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Gouritz River Estuarine Management Plan

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DOCUMENT USE

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

In 2013/2014, a review was conducted by the National Department of Environmental Affairs: Oceans and Coasts (DEA, 2014) on existing estuarine management plans to ensure, *inter alia*, the alignment of these plans with the Protocol.

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

- Updating the terminology as per the Protocol;
- Including a summary of the Situation Assessment;
- Extending the monitoring plan to explicitly include a performance monitoring plan to gauge progress towards achieving Estuarine Management Plan objectives (i.e. using performance indicators); and
- Including a description of institutional capacity and arrangements to manage elements of Estuarine Management Plan provided as per the Protocol.

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

EXECUTIVE SUMMARY

Introduction

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

Situation Assessment

Physical Characteristics

The Gouritz River catchment drains an area of 45 134 km^2 and has a river length of 328 km. The catchment has two distinct areas: a large, dry inland area that is comprised mainly of the Karoo and Little Karoo; and the smaller humid strip of land along the coastal belt. The Gouritz River catchment has four sub-catchments, Gamka sub-Catchment, Groot sub-Catchment, Olifants sub-catchment and Gouritz sub-catchment

The Gouritz estuary is a warm temperate, medium/large permanently open, tidally dominated, barred estuary that displays a moderate ichthyofaunal community, good water quality and only moderate aesthetic appeal. The overall condition of the Gouritz has been rated as Good.

Depth at the estuary mouth ranges from 0.5 to 2 m at high tide, while main channel depth has been measured between 1.3 and 4 m, with the deepest site of 6 m located near the road crossing at Die Eiland. The system is mostly marine dominated but severe flooding from the inland catchment occurs from time to time. The banks for the most part of the middle to upper reaches are gently sloping but the extreme upper reaches are characterized by steep- sided banks on both sides. The estuary extends a maximum of 10 km from the mouth when freshwater flows are at a minimum and tidal influences are dominant.

Physico-chemical characteristics of the estuary are not well documented but limited historical data for salinity and oxygen concentrations indicates good mixing except in the upper reaches when freshwater runoff causes stratification. The estuary is marine dominated with salinities ranging from 34 ppt at the mouth to 23.3 ppt eight km upstream.

Bio-physical characteristics

In terms of the bio-physical characteristics of the area, the table below highlights some of the fauna and flora species found within the Gouritz River Estuary.

Algae and Aquatic Vegetation	• Marine algae (*Porphyra capensis* and *Sargassum heterophyllum*) - restricted to the rocky platforms on the eastern bank in the mouth region. • Submerged macrophytes are not well represented in the system and isolated *Zostera capensis* beds on some mudbanks.

	• Saltmarshes are not extensive but are dominated by *Sarcocornia perennis*, *Chenolea diffusa*, *Cotula coronopifolia*, *Disphyma crassifolium*, *Sporobolus virginucus* and *Salicornia meyerana* in the areas close to the mouth and near to the water. • In the middle to upper reaches, saltmarsh vegetation is represented by *C. coronopifolia*, *Triglochin* spp. and *Sarcocornia* sp. • Further away from the water a transition zone between the terrestrial vegetation types comprises *Juncus kraussii*, *Stenotaphrum secundatum* and *Suaeda caespitosa*. A single rare species (*Reihania garnotii*) is confined to this community. • Large patches of *Spartina maritima* are found semi-submerged along the water's edge but not always in association with other saltmarsh plants. • The flora associated with areas of freshwater seepage is dominated by *Juncus acutus*, *J. kraussi* and *Phragmites australis*.
Aquatic invertebrates	• The mudprawn (*Upogebia africana*) is found on all mudbanks of the estuary and sandprawns (*Callianassa kraussii*) are found on sandbanks from about 6.5 km from the mouth to areas well beyond the Road Bridge and Die Eiland. • Bloodworm (*Arenicola loveni*) and pencil bait (*Solen* sp.) has been found in the past, but appear to be absent now. • Although the swimming crab (*Scylla serrata*) is found in the estuary, the numbers are low.
Fish	• The rivers of the Gouritz catchment feature six indigenous freshwater species, of which at least two (*Pseudobarbus asper* and *P. tenuis*) are endangered/threatened. • Several eel species are also present, but these catadromous as adults migrate to sea to spawn. • Invasive fish in the catchment include *Tilapia sparrmanii*, *Cyprinus carpio*, *Micropterus salmoides* and *Clarias gariepinus*.
Reptiles & amphibians	• Eleven amphibian species, three tortoises, 26 snakes and 12 lizards, none of which are rare or endangered species.
Birds	• 292 birds from 12 species of which 35 (comprising two species; whitefronted plover and Kittlitz's plover) were residents and 257 migrants (including ringed plover, turnstone, grey plover, curlew sandpiper, little stint, knot, terek sandpiper, greenshank, bar-tailed Godwit and whimbrel). • Later counts comprised 17 species totalling 158 birds on one occasion, with the most abundant being kelp gulls followed by swift terns and whitefronted plovers. • On another occasion, 36 species (totalling 625 birds) were recorded and were dominated by the summer migrants such as the curlew sandpiper, terek sandpiper, ringed plover, greenshank, little stint and whimbrel. • Kelp gulls are by far the most abundant species followed by the Egyptian goose and swift terns. • Breeding activity has only been confirmed for three species, the Egyptian goose, African fish eagle, and Black harrier
Mammals	• There are no records of mammals found, although 80 species, including the Cape clawless otter, are thought to occur in the region. • Of these, eight species are listed as being rare or vulnerable.
Terrestrial Vegetation	• arid scrub thicket, renosterveld, strandveld, strandveld – thicket mosaic, dune scrub, dune scrubland, Acacia cyclops thicket, dune thicket, limestone fynbos and secondary grassland, vegetation associated with the middle to lower reaches of the estuary • A recent vegetation sensitivity analysis on a portion of land located to the west of the middle reaches of the estuary, revealed nine rare and endemic (to the immediate area) plant species. • One of these, *Leucadendron galpinii* is also listed as a vulnerable Red Data species.

Alien vegetation	• predominant alien plants in the lower estuarine area are rooikrans (*Acacia cyclops*), gum tree (Eucalyptus sp.), kikuyu (*Pennisetum clandestinum*), prickly pear (Opuntia ficus-inidica) and manatoka (Myoporum tenuifolium). Alien plants in the riverine regions include Kariba weed (*Salvinia molesta*), red water fern (*Azolla filiculoida*) and Spanish reed (*Arundo donax*).

Exploitation Living Resources

Historically the Gouritz River estuary was considered to be an excellent fishing destination and was known for periodic runs of large dusky kob during September, October and November. Fishing is distinctly seasonal, with very little fishing effort occurring between June and August. Grunter fishing in the estuary occurs throughout the year, with recreational and subsistence fishers targeting these fish using mud prawn, sand prawn and sand mussel. Unlike the grunter, large dusky kob are targeted during spring and summer using a variety of baits such as live mullet, sardine, squid, octopus leg and artificial lures (rapalas).

Current legislation within the area prohibits scuba diving, spearfishing, fishing without a permit and the use of fish nets other than a landing net or casting net in all estuaries. In addition, no fish captured in an estuary may be sold. A Hessequa municipal by-law (yet to be promulgated) prohibits people from holding or arranging any fishing competition without permission from the Municipality and the Gouritz River Conservation Trust. Fishing from any bridge or within 20 metres either side of a slipway is also prohibited

While the existing regulations have been implemented nationally in an attempt to maintain a healthy fishery, a history of disregard for the regulations is thought to be a major contributor to the poor fishing in the estuary. Anglers frequently retain undersize fish, exceed their bag limits and sell their fish. Recently, at least one boat has been recognized to be involved in illegal gillnetting and several reports of illegal gillnetting have been received. Boat anglers were also recognized as the group mostly responsible for the illegal activities. Approximately 30% of all user groups fishes without licenses.

Enforcement and monitoring of living resource exploitation on the Gouritz River estuary is practically non-existent, with the Department of Agriculture, Forestry and Fisheries (DAFF) officers patrolling the system about twice a year. The Hessequa Municipality has appointed a single River Control Officer to issue and enforce boat licenses and to monitor other by-laws. The officer is however not appointed in terms of the Marine Living Resources Act (Act No.18 of 1998) (MLRA) and is thus unable to enforce the Act as it applies to living resource regulations. CapeNature is responsible for ensuring compliance with regulations pertaining to the construction of structures (slipways and jetties) on the estuary in terms of the Seashore Act.

