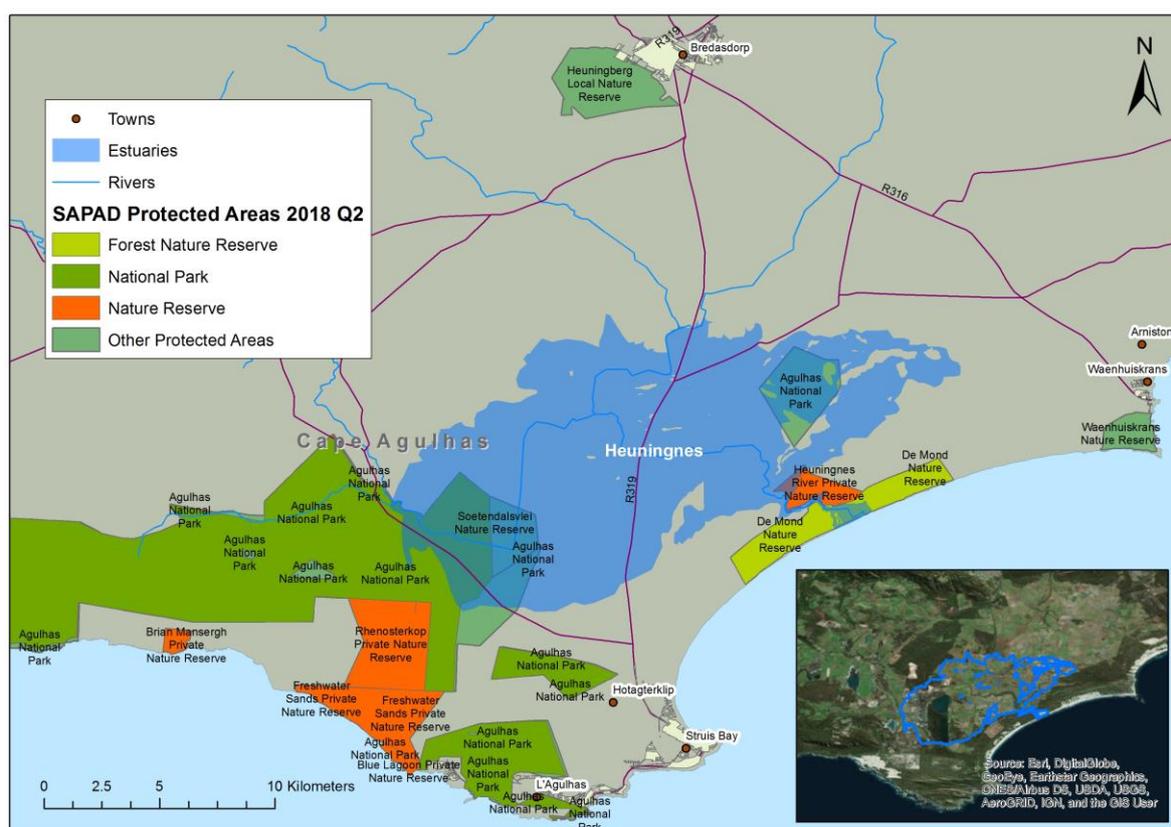


Figure 3: Protected Areas around the Heuningnes River Estuary

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 NEMP (2013) 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 develop 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 that protected area’s management plan as contemplated in section 39 of NEMPAA.”*

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 ICMA; and
- b) ensure that the EMP and the process by which it is developed are consistent with:
 - i) the NEMP; and
 - ii) the National CMP and with the applicable provincial CMP referred to in Parts 1, 2 and 3 of Chapter 6 of the ICMA;
- 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.

The implementation of the actions by CapeNature and the strategic partners (SANParks, Cape Agulhas LM, Overberg District Municipality (ODM), Western Cape Provincial Government, Department of Water and Sanitation (DWS), and Department of Environmental Affairs, Forestry and Fisheries: Oceans & Coast (DEFF:O&C)), will be monitored by the Heuningnes Estuary Advisory Forum (HEAF) comprising

representatives of all key stakeholder groups on the estuary (including various State Departments both Provincial and National, Local Government, NGOs and landowners).

It is important to recognise that this document is designed to focus management attention at a strategic level and does not provide guidance on the day-to-day management actions required for management of the estuary. Annual Business Plans will have to be developed by CapeNature and the relevant government departments and authorities, and should be guided by this EMP in that major effort should be directed towards priority activities that support its overarching objectives included in this plan.

Progress towards achieving the objectives set out in this EMP should be reviewed on an annual basis by the RMA and supported by the HEAF and management efforts adjusted to ensure targets are met within specified timeframes. This Heuningnes River EMP will have to be revisited and updated within the next five years to reflect goals that have been achieved and to accommodate changing priorities.

2 SUMMARY OF SITUATION ASSESSMENT

The Situation Assessment Report provides an overview of the current status of the Heuningnes River estuary, identifies areas of deficiency in terms of management and provides a platform for the EMP envisaged.

Introduction

The Heuningnes River estuary is a low-lying permanently open estuarine system situated on the Cape south coast, approximately 300 km south east of Cape Town, within the Cape Agulhas LM.

Catchment characteristics

The catchment of the Heuningnes River is characterised by hilly slopes in the upper reaches of the catchment and a very flat coastal plain in the lower reaches. The geology of the Heuningnes River estuary is predominantly limestone

The Cape Agulhas LM has a mild, Mediterranean climate, with hot, dry summers and cold, wet winters. Rainfall averages around 540 mm per annum, with the majority of the rainfall (60 – 75 %) received between May and October (winter – spring). The annual temperature averages around 15 °C, with a highest mean monthly temperature of 26.6 °C (January) and lowest mean monthly temperature of 6.6 °C (August).

The proportion of Heuningnes floodplain located in the Agulhas National Park is characterised by wetland features associated with the Soetendalsvlei, which in turn is linked to the Heuningnes River estuary.

Overview of Ecological Function and State of the Estuary

The Heuningnes River estuary is located within the cool temperate biogeographic region of South Africa. The size of the estuary, as defined by EFZ, is appreciably large, covering approximately 14 123 ha (1 475 ha open water), extending over a length of 19 km. The mouth of the estuary falls within the De Mond Nature Reserve Complex (DMNRC), managed by CapeNature. In addition, a small portion of the Heuningnes River Estuary in the south west corner abutting Soetendalsvlei is located in the Agulhas National Park (Figure 3).

Abiotic function

The total natural Mean Annual Runoff (nMAR) for the Heuningnes River estuary is estimated at 53.41 Mm³/a. There are no major dams within the Heuningnes catchment, however, there are numerous farm dams that are used to supply water for irrigation. An estimated 8.69 Mm³/a is abstracted from the system for irrigation, while abstraction for industrial and domestic supply is estimated at around 0.444 Mm³/a.

The lower reaches of the system are dominated by marine sediments. Limited bathymetry data indicate an ingress of marine sediment into the lower reaches of the

system as a result of keeping the mouth permanently open and reduction in river inflow.

No measured data on the reference water quality (i.e. prior to anthropogenic influences) could be obtained for this estuary. However, it is assumed that under the natural condition the system would have been oligotrophic (DIN <50 mg/ℓ and DIP < 10 mg/ℓ) and mostly well-oxygenated. Recorded pH levels in Soetendalsvlei remained alkaline (between 8 and 9), which is expected considering the geology of the catchment. Overall, pH levels throughout the estuary were also slightly alkaline, which is not unexpected given the alkaline river inflow and pH levels of seawater being around 8.2.

Biotic function

Despite intensive agriculture in the catchment, the Heuningnes Estuary is in a good condition. This assessment was based on the low phytoplankton chlorophyll a concentrations (<10 µg l⁻¹) measured during the 2017 study. However, the large stands of emergent macrophytes (i.e. *Phragmites australis* and *Schoenoplectus scirpoides*) present along the estuary may overshadow the increase in nutrient concentrations because of their high nutrient uptake rates.

The dominant macrophyte habitats in the Heuningnes Estuary are seagrass and salt marsh. Reeds and sedges also occur but are abundant only in Soetendalsvlei. Large areas of salt marsh (*Limonium*, *Salicornia* and *Sarcocornia* spp.) occur in the lower and middle reaches of the Heuningnes Estuary, while stands of reeds and sedges (*Phragmites australis* and *Schoenoplectus scirpoides*) line the water channel in the upper reaches. The salt marshes near the mouth are cut off by levees and are only inundated during extreme high tides. The dominant zooplankton groups in the Heuningnes estuary (% of total density) included the Copepoda (81.5%), Amphipoda (6.1%) and Cladocera (5.1%).

The invertebrate fauna of the Heuningnes Estuary is predominantly composed of marine and typical estuarine species. The occurrence of the hermit crab, *Diogenes brevisrostris*, the sea hare, *Notarchus* sp. and the false limpet *Siphonaria oculus* and the necklace shell *Natica* sp. up to 3 km upstream of the mouth indicates a strong marine influence as these invertebrates are usually limited to the mouth region in other Cape estuaries of similar size.

In total, 72 species of fish from 34 families have been recorded from the Heuningnes Estuary, Soetendalsvlei and surf-zone adjacent to the mouth. Resident fish that breed only in estuaries (Category 1a) comprise four species, estuarine round herring *Gilchristella aestuaria*, Cape halfbeak *Hyporhamphus capensis*, kappie blenny *Omobranchus woodii* and the yet to be confirmed but unlikely Knysna seahorse *Hippocampus capensis*. Fish that breed in the marine and estuarine environments (Category 1b) e.g. estuarine pipefish *Syngnathus temminckii* and prison goby *Caffrogobius gilchristi* were represented by seven species.

Gulls and terns dominate the avifauna on the Heuningnes Estuary with numbers reaching upwards of 6000 in some years. Waders are the next most common group. Cormorants, such as the White-breasted and Cape Cormorant, are also relatively common, however, the Reed Cormorant and African Darter are less common. Waterfowl are the dominant bird group on Soetendalsvlei, followed by cormorants, darters and pelicans, and wading birds.

Ecological health status, importance, recommended and future state and ecosystem services

The Heuningnes Estuarine Health Assessment was conducted as an Ecological Water Requirement (EWR) study in 2017 using a standardised approach also applied in Ecological Water Requirement studies for DWS. The health condition, also referred to as the Present Ecological State (PES), of an estuary is typically defined on the basis of the similarity of its current condition to an estimated natural or reference condition. The overall ecological health of the Heuningnes River estuary is rated as a C Category, that is, moderately modified.

Estuarine Biodiversity and Conservation

The 2011 National Biodiversity Assessment developed a biodiversity plan for the estuaries of South Africa by prioritising and establishing which estuaries should be assigned partial or full Estuarine Protected Area status. The Heuningnes River Estuary is considered as a priority estuary given its location within a formal protected area, the De Mond Nature Reserve. It has been identified as Ramsar wetland of international importance and is now included in the Cape Floristic Region (CFR) World Heritage Site (WHS) extension.

The Estuary Importance Score (EIS) for an estuary takes size, the rarity of the estuary type within its biographical zone, habitat diversity and biodiversity importance of the estuary into account. Biodiversity importance, in turn is based on the assessment of the importance of the estuary for plants, invertebrates, fish and birds, using rarity indices. These importance scores ideally refer to the system in its natural condition. The Heuningnes River estuary was deemed of high importance due to its EIS.

Recommended Ecological Category

The Recommended Ecological Category (REC), or desired state, signifies the level of protection assigned to an estuary from a flow perspective. The REC for the Heuningnes River estuary is an A Category or Best Attainable State (BAS). Based on finding of the EWR study however, the BAS for the Heuningnes Estuary is considered to be a B (one class higher than Present). Attaining this state would require restoring a certain amount of flow to the system as well as addressing some of the existing non-flow related issues affecting the estuary. Priority interventions (non-flow related) that need to be undertaken by the respective authorities, landowners and other stakeholders are provided (see below: Priority Restoration Actions). Given the high importance of this system, it is strongly recommended that these remedial actions be implemented.

Impacts or potential impacts

The Heuningnes River estuary is in a fairly good condition. However, the low-lying nature of the Agulhas Plain renders the area vulnerable to extensive flooding during prolonged closure of the estuary mouth. This negatively affects farming practices and thus the local economy. Back flooding is necessary in order for water to reach the Soetendalsvlei, which forms a critical part of the broader ecosystem.

River flow changes, sea level rise and increased storminess can change sediment dynamics at the mouth with consequences for mouth functioning, as well as intrusion of saline water in the long term. This could have significant consequences for the ecology of the estuary and also socio-economic consequences for land-owners.

Changes in the distribution of living marine resource species, both in the sea and in the estuary, are also likely in the long term due to climate change. This in turn could have serious consequences for commercial fish species of the Heuningnes estuary which utilise the estuary as a nursery area.

Overview of socio-economic context

The ODM population is approximately 286 786 persons. A comparison of the 2001 and 2011 census results shows that the ODM has experienced a 2.39% increase in population. The Overstrand LM experienced the greatest average growth rate of 3.42% among the four local municipalities. The Cape Agulhas population is the smallest population in the district (36 000) and has an average growth rate of 1.95%. Within the Cape Agulhas municipal area, approximately 75% of the population is coloured, 16% is white and 8% is black African, with the other population groups making up the remaining 1%. Of those aged 20 years and older, 8.4% have completed primary school, 38.6% have some secondary education, 29.8% have completed matric, and 6.9% have some form of higher education, while 1.5% have no form of schooling. The overall unemployment rate for the municipal area is 10%, while the youth unemployment rate is 9%. There are 11 321 households in the Cape Agulhas LM, of which 86% have access to piped water to their property, 93% have access to toilet facilities, and 90% regular refuse disposal services. Approximately, 0.8% do not have access to electricity

The economy of the Cape Agulhas LM is described as well-diversified with an established manufacturing sector. The coastal and inlands are dominated by agriculture, forestry, fishing and tourism sectors. The municipality is generally rural in nature and is supported by an average business core that contains most of the important services such as a hospital, clinic and police stations. The Commercial Services sector is the largest and most important economic sector within the Cape Agulhas LM, contributing R1.1 billion (55.6%) to the Municipality's Gross Domestic Product (GDP). Other large economic sectors include Manufacturing and Agriculture, Forestry and Fisheries. Manufacturing contributed R274.3 million (13.8 %) to the municipality's GDP in 2015. Agriculture contributed R145.9 million (7.3 %) to the regional GDP.

The tourism industry is one of the fastest growing economic sectors in the Cape Agulhas region and contributes significantly towards the regional GDP of the ODM. It is viewed as the area of greatest economic opportunities, particularly to facilitate Local Economic Development. Strategically located within the renowned CFR, the Agulhas Plain possesses significant economic potential from a biodiversity perspective with the potential to derive approximately R 64m – R 123m per annum

Legislative instruments and relevant strategies, plans and policy directives

The main directive for instituting estuarine management stems from the ICMA and the associated NEMP, which prescribes the national estuarine management objectives, the contents and minimum requirements of estuarine management plans, as well as assigns responsibilities for developing and coordinating implementation of estuarine management plans to various levels of government based on municipal jurisdiction. Under the legislative review, key legal instruments that are applicable to estuarine management are described, and include national, provincial and local management documents. At the local management level, both the ODM Integrated Development Plan (IDP) and the Cape Agulhas LM IDP address the management of estuaries within their jurisdiction areas, e.g. the Overberg District Coastal Management Programme, advocates the preservation of the coastal zone, and all watercourses, wetlands and estuaries are considered vital components of the ecological infrastructure of the region. Of particular relevance to this report and estuarine management plan is the Agulhas National Park Protected Area Management Plan (PAMP) and the De Mond Nature Reserve PAMP.

Opportunities and Constraints for Consideration in Estuarine Management Plan

After review of the background information and comment from stakeholders, the following SWOT analysis of the estuary under the current management practices was prepared to inform the EMP.

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • The conservation status of the estuary (within the De Mond NR) as a protected area, Ramsar site, and CFR World Heritage Site status of the estuary • Riparian owners' commitment to biodiversity conservation • Lack of high density infrastructure along the estuary • Commitment in terms of the IDP and SDF 	<ul style="list-style-type: none"> • Capacity issues within CapeNature and other management partners • Communication gaps between management authority and the Riparian Owners • Access control to the estuary • Data Collection - both scientific and statistical (users) • Multiple entities controlling legal aspects of the estuary • Problems with enforcement
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Establishment of honorary conservation officers to assist with management and law enforcement 	<ul style="list-style-type: none"> • Biodiversity and river dynamics as a result of management practices • Public liability due to sometimes uncontrolled access to private property

<ul style="list-style-type: none"> • Establishment of a Marine Protected Area (MPA) • Research opportunities regarding the effects of open mouth systems • Possible eco-tourism with emphasis on sustainability 	<ul style="list-style-type: none"> • Non implementation of management plans • Over- and unlicensed abstraction of water upstream • Pollution both from the sea and upstream • Waste Water Treatment Plant – Spillages during flooding • Over utilisation of bait and fish stocks • Poaching • Alien vegetation
--	---

Potential for Protected Area Extension

The Heuningnes River estuary is identified as a high sensitivity special habitat, resulting in high overall biodiversity sensitivity for this and associated habitats. It is integral to the De Mond Nature Reserve Complex, however, only a portion of the expansive system is afforded formal protected area status. The DMNRC comprises of the following properties:

- The De Mond Forest Nature Reserve proclaimed in terms of section 15(1) (a) (i) of the Forest Act, 1984 (Act No. 122 of 1984) (NFA) and published in the Government Gazette 10487 of 17 October 1986, Proclamation No. 2136.
- Waenhuiskrans Farm 264/10 & 11 as demarcated state forest in terms of notice no. 2579 of 1977 and Waenhuiskrans erf no. 171 (rem) demarcated state forest in terms of notice 2753 of 1979.
- Soetendalsvlei farm 276 being un-demarcated state land.

The desirability and potential for expanding the protected area for the Heuningnes is therefore very high in order to preserve the health of the system and ensure appropriate management of this sensitive area.

Several opportunities to expand the protected area in this region include stewardship options on private land, proclamation of sections of the Heuningnes River as a protected area; and proclamation of a Marine Protected Area adjacent to the De Mond and Waenhuiskrans properties.

The commitment from the ODM in terms of its IDP and SDF alongside the existing protection in terms of the applicable portions of the CapeNature Ordinance, National Environmental Management Biodiversity Act (Act No. 10 of 2004)(NEM:BA), National Environmental Management Protected Areas Act (Act No.57 of 2003)(NEM:PAA), ICMA, Ramsar Convention and other legislation should ensure that this estuary receives sufficient legislative protection.

Priority Restoration Actions

One of the most important restoration actions that was identified was the need for ecological buffer areas on many of the agricultural areas. A 100 m buffer is proposed on the estuary and specific priorities within this buffer area will be defined and allocated to specific management objectives within the EMP.

The system is in need of alien vegetation management. The infestation of certain species of alien vegetation (mostly *Acacia cyclops* and *A. saligna*) has taken place along the estuary. Reducing the cover of invasive is critical to restoring the flow to the estuary, together with reduction water use for irrigation. Detailed mapping of the extent of invasive vegetation must be included in the succeeding EMP.

In addition, the recent EWR study for the Heuningnes River estuary identified the most important of the non-flow related restoration measures is an increase in the height of the threshold for breaching of the mouth of the estuary, which needs to be increased to at least 2.5 m above mean sea level (amsl). A number of priority non-flow related interventions that should be implemented by various role players to improve the health of the system to a "B" class, include:

- Reduce levels of inorganic nutrients in inflowing water from the catchment;
- Reduce direct inputs of inorganic nutrient into the estuary;
- Implement a mouth management plan (and MMP) that satisfies ecological requirements of the estuary (increased breaching water level, improved nursery function, improved water quality, increased connectivity with the Soetendalsvlei);
- Institute and enforce appropriate development set-back line around the estuary that provides adequate protection for estuarine fauna and flora;
- Management of recreational activities on the estuary through zonation to minimise impacts of recreational fishing and ecotourism; and
- Improved compliance in respect of use of living marine and estuarine resources (legal and illegal fishing).

Information Gaps and Research Opportunities

The following gaps in existing knowledge were identified:

- Classification and Resource Quality Objectives for the Heuningnes estuarine system – the EWR has been completed, classification has been completed, RQOs have been published in the gazette;
- Updated calculations of mean annual run off;
- Detailed Water Quality assessment of the lower reaches of the estuary; and
- Determination of the social use carrying capacity of the estuary

With the identification of the gaps in knowledge, certain research opportunities for the Heuningnes have become apparent.

- There is much information available regarding the management practice of maintaining the Heuningnes as an open system. The new management regime linked to the MMP needs to be monitored and reported on.
- There is also a need to undertake an economic assessment of the goods and services provided by the estuary in order to motivate funding for the proper management thereof.
- A catchment to coast monitoring and reporting programme needs to be set up (SAEON)

- A continual low level environmental observation (CLEO) program should be implemented by the management authority. This should start with the collation of all historical environmental data (rainfall, water levels, water quality, etc.).
- The possibility also exists to implement a fish tagging and telemetry program in order to become part of a greater project to further understand fish recruitment from estuaries.

3 VISION & OBJECTIVES

3.1 Vision

A Vision is a high-level statement which defines the strategic intent of a management intervention. The Vision for the estuaries of the larger CFR is:

“The estuaries of the CFR will continue to function as viable systems which are beautiful, rich in plants and animals, attract visitors, sustain our livelihoods and uplift our spirits.”