Water quality and quantity

In terms of the Gouritz River estuary, the ecological health and reserve were determined at an intermediate level as part of detailed reserve studies for water resources in the Gouritz Water Management Area (WMA). The results indicate that the estuary is in a moderately modified state but is at risk of deteriorating further to a largely modified condition. Due to the high demand for water in the catchment, it is unlikely to fully restore

the ecological status of the Gouritz River Estuary to its natural, pristine state. Thus the Recommended Ecological Category for the Gouritz Estuary was set as a Category B. This may be achieved by instating the Recommended Ecological Flow Scenario, which entails ensuring the present inflow plus restoring 25% of base flow (Mean Annual Runoff (MAR) of 440.85 million m^3), as well as additional non-flow related activities.

The Gouritz River estuary is a warm temperate, medium/large permanently open, tidally dominated, barred estuary that displays a moderate ichthyofaunal community, good water quality and only moderate aesthetic appeal; overall condition has been rated as Good. The Gouritz River estuary is ranked as the 49th most important estuary in South Africa in terms of conservation importance, with ratings based on a combination of scores given to size, habitat importance, zonal type rarity and biodiversity importance. More importantly, the Gouritz River estuary is one of the core priority systems to be protected in order to meet the national estuarine biodiversity targets and thus requires partial protection by means of establishing a no-take fishing zone and ensuring 50% of estuary margin be undeveloped.

There is no legal fishery in the Gouritz River estuary but it has been considered to be an excellent fishing destination, with a significant amount of boat-based and shore fishing effort. There is no notable subsistence bait fishery and anglers mostly collect their own bait on site. There is also no recorded use of craft or building materials (e.g. reeds, sand) gathered from the estuary for subsistence or commercial purposes. The Gouritz River Estuary provides the opportunity for various recreational activities include swimming, windsurfing, kite boarding, canoeing, boating, water skiing, hiking (along demarcated pathways), bird watching, dog walking and fishing/bait collecting. Several commercially-licensed deep-sea boats and many recreational ski-boaters use the slipway and the estuary as a launch site.

The Gouritz is one of the core set of temperate estuaries required to meet the targets for biodiversity protection of estuarine resources; scores (out of 100) that contributed to the overall rating of 75 for the Gouritz were size (90), habitat importance (60), zonal type rarity (20) and biodiversity importance (88). The recommended extent of sanctuary protection is half the system. The recommended extent of undeveloped margin is 50%. The recommended minimum water requirement falls under the A/B management class which means a high priority and requirement. The priority for rehabilitation is HIGH.

Preliminary thoughts on a spatial zonation plan for the Gouritz River estuary are that a sanctuary area be declared above the low road bridge at Die Eiland and that the remainder of the estuary be declared a conservation zone which will further be divided into specific management areas. The proposed sanctuary area would only comprise the estuary itself and not the adjacent land as this is mostly highly elevated above the channel. The rationale behind the sanctuary is the protection of a nursery area for juvenile fish such as dusky kob, white steenbras and spotted grunter. The conservation zone, which makes up most of the estuary, will comprise areas where activities are regulated to prevent over-exploitation, to ensure responsible non-consumptive recreational use and to ensure sustainable development.

Saltmarsh does not comprise a significant portion of estuarine habitat and is largely confined to the lower reaches. Large portions of what once was pristine saltmarsh have now been altered by farming activities and no longer fulfil their original function. Saltmarsh areas will need to be rehabilitated and this will require a change in mindset and farming practices. Mudbanks and sandbanks are found along much of the lower/middle and upper reaches respectively. Mudbanks do not need any special protection status and a portion of the sandbanks in the upper reaches will be protected within the proposed sanctuary area.

The greater catchment area is generally considered to be in good condition but there are serious issues relating to water supply and abstraction and soil erosion leading to increased sediment loads. The area will benefit through the Gouritz Initiative, but this may take some time. It is imperative that a dedicated catchment management plan run through a catchment management agency be implemented so that estuary-specific issues that rely on good catchment management can be addressed. The recently determined EWR or ecological reserves for the greater Gouritz WMA can be used to develop a programme that will ensure measured releases and pulses of freshwater that will not only help sustain farmers in the lower river regions but also help sustain ecological processes.

Vision and Objectives

The Vision developed for the Gouritz River resulted from the outcome of numerous stakeholder engagement workshops, finalised in the Situation Assessment Report. The Vision and resulting objectives, in consultation with the Cape Floristic Region Initiative Vision and Objectives, have been reviewed to ensure that no conflicts exists and that there is alignment with ecological and socio-economic opportunities and constraints.

Thus, the Vision for the Gouritz River estuary states that:

> ***The Gouritz estuary will continue to support ecological functioning and provide goods and services to all in a sustainable manner thereby ensuring the long-term survival of the system, its living resources, and the physical, psychological, and spiritual well-being of all its user groups.***

There are seven (7) key management objectives for the Gouritz River. These objectives form the foundation for the development of quantitative, operational specifications, required to realise the Vision for the Gouritz River.

Water Quality & Quantity	Determine and implement the Ecological Reserve requirements and Resource

	Quality Objectives to ensure that all ecological processes continue to function.
Living Resources & Conservation	A sustainable balance achieved between the conservation, protection, and exploitation of living resources.
Land Use & Infrastructure	Development and associated activities within the designated estuarine area is controlled via legislation thereby ensuring the maintenance of estuarine ecosystem functioning and services.
Institutional & management structures	The relevant spheres of government and civil society manage the Gouritz River estuary cooperatively and effectively.
Sustainable Livelihoods & Tourism	Existing activities are managed and additional opportunities promoted in a way that ensures compliance with legislation and the maintenance of ecosystem functioning and services. Maintain ecosystem functioning and services while exploiting the tourism potential of the in a responsible manner.
Education & Awareness	Public awareness and appreciation of the value of estuaries is created, which leads to a sense of ownership, and better understanding of the legal context and obligations with respect to estuarine management, and the need for integrated, informed and cooperative management that will ensure the maintenance of estuarine ecosystem functioning and services.

Spatial Zonation

Management objectives need to be translated into an Estuarine Zonation Plan (EZP) and Operational specifications. The purpose of the EZP is to identify areas along the estuary that have been designated for specific development or land use purposes, or for the delineation of different zones for specific visitor uses. In the case of the Gouritz Estuary, the EZP defines zones of conservation, sanctity, rehabilitation, recreational activity, land use planning provisions, infrastructure as well as areas of biophysical importance.

In addition, the EZP provides a set of operational specifications which the Responsible Management Authority needs to implement. A summary of the operational specifications, as part of the EZP are provided below.

Water Quantity & Quality
WQ1: Implement Ecological Reserve and minimum flow requirements
WQ2: Reduce incidents of pollution and poor water quality
Biodiversity (Conservation)
B1: Maintenance of plant communities
B2: Control of alien vegetation
B3: Maintenance of invertebrate populations (mudprawn, sandprawn, and bloodworm)
B4: Maintenance of waterbird populations
B5: Maintenance of fish populations
B6: Maintenance of estuarine habitats

B7: Protect estuarine habitats in formally protected area.
Human Activities (Conservation)
HA1: Ensure carrying capacity of estuary is not exceeded
HA2: Control human activities that impact on invertebrate (bait organism) populations
HA3: Protect linefish and bait organism populations by restricting fishing competitions
HA4: Reduce the amount of solid waste within the estuarine area
Law Enforcement (Conservation)
LE1: Improve law enforcement capacity
LE2: Compliance with EAs issued as part of EIA process
Exploitation of Living Resources
E1: Ensure sanctity of sanctuary area through compliance monitoring
E2: Ensure maintenance of bait organism populations
E3: Maintenance of fish populations
E4: Restrict number of competitions and participants and maintain high level of compliance with MLRA regulation and competition specific rules
Land Use & Infrastructure
LU1: Formalise the estuarine functional zone
LU2: Maintenance of riparian zone
LU3: Restrict additional development on the floodplain or 100-year floodline
LU4: Minimise the risks of climate change
LU5: Maintenance of water quality and normal hydrodynamic & sedimentary cycles
LU6: Land-use & development proposals evaluated through EIA procedure and guided by EMP and CMP. Record number of applications for development or rezoning
Institutional & Management Structures
IMS1&2: establishment of EAF and catchment institutions such as CMA, WUA and catchment forum
IMS3: Interaction between EAF and other institutional structures
Sustainable Livelihoods & Tourism
SL1: Ensure all existing activities and livelihoods dependant on the estuary comply with legislation and frameworks
SL2: Develop non-consumptive enterprises that involve the estuary and previously disadvantaged communities
Education & Awareness
EA1: Increase awareness of estuaries and their value amongst municipal workers and managers
EA2: Increased public awareness of estuaries and their value
EA3: Research projects initiated that fill knowledge gaps and provide information for monitoring programmes

Management Priorities

A full range of management actions have been identified in order to facilitate the achievement of the operational specifications within the sectors of biodiversity, conservation, exploitation of living resources, land-use & infrastructure and social issues (management & institutional arrangements, sustainable livelihoods, and education & awareness).

Within each of these sectors, the following actions plans include:

- A prioritized list of management actions required;

- Monitoring plans to measure effectiveness of actions. If TPCs are brought under control then management actions can be considered effective, however if they continue to be exceeded then changes need to be made to management actions, the EZP or operational specifications;
- A work plan identifying when each action should be initiated and by whom; and
- A resource plan detailing the human resources and the sources of funding or finances required to achieve these actions.

1. Management Actions for Water Quantity & Quality		
Management Actions	**Monitoring Plans**	**Work Plan**
Operational Specification WQ1: Ecological Reserve and instream flow; TPC is < 71% of combined MAR enters the estuary, and <0.5m³/s for more than 1 month, <5.0m³/s for more than 6 months		
Ensure that the minimum flow requirement (specifically baseflow) for the estuary is restored in accordance with the RDM process and RQOs.	Flow station to be constructed at the head of the estuary and data monitored monthly. All water use activities and licenses in the catchment to be assessed for compliance with Reserve requirements. All future water use licenses and dam proposals to be considered in the context of the Reserve requirements.	DWS is responsible; should be initiated immediately due to drought conditions and development (demand) pressure.
In the event that the Ecological Reserve requirements are not being met, abstraction activities may be declared as streamflow reduction activities and temporarily controlled, limited or prohibited.		
Eradicate/control invasive alien plant species from the Gouritz floodplain to increase base flow	Ensure eradication of alien vegetation to levels below the TPC (aerial photographs and transects).	As soon as TPC is attained; DWS, DEA & DAFF responsible for alien eradication.
Operational Specification WQ2: Pollutants and Poor Water Quality; TPC will varying according to pollutants and DWAF (now DWS) water quality guidelines		
Identify sources of pollution within the estuary and broader catchment and take steps to remedy or mitigate.	Regular water quality monitoring at set stations along the length of the estuary (including point sources) and in the rivers above the head of each estuary.	Eden DM is responsible; Monitoring is ongoing and needs to be done monthly or if contamination is visible.
Design and implement a water quality monitoring programme for the Gouritz River estuary in line with RDM methods and taking RQOs into account.		

2. Management Actions for Biodiversity (Conservation)		
Management Actions	**Monitoring Plans**	**Work Plan**
Operational Specification B1: Plant communities; TPC of 20% change in surface area of any plant community type is exceeded.		
Human disturbance - enforce by-laws and EZP to reduce trampling; enforce national legislation to prevent clearing of indigenous forests, riparian vegetation and damage to saltmarsh.	Compliance w.r.t. by-laws and national legislation; recovery period (aerial & reference photographs).	As soon as TPC is attained. Responsible agents are DWS, DEA&DP, DAFF and local authority; EAF or tertiary institutions.
Operational Specification B2: Alien vegetation infestation; TPC of >5% of riparian vegetation infested by alien vegetation is exceeded.		
Initiate clearing of vegetation in affected areas.	Ensure eradication of alien vegetation to levels below the TPC (aerial photographs and transects).	As soon as TPC is attained; DWS, DEA & DAFF responsible for alien eradication.
Operational Specification B3: : Invertebrate species; TPC is densities deviation > 25% for mudprawn and >40 for zooplankton and benthos of baseline counts		
Human disturbance - enforce by-laws and EZP to reduce trampling; enforce national legislation to limit bait collection according to quotas and collection methods.	Compliance w.r.t. by-laws and national legislation; recovery period (quadrat counts).	As soon as TPC is attained. Responsible agents are DEA:O&C and local authority; EAF or tertiary institutions.

Operational Specification B4: Waterbirds partially or highly dependent on estuaries; TPC for species richness is <20 for three consecutive summer counts; numbers of birds other than gulls, terns and regionally increasing species <120 for three consecutive summer counts.		
Loss of habitat and food source due to human interference - enforce national legislation and municipal by-laws pertaining to EZP and human activities.	Compliance with national legislation, SDF/IDP and municipal by-laws; recovery of populations (bi-annual bird counts)	As soon as any of the TPCs are attained. Responsible authorities are DEA, DEA&DP, CapeNature and municipal; EAF and tertiary institutions (e.g. UCT).
Operational Specification B5: Fish abundance; TPC for dusky kob & white steenbras is >10% decrease from baseline values. TPCs vary for other fish categories.		
Address levels of fishing effort, bag limits and extent & location of sanctuary areas.	Compliance with legislation; levels of effort and cpue to be measured (catch monitors and fishery survey).	Continuous from implementation of EMP. DAFF is responsible national authority; tertiary institutions to conduct fishery survey.
Operational Specification B6: Extent of habitat types and habitat loss; TPC is the loss of 10% or more of any habitat type.		
Remove invasive plants (see above) and agricultural levees from the floodplain to restore ecological processes and promote habitat restoration	Compliance with legislation restricting activities below the coastal management line, the 1:100 flood line and/or EFZ; monitor applications for activities within the floodplain; monitor changes in landform using aerial photography and satellite imagery.	As soon as TPC is attained. Responsible agents are DWS, DAFF CapeNature, DEA&DP, DEA:O&C and local authority; EAF or tertiary institutions.
Human interference - ensure compliance with EZP and associated by-laws governing human activities and national legislation; consider additional sanctuary areas to protect habitats if degradation occurs.	Compliance w.r.t. by-laws, IDP and national legislation; recovery period and efficacy of sanctuary areas (aerial & reference photographs).	As soon as TPC is attained. Responsible agents are DWS, DAFF DEA&DP, DEA:O&C and local authority; EAF or tertiary institutions.
Operational Specification B7: Extent and location of formally protected estuarine habitat; TPC is the decline in terms of surface area of sanctuary areas.		
Enforce legislation pertaining to protected areas; ensure compliance with EZP and other legislation pertaining to human activities.	Compliance with relevant legislation to ensure sanctity of protected areas (aerial photographs and active patrols)	Continuous from implementation of EMP. DEA, CapeNature and DEA&DP are responsible national authority; EAF can conduct visual surveys on a daily basis to monitor non-compliance.

3. Management Actions for Human Activities (Conservation)		
Management Actions	**Monitoring Plans**	**Work Plan**
Operational Specification HA1: Carrying capacity (to be determined by EAF based on DWS models); TPC is when numbers exceed carrying capacity.		
Regulate number of boats launching or taking part in a specific activity (e.g. angling competitions).	Visual counts of boats on the water or at each launch site; counts of numbers of users engaged in recreational activities.	Number of users should be monitored all the time; restrictions come into play when carrying capacity is exceeded; Municipal river control officer at launch site, municipal estuarine managers and EAF are responsible.
Operational Specification HA2: Bait collecting; TPC is a 30% decrease in population size of any bait organism; and a single user that is non-compliant.		
Enforce MLRA regulations to ensure compliance.	Fishery survey to include collectors; random quadrats for population density; inspections of bait collectors catch.	Ongoing from time of EMP inception; responsible authority is DAFF and DEA:O&C (MPA) for compliance; tertiary institutions for fishery survey with
Police sanctuary area in accordance with the EZP.		