This broader vision highlights the following aspects of the estuaries in the CFR which require proper management action plans in order to enhance the benefits:

- The contribution of our estuaries to our spiritual well-being;
- The role that estuaries play in our economic welfare;
- Our dependency on the goods and services that our estuaries provide;
- The importance of the biophysical attributes of our estuaries; and
- The value of maintaining biodiversity and ecosystem function of our estuaries so that we can derive these benefits from our systems.

The Vision adopted for the Heuningnes River estuary is:

“The sustainable, non-commercial management of this near pristine Ramsar site while preserving and promoting biodiversity, fish recruitment and controlled Eco-Tourism Activities as well as the promotion of sustainable agriculture practices along the estuary banks for the benefit of present and future generations.”

The Mission statement of the Heuningnes EMP is:

“To manage the Heuningnes River estuary in an ecologically sustainable way, by preserving its rich biodiversity and natural beauty.”

3.2 Objectives

The ideals of the Vision are then translated into key objectives that address the following key aspects:

Table 1: Key Objectives for the Heuningnes River estuary

Sector/ Category and Key Objective	Performance Indicators	Priority
1. Biodiversity Conservation		
<p>Targets for ecosystem biodiversity and health (in terms of the long-term persistence of habitats, species, community structure, biomass and functioning) are achieved and the estuary continues to function as a Ramsar site.</p>	<ul style="list-style-type: none"> • Estuarine area under formal protected area status is increased • Biodiversity hotspots/ Sensitive species habitats are documents and protected • Integrity and functionality of estuary and wetlands improved • Spatial zonation plan (revised) is adopted and enforced through appropriate bylaws and regulations • Monitoring programmes are in place, and data is captured by an effective database management system • A rehabilitation programme is developed and implemented, that is backed by adequate funding and sponsorships • Improved law enforcement resulting in a reduction in degrading and illegal activities 	HIGH
2. Water Quantity & Quality		
<p>Estuarine structure and function is preserved and maintained through implementation and monitoring of Resource Quality Objectives (RQOs)/Ecospecs (also taking into account public health).</p>	<ul style="list-style-type: none"> • Ecological reserves for water quantity and quality are secured • Effective catchment management through the active participation of key role players • Mouth Management is not detrimental to the ecological functioning of the estuary • Waste water discharge is not detrimental to the ecological functioning of the estuary • IAPs eradication programme developed and implemented on an ongoing basis • Water quality monitoring programme is in place • Ecological health of the estuary is improved 	MEDIUM
3. Land-use & Infrastructure Planning		
<p>The current status and values of the various estuarine areas are established, and implications of future flood levels for the estuarine functional zone (5m contour) determined.</p>	<ul style="list-style-type: none"> • Spatial zonation plan(revised) is adopted and enforced through appropriate bylaws and regulations 	MEDIUM

Sector/ Category and Key Objective	Performance Indicators	Priority
	<ul style="list-style-type: none"> • Reduced habitat loss/degradation and disturbance, and inappropriate activities • Viable and compatible socio-economic opportunities to uplift local communities or specific target groups are identified and implemented 	
4. Compliance & Law Enforcement		
<p>The estuary and its resources are utilised in sustainable manner through an effective level of compliance management.</p>	<ul style="list-style-type: none"> • Monitoring programme is developed and implemented, which is supplemented by additional appointment and deployment of trained and endorsed law enforcement officers/rangers • Effective permitting and data monitoring system developed, which regulates the number and type of resource use, and yields useful data that is easy to interpret • Preservation of the lower estuary as a bait sanctuary / bait collection policy is strongly enforced • Sustainable use of estuarine and marine living resources throughout the system 	MEDIUM
5. Agricultural Activities		
<p>Viable agricultural activities within the estuarine functional zone are maintained and promoted. All agricultural activities in the catchment area are not detrimental to the functioning of the estuary².</p>	<ul style="list-style-type: none"> • Riparian buffer is re-established and functional, and damaging activities are reduced • Implementation of the mouth management plan that protects sustainable and legal agricultural activities • Effective cooperative catchment management • Adoption of environmental best practices, specifically toward reducing the use of fertilizers and remediating damaging activities 	HIGH

² Specifically the ploughing of lands within the riverine buffer area. Also the strategic conflict between mouth management, climate change and the potential salinity build up in the agricultural lands.

Sector/ Category and Key Objective	Performance Indicators	Priority
6. Education & Awareness		
<p>The importance of Heuningnes River estuary as a Ramsar site and a fish nursery is realised through effective awareness raising and education</p>	<ul style="list-style-type: none"> • Awareness programme developed and successfully implemented on an on-going basis • Informative signage erected at strategic points and information disseminated 	MEDIUM
7. Climate Change Preparedness		
<p>The detrimental impacts of predicted climate change are minimised by:</p> <ol style="list-style-type: none"> 1. taking a long-term precautionary approach to infrastructure development and water-resource planning³; 2. influencing land management in upper and middle catchments to reduce impacts on estuary; and 3. promoting long-term sustainable livelihoods through estuarine management that minimises risks. 	<ul style="list-style-type: none"> • Impacts of climate change on the Heuningnes River estuary determined and documented • The options of planned retreat out of high risk areas are investigated • An estuary-specific climate change adaptation strategy is developed • New development excluded from sensitive areas and high risk areas • Applicable building controls applied to risk areas 	HIGH
8. Institutional & Management Structures		
<p>The estuary is managed in a cooperative and integrated manner between appropriate spheres of government, relevant management institutions and civil society.</p>	<ul style="list-style-type: none"> • Appropriate regulations and bylaws are developed and gazetted to give effect to the EMP and zonation plan • Effective co-operative governance through a committed management committee • Roles and responsibilities defined and accepted via signed MOUs • Mandated authorities and participating agencies are well capacitated, actions are fulfilled • Functional HEAF with representatives of all relevant spheres of government and civil society that meets regularly • Integration and active collaboration with the Heuningnes Riparian Owners Association (HROA) and Agulhas Biodiversity Initiative (ABI) 	MEDIUM

³ Cross cutting with Land-use and infrastructure planning

Sector/ Category and Key Objective	Performance Indicators	Priority
	<ul style="list-style-type: none"> Effective communication between responsible authorities and stakeholders 	

A strategic overview will be required in order to manage the conflicting strategic objectives. A potential conflict is identified between the following: climate change, agriculture, estuarine functioning and catchment management. The conflict is viewed as potentially occurring as follows:

- Rising sea levels (estimated at 1.5m increase) will push the salinity profile further up into the catchment having an impact on the various inland water bodies. Reduced rainfall and freshwater input within the catchment will further increase the salinity of the inland water bodies. Historically, before the dune stabilization and open mouth maintenance policy, it is anticipated that the mouth would have been closed for long periods through the movement of the large dune field, resulting in the flooding of large areas of the catchment – this could be the historic origin of the inland wetland systems.
- An increase in sea level together with decrease in rainfall could result in the low lying agricultural lands becoming increasingly saline and unsuitable for production. The closing of the mouth will flood the catchment with fresh water and reduce the salinity build up within the catchment (freshwater flushing). Further hydrological modelling and research in this regard may become an economic reality. The estuarine system that has developed and become adapted over the period of time that the mouth has been maintained in its open state will be influenced through the implementation of the new MMP.

4 MANAGEMENT OBJECTIVES

The detailed management objectives to achieve the key objectives and ultimately the Vision are summarised in Figure 4. Detailed explanations are provided hereunder.

4.1 Biodiversity Conservation

- 4.1.1 Indigenous fauna and flora associated with the estuary and the extended wetlands feeding into the system are protected
- 4.1.2 Degraded areas within the estuary and its surrounds are rehabilitated (*cross-cutting with Agricultural Practices)

4.2 Water Quantity & Quality

- 4.2.1 Ecological Reserve for water quantity & quality is secured and implemented
- 4.2.2 The estuary mouth is managed in a sustainable manner, in accordance with an approved mouth management plan
- 4.2.3 Pollution to the estuary is minimised
- 4.2.4 Invasive alien vegetation within the estuarine boundaries and broader catchment area is eradicated

4.3 Land-use & Infrastructure Planning

- 4.3.1 Implementation of a zonation plan that directs appropriate infrastructural development and other land use practices (e.g. agriculture) within the various policy zones, management lines and buffers.
- 4.3.2 Control development and activities within and adjacent to the estuarine functional zone.
- 4.3.3 Enable appropriate and sustainable social and economic development.

4.4 Compliance & Law Enforcement

- 4.4.1 Establish and maintain an effective compliance management system.

4.5 Agricultural Practices

- 4.5.1 Re-establish a functional riparian margin in agricultural areas
- 4.5.2 Ensure sustainable agricultural practices in the estuary surrounds and the catchment area

4.6 Education & Awareness

4.6.1 Ensure that all users of the estuary are well informed of the estuary importance and biodiversity value

4.7 Climate Change Preparedness

4.7.1 Minimise the risks of climate change by adopting a precautionary approach to infrastructure and development planning

4.8 Institutional & Management Structures

4.8.1 Effective implementation of estuary management responsibilities and activities through a management committee (With existing institutional management structures and strategies incorporated where appropriate)

4.8.2 Secure funding

4.8.3 Secure adequate resources and capacity

4.8.2 Re-constitute the HEAF to ensure sound co-operative management

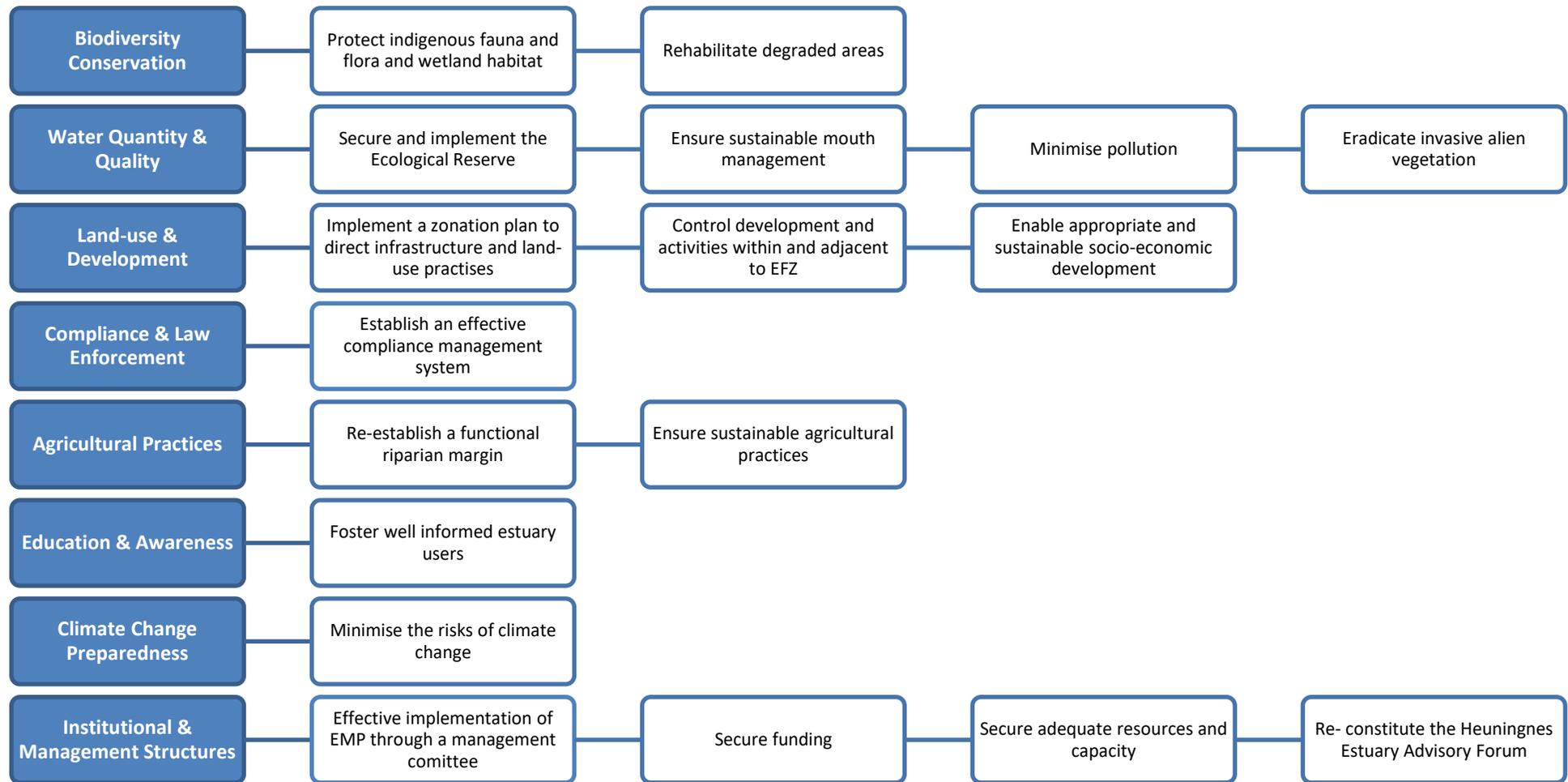


Figure 4: Summary of management objectives to achieve the key overarching objectives and the Vision for the Heuningnes River estuary

5 MANAGEMENT PRIORITIES

Management priorities will have to be refined through collaboration with stakeholders as required from time to time, in accordance with threats identified through the ongoing monitoring proposed. The details of the required management actions should also be investigated and evaluated so as to optimally utilize financial and human resources.

5.1 Biodiversity Conservation

Key Objective 1: Targets for ecosystem biodiversity and health (in terms of the long-term persistence of habitats, species, community structure, biomass and functioning) are achieved and the estuary continues to function as a Ramsar site.

Table 2: Management Actions for Biodiversity Conservation

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective BC 1.1: Indigenous fauna and flora associated with the estuary and the extended wetlands feeding into the system are protected				
a) Establish a statutory protected area that covers at least 50% of the estuary area	NEM:PAA	Meetings held Agreements signed by relevant parties Extension De Mond Nature Reserve (NR) gazetted	HIGH	CapeNature, DEFF, Cape Agulhas LM
b) Establish the Coastal Protection Zone (CPZ) as a Special Management Area (SMA) with specific regulations	ICMA	Special Management Area declared and gazetted Specific regulations compiled and gazetted	MEDIUM	CapeNature, DEFF, Cape Agulhas LM
c) Define the areas of critical / important living resources associated with the estuary and the extended wetlands feeding into the estuary and incorporate these into a zonation plan	NEM:BA ICMA, NEMA	Biodiversity hotspots/ Sensitive species habitats identified Critical areas mapped	HIGH	CapeNature, SANParks

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
d) Develop and enforce regulations to protect indigenous fauna and flora associated with the estuary waters and its defined surrounds, particularly identified red data species, and to eliminate activities against policy (e.g. clearing of indigenous vegetation, beaching of boats, consumptive resource i.e. fishing and bait collection).	National Water Act (Act No. 36 of 1998) (NWA), NFA, MLRA	Bylaws/regulations developed Reduction in degrading and illegal activities Improved law enforcement Improved biodiversity value	MEDIUM	CapeNature, SANParks
e) Implement environmental custodianship/ stewardship agreements / conservancy with private landowners within the catchment where they contribute to the well-being of the catchment – especially the vleis and wetlands and their functioning in the catchment.	NEM:PAA; ICMA	Meeting with land owners convened Signed agreements with land owners Degraded areas rehabilitated Integrity of estuary and wetlands improved On-going relationship with landowners developed	HIGH	CapeNature
f) Monitor the estuary and water supply wetland system to identify threats early enough to ensure sustainable management of the estuary and feeding wetlands ⁴ .	NWA (RDM)	Aerial/satellite imagery examined Patrols undertaken Problem areas/activities identified & documented	HIGH	Breede-Gouritz Catchment Management Agency (BGCMA), DWS
g) Improve the system of monitoring the various ecological datasets which are required for the estuary (fish, bait organisms, bird counts, water quality and quantity data etc.).		Database management system compiled and implemented Quarterly reporting	MEDIUM	CapeNature

⁴ These catchment wetlands do not all fall within the core and secondary boundaries of the Heuningnes River estuary – however, the management principles should cover these areas too.

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective BC 1.2: Degraded areas within the estuary and its surrounds are rehabilitated⁵				
a) Develop a rehabilitation plan, identifying and profiling (prioritising) specific areas requiring rehabilitation (including areas degraded by agricultural activities, pathways and roads, and new pathways through saltmarsh for pedestrian access).	Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA) ICMA NEMA	Rehabilitation areas detailed & prioritised Rehab methods identified and costed Ongoing maintenance compiled	MEDIUM	Cape Agulhas LM, CapeNature
b) Secure financial assistance for rehabilitation work required (including signage rehabilitation works, paths and boardwalks, no entry, etc.)		Funding secured 5 year financial plan compiled		
c) Implement the rehabilitation plan, particularly for indigenous flora especially surrounding the wetland areas and along riparian corridors/buffer to ensure protection of the river banks.		Rehabilitation plan approved and implemented Improved integrity and functionality of wetlands and riparian corridors		

⁵ Cross-cutting with Agricultural Practices

5.2 Water Quantity & Quality

Key Objective 2: Estuarine structure and function is preserved and maintained through implementation and monitoring of RQOs/Ecospecs (also taking into account public health)

The management of the estuary mouth has been single most important issue raised by stakeholders during the process to date. See the management of conflicting strategic objectives above (Section 3.2, pg. 17).

As described in the SAR, the estuary mouth has been historically artificially maintained in an open state. The main reason for this intervention was due to the extensive flooding of viable actively farmed agricultural areas when the mouth is closed. The extent of the potential risk area is clearly indicated in Figure 9, which shows the level of the 5m contour and the vast area that would be affected by flooding within this area. In 2012, the practise of actively stabilizing dunes on either side of the mouth and erecting barriers to trap longshore wind-blown sand and prevent it from being deposited in the mouth was stopped pending further studies.

In 2017, a hydrodynamic modelling and flood line delineation of the entire Heuningnes River estuarine system was undertaken by SMEC South Africa in order to determine the 1:50 and 1:100 year flood lines under different mouth conditions (SMEC, 2017), in support of sustainable mouth management and proposed conservation development at De Mond Nature Reserve. The data was used to make recommendations for the management of the mouth so ensure optimal ecological functioning of the system, while at the same time protecting infrastructure, cultivated farmlands and livestock within the estuary floodplain area. The results of the study are included in the spatial zonation of the estuary (Figure 10 and Figure 11) and the Heuningnes Mouth Management Plan (MMP) (SMEC, 2017) is included in Appendix 6.

Further to this study, a research team should be appointed to further research:

- Historic functioning of the mobile dune system and mouth opening scenarios,
- Historic salinity profiles in the inland water bodies and wetlands, with the historic flooding associated with a close mouth system,
- Changes to fish recruitment with the estuary since being maintained as an open mouth system,
- Economic model of the mouth closed and open wrt agriculture, salinity build up, fish recruitment.

The RMA must determine the way forward in mouth management following expert advice from estuarine specialists as well as stakeholder engagement. If mouth opening is required, this must be undertaken according to the recently developed MMP with the necessary authorisations in terms of NEMA.

Table 3: Management Actions for Water Quantity and Quality

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective WQ 2.1: Ecological Reserve (Ecological Water Requirements) for water quantity & quality is secured and implemented				
a) Ensure that the water quality & quantity required for the river and estuarine functional zone (as established through the recently completed EWR study) is signed off by the Minister of DWS	NWA	Ecological reserve and Resource quality objectives gazetted	HIGH	DWS, BGCMA, DEA&DP, CapeNature
b) Lobby for representation of the Heuningnes management committee on the Catchment Management Agency (CMA), and/or irrigation boards, to communicate the freshwater requirements of the Heuningnes River estuary and ensure proper management of the water resources.		Attendance at CMA meeting / workshops Meeting minuted		
c) Active permanent representation of the Nuwejaars and Kars River catchment areas as part of the HEAF, as these catchment areas are critically important to the ecological estuary functioning.		Attendance at HEAF meetings Meeting minuted		
d) All water use (groundwater and surface water) within the CPZ must be licensed by DWS and punitive action must be taken against illegal abstractions.		Register of water use licenses maintained/up to date Transgressors prosecuted Reduction in illegal activities		
e) Monitor the estuary and water supply wetland/vlei system to identify threats early enough to ensure sustainable management of the estuary and feeding wetlands		Monitoring sites identified Ongoing water resource monitoring		
Management Objective WQ 2.2: The estuary mouth is managed in a sustainable manner, in accordance with an approved mouth management plan				
a) Compile and submit the Heuningnes MMP for approval	NEMA	MMP approved	HIGH	DEFF/DEA&DP
b) Obtain Environmental Authorisation under a general Maintenance Management Plan (MaintMP)		Environmental Authorisation obtained		DEA&DP

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
c) Implement the Heuningnes MMP (only breach under flooding, water quality or fish recruitment purposes 2.5 m amsl)		Breaching actioned according to MMP and MaintMP		CapeNature, DEA&DP
Management Objective WQ 2.3: Pollution to the estuary is minimised				
a) Identify sources and types of pollution, and mitigation measures to remedy the problems	NWA, National Health Act	Water pollution investigation undertaken, sources identified and remediation measures identified	MEDIUM	CapeNature/DEA&DP
b) Enforce best practice guidelines in sustainable urban drainage systems (SUDS), such that direct discharge into the estuary and vleis areas is avoided.	Local Government: Municipal Systems Act (Act 32 of 2000)(MSA)	Training for officials convened and attended Landowners engaged in SUDS SUDS enforced and applied by building control and technical services	MEDIUM	Cape Agulhas LM
c) Investigate methods to improve current domestic sewage disposal systems (e.g. conservancy tanks, sewage package plant, sewage reticulation infrastructure etc.)	MSA	Working group convened Current and best practice methods identified Resolution implemented	HIGH	Cape Agulhas LM
d) Ensure that disposal of water containing waste into the estuarine environment is controlled and is authorised under coastal waters discharge permit	MSA, ICMA	Inventory of legal and illegal discharges compiled Review of discharge permits & conditions where necessary	HIGH	DEFF, DEA&DP
e) Establish water quality monitoring programme within the (entire) estuary taking RQOs/ Ecospecs into account, according to EWR study.	NWA, ICMA	Water quality monitoring programme established Database of water quality variables maintained Quarterly reporting	HIGH	CapeNature, DWS
Management Objective WQ 2.4: Invasive alien vegetation within the estuarine boundaries and broader catchment area is eradicated				

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
a) Prioritise areas for invasive alien plant (IAP) removal within the estuarine boundaries and broader catchment area, through detailed mapping, focussing on wetland areas and riparian corridors.	CARA, NWA	Detailed maps of invasive vegetation produced Priority areas identified Appropriate methods of control determined	MEDIUM	DEFF, CapeNature
b) Develop and implement systematic eradication programme, including providing assistance to private land owners to eradicate all invasive alien vegetation		IAPs eradication programme implemented Engagement with landowners Increased area of IAPs removed		DEFF, Private land owners, CapeNature

5.3 Land-use & Infrastructure Planning

Key Objective 3: The current status and values of the various estuarine areas are established, and implications of future flood levels for the estuarine functional zone (5m contour) are established.