Consider additional sanctuary areas or control collection activities (e.g. method employed, daytime only or rotate sites).		help from EAF.
Operational Specification HA3: Number of fishing competitions and participants; TPC is an increase from current number of competitions and participants.		
Regulate number of fishing competitions and participants.	Monitor number of competitions and count number of participants.	Use records from last year to set standard; municipal nature conservation, EAF and river control officer.
Operational Specification HA4: Waste accumulation; TPC is an increase in volume from baseline values.		
Initiate clean-up operations on a regular basis; draft by-laws to prevent offal disposal; monitor solid waste dump site; all boats to return to launch site with litter in plastic bags; and consider implementing punitive measures for responsible individuals or organizations.	Monitor volume of litter collected by the number of standard garbage bags filled. Monitor fish cleaning and offal disposal particularly after fishing competitions.	Ongoing from time of EMP inception during peak periods, during the year and after fishing competitions; inspections and clean ups can be done by DEA&DP, DEA, LA ; inspections can be carried out by catch monitors and river control officer during patrols and general public; clean-up operations by angling club members

4. Management Actions for Law enforcement (Conservation)		
Management Actions	**Monitoring Plans**	**Work Plan**
Operational Specification LE1: Law enforcement capacity; TPCs are non-compliant users and a low conviction rate.		
Increase presence of law enforcement personnel on estuary; education & awareness programmes for enforcement officers and users.	Monitor number of patrols and non-compliant users; survey to assess effectiveness of education & awareness programme.	Ongoing from time of EMP inception; DEA:O&C is the responsible authority with help from municipal environmental conservation, river control officer and EAF (education & awareness).
Operational Specification LE2: Enforce & monitor developments in the context of their EAs; TPC is any non-compliance with the EA conditions.		
Enforce compliance with EA conditions and report any infringements.	Inspections of all sites where activities or developments are taking place; ensure independent environmental control officer is appointed.	Regular (weekly) from the time an activity or development is authorized; responsible authority is mostly DEA&DP but may include other government agencies such as DWS; independent environmental control officer; estuary stakeholders (I&APs).

5. Management Actions for Exploitation of Living Resources		
Management actions	**Monitoring plans**	**Work plan**
Operational Specification E1: Protection of living marine Resources in Sanctuary Area; TPC in the number of non-compliant individuals annually.		
Enforce no take zone in the sanctuary areas.	Compliance with relevant legislation to ensure sanctity of protected areas.	Continuous from implementation of EMP. DAFF and DEA:O&C (CapeNature) are the is responsible national authorities. All MLRA appointed

		enforcement personnel to operate on a daily basis to monitor non-compliance; estuary users can assist by reporting incidents of non-compliance.
Operational Specification E2: Protection of bait organisms; TPC for any bait organism is a 30% reduction (from baseline) in the bait organism.		
Enforce legislation and by-laws pertaining to bait collection.	Inspection of activities and collectors to ensure compliance with MLRA regulations and by-laws.	Continuous from implementation of EMP. DAFF is responsible authority. All MLRA appointed enforcement personnel to operate on a daily basis to monitor non-compliance by active patrols and point access checks; estuary users can assist by reporting incidents.
Operational Specification E3: Protection of fish populations; TPCs are noncompliant individuals; a decrease of >10% from baseline cpue values for dusky kob & white steenbras; and variable TPCs for other species.		
Enforce legislation in the form of MLRA regulations.	Inspection of activities and fishermen to ensure compliance with MLRA regulations.	Continuous from implementation of EMP. DAFF is responsible authority. All MLRA appointed enforcement personnel to operate on a daily basis to monitor non-compliance by active patrols and point access checks; estuary users can assist by reporting incidents.
Operational Specification E4: Regulate number and format of competitions. TPCs are increase in competitions and non-compliance with the rules of participation.		
Maintain a limited and predetermined number of well structured, regulated fishing competitions	Number of competitions to be determined and monitored; participants to be assessed for compliance with MLRA competition rules.	Continuous from implementation of EMP. The Municipality (MLRA appointed officer) and EAF are the responsible authority with help from angling club structures and appointed specialists to recommend competition formats and assist in measure & release effort

6. Management Actions for Land Use & Infrastructure		
Management actions	**Monitoring plans**	**Work plan**
Operational Specification LU1: Formalise the boundaries of the Gouritz River Estuary; TPC is if this is not done		
Delineate and formalise the Gouritz River Estuarine Functional Zone according to the 5m topographical contour	Compliance with legislation restricting activities in this zone; monitor applications for activities within the zone.	Initiate as soon as EMP is implemented and integrate with IDP and SDF; RMA (Eden DM) is responsible; EAF can monitor infringements and register as I&APs in any applications.
Operational Specification LU2: Nature & extent of land-use & infrastructure; TPCs are broad statements of intent.		
Maintenance of a riparian zone along the length of the estuary - enforce a zone that is 100 m wide or inclusive of sensitive habitats.	Compliance with legislation restricting activities in this zone; monitor applications for activities within the zone.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, Cape Nature & Municipality (conservation and planning) are responsible; EAF can monitor infringements and register as I&APs in any applications.

No additional development on the floodplain (1:100 flood line) - enforce recommendations in planning frameworks; difficult to implement due to size of area and demand for developments.	Compliance with legislation restricting activities in this zone; monitor applications for activities within the floodplain.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DAFF DWS, Cape Nature, Municipality and planning consultants are responsible; EAF can monitor infringements and register as I&APs in any applications.
Develop and implement a climate change adaptation plan for Gouritz (in response to changes in freshwater flow, sea level rise, etc.)	Compliance with legislation restricting activities below the coastal management line, the 1:100 flood line and/or EFZ; monitor applications for activities within the floodplain; monitor changes in landform using aerial photography and satellite imagery.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DAFF, DWS, Cape Nature, Municipality and planning consultants are responsible; EAF can monitor climate change effects, and development infringements and register as I&APs in any applications.
Developments and land use in the catchment and estuarine area should not lower water quality or interfere with normal hydrodynamic or sedimentary processes - ensure all developments do not impact negatively on water quality by enforcing relevant legislation	Monitor EIA process to ensure all impacts are adequately mitigated; ensure compliance with EA conditions; monitor water quality parameters according to EcoSpecs; ensure compliance with legislation and planning frameworks.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DWS, DAFF Eden District Municipality* & local Municipality are responsible; EAF, CMA and WUA can monitor infringements and register as I&APs for any applications within estuarine area. DWS and BGCMA to develop and implement Catchment Management Plan and ensure that estuary ecological flow requirements are considered.
Development proposals should be evaluated through the EIA procedure and guided by the EMP specifically and the broader catchment management plan - register as I&AP for all development applications and ensure compliance with all legislation.	Monitor the EIA process for each application and ensure compliance with all legal requirements.	Initiate immediately - for all new applications and review of applications currently under consideration; EA issuing authority, EAF and Municipality are responsible for ensuring developers adhere to EIA procedures. DWS and BGCMA to develop and implement Catchment Management Plan and ensure that estuary ecological flow requirements are considered.
Operational Specification LU3: Number of applications for development and/or rezoning of land within estuarine area; there are no quantitative TPCs but an increase in applications over a five-year period should be cause for concern.		
Register as I&AP for all development and rezoning applications and ensure compliance with all legislation and planning frameworks.	Record numbers of new applications for comparison to recent years; monitor the EIA process for each application to ensure it fulfils legal requirements.	Register as I&AP for all new applications and check municipal records for compliance regarding older applications; the DEA&DP are responsible for ensuring correct procedures are followed.
Operational Specification LU4: Use of planning and management tools to guide development; TPC would be the exclusion of estuaries in any of these frameworks.		
Ensure that the estuarine area is specifically addressed in all planning and management frameworks.	Review of all existing planning and management frameworks; monitor progress of all new management & planning documents through direct participation.	Initiate immediately and register EAF, CMA and WUA as civic organizations that must be consulted; EAF is responsible for input; planning and management consultants together with the municipality are responsible for addressing estuarine area in frameworks. Estuarine requirements included in the catchment classification process.