In terms of the EMP, the policy zones and buffers includes the CPZ, Coastal Management Line (CML) in terms of the ICMA; the 5 m topographical contour (the EFZ) and the 32 m riparian/wetland buffer (See Section 6).

Table 4: Management Actions for Land-use & Infrastructure Planning

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective LU 3.1: Implementation of a zonation plan that directs infrastructural development and other land use practices (e.g. agriculture) within the various policy zones, management lines and buffers				
a) Apply for legal status (have gazetted) of the setback line under the ICMA.	ICMA	Setback line gazetted	MEDIUM	DEA&DP
b) Ensure that setback line is integrated into IDPs and Spatial Development Frameworks (SDF) and are enforced.	MSA	Setback line incorporated into IDP and SDF	MEDIUM	Cape Agulhas LM
c) Ensure that development needs and restrictions are integrated into IDPs and SDFs.	MSA	Estuarine-specific development specifications incorporated in IDP and SDF	HIGH	DEA&DP, Cape Agulhas LM
d) Clearly define the geographic boundaries of the Heuningnes River estuary (land, sea and air) with particular attention to influences of rising sea levels.	ICMA	Geographic boundaries included in all planning documents	HIGH	CapeNature
e) Establish an ecological corridor along the river banks in conjunction with riparian owners.	NEM:BA, ICMA	Meetings with land owners convened Meetings minuted Ecological corridor mapped & maps distributed	MEDIUM	CapeNature, SANParks
f) Enforce a riparian setback line (32 m) in order to protect riparian vegetation, river banks and to prevent detrimental agricultural practices on land adjacent to the river.	NWA, NEMA	Meetings with farmers' associations convened Meetings minuted Riparian setback agreed and Memorandum of Understanding (MOU)	HIGH	DEA&DP, National Department of

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
		signed Riparian setback mapped & maps distributed		Agriculture, DEFF
g) Limit activities and types of activities to the appropriate zones through the development, implementation and enforcement of local bylaws/regulations.	MSA, ICMA	Bylaws developed and gazetted Bylaws enforced by applicable authorities	HIGH	Cape Agulhas LM, CapeNature
Management Objective LU 3.2: Control development and activities within and adjacent to the estuarine functional zone				
a) Determine the existence and number of title deed restrictions existing that could have an influence on the estuary and reserve management.	Deeds Registries Act	Inventory of applicable properties Land owners identified Map interrogated and produced Historical agreements documented Engagement land owners MOUs signed	HIGH	CapeNature
b) Check cadastral boundaries of the properties surrounding the estuary and determine the influence of these boundaries on estuary and reserve management. Particular attention should be given to boundaries on the river.				
c) Document and negotiate past agreements with riparian land owners.				
d) Align any future or proposed developments (including agricultural expansion) with the agreed zonation for the estuary, CML, IDP, municipal bylaws and the title deed restrictions.	MSA	No further permanent development, infilling or land transformation of EFZ (e.g. only new sacrificial infrastructure permitted) No inappropriate development in the CPZ or against policy Transgressors prosecuted Corrective action undertaken Reduced habitat loss/degradation and disturbance, and inappropriate behaviour	HIGH	DEA&DP, Cape Agulhas LM
e) Obtain development approval for future management development or changes in development at De Mond, in alignment with the EMP, NEMA, municipal bylaws and title deed restrictions	NEMA	Development design and location informed by legislation and policy, etc. Environmental authorisation duly obtained New developments are compliant	HIGH	DEA&DP, DEFF

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
f) New agricultural and development (including jetties and slipways) applications must comply with relevant Environmental Impact Assessment (EIA) regulations and process in terms of NEMA, and special planning regulations in the CPZ and municipal bylaws.	NEMA, CARA, ICMA, Seashore Act	Engagements with CapeNature and DAFF Inspections undertaken New developments are compliant	HIGH	CapeNature, DEFF, DEA&DP
g) Ensure environmental authorisation for mouth management and dune stabilisation prior to commencement.	NEMA	Engagements between CapeNature, DEA&DP and landowners Environmental authorisation duly obtained	HIGH	DEA&DP, CapeNature
h) Use HEAF as source of I&APs for EIAs to ensure that no listed activities take place without environmental authorisation.	NEMA	HEAF partakes in development planning affecting the estuary Impacts on the estuary are mitigated/prevented	MEDIUM	DEA&DP
i) Enforce altitude restrictions on aircraft operations.	Civil Aviation Act, National Heritage Resources Act (Act No. 25 of 1999) (NHRA), WHS regs.	Adequate monitoring and law enforcement	MEDIUM	Civil Aviation Authority, South African Heritage Resource Agency (SAHRA), CapeNature
Management Objective LU 3.3: Enable appropriate and sustainable socio-economic development				
a) Monitor recreational activities to ensure that any problems which may arise are remedied.	Marine Living Resources Act (Act No. 18 of 1998) (MLRA), ICMA, Health Act, Municipal bylaws	Counts of visitors/users and types of activities recorded Number of boats and license holders recorded Beaching of boats recorded Impacts and incidents assessed recorded	LOW	Cape Agulhas LM, CapeNature

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
b) Identify and implement viable socio-economic opportunities that conform with the vision and priority objectives for the estuary (e.g. trail guides, invasive plant clearing, etc.)	ICMA National Environmental Management Protected Areas Act (Act No. 57 of 2003)(NEM:PAA)	Target groups/areas identified Potential opportunities identified Community projects initiated Employment opportunities created	LOW	Cape Agulhas LM, CapeNature
c) Encourage environmentally friendly development and business and maintain sustainable building design and techniques	ICMA, NEM:PAA, MSA	Heuningnes catchment marketed as an ecotourism destination Development is energy efficient, water wise with effective waste management practices	LOW	DEA&DP, Cape Agulhas LM,

5.4 Compliance & Law Enforcement

Key Objective 4: The estuary and its resources are utilised in sustainable manner through an effective level of compliance management.

Table 5: Management Actions for Compliance & Law Enforcement

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective CLE 4.1: Establish and maintain an effective compliance management system				
a) Ensure strict gate control and record collection at De Mond Nature Reserve.	NEM:PAA	Adequate number of staff at applicable stations Staff attend relevant training courses On going training of staff	HIGH	CapeNature
b) Ensure that there is adequate management staff and law enforcement at De Mond where the only public access occurs.				
c) Ensure enforcement staff are suitably qualified, i.e. have the necessary DEFF training and endorsement.				
d) Improve permitting system for the use of the estuary.		Permitting system investigated and shortcomings identified Appropriate amendments implemented (e.g. improved data sheets for users of the facilities at De Mond)		
e) Improve data collection of the use of the estuary and its natural resources.	MLRA, NEM:PAA	Adequate data sheets designed for recording the use within the estuary, and fish catch records. Staff trained in sample and data collection, database management, and record keeping	MEDIUM	Cape Nature
f) Improve compliance monitoring within the estuary especially in use of living marine and estuarine resources.	MLRA, NEM:PAA	Monitoring programme developed and implemented Scheduled and ad hoc patrols undertaken Additional compliance officers and honorary rangers deployed Monthly counts of number of harvesters/fishers and users Number of permit holders	HIGH	Cape Nature

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
g) Ensure the placement of signage and information regarding limited use.	ICMA	Educational signage erected at strategic points Posters and pamphlets erected/ disseminated	MEDIUM	CapeNature
h) Appoint of Honorary rangers for ad hoc checking of anglers and unlawful bait collecting.	MLRA	Honorary rangers appointed Ad hoc patrols conducted Incidents of poaching reduced Transgressors prosecuted	HIGH	DEFF, CapeNature, SANParks
i) Bait collection policy enforced				

5.5 Agricultural Practices

Key Objective 5: Viable agricultural activities within the estuarine functional zone are maintained and promoted. All agricultural activities in the catchment area are not detrimental to the functioning of the estuary.

Table 6: Management Actions for Agricultural Practices

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective AP 5.1: Re-establish a functional riparian margin in agricultural areas				
a) Rehabilitate the 32m riparian buffer to ensure protection of the river banks	ICMA, CARA	Rehabilitation methods identified and implemented Ongoing maintenance of rehabilitated areas until well established	HIGH	DEFF, Cape Agulhas LM, Private land owners
b) Ensure activities within the 32m river buffer have Environmental Authorisation	NEMA	No activities without Environmental Authorisation Illegal activities penalised	MEDIUM	DEA&DP, CapeNature
Management Objective AP 5.2 : Ensure sustainable agricultural practices in the estuary surrounds and the catchment area				
a) Ensure that sustainable and legal agricultural activities are protected.	CARA	Effective mouth management plan approved and implemented when necessary On-going relationship with farmers developed	HIGH	DoA
b) Create a check list of detrimental practices and acceptable agricultural management of land (particular attention should be given to wetland management on private land).	CARA, NEMA	Check list compiled Discussion with major role players Remedial plan compiled and actioned	HIGH	DoA, HROA, CapeNature
c) Educate landowners/ farmers on the impacts of excessive fertilizer use on the Heungines River estuary.		Informative meeting/seminars with adjacent land owners / farmers convened Alternative / improved methods discussed and agreed to	HIGH	CapeNature, ABI, DoA DEFF, BGCMA
d) Lobby farmers in the catchment to reduce the use of fertilizers.	NWA, CARA	Use of inorganic fertilisers reduced Improved quality of agricultural return flows On-going relationship with farmers developed	HIGH	

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
e) Ensure that all agriculture and development in the catchment area is planned to include sustainable environmental best practice designs and solutions.	NEMA	Meeting with farmers' association convened Environmental best practice / improved methods discussed and agreed to Environmental authorisation of new developments includes energy efficient and water-wise methods as well as sound waste management practices.	LOW	DoA, DEADP, CapeNature

5.6 Education & Awareness

Key Objective 6: The importance of Heuningnes River estuary as a Ramsar site and a fish nursery is realised through effective awareness raising and education.

CapeNature and SANParks need to provide for environmental education and interpretation of the unique biodiversity of the area, the Ramsar status and the need for maintaining low key ecotourism activities as included in the vision for the Heuningnes River estuary. CapeNature and SANParks need to investigate the need for additional trails or to upgrade any trails or facilities.

Table 7: Management Actions for Education & Awareness

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective EA 6.1: Ensure that all users and visitors to the estuary are well informed of the estuary importance and biodiversity value				
a) Develop and implement an ongoing intensive public awareness campaign and environmental education program	ICMA, NEM:PAA	Education & awareness programme developed and implemented at schools and through interest groups Posters, pamphlets, signage, literature compiled and disseminated Increased educational opportunities at group gatherings, community meetings, conferences, etc. Webpage on the Heuningnes River estuary linked to De Mond NR and Agulhas NP	MEDIUM	CapeNature, ABI, HROA, SANParks
b) Devise strategies to perpetuate and/or instil a respect for, and create an interest in, the local fauna and flora and the protection thereof.		Projects / initiatives of ABI implemented where feasible New initiatives devised and implemented		
c) Erect signage at strategic points relating to permissible activities within the estuary.		Signage erected at key visitor locations Signage maintained		

5.7 Climate Change Preparedness

Key Objective 7: The detrimental impacts of predicted climate change are minimised.

Table 8: Management Actions for Climate Change Preparedness

Management Actions	Legislation	Deliverables / Indicators	Timing	Responsible Agent(s)
Management Objective CC 7.1: Minimise the risks of climate change by adopting a precautionary approach to infrastructure and development planning				
a) Investigate the impacts of climate change on the Heuningnes system (i.e. mouth dynamics, tidal influence, flood dynamics and agricultural activities)	Disaster Management Act, ICMA	Consultants appointed Study conducted Findings incorporated into EMP, development planning and climate change adaptation strategy MMP compiled	HIGH	CapeNature, DEA&DP
b) Investigate options of retreat/relocation for risk prone infrastructure and development	ICMA, NEMA	Key areas identified as per risk assessment Feasibility of retreat/relocation investigated	MEDIUM	CapeNature, DEA&DP
c) Develop and implement an estuary-specific climate change adaption strategy based on existing strategies and outcomes of flood risk study	National Climate Change Response Strategy; Western Cape climate change strategy and action plan; NEMA EIA Regulations; ICMA	Estuary risks and early warning system included Contingency plans developed Emergency response networks established		CapeNature, Cape Agulhas LM DEA&DP
d) Ensure innovative planning and consideration of local environmental factors for the construction of any new developments within the estuarine functional zone (e.g. site selection and position, building design irt development setbacks, tide and flood levels, etc.).	ICMA, Municipal bylaws	New development excluded from sensitive areas and high risk areas Applicable building controls applied to risk areas		CapeNature, DEA&DP

5.8 Institutional & Management Structures

Key Objective 8: The estuary is managed in a cooperative and integrated manner between appropriate spheres of government, relevant management institutions and civil society.

Table 9: Management Actions for Institutional & Management Structures

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
Management Objective IMS 8.1: Effective implementation of estuary management responsibilities and activities				
a) Establish a management committee comprising the RMA, existing management agencies (e.g. CapeNature, SANParks), government departments and other participating institutions (e.g. HROA) for implementation of EMP actions.	ICMA, NEMA	Terms of Reference for co-operative governance arrangements signed by all strategic partners Roles and responsibilities defined and accepted via MOUs signed between RMA and all strategic partners Active collaboration of various implementing agents	HIGH	CapeNature, all strategic partners
a) Develop and implement local bylaws/regulations that will enable the RMA to give effect to the EMP objectives, the zonation plan and associated restrictions, and manage its allocated responsibility.	MSA, NEM:PAA	Bylaws/ regulations gazetted or published Dissemination of bylaws/regulations to landowners and visitors	HIGH	Cape Agulhas LM, CapeNature, SANParks,
b) Identify and propose policy/ regulations (through the HEAF) to the relevant authorities to ensure elimination of activities that are damaging to the environment (decide on fishing policy, e.g. no fishing or catch and release only; disallow catching of line fish using cast nets, seine nets, gill and traps; disallow night time fishing; controlled access or increased costs, etc. to protect the resource).	ICMA	Technical meetings convened New policy/regulations submitted and recorded by CapeNature Proposals submitted to relevant depts. or institutions	MEDIUM	CapeNature
c) Develop an efficient law enforcement (compliance monitoring) capability / network to ensure that both proactive and consequent steps are taken in support of the RMA's duties and objectives.	MLRA, ICMA	Enforcement/reaction protocols established	MEDIUM	Cape Agulhas LM, CapeNature, SANParks

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
		Increased patrols and monitoring conducted Number of joint operations conducted Incidents of poaching/illegal activities reduced Transgressors prosecuted		
d) Establish ad hoc work groups to head up various key aspects, (e.g. climate change, mouth management, and floodplain farming activities, and implications thereof on the estuarine environment).	ICMA	Ad hoc technical groups established and dissolved, as and when required Recommendations recorded and submitted Meeting minuted	When required	CapeNature and required parties
Management Objective IMS 8.2: Secure funding				
a) Individual government agencies to make provision for the necessary resources in the short, medium and long-term expenditure frameworks to create and fill posts, and acquire necessary infrastructure and resources for effective management of critical areas.	MSA, NWA, ICMA, NEM:PAA	Formal feedback from authorities on mandated activities Motivation for budget drafted and approved Funding secured for 5 year cycle	HIGH	All authorities
Management Objective 8.3: Secure adequate resources and capacity				
a) Individual agencies to acquire necessary equipment (office equip, water quality meter, boat, vehicle) for effective management	MSA, NWA, ICMA, NEM:PAA	Need and Desirability investigation undertaken Motivation for acquisition drafted and approved Equipment purchased and maintained	MEDIUM	All authorities
b) Individual agencies to identify and address training needs among staff involved in estuary management and enforcement to ensure the proper and effective application of the promulgated regulations and bylaws		Motivation for training drafted and approved	MEDIUM	

Management Actions	Legislation	Deliverables / Indicators	Priority	Responsible Agent(s)
		Staff attend relevant accredited training courses MOU to be developed for secondments		
c) Evaluate performance of staff, contractors and volunteers		Staff appraisals into management actions and projects (performance management system implemented)	LOW	
Management Objective IMS 8.4: Re-constitute the Heuningnes Estuary Advisory Forum to foster stakeholder engagement				
a) Invite representative members of government and stakeholders to be members of the HEAF (including public stakeholders that are sincerely committed to the Vision and Mission), and ensure the HROA and ABI are well represented to ensure catchment & estuary sustainably managed.	ICMA	HEAF reconstituted Formal invitations sent Membership list compiled HEAF meets on a quarterly basis Meetings minuted	MEDIUM	CapeNature
b) Embrace and build-on the existing commitment of the already established HROA and the ABI in order to get the larger catchment of the estuary under sensible management/conservation beneficial to both the land owners and the Heuningnes estuary.		Integration and active collaboration with HROA and ABI	MEDIUM	CapeNature
c) Ensure relevant members of the HEAF have the required authority (or delegated powers from various departments and local authorities through an MOU) and resources to undertake and enforce their allocated responsibilities.		Portfolio of MOUs Attendance and actions of meetings reviewed Formal feedback from agencies wrt implementation and budget provisions	HIGH	Applicable agencies
d) Maintain excellent communication lines between all role players		Stakeholder database maintained Communication protocols developed	MEDIUM	CapeNature

6 SPATIAL ZONATION

6.1 Geographical Boundaries

Estuarine systems are defined differently under different legislative acts in South Africa. The ICMA 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”.

Similarly, the NWA defines an estuary as “a partially or fully enclosed water body that is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land”.

The EFZ is defined by 2014 EIA Regulations (GNR 985) 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...”. The EFZ is acknowledged as a sensitive habitat. The NEMP (2013) acknowledges the EFZ as the geographical boundary of estuaries in South Africa. In practice, it is found that the 5 m topographic contour approximates the EFZ for most estuaries in South Africa. It is consequently commonly used to delineate the EFZ in the absence of specific biophysical assessments.

At the time of drafting the initial EMP, the Heuningnes estuarine area was delineated from the Bredasdorp / Struisbaai road (R319) to the mouth of the estuary (Figure 5), i.e. the extent of saline influence (Hilland, 2010). However, there is a realisation that the EFZ, according to the 5 m contour, incorporates a significantly larger area including extensive wetland habitat associated with the Heuningnes River estuary (Figure 2).

It is therefore imperative that future revisions of the Heuningnes EMP incorporate the full extent of the EFZ as delineated by the 5 m topographical contour (or future refinements of the EFZ).

Table 10: The Heuningnes River estuary management area (Hilland, 2010)

Downstream boundary	Estuary mouth 34°42'50.23"S and 20° 07'13.75"E
Upstream boundary	R319 road bridge 34°41'19.47"S and 20° 1'58.73"E



Figure 5: Current extent of the Heuningnes River estuary management area (Hilland, 2010)

6.2 Bioregional Planning

In order to give effect to the spatial zonation and the framework within which the RMA will operate, the plan needed to take into account the Bioregional Planning Categories, which are used as the framework for human activities, requirements and individual rights on a planning level. The Bioregional Planning Framework (Denis Moss, 2004) serves as a framework within which a consensus approach to “managing” our resources in a sustainable manner can be undertaken, and where a balanced integration of conservation and land use practices can take place.

Two broad existing Bioregional Categories are currently relevant to the categorising of the estuary management area, namely Category A: Core Areas and Category C: Agricultural Areas (Table 11). In order to facilitate appropriate bioregional planning however, the additional categories are now also included in the Heuningnes River EMP, in order to achieve the management objectives, such as Category B: Buffer Areas.

Table 11: Bioregional Planning Categories relevant to the Heuningnes spatial zonation (HillLand, 2010)

Spatial Planning Category	Description
1. Category A: Core Areas	
Sub-Category A.b: Other Statutory Conservation Areas	Statutory Conservation Areas such as Provincial Nature Reserves and registered Private Nature Reserves.
2. Category B: Buffer Areas	
Sub-Category B.b: Private Conservation Areas	Areas where conservation is practiced but where the area has no formal conservation status - The areas of intact natural vegetation along the river would fall into this category.
Sub-Category B.c: Ecological Corridors	Areas with a high prevalence of natural vegetation or where reintroduction of indigenous flora could be undertaken to provide a network of contiguous natural corridors through the region. The areas of intact natural vegetation within the riparian corridor even if they are utilized for extensive agriculture could fall into this category.
Sub-Category B.d: Rehabilitation Areas	Areas which, notwithstanding significant modification / degradation, justify being rehabilitated to their natural state to allow for linking corridors. The primary purpose of this category is to repair environmental degradation, increasing buffer areas and linking areas of high conservation value. The areas of intensive agriculture within the riparian corridor would fall into this category.
3. Category C: Agricultural Areas	
Sub-Category C.b: Intensive Agricultural Areas	Intensive Agricultural Areas

In addition to the Bioregional Planning Categories, Critical Biodiversity Mapping has been done for the Agulhas Plains (Holness, 2010) and covers the Heuningnes River estuary management area. In order to include this mapping with the bioregional zones mentioned above, the Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) have been merged into one overall Biodiversity /Bioregional Plan (Figure 7).

This plan reflects the Core Areas (Protected Areas and CBAs), Buffer Areas (including the various wetland and riverine buffers and the ESAs) and the Transitional Zone (Extensive and Intensive Agricultural Areas).

6.3 Coastal & River policy buffer zones and management lines

6.3.1 Coastal Protection Zone

The ICMA defines a default CPZ which, in essence, consists of a continuous strip of land, starting from the High Water Mark (HWM) and extending 100 m inland in developed urban areas zoned as residential, commercial, or public open space, or 1 000 m inland in areas that remain undeveloped or that are commonly referred to as rural areas. It also includes certain sensitive or at-risk land such as estuaries, littoral active zones and protected areas.

Any regulations published in terms of the Act will apply to this area.

6.3.2 Coastal Management Line

The ICMA also provides for the establishment of a CML, designed to limit development in ecologically sensitive or vulnerable areas, or an area where dynamic natural processes pose a hazard or risk to humans. A CML, as envisaged by the amended ICMA, is informed by the projections of risk emanating from dynamic coastal processes such as sea level rise or erosion, information on ecological or other sensitivities adjacent to the coast, as well as the location and extent of existing development and existing executable development rights. The CML is a continuous line, seawards of which lies:

- Areas of biophysical or social sensitivities such as sensitive coastal vegetation identified as priority conservation areas and formal protected areas,
- those areas that should be left undeveloped, or only be granted appropriately restricted development rights, due to a high risk from dynamic coastal processes, or
- coastal public property.

In the absence of detailed CML determination studies, the default CML in estuaries may delineated by the 5 m amsl contour or 1:100yr floodline, whichever is wider (See Section 6.3.6 below), to differentiate a zone where formal development should be discouraged.

6.3.3 100m buffer from the High Water Mark

The 100 m buffer from the HWM of the sea and estuary is a zone listed in terms of the NEMA EIA regulations. An Environmental Authorisation is required for certain activities within this zone. The area is proposed as a setback line along the estuary in order to facilitate the protection of the river banks and the sensitive vegetation along these banks, as well as allowing for rehabilitation and the formation of an ecological corridor along the coast and inland up the estuary (Figure 8). This area doubles well with the zone defined as CBA, ESA and rehabilitation areas.

For the purpose of any new activities within the estuarine area, it is proposed that this area should be avoided and if possible should be rehabilitated. Existing farming, recreational and conservation activities should be reviewed in order to prioritise any areas where the current activities are detrimental to the estuarine environment (including the adjacent terrestrial environment) and these should be remedied, curtailed or modified to reduce the impact.

6.3.4 32m river and wetland buffer

A buffer area of 32m from the edge/bank of all rivers, water bodies and wetlands / saltmarsh is listed in terms of the EIA regulations. This buffer zone intended to protect the ecological functioning of the riparian system. Any activities within this area are controlled by the EIA regulations of NEMA. An Environmental Authorisation is required for activities within this zone.

The area is proposed as a management line along the estuary in order to facilitate the protection of the river banks and the sensitive vegetation along these banks (Figure 8). It is also proposed as a rehabilitation priority area where current agricultural / development activities encroach into this buffer zone. In such areas (i.e. wherever ploughing is occurring within this 32m buffer) the priority is to stop such activities and to rehabilitate.

Within the De Mond Nature Reserve, this area should be rehabilitated and access into the rehabilitation area should be strictly controlled to boardwalks. In relation to wetlands, the wetland delineation datasheet is attached to the EMP (Job, pers. comm., 2010) in order to facilitate ease of recognition of a wetland or standardising the future research into the wetlands of the area.

6.3.5 5m contour (Estuarine Functional Zone and Floodplain)

Details of the 5m contour are given Section 6.1. In brief, the 5m contour approximates the EFZ that is, it encapsulates sensitive estuarine habitats and processes. The EFZ is acknowledged in the NEMA EIA Regulations.

There is a strong view that the 5m contour should be the determining level for any development within an estuary. Figure 9 shows the refined EFZ of the Heuningnes River estuary using provincial Lidar data (Anchor, 2017) and thus the area that is likely to be flooded should the water level ever reach the 5m contour.

It is important to note, that full EFZ must be included future revisions of the Heuningnes EMP to ensure integrated management of the system.

6.3.6 1:50 and 1:100 year Flood lines

The NWA requires that flood lines be determined for areas where high risk dams exist and where new town developments occur. In general terms, the 100-year flood line is considered to be the minimum standard for flood management (Holmes & Dinicola 2010, cited in MacFarlane et al., 2014).

A hydrodynamic modelling and flood line delineation of the entire Heuningnes River estuarine system was undertaken by SMEC South Africa in 2017 in order to determine the 1:50 and 1:100 year flood lines under different mouth conditions (SMEC, 2017), in support of sustainable mouth management and proposed conservation development at De Mond Nature Reserve.

The data was used to make recommendations for the management of the mouth so ensure optimal ecological functioning of the system, while at the same time protecting infrastructure, cultivated farmlands and livestock within the estuary floodplain area. The results of this study are illustrated in Figure 10 and Figure 11. It is evident that low lying development is relatively at risk. All new development should be located above the known risk lines. For detailed information on various areas of the estuarine system can be obtained in the flood delineation report (SMEC, 2017).

6.4 De Mond Nature Reserve Zonation

The portion of the Heuningnes River estuary within the DMNRC is managed according to the De Mond PAMP and the zonation plan therein (Hoekstra & Waller, 2014) (Figure 12). The Soetendalsvlei section is zoned for Species/ Habitat Protection. The estuary mouth region includes three zones, namely,

- **Development – Management:** location of infrastructure and facilities for conservation administration and management purposes;
- **Development – Low Intensity:** location of infrastructure and accommodation to enable access to and recreation within the natural environment; and
- **Nature Access:** Area of reduced disturbance, that allows for more intensive biodiversity management, whilst still providing for public access and low impact recreational activities.

In addition, the De Mond Nature Reserve is managed as a bait reserve/sanctuary (Anchor, 2017), i.e. no collection of bait organisms.

6.5 Habitat Sensitivity

A habitat sensitivity analysis is the baseline which guides the differentiation of the various zones, specifically identifying:

- threatened, ecologically important habitats as no-go or minimal disturbance zones;
- those areas which can support controlled, sustainable exploitation of marine living resources; and
- those where various forms and levels of appropriate water-based recreation are acceptable.

The following areas have been identified as sensitive habitats, sensitive hydrological, sensitive vegetation, and sensitive floral or faunal sites (Figure 13 and Figure 14a-e). They transcend bioregional category boundaries and require a degree of protection.

Table 12: Description of sensitive habitat areas

HABITAT	DESCRIPTION
<p>Estuarine Dominated Reach (EDR) (also termed the River Estuarine Interface, REI)</p>	<p>The EDR area is where incoming marine water wedges in under freshwater flowing downstream. The EDR moves up and down with the tidal exchange and also moves up and down in the estuary according to seasonal freshwater input variations, this extends to approximately 12 km upstream (Figure 13). This area is likely to shift further upstream with the anticipated rise in sea level. The land on either side of this entire zone falls under private ownership, and is managed by the HROA. It is included in the Limited Activity Zone (LAZ) due to the role it plays as a nursery to fish and the associated habitats it sustains.</p>
<p>Freshwater Dominated Reach (FDR)</p>	<p>The FDR extends from the inland side of the REI to the upper freshwater reaches with no tidal influence; this extends roughly from the bridge all the way into the Soetendalsvlei. Representative sections of this reach must be protected. Figure 13, shows the link between the Soetendalsvlei and the estuary.</p> <p>The 32m wetland / river buffer extends all the way up the river, protecting the banks and the associated wetlands in the area. This should be regarded as part of the LAZ.</p> <p>In the Heuningnes, the FDR is adjacent to private land and protection of this region should be negotiated between the relevant parties, who should be represented on the HEAF. It is important to note that the various wetlands/pans that are critical to the Heuningnes River estuary and they should be protected at all costs. If possible a long term objective should be to extend the area of the EMP to include these water bodies.</p>
<p>Marine Dominated reach (MDR)</p>	<p>The MDR reach extends from the REI to the sea (Figure 13). The ebb and flow habitats of this reach will be dominated by tidal action and flooding and will be prone to damage by storm surges and are likely to be impacted on by and sea level rise changes. This area is the key focus of the mouth management activities – mouth opening and dune stabilisation. These areas are important from a conservation point of view for the nursery fish and invertebrates. This area extends to approximately 2km inland of the river mouth.</p>
<p>Sand banks</p>	<p>Sand bank habitat is well represented in the Heuningnes River estuary. This important habitat for invertebrate fauna is one of a very limited number of open estuaries that can serve as a breeding and re-stocking ground for important bait organisms. Disturbance of this habitat should be restricted.</p>
<p>Mud banks</p>	<p>Mud banks are limited and readily accessible. Due to the sensitive nature of mud banks, access should be restricted.</p>
<p>Stabilized dune field</p>	<p>The dune field historically stabilized in order to prevent the closure of the mouth and inland flooding requires active management in the form of alien plant species control and maintenance of hiking pathways. As these dunes were historically un-vegetated and</p>

HABITAT	DESCRIPTION
	mobile, they will naturally tend back towards this state. Monitoring of the situation with a view towards the management priorities will be required. It must be remembered that any dune stabilization or disturbance of dune vegetation is currently a trigger in terms of NEMA EIA Regulations.
Estuary mouth	<p>The mechanical opening of the mouth for flood control over agricultural areas is a historic management practice for the catchment. The importance of maintaining the open mouth has been raised by the land owners that are affected by flooding through the EMP process. This activity is listed in terms of NEMA EIA Regulations. Environmental Authorisation is required prior to the activity taking place, unless in accordance with an appropriate maintenance management plan.</p> <p>A mouth management plan for the Heuningnes River estuary (SMEC, 2017) is in the process of being finalised.</p>

6.6 Zonation of Activities

Estuaries can be zoned for different activities, primarily to reduce conflict between uses or user groups. These activities can include recreational, development or change in land-use, recreational fishing activities and non-consumptive activities (e.g. swimming, hiking). These zones must ensure no conflict with the Vision and Mission and Management Objectives as defined for the Heuningnes River estuary.

The initial spatial zonation plan for the Heuningnes River Estuary was established through public & stakeholder participation, as well as through scientific evaluation. The requirements and rights of all individuals were taken into consideration with due consideration of the physical and environmental restraints existing in the estuary or which should be implemented (Hilland, 2010).

The initial zonation does not indicate the zonation, and associated controls, employed by CapeNature for the De Mond Nature Reserve, as provided above. While zonation should be continuous throughout the system as a whole, CapeNature administration and policies should take precedence, within this protected area. Thus, the De Mond Nature Reserve zonation must be duly considered.

6.6.1 Development Areas

The development areas are limited to the existing areas of infrastructure both on the private land and within the De Mond Nature Reserve (Development-Management and Low-Intensity zones) (Figure 12 and Figure 15). Any expansion of development on either private land or within the De Mond Nature Reserve will be subject to the EIA regulations and will require Environmental Authorisation. Development infrastructure refers to the physical buildings on the ground, as well as pipe lines and roads. Within De Mond, this will have to go through DEA (National) and on private land, through DEA&DP (Provincial). Expansion of development areas is limited through the 1:50 and

1:100 year flood line delineations, 32m buffer, the 100m HWM buffer, and the 5m contour line.

The 5m contour line also incorporates the potential flood risk areas due to back flooding when the mouth is closed as well as climate change and sea level rise. This could be used in addition to the 1:100 year flood line. Due to the low-lying nature of the area, the 5m contour places a large restriction on new activities or developments). Furthermore, according to the National Estuaries Biodiversity Plan, 75% of the estuary margin to remain undeveloped or with a > 500m development setback line (Turpie et al., 2012). The Coastal Management Line process should integrate all these (DEA&DP).

6.6.2 Conservation (Ecologically sensitive areas)

6.6.2.1 Limited Activity Zone

The Limited Activity Zone (LAZ) comprises the estuarine habitats identified during the habitat sensitivity analysis (Table 12 and Figure 14a-e). The purpose of the LAZ is to preserve these sensitive areas by limiting disturbance and potentially damaging activities.

Within the De Mond Nature Reserve, these habitats fall within the area zoned as Nature Access. The following conditions of use apply (Hoekstra & Waller, 2014), to all estuarine habitats in the protected area:

- No building of any new (permanent) structures outside of the designated development zones;
- No accommodation or camping;
- No motorised vessels permitted on the estuary except CapeNature patrol vessels;
- Vehicular and pedestrian access restricted to designated and maintained paths, tracks and access roads;
- No bait harvesting;
- Prevent, restore and mitigate visible trampling or any other visitor impacts (e.g. installing raised boardwalks through saltmarsh habitat);
- Rehabilitation of non-useful roads and paths to natural vegetation;

Outside of De Mond Nature Reserve and on the privately owned land, conditions of use of the LAZ are as follows:

- No building of any new structures allowed in the area below 5 meter contour;
- No motorised vehicle access should be permitted, except on existing tracks;
- No new tracks are to be created;
- Access to and use of the river is restricted to its current use which has been controlled and limited by the HROA over the years;
- Any vehicle tracks across saltmarsh habitat need to be rehabilitated and pathways raised on boardwalks or clearly designated;

- No motorised vessels permitted on the estuary (except riparian land owners and CapeNature patrol vessels); and
- All activities within this zone are limited to the current use with the RMA deciding on aspects such as suspending / controlling fishing.

The RMA and strategic partners are to review and advise if any current activities need to be changed due to impacts.

6.6.2.2 *Ecological corridors*

Ecological corridors are the areas identified adjacent to the river where rehabilitation is necessary in order to allow for the continued functioning of pattern and process along the river corridor (Figure 16). These areas are the ESA as indicated on the CBA mapping and the buffer areas in the Bioregional Planning Zones (Figure 7). These areas within the estuarine management area are largely areas where alien invasive vegetation needs to be targeted for removal and other areas where the natural riparian or salt marsh / wetland vegetation has been lost in the river buffer due to agricultural practices. These are areas where every effort should be made to reinstate the natural vegetation which will assist in reducing the negative impacts on the estuary through increased sediment loss and river bank destabilization. The rehabilitation area should follow at least the 32m buffer from the edges of the wetlands, saltmarshes and rivers. The connectivity between the ocean and Soetendalsvlei via the estuary mouth is important.

6.6.3 Recreational Use Zones

Existing recreational activities within the estuary are limited due to the inaccessibility of the estuary to the general public. Access is limited through the largely private ownership of the farms along the river and the strict carrying capacity of De Mond Nature Reserve at the mouth.

Use is currently limited to swimming, hiking, sport fishing and canoeing by visitors and the private owners. Activities such as motor boating, jet-skiing, wind and kite surfing are not seen as compatible with the ecological sensitivity of the estuary and are therefore not be permitted. Only riparian owners needing to gain access to their property on the other side of the river may use motor vessels on the river and this is for direct access only and not for activities such as skiing etc.

By virtue of the De Mond Nature Reserve boundary, no motorised vessels (except for CapeNature patrol vessels) are permitted in the mouth region of the Heuningnes River estuary. Beyond the protected area, the safety of swimmers and other water users must be considered by boat users.

6.6.4 Marine Living Resource Use

The use of marine living and estuarine resources within the estuary is currently only partially controlled. CapeNature monitor visitors' activities within the protected area, however, there is a shortage of personnel and this is often not controlled and bait collecting occurs within the mudflats and importing of live bait from other systems for fishing both surf, shore and estuarine occurs. Similarly, problems with gillnet fishing have also been reported from within the protected area.

A strict policy of "no bait collection" has been enforced in the De Mond Nature Reserve, i.e. the estuary is managed as a bait reserve (Anchor, 2017). This limits the disturbance to the mudflats and other areas where bait collecting results in disturbance of the estuarine system. Subsequently, these species have experienced an increase in population numbers. Recreational fishing is permitted within the De Mond NR and must comply with regulations in terms of the MLRA.

On private property, the owners monitor trespassers and limit their families and staff with respect to fishing and bait collecting. Due to the damage caused through bait collection, it is proposed that no bait collection is permitted in the estuary (LAZ) outside of the De Mond Nature Reserve.

According to the National Estuaries Biodiversity Plan, a portion of the Heuningnes River estuary is required to be Sanctuary (i.e. no-take for extractive use) (Turpie et al., 2012). Thus CapeNature should consider the option of restricting fishing to specific areas, or at least a strict 'catch and release' area.

In its current form, the spatial zonation of the Heuningnes River estuary is very restrictive, with 75% being no-go for any form of use. This is unpractical or desirable (DEA, 2014a). Therefore, it is strongly recommended that the zonation of the estuary be revised in future revisions of the EMP.

Table 13: Zonation specifications for the Heuningnes River estuary

Zonation/ Use	Condition of use	Relevant Legislation	Responsible Authority	Enforcement
Development	Environmental Authorisation required	NEMA EIA Regulations	DEFF	De Mond Nature Reserve: DEFF Private: DEA&DP
	Compliance with development controls related to the CPZ and CML	ICMA	DEA&DP	DEA&DP

Zonation/ Use	Condition of use	Relevant Legislation	Responsible Authority	Enforcement
	Compliance with buffer zones	NEMA EIA Regulations	DEA&DP	DEA&DP
	Compliance with building regulations and bylaws	MSA	Cape Agulhas LM	Cape Agulhas LM
Conservation: LAZ and Ecological corridors	Compliance with De Mond PAMP and zonations/ stipulations	NEM:PAA,	DEFF	CapeNature
	Compliance with Agulhas National Park PAMP (Soetendalsvlei)	NEM:PAA	DEFF	SANParks
	Compliance with CARA irt invasive plant removal and rehabilitation of agricultural land	CARA	DoA	Cape Agulhas LM
Recreation: Swimming / Canoeing	Compliance with water quality guidelines for recreational use	Health Act, NEM:PAA	DWS / DEFF	DWS / DEFF CapeNature
	Compliance with De Mond PAMP and zonations/ stipulations			
Boating	Permissible for riparian land owners (Private land) and CapeNature patrols (De Mond NR) only	Merchant Shipping Act and Small Vessel Safety Regulations	SAMSA	CapeNature
	Compliance with boating regulations and bylaws Riparian owners may only beach/moor boats at designated positions No jetskis, No kite-surfing	Municipal bylaws		Cape Agulhas LM
	Compliance with De Mond PAMP and zonations/ stipulations	NEM:PAA	CapeNature	CapeNature
Marine Living Resource Use Zone:	Compliance with MLRA Compliance with additional DAFF regulations (e.g. Kob restrictions "catch and	MLRA regulations	DEFF	CapeNature

Zonation/ Use	Condition of use	Relevant Legislation	Responsible Authority	Enforcement
Recreational Fishing	release" basis inside the estuary, night time ban on Kob fishing)			
	No commercial fishing			
	Compliance with De Mond PAMP and zonations/ stipulations (e.g No fishing in Zostera beds without a permit)	NEM:PAA		

7 INSTITUTIONAL ARRANGEMENTS

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. **The CapeNature Governance Tool will be used to list management objectives and monitor, track and report on progress with EMP implementation.**

7.1 Key Role Players

Co-management and effective governance has been identified as the keystone to the efficient and effective management of the Heuningnes River Estuary. Figure 6 displays the key role players that should be included in the management of the Heuningnes River Estuary.