7. Management Actions for Institutional & Management Structures		
Management actions	**Monitoring plans**	**Work plan**
Operational Specification IMS1: Establishment of a local EAF (forum); TPC would be the absence of such an institution.		
Form a local Estuarine Advisory Forum	Monitor progress of EAF and ensure it fulfils its obligations.	Initiate immediately - assemble members and elect chairman and appoint technical working groups; constitute EAF and set mandate and responsibilities. Municipality is responsible authority together with specialist consultants.
Operational Specification IMS2: Establishment of CMA, WUA and catchment forum; TPC would be the absence of any such institutions.		
Form CMA & WUA and associated forum and integrate with the EAF.	Monitor progress of CMA, WUA and catchment forum and ensure they fulfil their obligations; ensure their integration within the EAF.	Initiate immediately - assemble all interest groups and form CMA (WUA already exists); set mandate and responsibilities. DWS is responsible authority together with EAF and specialist consultants.
Operational Specification IMS3: Interaction between EAF, CMA, WUA and catchment forum; TPC would be if no integration and interaction existed between these institutions.		
Integrate CMA, WUA and catchment forum representatives with EAF and host regular meetings.	Ensure integration and keep record of number and types of projects or management scenarios that are resolved or addressed cooperatively.	Initiate immediately; integrate CMA, WUA and catchment forum representatives within the EAF (water quality & quantity working group) and identify opportunities to interact. Institutions are themselves responsible for integration assisted by DWS. Ensure that estuary flow requirements are embedded in catchment classification process.

8. Management Actions for Sustainable Livelihoods & Tourism		
Management actions	**Monitoring plans**	**Work plan**
Operational Specification SL1: Existing activities compliant with all forms of legislation and planning frameworks; TPC would be any activity not complying with these regulations.		
Engage relevant government authorities to address activities that do not comply with legislation and planning frameworks.	Review all existing activities for compliance with legislation and planning frameworks; monitor all proposed new activities for compliance; monitor reparation where applicable.	Initiate immediately; members of EAF to engage municipality (town planning), tourism industry and government departments such as DEA&DP, DWS, DAFF and DEA to enforce applicable legislation and planning frameworks.

Operational Specification SL2: Promote non-consumptive enterprises involving previously disadvantaged communities which are compliant with all forms of legislation and planning frameworks; TPC would be no new initiatives and non-compliance with these regulations		
Engage community representatives, municipality, civic organizations, birding clubs and tourism industry to identify opportunities and ensure they are compliant with all forms of regulation.	Monitor progress with regards initiation of new activities and their compliance with regulations; monitor reparation where applicable.	Initiate immediately; local government and EAF to engage all stakeholders to identify opportunities and draft operational frameworks to ensure compliance.

9. Management Actions for Education & Awareness		
Management actions	**Monitoring plans**	**Work plan**
Operational Specification EA1: Educational workshops on value of estuaries, their context within planning frameworks and legislation and consequences of poor decision making; TPCs would be no workshops, poor attendance or continued poor decision making that		
Initiate series of workshops (with help from CapeNature and DEA&DP) and get buy-in from Municipality to ensure attendance.	Keep record of number of workshops and attendance by municipal staff and managers; participants to submit to a questionnaire to test awareness, understanding and effectiveness of workshop.	Initiate immediately. DEA (Working for the Coast Programme) is responsible for education on a national level, but the workshops can be hosted by CapeNatre, EAF or municipal Community Services; EAF can make use of in-house expertise or specialists from tertiary or research institutions to give presentations.
Operational Specification EA2: Interactive public awareness campaign; TPCs would be no visual aids, lack of public interest and poor level of understanding of estuaries and the regulations that govern their well-being.		
Ensure that visual aids (notice boards) are erected at key points (launch sites and resorts); host school groups for interactive tours of the estuary.	Monitor placing of notice boards and ensure their content is relevant to the Gouritz scenario; provide school groups and general public with a questionnaire to determine effectiveness of the programme.	Initiate immediately. DEA (Working for the Coast Programme) is responsible for education on a national level and should supply the visual material; EAF or Municipal Community Services can host school groups and make use specialists from tertiary or research institute on occasions to give informal talks
Operational Specification EA3: Research projects by tertiary & research institutions and government departments; TPCs would be no research projects or the continued lack of information/data required for monitoring programmes.		
Identify key areas where research efforts should be concentrated (e.g. water quality & quantity; fishery survey; rehabilitation areas/methods); actively engage government and tertiary & research institutions to initiate projects.	Monitor progress of all research activities concerned with the Gouritz and ensure that outcomes are practical and effectively used in long term monitoring programmes that will guide the implementation of the EMP.	Initiate immediately; EAF can interact with government and tertiary & research institutions. Government departments such as DWS and DEA may initiate projects on their own and institutions such as CSIR and SAEON can be involved in long term monitoring projects

Implementation

The Protocol identifies the Eden District Municipality, or its assigned representative, as the Responsible Management Authority responsible for the development of the Gouritz River Estuarine Management Plan as well as being responsible for the co-ordination of its implementation. This implementation function can be effected through a range of different forums and actors.

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

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

- Western Cape Government departments: Responsible for legislative support, including compliance, funding, research and monitoring;
- Hessequa and Mossel Bay Local Municipalities: Responsible for legislative support and funding;
- Relevant National government departments, especially Department of Environmental Affairs, Department of Water and Sanitation (via the regional office), Department of Forestry and Fisheries, Department of Rural Development and Land Reform; and
- Organs of State (SANparks, CapeNature, Breede-Gourtiz Catchment Management Agency).

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

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

Monitoring & Evaluation

The Gouritz Estuarine Management Plan proposes two forms of monitoring, namely baseline measurement programmes, e.g. intensive investigations of a wide range of parameters to obtain a better understanding of ecosystem functioning; and long-term monitoring programmes, referring to ongoing data-collection programmes that are done to evaluate continuously the effectiveness of management strategies and management actions within action plans that are designed to maintain a desired environmental state. The former, includes a detailed description of the baseline requirements, spatial and temporal scales, required resources and sampling & analysis techniques with regards the Thresholds of Potential Concern referred to in the action plans. Long-term monitoring programmes tend to be the responsibility of government departments such as the Departments of Water and Sanitation, and Environmental Affairs, who usually contract the services of tertiary & research institutes. However, at all times the Estuary Advisory Forum should be involved so as to ensure that programmes will be beneficial to the effective implementation of the Estuarine Management Plan. Long-term monitoring programmes for the following components are proposed, namely hydrology, sediment dynamics, hydrodynamics, water & sediment quality, microalgae, macrophytes, invertebrates, fish and birds.

In addition to monitoring, the Estuarine Management Plan will need to be evaluated on a five-yearly basis to assess whether that vision, objectives and targets are being achieved. This is the responsibility of the RMA (Eden District Municipality), supported by the Gouritz Estuary Advisory Forum. Usually this will involve the adaptation of management strategies and objectives or aspects of the action plans themselves, although the problem may be with implementation (capacity and finance). Ideally, representatives of the major components, namely conservation & living resources, social & cultural issues, land-use & infrastructure, and water quantity & quality, should evaluate the efficiency of the Estuarine Management Plan in the context of their area of responsibility.

Research

Specific research projects were identified to fill the knowledge gaps and provide supplementary data for monitoring programmes. There may be a degree of overlap with the identified long-term monitoring programmes. These include, inter alia, a fishery survey, survey of invertebrate organisms, determination of carrying capacities, study of the effectiveness of sanctuary areas, a study of the effectiveness of the education and awareness programme, and long-term monitoring of habitats and community structures.

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ACRONYMS & ABBREVIATIONS

ADU	Animal Demography Unit
amsl	Above mean sea level
C.A.P.E.	Cape Action for the People and the Environment
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CFR	Cape Floristic Region
CMA	Catchment Management Agency
CMF	Catchment Management Forum
CML	Coastal Management Line
CMP	Coastal Management Programme
CMS	Catchment Management Strategy
CPUE	Catch-per-unit-effort
CPZ	Coastal Protection Zone
CWAC	Co-ordinated Waterbird Counts
DAFF	Department of Agriculture, Forestry and Fisheries
DEA&DP	Western Cape Department of Environmental Affairs & Development Planning
DEA:O&C	Department of Environmental Affairs: Oceans & Coasts Branch (formerly MCM)
DWS	Department of Water and Sanitation (formerly DWAF)
EA	Environmental Authorisation (Formerly Record of Decision, RoD)
EAF	Estuarine Advisory Forum
EcoSpecs	Ecological Specifications (termed RQO's once EcoClassification is signed off)
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Estuarine Management Plan
EWR	Ecological Water Requirements
EZP	Estuarine Zonation Plan
GREAF	Gouritz River Estuary Advisory Forum
I&AP	Interested & Affected Party
ICMA	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) as amended
IDP	Integrated Development Plan
MAR	Mean Annual Runoff
MEC	Member of the Executive Council
MLRA	Marine Living Resources Act (Act No. 18 of 1998) as amended

NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004) as amended
NEM:PAA	National Environmental Management: Protected Areas Act (Act No.57 of 2003)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NFA	National Forests Act (Act 84 of 1998)
NGO	Non-government Organization
NHRA	National Heritage Resources Act (Act 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
NWRS	National Water Resource Strategy
PDC	Previously Disadvantaged Community
PES	Present Ecological State
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RMA	Responsible Management Authority
RQO	Resource Quality Objectives
SAR	Situation Assessment Report
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
The Protocol	National Estuarine Management Protocol
TPC	Threshold of Potential Concern
WMA	Water Management Area
WUA	Water User Association

1 INTRODUCTION

Estuarine ecosystems are not isolated systems. They form an interface between marine and freshwater systems and are part of regional, national and global ecosystems either directly via water flows or indirectly through the movement of fauna. In addition to the biota that these estuaries support, they provide a range of goods and services (uses) to the inhabitants of the various regions. Disturbances in one estuary can influence a wide variety of habitats and organisms in the broader freshwater or marine ecosystem. Thus, the interaction between the systems and users creates a delicate balance, the sustainability of which needs to be addressed by some form of management plan.

In order to address this balance in a consistent manner in the Cape Floristic Region (CFR), the Cape Action for People and the Environment (C.A.P.E.) Estuaries Management Programme developed a holistic and inclusive management process representative of all stakeholders.

The urgent need for Estuarine Management Plans (EMPs) became apparent during the development of the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008 as amended by Act No. 36 of 2014) (ICMA). Estuaries and the management thereof have not been adequately addressed by past marine, freshwater and biodiversity conservation Acts. Estuaries and estuarine management have been marginalized due to the fact that they do not fit the ambit of any one government Department. Estuaries and the management thereof now form an integral part of the ICMA, which outlines the need for a National Estuarine Management Protocol (the Protocol). The Protocol identifies the need for the development of EMPs, as these would help to align and coordinate estuaries management at a local level.

Enviro-Fish Africa (Pty) Ltd. was contracted by Cape Nature to develop the initial EMP for the Gouritz River estuary, based on a generic EMP Framework (Van Niekerk & Taljaard, 2007). This report follows on from the Situation Assessment Report (SAR) or State of Play Report (EFA 2008) and fulfils the requirements of Objective 2, namely the development of an EMP for the Gouritz River estuary, according to the Protocol.

2 FRAMEWORK FOR THE DEVELOPMENT OF AN EMP

2.1 Approach

The Gouritz River EMP was initially developed based on the key components of the generic framework for EMPs, as proposed in Van Niekerk & Taljaard (2007). The current update places it in line with the Protocol. Figure 1 is a graphical representation of this framework. It is essential to understand that the EMP developed within this framework is not cast in stone but will instead become a 'living document' that can be adapted according to the changing requirements of the system itself and its users. A feedback system involving a regulated monitoring programme and a detailed situation assessment once every five years will allow for changes to be made through the working groups responsible for each sector.

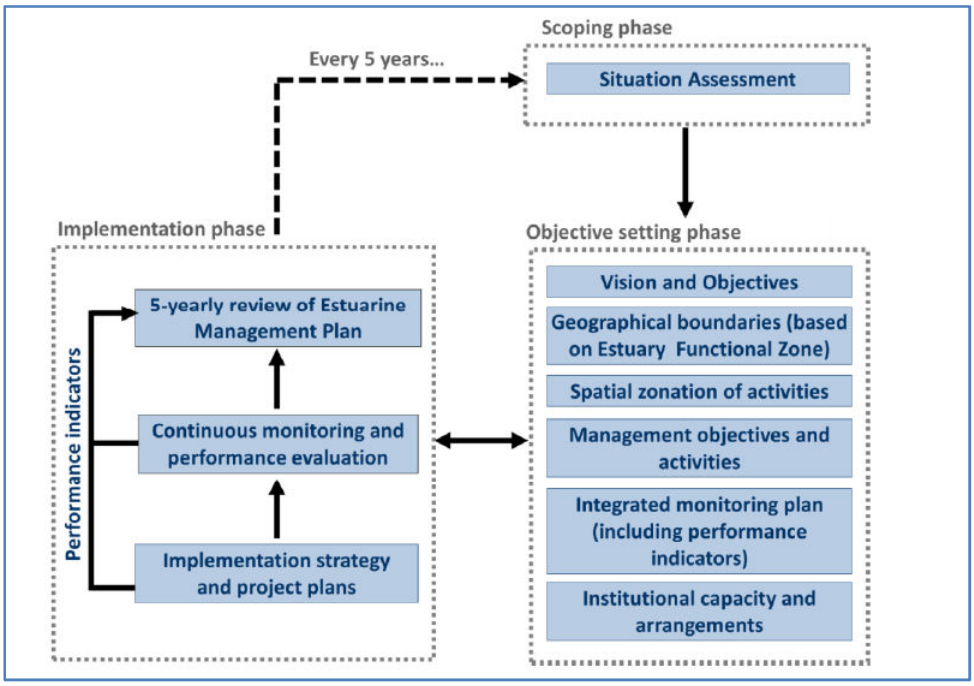

Figure 1: A framework for integrated estuarine management in South Africa

This EMP is a strategic planning document, and as such does not provide detailed, routine planning for the management of the estuary. Furthermore, the ICMA provides for a report to be submitted to the Department of Environmental Affairs (DEA) every two years in respect to implementation once an EMP has been signed off and approved. The EMP should also be recognized as a dynamic document, whereby certain components could be revised as important new information becomes available and management priorities change. Adaptive management should be continually pursued through a process of annually reviewing the progress made in achieving the management objectives. Finally, the management plan should be subject to a comprehensive revision on a five-year cycle, as required by the Protocol.

2.2 Summary of Legal framework

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

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

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

a) The strategic vision and objectives for achieving effective integrated management of estuaries in South Africa;
b) The standards for the management of estuaries;
c) The procedures regarding how estuaries must be managed and how the management responsibilities are to be exercised by different organs of state and other parties;
d) The minimum requirements for EMPs;
e) Who must prepare EMPs and the process to be followed in doing so; 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/ Member of the Executive Council (MEC) 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. The Premier of each coastal province must identify a lead agency (organ of state) that is responsible for the coordination, monitoring and implementation of the provincial coastal management programme, monitoring the state of the environment in the coastal zone, and identifying

relevant trends and priority issues. The lead agency for coastal management is directly responsible to the MEC. Each metropolitan, district or local municipality which has jurisdiction over the coastal zone may establish a municipal coastal committee. The establishment of Municipal Coastal Committees is discretionary.

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

2.3 Mandate and responsibilities of the Responsible Management Authority

The Protocol identifies the Eden District Municipality as the Responsible Management Authority (RMA) responsible for developing and co-ordinating implementation of the Gouritz River Estuarine Management Plan, as the estuary forms the border between Hessequa and Mossel Bay local municipalities (Figure 2).

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

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

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

Section 5:	*"…authorities are **responsible for the development of EMPs** and **coordination of the implementation process**…"*
Section 5(7)(e):	*"The identified responsible management authority to development the EMP needs to **budget accordingly for the development of these plans**."*
Section 8(1):	*"The responsible management authority developing an EMP must **actively engage all the relevant stakeholders** including government departments, non-government organisations and civil society in the development and implementation of the EMP."*
Section 9.1(1) and 9.2:	*"…it **must obtain formal approval** for the EMP…" and "Once approved…the EMP shall be formally adopted by the responsible management authority and signed by the head of the responsible management authority."*

Figure 2: Location of the Gouritz River Estuary within Eden District Municipality

The responsible body contemplated in Section 33(3)(e) of the ICMA 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 Protocol; and
   ii) the National CMP and with the applicable provincial CMP and CMP referred to in Parts 1, 2 and 3 of Chapter 6 of the ICMA;
c) If applicable, ensure that relevant legislation is enacted to implement the EMP; and
d) Submit a bi-annual report to the Minister on the implementation of the EMP, the legislation and any other matter.