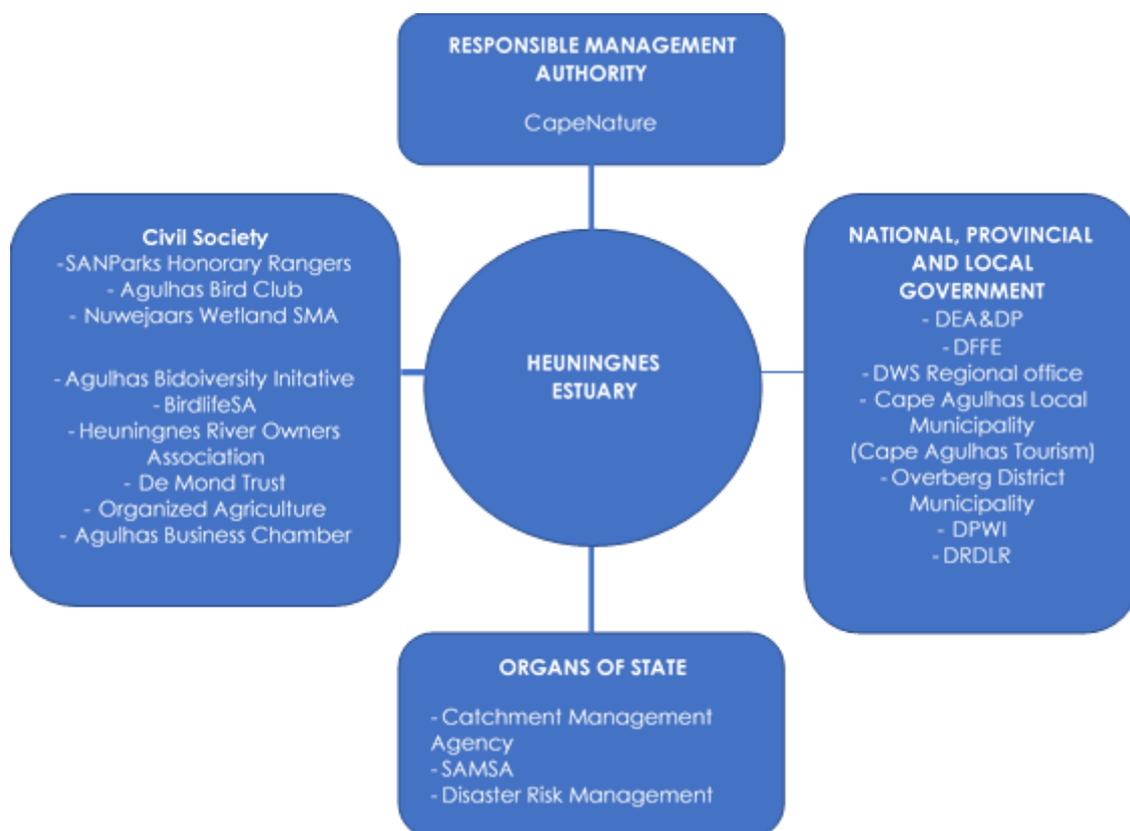


Figure 6: Key role players for the management of the Heuningnes River estuary with CapeNature as the RMA

7.1.1 Estuary Management Authority

The Heuningnes River estuary falls partially within the De Mond Nature Reserve, thus inferring the responsibility of management authority and co-ordination of the implementation of the EMP on the CapeNature according to the NEMP (2013); CapeNature is already responsible for the management of the De Mond Nature Reserve. Memoranda of Understanding between entities, to co-manage the Heuningnes estuarine system should be considered. Implementation of the EMP, however, can be affected through a range of different forums and agencies.

The main functions of the RMA include but are not limited to the following:

- Give effect to recommendations of the EMP;
- Propose and ensure/facilitate the promulgation of rules and regulatory framework;
- Budget/solicit funding for management projects of the RMA;
- Monitor execution of management plan activities;
- Development of an MOU between the various authorities in terms of regulatory functions and funding;
- Facilitate planning and execution of the IDP/SDF process with local authorities;
- Develop a communication strategy regarding the rules and regulations and relevant environmental information to stakeholders, authorities and the public;
- Develop an Environmental Education Programme for the Heuningnes River estuary. This should include a land use/stewardship strategy for the catchment area; and
- Keep record of all meetings and decisions and correspondence.

The actions of the RMA are detailed in Table 9 but are also cross-cutting and appearing in different action tables above.

Given the large size and various components of the system (e.g. De Mond Nature Reserve, Soetendalsvlei and Agulhas National Park), and the respective management agencies (e.g. CapeNature, SANParks, HROA), effective implementation of this EMP for the entire Heuningnes estuarine system may warrant the establishment of a management committee, administered by the RMA, for *de facto* implementation of the EMP. A Terms of Reference, containing roles and responsibilities, should be developed for the committee and signed by all the strategic partners.

It is strongly recommended that an Estuarine Management Co-ordinator be appointed within the RMA to administer estuary-related matters at the local level. This individual will play a critical co-ordinating role for all other implementing agencies of the management committee.

In addition, a system of honorary rangers (CapeNature/SANParks) would work extremely well along this estuary due to the involvement of the private riparian owners in the catchment. Moreover, the respective conservation authorities are only permitted to operate within protected areas/their areas of jurisdiction.

7.1.2 Heuningnes River Estuary Advisory Forum

According to the NEMP (2013), the role of the HEAF is interpreted as providing an advisory capacity 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 specified or prioritised by the HEAF.

It is recommended that the HEAF functions along the lines of the HROA as this particular structure functions well. The HEAF must also embrace the ABI and De Mond Trust in order to get the larger catchment of the estuary under sensible management beneficial to both the land owners and the Heuningnes River estuary. A set of rules and protocols governing the actions of the HEAF members must be negotiated early to avoid misunderstandings and conflict. hereby ensuring they are well represented on the HEAF

The broader community, e.g. NGO's, conservancies, etc., and representatives from surrounding agriculture will be able to voice concerns and raise issues via the Forum. Local members will play an invaluable role in providing on the ground, local insight and support to the authorities. Any representatives are obliged to raise issues identified by their constituents and to provide feedback to the constituents. Importantly, the Forum will not represent or supplant the individual positions of its members unless specifically mandated to do so.

More specifically, the HEAF should consist of the following:

1. A chairperson who will take the lead in co-ordinating the forum;
2. Government Representatives (See section 7.1.3 below) of the major management sectors/areas with executive powers in terms of respective legislation:
 - a. Conservation & Living Resources;
 - b. Land-use and infrastructure development;
 - c. Water quantity and quality; and
 - d. Social (and cultural) issues.
3. Representatives of all the above remaining institutions and interest groups, including existing institutions such as BGCMA, Water User Associations or catchment forums, and conservancies.

The HEAF serves to keep all stakeholders informed of the progress and effectiveness of the EMP, identifies areas of concern and makes management recommendations that may need to be incorporated into the EMP, liaises with government departments through the RMA, to ensure they fulfil their legal obligations and interacts with tertiary & research institutions to help coordinate research programmes. The HEAF is thereby instrumental in facilitating the implementation of the action plans.

The principle functions of the HEAF may include:

- Promoting co-operative governance between stakeholders;
- Providing the platform to voice concerns and raise issues;
- Assisting the RMA leveraging funding for implementation of various actions and project plans;
- Motivating for supportive legislation (by-laws) for estuarine management;
- Disseminating information and providing feedback to stakeholders on estuary-related issues;
- Promoting environmental awareness and capacity building with regard to estuarine issues; and
- Keeping record of all forum meetings, decisions, and correspondence.

The HEAF and its members may also be directly involved with monitoring programmes by collecting data (physical measurements or visual observations) and can act as the eyes and ears for law enforcement authorities.

It is proposed that the HEAF should meet at least four times per year initially, with less frequent meetings when properly established.

Special task groups may also be established on an ad hoc basis to handle specific issues, such as the Mouth Management - Climate Change – Agricultural issue, and thereafter dissolved once the issue is resolved or settled.

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:

- CapeNature as the RMA, who is also responsible for general conservation in the region, including the De Mond Nature Reserve Complex, biological monitoring, compliance management and facilitating rehabilitation;
- Cape Agulhas LM: Responsible for providing key municipal services, as well as the provision of management, technical and legislative support;
- SANParks (potential co-management authority) responsible for administration of the section of the estuary within the Agulhas National Park;
- Overberg DM: Responsible for fulfilling key municipal roles relating to *inter alia* water and sanitation, disaster management as well as the provision of management, technical and legislative support;

- Western Cape Government departments: Responsible for legislatively mandated responsibilities as well as support, including compliance, funding, and monitoring (e.g. DEA&DP, Department of Transport and Public Works, etc.);
- Relevant National government departments, especially DEFF: O&C, DWS (via the regional office), DEFF, Department of Rural Development and Land Reform (DRDLR), and Department of Science and Technology; and
- Organs of State, such as BGCMA, CSIR.

The DEFF 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 Heuningnes, will occur via existing forums for intergovernmental coordination. These forums will have the management of the Heuningnes River estuary on their agendas from time to time, and include:

- The Overberg Municipal Coastal Committee: Responsible for facilitating co-management, effective governance and district level co-ordination of coastal and estuarine management issues; and
- Western Cape Provincial Coastal Committee: Responsible for facilitating co-management and effective governance and provincial co-ordination of estuarine management.

A crucial element towards achieving the vision and objectives of this plan, is to ensure that the responsible authorities and their constituent departments, fulfil their roles and responsibilities as identified within the EMP.

In terms of practical implementation of the EMP, each responsible government department is required to produce internal project plans linked the identified management actions, and in line with their legislative mandates. Funding and staff resources will need to be sourced within each respective sector department and/or institute. Alternatively, departments may fund other entities to undertake their necessary functions on their behalf. It would be important for positions to be multi-use, e.g. law enforcement staff should double as doing the monitoring and data collection during their patrols. Similarly post graduate students could obtain funding through the GEF/WRC funding for specific research projects in the estuary.

7.1.4 Estuarine Experts

Estuarine experts for fish, birds, vegetation, aquatic ecosystems etc. should be employed in an Estuary Management Unit to collectively service all national priority estuaries. This is especially important on the Heuningnes as this estuary is primarily an ecological reserve and is one of the few estuaries that has had very limited development impact and is therefore a key research estuary. This team of specialists may be contractual positions or permanent depending on funding. Additionally, many of the universities have students who are undertaking research within the area or who would be willing to undertake such research – it may be well worth establishing

a system of post graduate students who could work on the various aspects of research required within this estuary.

Although various determinations had been made of the carrying capacity of the system, it is highly recommended that the exercise be repeated in view of new policies and legal framework.

Ad hoc work groups to deal with specific problems, such as:

- Mouth management and climate change to determine the implications of tidal influence and flood dynamics on agricultural activities
- Dune stabilisation and impact on mouth management

8 MONITORING AND EVALUATION

8.1 Ecological Monitoring

8.1.1 Current Monitoring

The following monitoring activities are currently undertaken on the Heuningnes River estuary by various role-players:

- DWS water flow recorder: The gauging station, G5H002, is located on the Kars River (34°34'18"S, 20°06'55"E). It is imperative that this monitoring station be reinstated to provide an indication of water flow reaching the estuary, particularly in respect to flood risk assessment.
- Water level recorder: The tidal measuring station G5T002 located on the De Mond suspension bridge measures water levels within the estuary and is influenced by both river inflow as well as tidal fluctuations. Ongoing monitoring at this site is critical in respect to the proposed mouth management strategy and the risk to low-lying development.
- Water quality monitoring (Fortuin, pers. comm., 2018):
 - Bi-weekly (every two weeks) water quality monitoring is undertaken by CapeNature at three sites within the De Mond estuary portion. This includes salinity, temperature, pH, dissolved oxygen, and conductivity.
 - Water quality monitoring is also undertaken by DEFF at 12 sites across the system, every six months.
 - Installation of a permanent water quality probe within the estuary at the footbridge by DWS is anticipated by end 2018.
- Birds: Two CWAC surveys conducted per year (January, July) per in each water body (De Mond & Soetendalsvlei management areas) and two Coastal CWAC conducted every quarter (January, April, July, October). Also observations of historical breeding sites, breeding pairs and breeding success of various bird species, Damara Terns, Caspian Terns, White breasted Cormorant, Crowned cormorants, Cape cormorants, Black Harriers and Kelp gulls (Hoekstra & Waller, 2014).
- Fish: National Marine Linefish System (NMLS) surveys undertaken with fishermen within De Mond, four times a month; *ad hoc* compliance patrols, and inspection of shoreline catch card entries on departure (Hoekstra & Waller, 2014).

These data are collected and entered into existing databased and are used to update the State of Biodiversity report.

8.1.2 Recommended Ecological Monitoring

To enable sustainable management of estuaries, it is imperative to collect and analyse appropriate and reliable quantitative data. The requirements for monitoring are estuary-specific. Appendix 2 provides a list of recommended abiotic and biotic

parameters to be monitored on the Heuningnes River estuary, as determined through the EWR study (Anchor, 2017) to assess changes in health of the system over time, as well as other aspects deemed necessary for the effective management of the Heuningnes system.

These are accompanied by Ecological Specifications and Thresholds of Potential Concern provided in Appendix 3 (Anchor, 2017). Ecological Specifications (EcoSpecs) are 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 category, in the case of the Heuningnes River estuary, a Category B.

Thresholds of potential concern (TPC) 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) prompts management action. In essence, TPCs should provide early warning signals of potential non-compliance to ecological specification (i.e. not the point of 'no return').

8.2 Compliance Monitoring / Law Enforcement

Law Enforcement in the Heuningnes River estuary is currently insufficient due to lack of capacity. Through the RMA, all authorities, including SANParks, will need to increase their law enforcement personnel. Recommended compliance monitoring is provided in Appendix 3, and includes monitoring visitor numbers, uses, and exploitation of living resources, required in terms of the management plan.

8.3 Performance Monitoring (Review and Evaluation)

Evaluation of the EMP will become the responsibility of the RMA, supported by Cape Agulhas LM, SANParks and the HEAF. This is to determine and grade the success and failures with the implementation of the management plan. This component utilises performance indicators included for the various actions, specifically the management priorities, and includes a temporal scale or the frequency of the collection of the performance data and the targets that should be achieved. A recommended performance monitoring programme is provided in Appendix 6. It is also anticipated that CapeNature and SANParks will employ the Management Effectiveness Tracking Tool – South Africa (METT-SA) to assess the implementation of the EMP and effectiveness of the management of the estuary in their areas of jurisdiction.

Ultimately, this EMP should be reviewed and updated on a five-yearly basis to ensure that objectives and targets are being achieved. 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 RESEARCH

Research is an integral part of any management approach. With management actions and monitoring, existing and new questions will arise that needs to be addressed through proper research.

The following preliminary list of the basic research requirements for effective monitoring of the Heuningnes River estuary. Research is listed in priority order.

- a) Determine the impact of fishing activities on fish stocks.
- b) Collection of reliable climatic data to enable accurate recording for input towards climate change.
- c) Research into the effect of climate change, reduced fresh water input and salinity build up within the low lying agricultural lands, with a view towards the mouth opening strategy.
- d) Determine the sediment dynamics within the Heuningnes River estuary, both marine and catchment sediments.
- e) Determine the reason for the perceived erosion and wetland degradation in the catchment by assessing land-use through LandSat to indicate sediment yields.
- f) Determine impacts of upstream impoundments and dredging activities on the functioning of the estuary and wetlands.
- g) .Determine the freshwater requirement for the Heuningnes River estuary.
- h) Determine the quality of the water entering the Heuningnes.
- i) Determine ground water surface water interface with Heuningnes River estuary. Map aquifer types and potential yields of groundwater discharge or recharge to and from the estuary.
- j) Determine the importance of sub-surface water input for the health of the river.
- k) Determine the impacts of existing farming activities on the water quality and sediment yields in the estuary.
- l) Determine the impacts of aquatic and picnic recreation activities on the estuary (carrying capacity must be determined).
- m) Determine the impact of possible expansion of tourism facilities on the sensitive coastal vegetation and estuary resources.
- n) Assess proposals for generation of revenue against environmental sensitivity, financial viability, possible market for the product, sense of place, carrying capacity.
- o) Determine through pollen analysis of the various wetlands in the catchment, the pre-history of the catchment with specific reference to the debate regarding the mouth status and the long term prediction for the area with respect to climate change.

Research funding mechanisms must be investigated as part of the implementation phase of the EMP. Collaboration with the various tertiary academic institutions should be sought, as post graduate study could be an effective mechanism of achieving the

research objectives and accessing funding which is available. Funding through Water Research Commission, Department of Science and Technology, and Global Environment Fund should be investigated.

It is proposed that a team of experts be identified to form a research unit/consortium to undertake the baseline and other priority research in all national priorities estuaries.

Relevant scientific and management information must be made accessible to the general public. Use information brochures, posters and web site to distribute information. Some workshops can be arranged to introduce the community to the use of scientific information in applied management.

10 RECOMMENDATIONS

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

Spatial Zonation Plan:

- The EMP highlights that the initial zonation of the estuary only extended up to the R319 road bridge to the mouth of the estuary, excluding the upper reaches of the estuary as well as extensive wetland habitat e.g. Soetendalsvlei, associated with the Heuningnes River estuary.
- The zonation plan is not practical or desirable with approximately 75% being no-go for any form of use, and it does not maximise the value of the estuary (DEA, 2014a). It is also difficult to enforce given the extent of no-go or limited activity areas.

It is therefore imperative that the zonation plan be reviewed by the RMA in the next EMP review in order to produce a map that is inclusive of the full the extent of the EFZ and the use zones. In reviewing the zonation plan, various scenarios/options should be proposed and put forward to the various stakeholders.

11 REFERENCES

Anchor Environmental Consultants (2017). Determination of the Ecological Reserve for the Heuningnes Estuary. Report prepared for the Breede-Gouritz Catchment Management Agency, 176pg.

Cleaver, G and Brown, L.R. (2005). Wetland Restoration: Nuwejaars, Heuningnes, Kars and Rater Wetland and River Systems: Information Status Quo Report and Recommendations.

DEA (2014a). National Estuarine Management Protocol. Review of Existing Estuarine Management Plans 2007-2014. Department of Environmental Affairs, Cape Town.

DEA (2014b). The National Coastal Management Programme. Department of Environmental Affairs, Cape Town.

DEA (2015). Guidelines for the Development and Implementation of Estuarine Management Plans in terms of the National Estuarine Management Protocol. Department of Environmental Affairs, Cape Town.

DEA&DP (2012). The Establishment of Coastal Set-back Lines for the Overberg District. Report prepared by SSI Engineers and Environmental Consultants for the Western Cape Department of Environmental Affairs and Development Planning.

DEA&DP (2018). Heuningnes River Estuary Management Plan: Revised Situation Assessment. Western Cape Department of Environmental Affairs and Development Planning.

Dennis Moss Partnership (2004). Overberg Spatial Development Framework, Project No. D3049. Overberg District Municipality.

Fortuin, A (2018). Personal communications regarding monitoring programmes on the Heuningnes River estuary in De Mond Nature Reserve. CapeNature.

HillLand Associates (2010). Draft Estuary Management Plan for Heuningnes Estuary. Unpublished report prepared for Cape Nature, 50 pp + Appendices.

Hoekstra T. & Waller L. (eds.) (2014). De Mond Nature Reserve Complex: Protected Area Management Plan. Unpublished report. CapeNature, Cape Town.

Holness, S. (2010). CBA mapping for the Agulhas Plains and Overberg.

Job, N. (2010). Personal communications relating to wetland delineation and potential flooding of the floodplain to improve agricultural yield and biodiversity initiatives. Wetland delineation data sheets.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. (2014). Preliminary guideline for the determination of buffer zones for rivers,

wetlands and estuaries. Final Consolidated Report. WRC Report No TT 610/14, Water Research Commission, Pretoria.

SMEC (2017). Heuningnes Estuary Hydrodynamic Modelling, Flood Line Delineation and Mouth Management Recommendations. Unpublished report prepared for Cape Nature, 50 pp.

Turpie, J.K. (2004). South African Spatial Biodiversity Assessment, Technical Report Vol. 3: Estuary component. DEAT: SANBI.

Turpie, J.K. & Clark, B.M. (2007). The health status, conservation importance, and economic value of temperate South African estuaries and development of a regional conservation plan. Report to CapeNature.

Turpie, J.K., Wilson, G. & Van Niekerk, L. 2012. National Biodiversity Assessment 2011: National Estuary Biodiversity Plan for South Africa. Anchor Environmental Consultants Report No AEC2012/01, Cape Town. Report produced for the Council for Scientific and Industrial Research and the South African National Biodiversity Institute.