Coordination of the implementation actions by the RMA and its strategic partners (CapeNature, DEA, Mossel Bay and Hessequa local municipalities, Western Cape Provincial Government, Department of Water and Sanitation (DWS), Department of Agriculture, Forestry and Fisheries (DAFF)), will be supported by the Gouritz River Estuary Advisory Forum (GREAF) representing all key stakeholder groups on the estuary.

3 SUMMARY OF SITUATION ASSESSMENT

3.1 Introduction

This is a Situation Assessment Report for the Gouritz River estuary and will form the basis from which an Estuarine Management Plan will be developed, based on the National Estuarine Management Protocol as outlined in the National Environmental Management: Integrated Coastal Management Act, Act no 24 of 2008, as amended in 2014. The report describes the current situation on the Gouritz River estuary and provides an assessment of the legal requirements relevant to the system, a bio-physical description, a description of land-use patterns, water use and requirements, good and services, exploitation of living resources, economic importance, conservation and rehabilitation priorities, institutional arrangements, recommendations for management and the way forward with regards the formulation of the EMP itself. The estuary has also been represented spatially in the form of GIS maps which indicate land-use patterns and infrastructure, recreational use areas, exploitation areas, sensitive habitats and proposed sanctuary areas.

3.2 Biophysical description

The catchment that supplies the Gouritz River is extensive and drains an area in excess of 45 000 km^2. Mean annual precipitation is 262 mm and the Mean Annual Runoff (MAR) is 695 x 10^6 m^3. The catchment covers six eco-regions, namely Great and Nama (Little) Karoo, Southern and Western Folded Mountains and the South-Eastern and South-Western Coastal Belt. The main tributaries feeding into the Gouritz River are the Olifants in the east, the Gamka in the north and the Groot in the north-west. The remaining rivers which comprise smaller tributaries within the greater catchment are the Touws, Buffels, Dwyka,

Koekemoers, Leeuw and Kammanassie. Main land-uses in the catchment are irrigated agriculture, livestock and some conservation areas. According to the DWAF State of the Rivers Report the majority of rivers and tributaries are in a good to fair state, with only the lower Olifants west of Oudtshoorn and the Buffels River at Laingsburg being classed as poor.

The Gouritz River estuary is a medium/large, permanently open system, entering the sea through a shallow dynamic mouth region which shifts according to tidal and freshwater flood regimes. The Gouritz River estuary is a Type F Barred system which means it is characterized by a supratidal barrier at the mouth. Net longshore transport of sediment at the mouth as a result of the dominant south-westerly swells is towards the east and as such the sandspit (barrier) tends to form from the west. Depth at the mouth ranges from 0.5 to 2 m at high tide, while main channel depth has been measured between 1.3 and 4 m, with the deepest site of 6 m located near the road crossing at Die Eiland. The system is mostly marine-dominated but severe flooding from the inland catchment occurs from time to time. The banks for the most part of the middle to upper reaches are gently sloping but the extreme upper reaches are characterized by steep- sided banks on both sides. The estuary extends a maximum of 10 km from the mouth when freshwater flows are at a minimum and tidal influences are dominant. Degradation of the estuary due to coastal developments, off-road driving, trampling of riparian habitats, modified or altered habitats and channels, livestock grazing and planting of crops close to the edge that cause bank collapse, erosion and increased sediment loads, nutrient enrichment from agricultural practices, invasive alien plants and fish, and weirs and abstraction activities that obstruct/alter flow dynamics, is cause for concern.

Physico-chemical characteristics of the estuary are not well documented but limited historical data for salinity and oxygen concentrations indicates good mixing except in the upper reaches when freshwater runoff causes stratification. The estuary is marine dominated with salinities ranging from 34 ppt at the mouth to 23.3 ppt 8 km upstream. Recent monitoring of salinities has shown that freshwater pulses have become weaker and infrequent and confirmed that marine influences are strong. Periodical construction of barriers above the road bridge isolates the estuary from the river and results in the breakdown of the river- estuarine-interface.

3.2.1 Algae and aquatic vegetation

Marine algae (*Porphyra capensis* and *Sargassum heterophyllum*) appear to be restricted to the rocky platforms on the eastern bank in the mouth region. Submerged macrophytes are not well represented in the system and there are conflicting reports of isolated *Zostera capensis* beds on some mudbanks although the 2011 National Biodiversity Assessment documents the preliminary identification of one new endemic species of *Limonium* found in the estuary. Saltmarshes are not extensive but are dominated by *Sarcocornia perennis, Chenolea diffusa, Cotula coronopifolia, Disphyma crassifolium, Sporobolus virginucus* and *Salicornia meyerana* in the areas close to the mouth and near to the water. In the middle to upper reaches, saltmarsh vegetation is represented by *C. coronopifolia, Triglochin spp.* and *Sarcocornia sp*. Further away from the water a transition zone between the terrestrial vegetation types comprises *Juncus kraussii, Stenotaphrum secundatum* and *Suaeda*

caespitosa. A single rare species (*Reihania garnotii*) is confined to this community. Large patches of *Spartina maritima* are found semi-submerged along the water's edge but not always in association with other saltmarsh plants. The flora associated with areas of freshwater seepage is dominated by *Juncus acutus, J. kraussi* and *Phragmites australis*.

3.2.2 Aquatic invertebrates

The mudprawn (*Upogebia africana*) is found on all mudbanks of the estuary and sandprawns (*Callianassa kraussii*) are found on sandbanks from about 6.5 km from the mouth to areas well beyond the Road Bridge and Die Eiland. Bloodworm (*Arenicola loveni*) and pencil bait (*Solen sp*.) have been found. Although the swimming crab (*Scylla serrata*) is found in the estuary, the numbers are low.

3.2.3 Fish

The rivers of the Gouritz catchment feature six indigenous freshwater species, of which at least two (*Pseudobarbus asper* and *P. tenuis*) are endangered/threatened. Several eel species are also present, but these are strictly speaking catadromous as adults migrate to sea to spawn. Invasive fish in the catchment include *Tilapia sparrmanii, Cyprinus carpio, Micropterus salmoides* and *Clarias gariepinus*.

Until 2007, a detailed ichthyofaunal survey of the Gouritz River estuary had not been conducted, and only eleven species were recorded during the River Health Programme study. These were *Gilchristella aestuaria*, *Mugil cephalus, Myxus capensis, Liza richardsoni*, *L. dumerilii, Atherina breviceps, Monodactylus falciformis, Solea bleekeri, Lichia amia, Psammogobius knysnaensis* and *Lithognathus lithognathus*. Earlier surveys also found *Argyrosomus japonicus, Pomatomus saltatrix, Pomadasys commersonnii, Galeichthys feliceps, Rhabdosargus globiceps, R. holubi* and *Caffrogobius multifasciatus*. Recent monitoring has shown that the estuary has a rich ichthyofauna dominated by dusky kob, spotted grunter, white sea-barbel, white steenbras and leervis. There are no records of larval fish.

Elasmobranch species appear to be restricted to the mouth area and include *Gymnura natalensis, Myliobatus aquila*, and *Rhinobatos annulatus*.

3.2.4 Reptiles and amphibians

Surveys within the planning area and environs have revealed eleven amphibian species, three tortoises, 26 snakes and 12 lizards, none of which are rare or endangered species.

3.2.5 Birds

Historical records of waders on the Gouritz revealed 292 birds from 12 species of which 35 (comprising two species; whitefronted plover and Kittlitz's plover) were residents and 257 migrants (including ringed plover, turnstone, grey plover, curlew sandpiper, little stint, knot, terek sandpiper, greenshank, bar-tailed Godwit and whimbrel). Later counts comprised 17 species totalling 158 birds on one occasion, with the most abundant being kelp gulls followed by swift terns and whitefronted plovers. On another occasion, 36 species (totalling 625 birds) were recorded and were dominated by the summer migrants such as the curlew sandpiper, terek sandpiper, ringed plover, greenshank, little stint and whimbrel.