APPENDIX 1: SPATIAL ZONATION MAPS

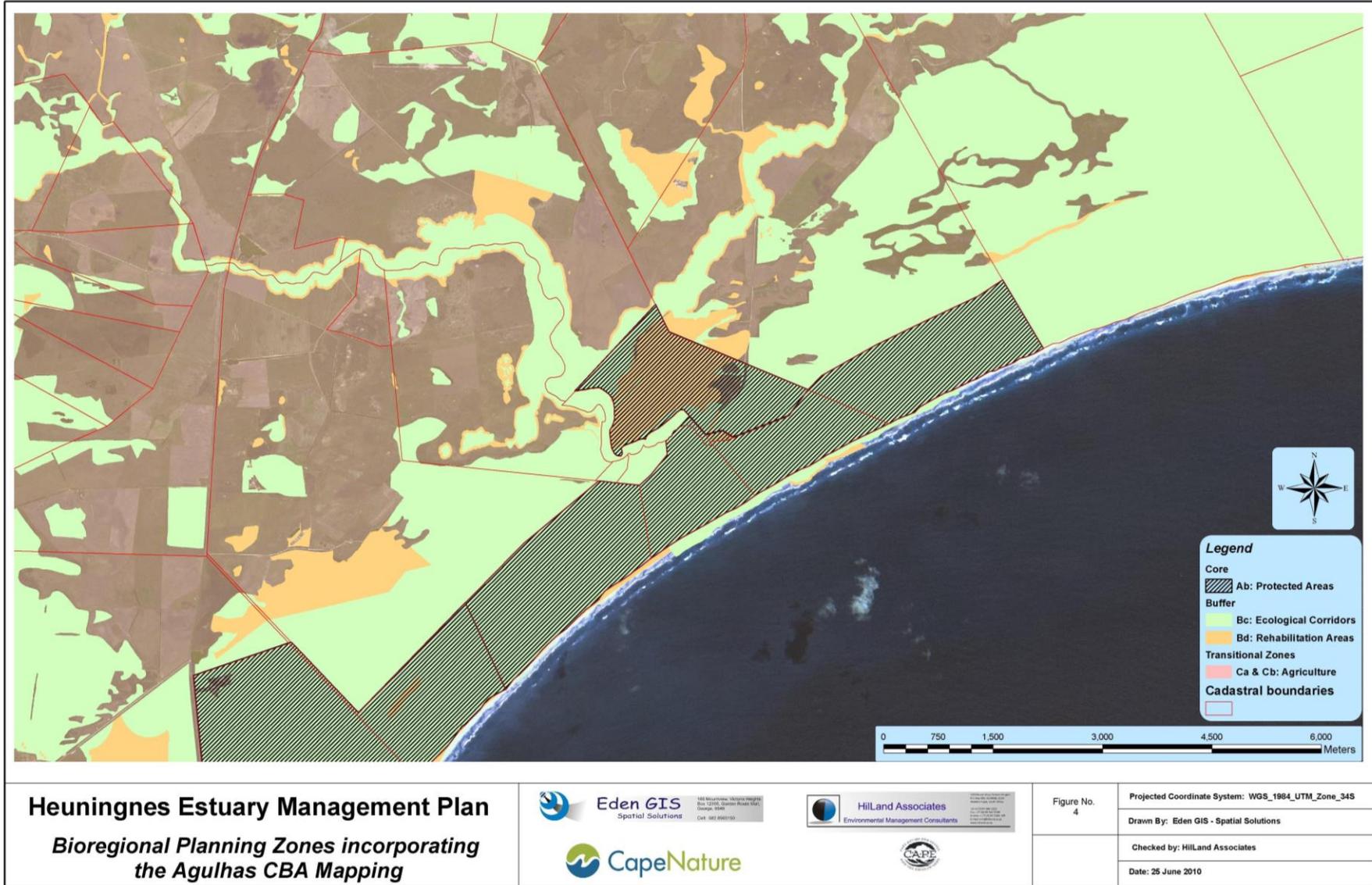


Figure 7: Bioregional Planning Zones incorporating the Agulhas CBA Mapping (Hilland, 2010)



Figure 8: Coastal & River policy buffer zones and management lines (excluding flood lines) (Hilland, 2010)



Figure 9: Heuningnes Estuarine Functional Zone according the 5m topographical contour using Lidar data (Anchor, 2017)

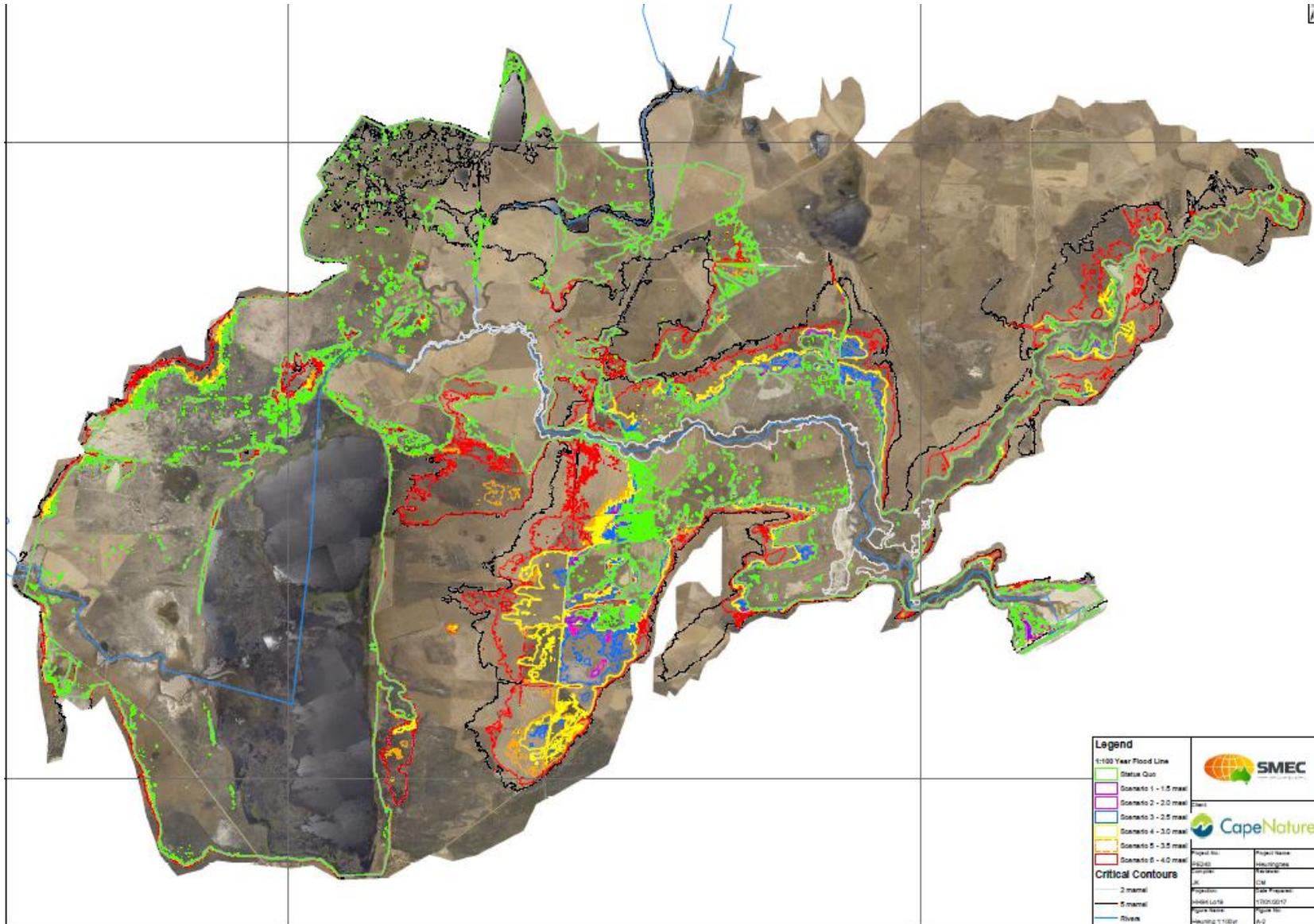


Figure 11: 1:100 year flood lines for the Heuningnes River estuary under different berm height scenarios (SMEC, 2017)

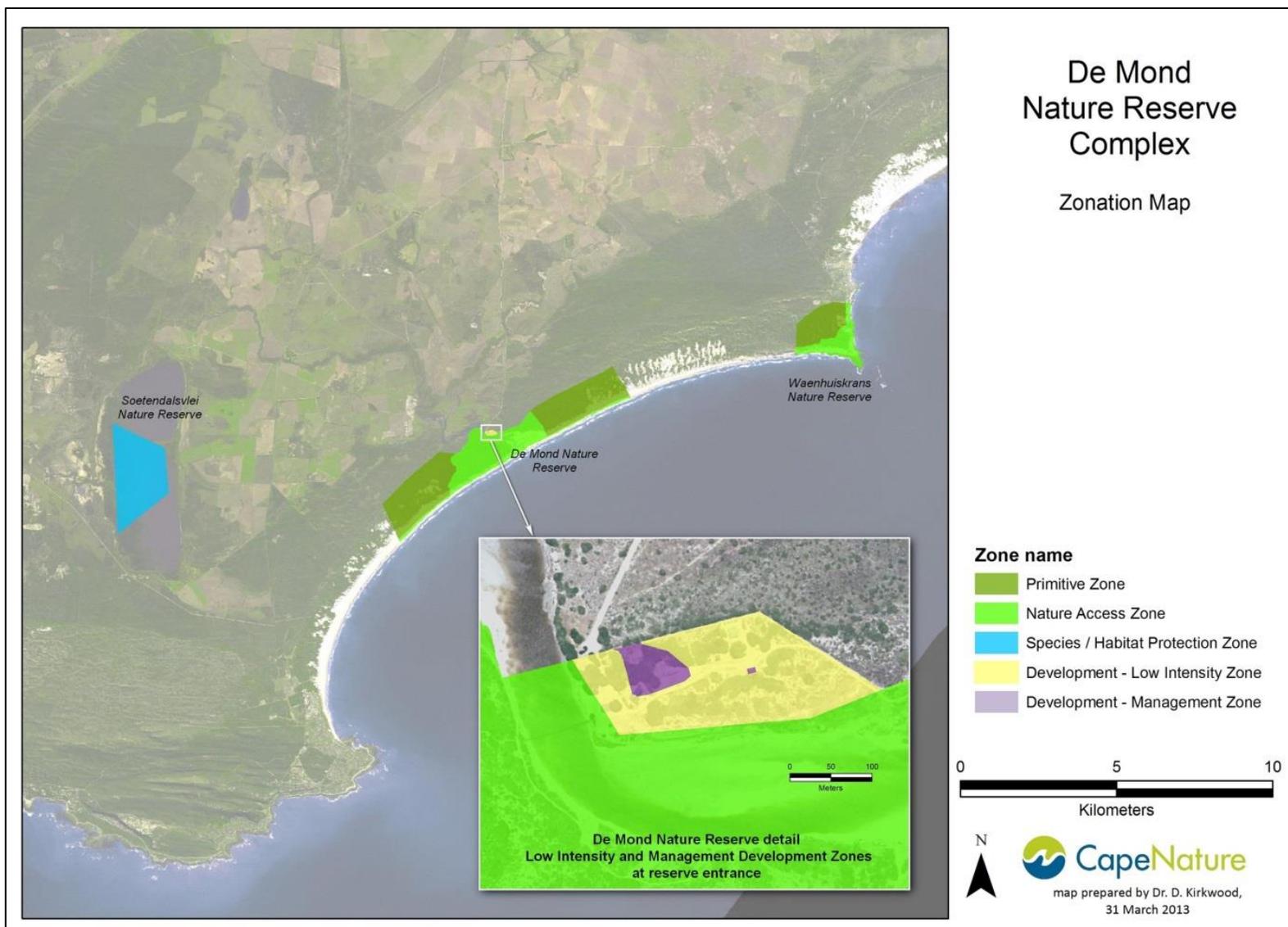


Figure 12: Zonation map of the De Mond Nature Reserve Complex (Hoekstra & Waller, 2014)



Figure 13: Aquatic habitats of the Heuningnes estuary water body & the Soetendaalsvlei, including 32m wetland/riparian buffer (HillLand, 2010)

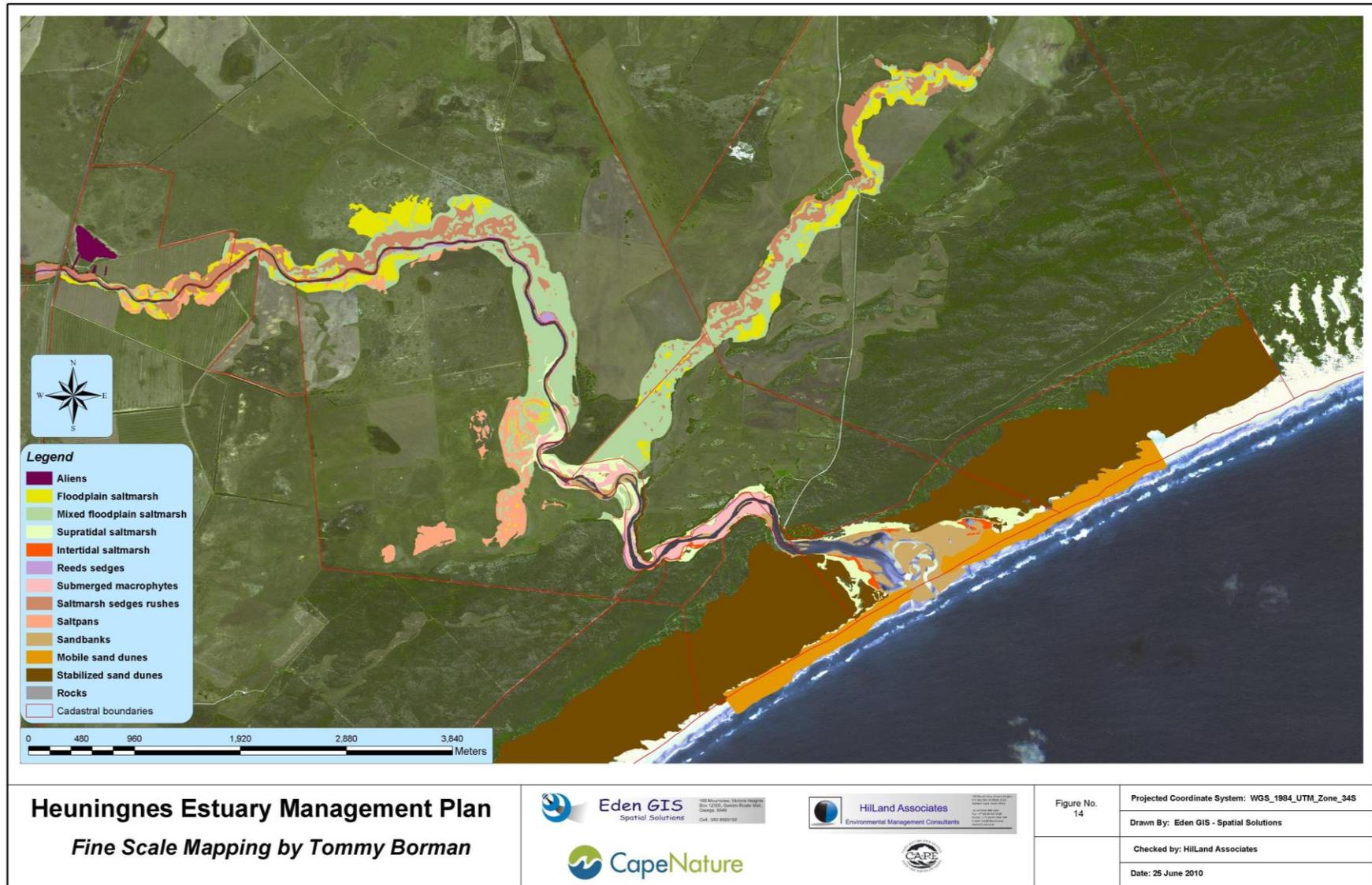


Figure 14a-e: Fine scale habitat mapping of the Heuningnes River estuary (HillLand, 2010)

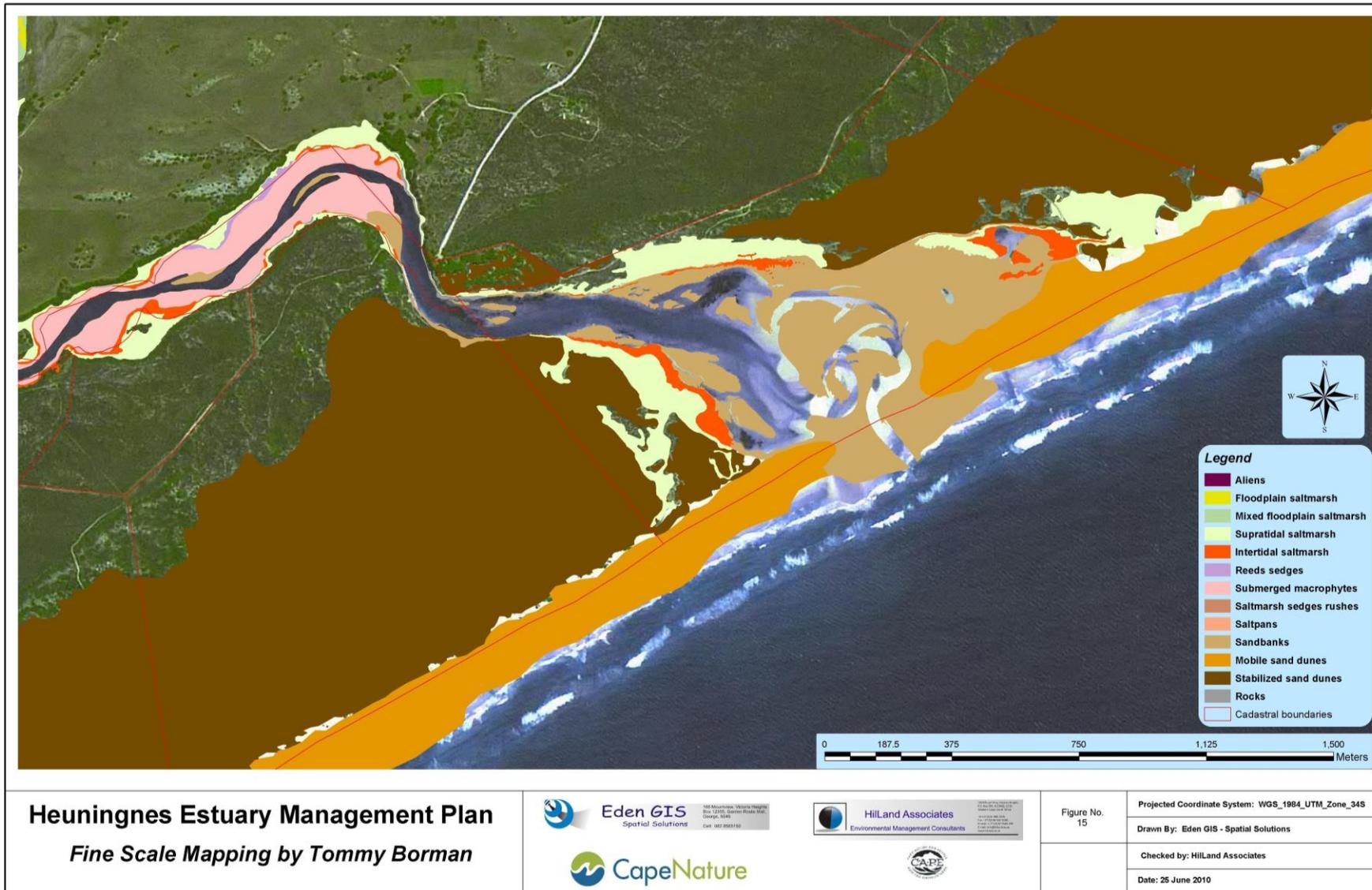


Figure 12b: Fine scale habitat mapping of the Heuningnes River estuary (HillLand, 2010)

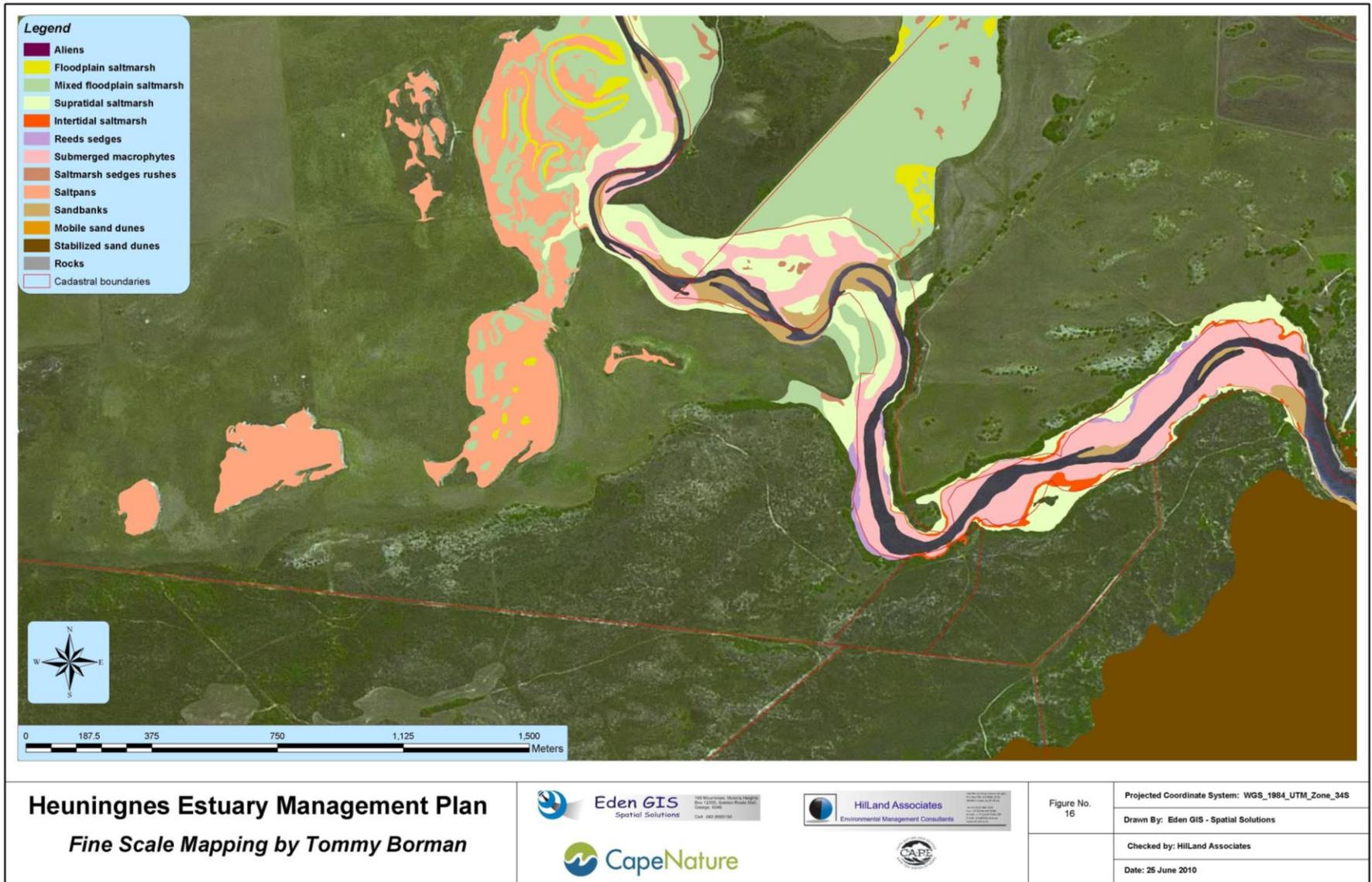


Figure 12c: Fine scale habitat mapping of the Heuningnes River estuary (Hiland, 2010)

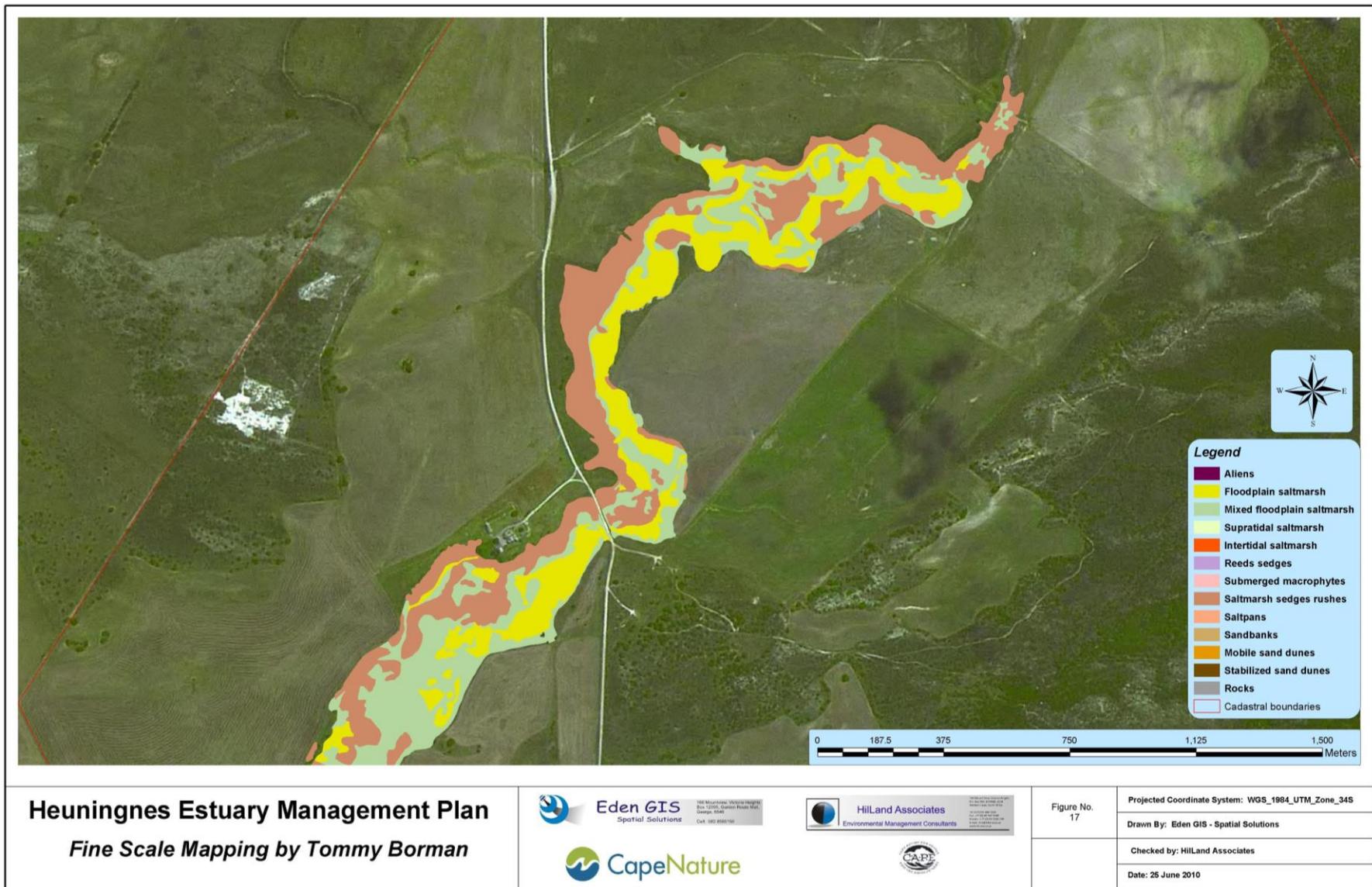


Figure 12d: Fine scale habitat mapping of the Heuningnes River estuary (Hiland, 2010)

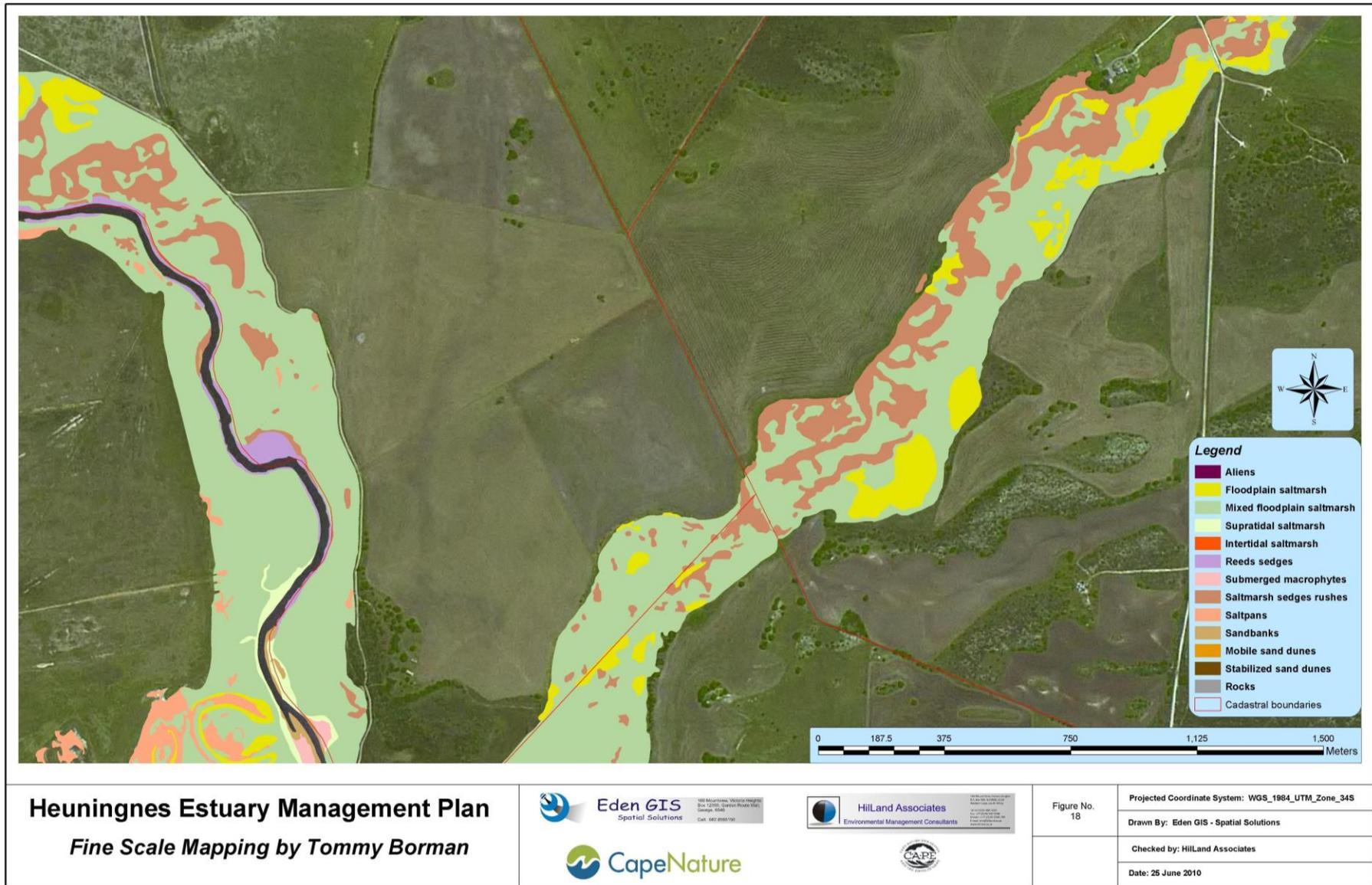


Figure 12e: Fine scale habitat mapping of the Heuningnes River estuary (HillLand, 2010)

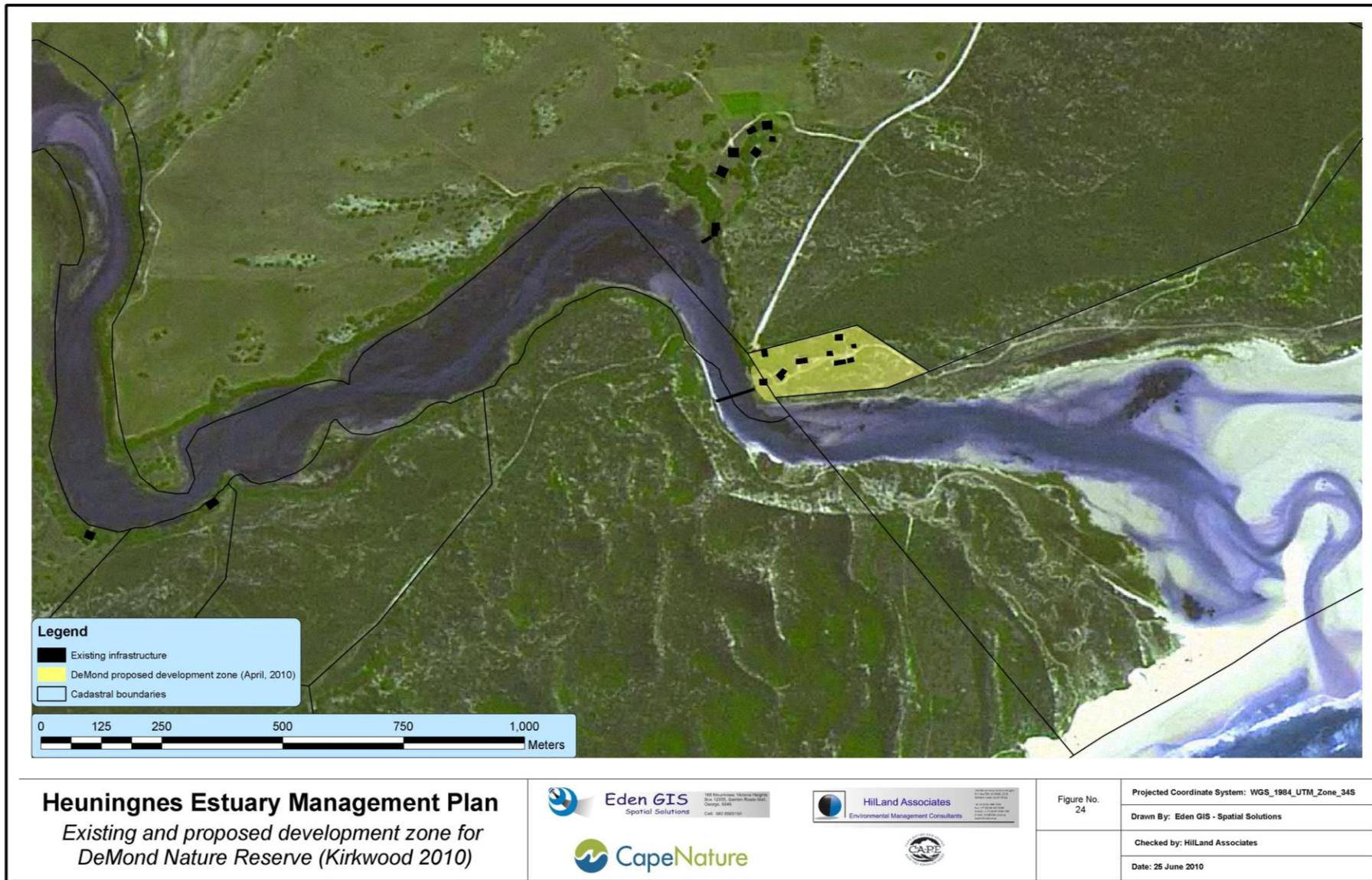


Figure 15: Existing and proposed development zone for the De Mond Nature Reserve (Hiland, 2010)

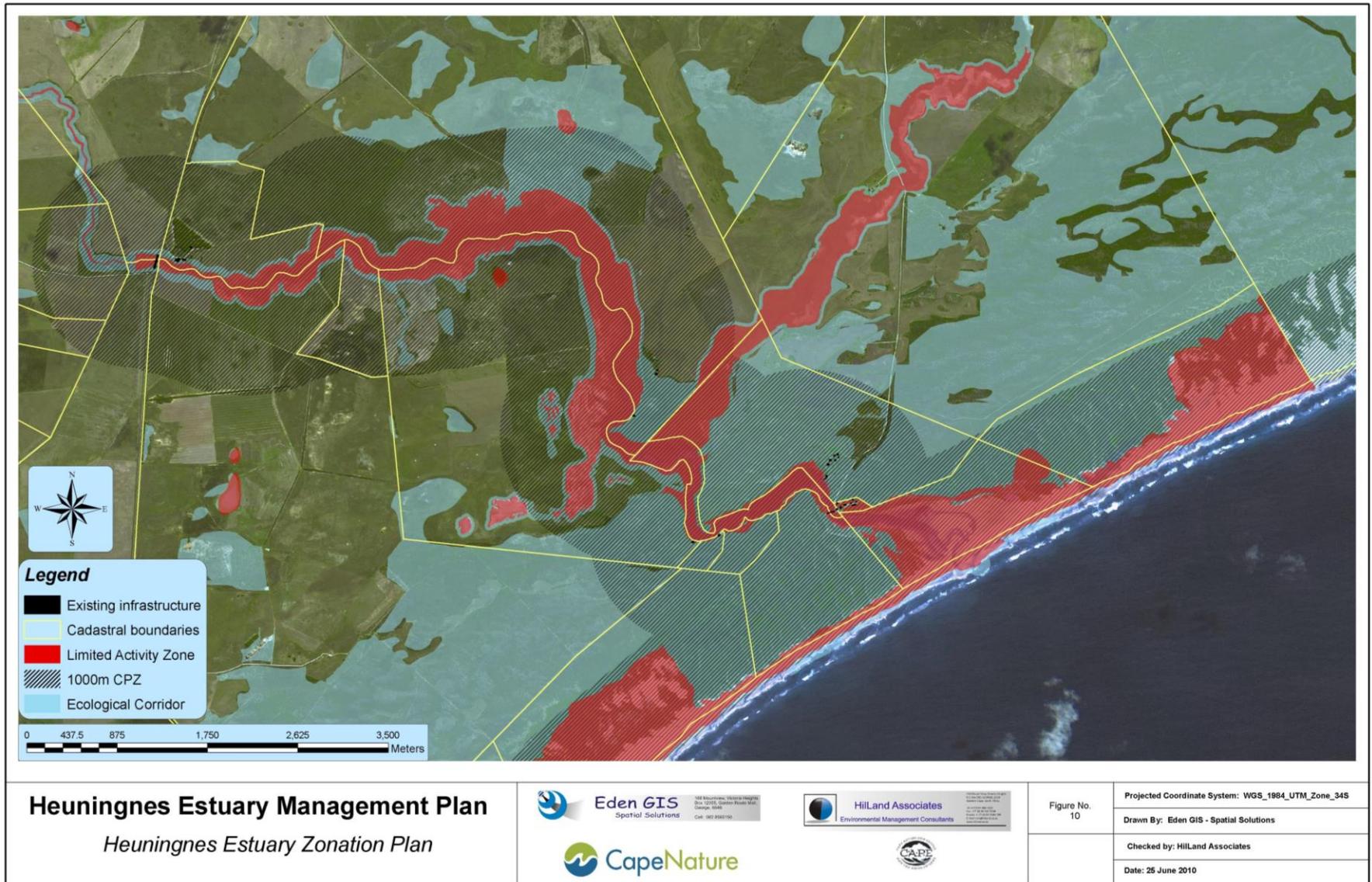


Figure 16: Extent of the LAZ and ecological corridors (Hiland, 2010)

APPENDIX 2: RECOMMENDED ECOLOGICAL MONITORING PROGRAMME

Recommended minimum monitoring requirements to assess changes in health of the Heuningnes estuarine system over time, ascertain impacts of changes in freshwater flow to the estuary (and any improvement or reductions therein) and to assess compliance with the Ecological Specifications and Thresholds of Potential Concern are listed in Table 14 (Anchor, 2017). Note, the below programme is designed for the full estuarine functional zone (not only to the R319 road bridge). Sample sites may include but are not limited to those indicated in Figure

Table 14: Recommended minimum requirements for long term monitoring (HilLand, 2010; Anchor, 2017)

Ecological component	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
Hydrodynamics <i>Monitoring objective:</i> To assess the fluvial and tidal variability and monitor effectiveness of management actions <i>Parameters:</i> increase/decrease in river flow, water levels, mouth condition	Record water levels	Continuous	DWS station G5T002 Wooden Bridge
	Measure freshwater inflow into the estuary	Continuous	At the head of the estuary
	Aerial Photographs of the estuary (spring low tide)	Every 3 years	Entire estuary
Sediment Dynamics <i>Monitoring objective:</i> To assess sedimentation at problem sites and monitor efficiency of management actions <i>Parameters:</i> Increasing or stable sedimentation/sandbank development or erosion	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 1000 m intervals, but in more detailed in the mouth (every 100m). The vertical accuracy should be about 5 cm.	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)	Every 3 years (with invertebrate sampling)	Entire estuary
	LiDAR survey of the EFZ corrected to 5 cm.	Every 6 years	EFZ below wooden bridge
Water Quality <i>Monitoring objective:</i> To assess intactness of water	Collect data on conductivity, temperature, suspended matter/turbidity, dissolved oxygen, pH, inorganic nutrients and organic content in river inflow	At least monthly continuous	Nuwejaars River at inflow to Soetendalsvlei and Kars and

Ecological component	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
quality in each of the river reaches, To assess effectiveness of management actions <i>Parameters:</i> See actions			Dwars river where it enters Upper Heuningnes Estuary
	Record longitudinal salinity and temperature profiles (and any other in situ measurements possible e.g. pH, DO, turbidity)	Seasonally, every year	Entire Estuary (12 Stations) and 4-6 stations in Soetendalsvlei
	Take water quality measurements along the length of the estuary (surface and bottom samples) for system variable (pH, dissolved oxygen, suspended solids/turbidity) and inorganic nutrients in addition to the longitudinal salinity and temperature profiles	Seasonal surveys once off and then at least every 3 years or when significant change in water quality is expected	Entire Estuary (12 Stations) and 4-6 stations in Soetendalsvlei
	Measure pesticides/herbicides and metal accumulation in sediments (for metals investigate establishment of distribution models – see Newman and Watling, 2007).	Once-off, and then 3-6 years depending on level of contamination in once-off survey	Entire Estuary (12 Stations) and then 4-6 stations in Soetendalsvlei sampling a range of sediment grain sizes (i.e. sandy to muddy)
Biota: Monitoring objective: To assess the population trends of the different organism types associated with the Heuningnes River estuary to inform management actions Parameters: Species composition and abundance, population dynamics (growth, shrinkage), structure irt age and sex.			
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, e.g. HPLC or fluoroprobe Intertidal and subtidal benthic chlorophyll-a measurements	Summer and winter survey every 3 years	Entire estuary (5 stations) and Soetendalsvlei
Macrophytes	Ground-truthed maps; Record number of plant community types, identification and total number of macrophyte species, number of rare or endangered species or those with limited populations documented during a field visit;	Summer survey every 3 years	Entire estuary (5 stations) and Soetendalsvlei

Ecological component	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
	Record percentage plant cover, salinity, water level, sediment moisture content and turbidity on a series of permanent transects along an elevation gradient; Take measurements of depth to water table and ground water salinity in supratidal marsh areas		
Zooplankton	Record species and abundance of zooplankton, based on samples collected across the estuary at each of a series of stations along the estuary.	Summer and winter survey every 3 years	Entire estuary (11 stations)
Benthic Invertebrates	Record benthic invertebrate species and abundance, based on van Veen type grab samples in subtidal and core samples in intertidal at a series of stations up the estuary, and prawn holes density. Measures of sediment characteristics at each station	Summer and winter survey every 3 years	Entire estuary (11 stations)
Fish	Record species and abundance of fish, based on seine net and gill net sampling.	Summer and winter survey every 3 years	Entire estuary (8 stations)
Birds	Undertake counts of all water associated birds, identified to species level.	A series of monthly counts, followed by winter and summer survey every year	Entire estuary (4 sections)

Table 15: Recommended additional resource monitoring (HilLand, 2010)

Component	Monitoring objective	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
Red Data and Endangered Species	Identify areas where red data species are likely or known to occur	Field work to be co-ordinated with other known collections/ collectors ABI and CapeNature and Kirstenbosch SANBI Monitoring parameters to be determine together with the ABI and CapeNature	Sampling sites in the remaining natural areas through all seasons	Sampling sites in the remaining natural areas through all seasons
Bacteriological monitoring	To detect bacteriological pollution as an early warning system of pollution to inform recreational use	Collect water quality samples according to laboratory specifications and sending it for analysis Assess bacteriological concentrations: <ul style="list-style-type: none"> • Total coliform bacteria • Faecal coliform bacteria • Must be less than 100 per 100ml for full contact recreation 	Quarterly and weekly during peak holiday season	Sampling at problem sites where full contact recreation is exercised
Groundwater (quality and water level)	To assess groundwater quality and water levels To inform management interventions and effectiveness	Collect water quality samples according to laboratory specifications and sending it for analysis pH and EC can be measured in situ with assistance of the local farmers making use of ground water. Measure the following parameters: Groundwater quality: <ul style="list-style-type: none"> • EC • pH • Hydrogeochemistry • Aquifer "type" characteristics Groundwater level data: <ul style="list-style-type: none"> • Rising • Declining • Rainfall relation 	Quarterly	Groundwater usage within CPZ and within 10 km there off

Component	Monitoring objective	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
Chemical pollution	To assess level of chemical pollution at problem sites To intervene with management where appropriate	Collect water quality samples according to laboratory specifications and sending it for analysis Asses chemical compound and concentration: <ul style="list-style-type: none"> • Presence or absence • Concentration • Possible source 	As and when a pollution incident is suspected or noted	At pre-selected sites only (<i>ad hoc</i>)
Aerial photography	To assess the changes in the wetlands within the catchment over time (Cleaver & Brown, 2005)	Undertake desktop GIS mapping exercise	Annually	Entire catchment
Alien invasive plant management	Assess the level of infestation within the catchment and their impact on the fresh	Undertake desktop GIS mapping exercise with ground truthing and Working for Water	Annually	Entire catchment
Detrimental agricultural practices	Proactively identify adverse agricultural practices before they cause damage	Co-ordinate with the Department of Agriculture Monitoring parameters to be determined/agreed on	Annually	Entire catchment
Climate data	To collect a reliable data set of climatic information which can be used to accurately provide reference with respect to climate change	Davis instrument advantage pro weather station with half hourly data logging of rainfall, intensity, UV, evapotranspiration, wind direction and speed, barometric pressure, humidity, temperatures, etc. Analysis and interpretation of climate data		One station at the De Mond Nature Reserve

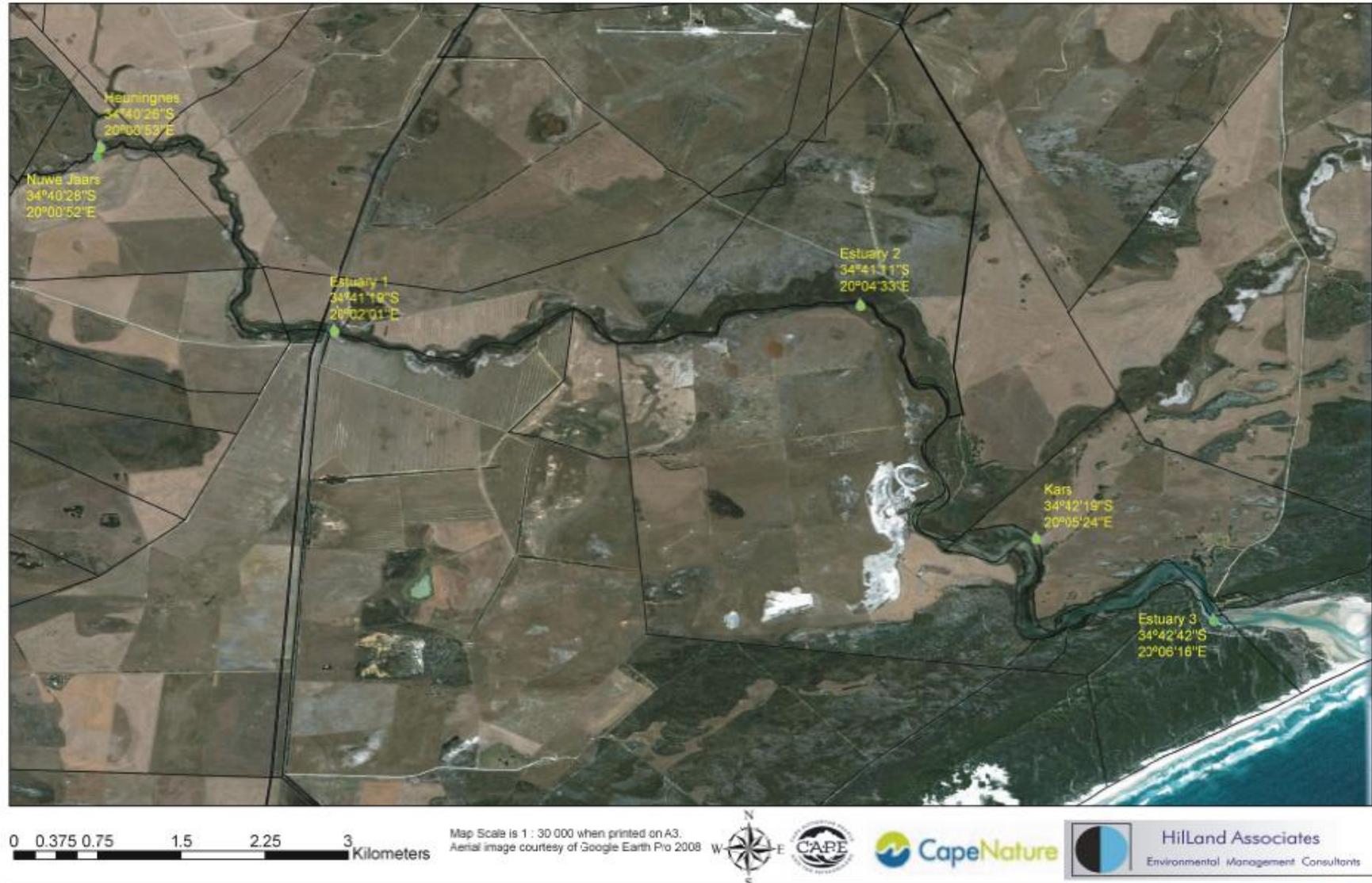


Figure 17: Proposed water sampling sites for inclusion in water quality monitoring programme (Hilland, 2010)

APPENDIX 3: ECOLOGICAL SPECIFICATIONS AND THRESHOLDS OF POTENTIAL CONCERN

The following table provides “Ecological Specifications/Resource Quality Objectives” and “Thresholds of Potential Concern” (TPC) for the taken from ecological water requirements study completed for the Heuningnes River estuary (Anchor, 2017). 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 since the Heuningnes estuary has to be restored from a C to a B-category, the thresholds of potential concern (TPCs) should be seen as targets to be met within 5 years. Thereafter the estuary should be maintained such that these thresholds are not breached. 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.

The TPCs for the Heuningnes estuary area listed in Table 16 and Table 17.

Table 16: Ecological specifications and thresholds of potential concern for abiotic components (Anchor, 2017)

Abiotic Component	Ecological Specification	Threshold of Potential Concern
		River inflow (Nuwejaars, Kars and Dwars rivers): <ul style="list-style-type: none"> • pH 8-9 • DO not to decrease below 6 mg/ℓ • DIN – not exceed present (to be determined) • DIP – not exceed present (to be determined) • Toxic substances: Comply with water/ sediment quality guidelines (DWAF, 1995; CSIR/UNEP, 2009 or future updates)

Abiotic Component	Ecological Specification	Threshold of Potential Concern
<p>Water quality</p>	<p>Water quality to maintain biota in allocated ecological categories</p> <p>NOTE: WQ TPC needs to be confirmed after more detailed monitoring, based on very limited data</p>	<p>Estuary:</p> <ul style="list-style-type: none"> • Salinity should not increase above 35 in the lower and middle reaches and above 30 in the upper reaches during the open low flow period • pH 8-9 • DO not to decrease below 6 mg/l • Average DIN during spring/ summer <150 µg/l (macrophyte die-back can increase DIN during autumn/winter, especially when mouth is closed) • Average DIP during spring/summer <30 µg/l (macrophyte die-back can increase DIP during autumn/ winter especially when mouth is closed) • Toxic substances: Comply with water/sediment quality guidelines (DWAF, 1995; CSIR/UNEP, 2009 or future updates) <p>Soetendalsvlei:</p> <ul style="list-style-type: none"> • Salinity should not exceed 10 • pH 8-9 • DO not to decrease below 6 mg/l • Average DIN during spring/summer <100 µg/l (macrophyte die-back can increase DIN during autumn/ winter) • Average DIP during spring/summer <20 µg/l (macrophyte die-back can increase DIP during autumn/winter) • Toxic substances: Comply with water/sediment quality guidelines (DWAF, 1995; CSIR/UNEP, 2009 or future updates)
<p>Hydrodynamics</p>	<p>Estuary should be allowed to function as naturally as possible within minimal human intervention</p>	<ul style="list-style-type: none"> • Mouth is breached artificially when water level is <2.6 m • Amount of time mouth remains open drops below 22%, averaged over a period of 3 years

Abiotic Component	Ecological Specification	Threshold of Potential Concern
Sediment dynamics	Flood and breaching regimes to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota	<ul style="list-style-type: none"> As for hydrodynamics above

Table 17: Ecological specifications and thresholds of potential concern for biotic components (Anchor, 2017)

Biotic Component	Ecological Specification	Threshold of Potential Concern
Microalgae	<p>Phytoplankton biomass, measured as water column chlorophyll-a, should not exceed 10 µg l⁻¹ in both the estuary and Soetendalsvlei.</p> <p>Maintain diversity of phytoplankton groups i.e. diatoms abundant during marine phase.</p>	<p>Phytoplankton biomass greater than 10 µg l⁻¹. Observable blooms in the estuary or Soetendalsvlei.</p> <p>Diatoms not dominant during the marine phase.</p>
Macrophytes	<p>Maintain:</p> <ul style="list-style-type: none"> the distribution of macrophyte habitats, salt marsh in the lower reaches, and reeds and sedges in the upper reaches of the estuary. the submerged macrophyte beds e.g. seagrass <i>Zostera capensis</i> in the lower reaches and pondweed <i>Potamogeton pectinatus</i> in the upper reaches. the integrity of the riparian zone 	<ul style="list-style-type: none"> Greater than 10 % change in the area covered by different macrophyte habitats. Increase in area covered by invasive plants (e.g. Acacias), should not be greater than 10% of total vegetated area. Die-back of reeds & sedges in the upper reaches. Unvegetated, disturbed and cleared areas along the banks.

Biotic Component	Ecological Specification	Threshold of Potential Concern
<p>Benthic Invertebrates</p>	<p>Maintain:</p> <ul style="list-style-type: none"> • viable populations of <i>Callichirus kraussi</i> in sandy zones. • viable populations <i>Upogebia africana</i> in muddy zones. • high densities of pencil bait (<i>Solen</i> sp.) <p>Breeding in <i>C. kraussi</i> and <i>U. africana</i> ceases at salinities lower than 17 ppt during prolonged closed mouth phase or during hypersaline conditions.</p> <p>During prolonged mouth phases export of larvae into marine and postlarvae back to estuary ceases (<i>U. africana</i>). Burrowing invertebrate species are excluded by <i>Zostera capensis</i></p> <p>Presence of <i>Ficopomatus enigmaticus</i> in Zone C (upper estuary)</p>	<ul style="list-style-type: none"> • Abundance of <i>C. kraussi</i> and <i>U. africana</i> drops below 50% of recorded total abundances. • No recruits in population recorded. (Identify zones where these are abundant). • Pencil bait densities decrease to 50% of recorded abundances • Increased salinities lead to increased <i>Zostera capensis</i> cover which excludes burrowing invertebrates (e.g. <i>C. kraussi</i> and <i>U. africana</i>) <p><i>F. enigmaticus</i> in Zone C indicates salinities have increased and community composition in this zone will be altered.</p>
<p>Zooplankton</p>	<p>Prolonged mouth closure would result in a loss of marine species (e.g. <i>Pseudodiaptomus</i> sp.) from the zooplankton community,</p>	<p>Absence of indicator marine species (<i>Pseudodiaptomus</i> sp.) changes by more than 50% of current levels (still to be determined).</p>

Biotic Component	Ecological Specification	Threshold of Potential Concern
Fish	Retain the following fish assemblages in the estuary (based on abundance): estuarine species (20-30%), estuarine associated marine species (60-70%) and indigenous freshwater species (<1%). All numerically dominant species are represented by 0+ juveniles.	<p>Level of estuary associated marine species drops below 50% of total abundance.</p> <p>Level of estuarine species increases above 30% of total abundance.</p> <p>Occurrence of alien freshwater species in the estuary.</p> <p>Absence of 0+ juveniles of any of the dominant fish species.</p>
Birds	The estuary should contain a rich avifaunal community that includes representatives of all the original groups, significant numbers of migratory waders and terns, as well as a healthy breeding population of resident waders. The estuary should support thousands of birds in summer and hundreds in winter.	Numbers of waterbirds drop below 600 and/or overall numbers of bird species drop below 12 for 3 consecutive counts

APPENDIX 4 RECOMMENDED COMPLIANCE MONITORING

Recommendations for monitoring of visitor numbers and exploitation of living resources required in terms of the management plan are included in the table below.

Table 18: Recommended estuary use and compliance monitoring (Hilland, 2010)

Component	Monitoring objective	Monitoring action	Temporal Scale (frequency and when)	Spatial Scale (no. of stations)
Estuarine Usage (Swimming, Angling, Hiking, Day visitors)	To assess level of estuarine use by different user groups; To relate estuary use to all of the ecological data; To inform management interventions where appropriate	Undertake counts of the number users, location and types of activities taking place Inspect permits issued and document non-compliance Record the number of organized events and participants Record the number of report incidents	Weekly (increased counts during peak seasons)	Entire estuary, at access points (permits etc.)
Exploitation of living resources (fish & bait)	To assess extent of living resources exploitation to inform management actions	Undertake bag inspections and examine catch records Relate exploitation of fish to population dynamics <ul style="list-style-type: none"> • Amount of permits issued • All catch records from site • Amount of non-compliance documented (with respect to no-bait collection policy) 	Weekly (increased counts during peak seasons)	Entire estuary for fish Lower part of estuary for bait (sand- and mud banks)

APPENDIX 5: RECOMMENDED PERFORMANCE MONITORING PLAN

Table 19: Recommended performance monitoring plan

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	FREQUENCY	LEGISLATION	RESPONSIBILITY
1. Biodiversity Conservation				
1) Indigenous fauna and flora associated with the estuary and the extended wetlands feeding into the system are protected	<ul style="list-style-type: none"> • Estuarine area under formal protected area status is increased (e.g. extension of the De Mond NR) • CPZ gazette as a special management area and gazetted • Integrity of estuary and wetlands improved through stewardship agreements • Biodiversity hotspots/ Sensitive species habitats are documents and protected • Appropriate regulations and bylaws are gazetted and enforced to protect fauna and flora • The state of the estuary and wetland systems are monitored for detrimental impacts/incidents • An database management system is in place that yields data that is easy to interpret • Improved law enforcement • Reduction in degrading and illegal activities 	Twice a year	NEM:PAA, NEM:BA, ICMA, NEMA, NWA, NFA, MLRA	CapeNature, DEFF, BGCMA, DWS, SANParks
2) Degraded areas within the estuary and its surrounds are rehabilitated (cross-cutting with Agricultural Practices)	<ul style="list-style-type: none"> • A rehabilitation programme is developed and implemented, that is backed by adequate funding and sponsorships • Integrity and functionality of wetlands and riparian corridors is improved 	Annual	CARA, ICMA, NEMA	Cape Agulhas LM, CapeNature, DEFF
2. Water Quantity & Quality				
1) Ecological Reserve for water quantity & quality is secured and implemented	<ul style="list-style-type: none"> • Ecological reserve approved and implemented • DWS and BGCMA representation on the HEAF • Representation of Nuwejaars and Kars River catchment areas on HEAF 	Twice a year	NWA	DWS, BGCMA,

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	FREQUENCY	LEGISLATION	RESPONSIBILITY
	<ul style="list-style-type: none"> • Effective catchment management, • Regulated water use and monitoring of abstractions 			
2) The estuary mouth is managed in a sustainable manner, in accordance with an approved mouth management plan	<ul style="list-style-type: none"> • Ad hoc breaching of the estuary is actioned according to an approved MMP and MaintMP • Mouth Management is not detrimental to the ecological functioning of the estuary 	When breaching is required	NEMA, ICMA	CapeNature
3) Pollution to the estuary is minimised	<ul style="list-style-type: none"> • All discharges of wastewater are authorized via a Coastal Waters Discharge Permit • Environmental best practice irt to stormwater drainage and domestic sewage disposal is implemented • Water quality (WQ) monitoring programme implemented 	Twice a year Quarterly for WQ monitoring programme	NWA, ICMA	DEA, CapeNature, DEA&DP
4) Invasive alien vegetation within the estuarine boundaries and broader catchment area is eradicated	<ul style="list-style-type: none"> • Detailed maps of invasive vegetation produced and priority areas identified • IAPs eradication programme developed and implemented on an ongoing basis 	Annually Twice a year	CARA	DEFF, CapeNature
3. Land Use & Infrastructure Planning & Development				
1) Implementation of a zonation plan that directs appropriate infrastructural development and other land use practices within the various policy zones, management lines and buffers	<ul style="list-style-type: none"> • Spatial zonation plan is adopted (**the current zonation plan must be revised**) • The CPZ, CML, 5m EFZ, 32 m riparian and wetland buffers, are demarcated in the EMP and acknowledged by all stakeholders • Appropriate regulations and bylaws are developed and gazetted to give effect to the zonation plan 	Annually	ICMA	CapeNature, Cape Agulhas LM, DEA&DP
2) Control development and activities within and adjacent to the EFZ.	<ul style="list-style-type: none"> • All proposed development and activities adhere to the full suite of relevant environmental legislation • Environmental authorization(s) is duly obtained • Reduced habitat loss/degradation and disturbance, and inappropriate behaviour 	Annually	NEMA and all relevant legislation	DEA&DP and all relevant authorities

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	FREQUENCY	LEGISLATION	RESPONSIBILITY
3) Enable appropriate and sustainable social and economic development	<ul style="list-style-type: none"> Recreational use of the estuary is monitored for detrimental impacts/incidents Viable and compatible socio-economic opportunities to uplift local communities or specific target groups are identified and implemented Heuningnes catchment marketed as an ecotourism destination where associated development and activities are sustainable and conform to environmental best practice 	Twice a year (recreation use: increased to monthly during peak season)	ICMA, NEM:PAA, MLRA	CapeNature
4. Compliance & Law Enforcement				
1) Establish and maintain an effective compliance management system.	<ul style="list-style-type: none"> A monitoring programme is developed and implemented, which is supplemented by additional appointment and deployment of trained and endorsed law enforcement officers/rangers An effective permitting and data monitoring system is developed, which regulates the number and type of resource use, and yields useful data that is easy to interpret Informative and interpretative signage erected at key strategic points around the estuary Preservation of the estuary as a bait sanctuary / bait collection policy is strongly enforced 	Quarterly	NEM:PAA MLRA	CapeNature
5. Agricultural Practices				
1) Re-establish a functional riparian margin in agricultural areas	<ul style="list-style-type: none"> Riparian buffer is re-established and functional Impacts/ damaging activities to the riparian buffer are reduced 	Twice a year	CARA, NEM:BA	BGCMA, CapeNature
2) Ensure sustainable agricultural practices in the estuary surrounds and the catchment area	<ul style="list-style-type: none"> Implementation of the mouth management plan that protects sustainable and legal agricultural activities Effective cooperative catchment management Engagements with BGCMA 	Twice a year	CARA, NWA	CapeNature, DEFF, BGCMA

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	FREQUENCY	LEGISLATION	RESPONSIBILITY
	<ul style="list-style-type: none"> • Engagements farmers' associations • Adoption of environmental best practices, specifically toward reducing the use of fertilizers and remediating damaging activities 			
6. Education & Awareness				
1) Ensure that all users of the estuary are well informed of the estuary importance and biodiversity value	<ul style="list-style-type: none"> • Education & awareness programme developed and implemented which reaches schools, interest groups, visitors and the broader community through various mediums and initiatives • Informative and interpretative signage erected at key strategic points around the estuary 	Quarterly	ICMA	CapeNature
7. Climate Change Preparedness				
1) Minimise the risks of climate change by adopting a precautionary approach to infrastructure and development planning	<ul style="list-style-type: none"> • Impacts of climate change on the Heuningnes River estuary determined and documented • The options of planned retreat out of high risk areas are investigated • An estuary-specific climate change adaption strategy is developed • Any new development within the estuarine functional zone a risk-averse approach through innovative planning and consideration of local environmental factors 	Twice a year	National Climate Change Response Strategy; Western Cape climate change strategy and action plan; NEMA EIA Regulations; ICMA, DMA	CapeNature
8. Institutional & Management Structures				
1) Effective implementation of estuary management responsibilities and activities	<ul style="list-style-type: none"> • Management committee established with signed ToR • Roles and responsibilities defined and accepted via MOUs signed • CapeNature, SANParks, local government HEAF, Ramsar, HROA, are regulating activities which impact on the estuary 	Twice a year	ICMA, MLRA, NEM:PAA, MSA	CapeNature, SANParks, Cape Agulhas LM,

MANAGEMENT OBJECTIVES	PERFORMANCE INDICATOR	FREQUENCY	LEGISLATION	RESPONSIBILITY
	<ul style="list-style-type: none"> • Appropriate regulations and bylaws are developed and gazetted to give effect to the EMP and zonation plan • New policy/regulations submitted and recorded by RMA, as and when necessary • An efficient law enforcement (compliance monitoring) capability / network is established • Ad hoc work groups are established to address key aspects and thereafter dissolved 			
2) Secure funding	<ul style="list-style-type: none"> • Funding is secured for the 5 year cycle and long term forecasts are developed 	Quarterly	MSA, NWA, ICMA, NEM:PAA	All authorities
3) Secure adequate resources and capacity	<ul style="list-style-type: none"> • Individual agencies have the necessary equipment, adequate number of suitably trained and knowledgeable staff, which are evaluated into their performance 	Quarterly	MSA, NWA, ICMA, NEM:PAA	All authorities
4) Re-constitute the Heuningnes Estuary Advisory Forum (HEAF) to ensure sound co-operative management	<ul style="list-style-type: none"> • Functional HEAF with representatives of all relevant spheres of government and civil society that meets regularly • Integration and active collaboration with HROA and ABI • An effective communication network between stakeholders is established 	Once off, then twice a year	ICMA	CapeNature

APPENDIX 6: HEUNINGNES ESTUARY MOUTH MANAGEMENT PLAN

(At the time of writing, the Mouth Management Plan was being compiled by CapeNature and its service providers)