The Animal Demography Unit's Coordinated Waterbird Counts compiled data for the Gouritz since 2000 from the mouth region to the Low- water Bridge. Between October 2000 and July 2007, ten counts were conducted and a total of 57 species identified. Of these, 28 species were only seen on three or less occasions and 13 species are represented by between one and three individuals. Kelp gulls are by far the most abundant species followed by the Egyptian goose and swift terns. Breeding activity has only been confirmed for three species, namely the Egyptian goose, African fish eagle and Black harrier.

3.2.6 Mammals

There are no records of mammals directly associated with the estuary although 80 species, including the Cape clawless otter, are thought to occur in the region, including the catchment. Of these, eight species are listed as being rare or vulnerable.

3.2.7 Terrestrial Vegetation

Vegetation associated with the middle to lower reaches of the estuary comprises arid scrub thicket, renosterveld, strandveld, strandveld – thicket mosaic, dune scrub, dune scrubland, Acacia cyclops thicket, dune thicket, limestone fynbos and secondary grassland.

A recent vegetation sensitivity analysis on a portion of land located to the west of the middle reaches of the estuary, revealed nine rare and endemic (to the immediate area) plant species. One of these, *Leucadendron galpinii* is also listed as a vulnerable Red Data species.

3.2.8 Alien vegetation

The predominant alien plants in the lower estuarine area are rooikrans (*Acacia cyclops*), gum tree (*Eucalyptus sp.*), kikuyu (*Pennisetum clandestinum*), prickly pear (*Opuntia ficus-inidica*) and manatoka (*Myoporum tenuifolium*). Alien plants in the riverine regions include Kariba weed (*Salvinia molesta*), red water fern (*Azolla filiculoida*) and Spanish reed (*Arundo donax*).

3.3 Legislation and planning documents

The purpose of this section in the report is to review all forms of legislation and all planning/management documents that may have an impact on the formulation of the estuarine management plan and the management of the Gouritz River estuary. This review incorporates international agreements, strategies and obligations as well as all forms of National (Acts and Policies), Provincial, Regional (including old Cape of Good Hope Ordinance) and local legislation. Local legislation and planning documents include municipal by-laws, recommendations and requirements detailed in the Integrated Development Plan and Spatial Development Framework planning documents and strategies within the Integrated Hessequa Environmental Policy for biodiversity conservation, coastal zone management, climate change, environmental education, estuaries and rivers, and management of the Gouritsmond Commonage. Most of these

planning documents all form the protection of estuarine and wetland habitats and place severe restrictions on future developments in these areas.

3.3.1 Human impacts

The majority of land within the greater catchment and along the Gouritz floodplain adjacent to the estuary is zoned as agricultural and a variety of high-intensity, irrigation dependant farming activities take place. Several conservation areas also exist, including the buffer zone of open space surrounding Gouritsmond which abuts onto the estuary to the north and north- east. There appear to be no restrictions governing how close to the river or estuary farming activities may take place, and in most cases cultivated lands or grazing of livestock takes place up to the water's edge.

The town of Gouritsmond, located immediately to the west of the estuary mouth, is classified as a third order Regional node in the Hessequa Spatial Development Framework (SDF) and ranks only 97th out of 131 Western Cape towns in terms of growth potential. There are currently no large-scale developments on the eastern side of the estuary and the resorts of Kanon, Fransmanshoek and Vleesbaai are located outside of the area of concern. The residents of these resorts, however may make use of the goods provided by the estuary in the form of fishing or recreational boating. Although several large-scale residential developments adjacent to the estuary had been planned, these have been successfully opposed by the Gouritz River Conservation Trust and the Municipality.

There is a single functioning slipway on the western side of the estuary just outside the urban edge of Gouritsmond comprising a parking area, a shelter for the river control officer, three braai areas, several waste containers, information boards and ablution facilities. An additional *ad hoc* type slipway and two small boat houses are located in the middle reaches of the system. Recreational activities include swimming, windsurfing, kite boarding, canoeing, boating, water skiing, hiking, bird watching, dog walking and fishing/bait collecting. Several commercially-licensed deep-sea boats and many recreational ski-boaters use the slipway and the estuary as a launch site. There are no jetties on the estuary, but one is being considered for the area adjacent to the slipway.

A single bridge crosses the estuary just before the road meets with the R325 and just above the area known as Die Eiland. The location of the structure and the degree to which the banks and flow of the estuary have been altered is cause for concern. Remnants of the old bridge are still present in the estuary and should be removed to improve flow along this section. The bridge spanning the river along the N2 does not interfere with the river or flow in any way.

Many sections of the estuary bank on both sides of the channel are severely eroded due to a combination of destabilization due to overgrazing; livestock accessing the estuary to drink; cultivating land too close to the edge; farm vehicles driving too close to the edge; fishermen walking along the edge and down onto mudbanks to access bait; wave damage from wind driven waves; flood damage; and to a lesser extent boat wakes. Attempts to stabilize this damage have been undertaken at several sites and gabions have been used to try and rectify the problem.

Above the estuary, the river itself is used extensively by farmers as a source of freshwater. At least eight pumps are located between the road bridge and the kranz's and this is only the extreme lower portion of the river. Water is pumped almost on a continual basis when levels are high enough. Several supply pipelines run along the bottom the estuary from the west to the east in order to supply farms with no access to groundwater and some have large structures protruding into the estuary for protection.

3.4 Exploitation of living resources

3.4.1 Current legislation

National legislation prohibits scuba diving, spearfishing, fishing without a permit and the use of fish nets other than a landing net or casting net in all estuaries. In addition, no fish captured in an estuary may be sold. A Hessequa municipal by-law prohibits people from holding or arranging any fishing competition without permission from the Municipality and the Gouritz River Conservation Trust. Fishing from any bridge or within 20 m either side of a slipway is also prohibited.

3.4.2 Fishery

Historically, the Gouritz River estuary has been considered to be an excellent fishing destination, and was particularly known for periodic runs of large dusky kob during September, October and November. Fishing is distinctly seasonal, with very little fishing effort occurring between June and August. Grunter fishing in the estuary occurs throughout the year, with recreational and subsistence fishers targeted these fish using mud prawn, sand prawn and sand mussel. Unlike the grunter, large dusky kob are targeted during spring and summer using a variety of baits such as live mullet, sardine, squid, octopus leg and artificial lures (rapalas).

The majority of recreational anglers come from Gouritsmond and the nearby urban centres of George, Albertinia and Mossel Bay. During December and April, a large proportion of the recreational fishers come from further away, including Cape Town, Bloemfontein, Johannesburg and Pretoria. The subsistence users hail from the immediate vicinity of Gouritsmond/Bitouville and the surrounding farms.

3.4.2.1 Fishing effort

There appears to be a significant amount of boat-based and shore fishing effort on the Gouritz River estuary. The Municipal River Control Officer estimates that approximately 80% of people launching boats from the slipway utilize the estuary's living resources. Records of boat registration permits between 2000 and 2008 suggest that there is increasing pressure on the estuary; the number of boat trips on the river per year ranged from approximately 1200 in 2000/2001 up to 6600 in the 2006/2007 season. Most of the boating activity occurs during spring, summer and autumn, peaking during the major holiday periods in December and April.

Shore angling effort in the Gouritz River estuary is not as high as boat-based angling effort. The lack of access to the estuary shoreline, particularly in the middle and upper reaches is

a major contributing factor. The slipway parking lot is the major access point for shore anglers on the western shore.

3.4.2.2 Distribution of effort

All boat fishing takes place between the mouth and approximately 8 km upriver at "Bar se Gat". Within this area, there are four high effort zones including the areas around what is known as "Steentjie se Gat", "Witkopklip" and "Bar se Gat".

Recreational shore fishing effort occurs mostly at sites where fishers can readily access the shore. Due to the limited access on the eastern shore, which is mostly privately-owned farmland, shore fishing areas for the public are almost exclusively on the western shoreline. Most shore fishing occurs from the slipway area up to Witkopklip, at "Bar se Gat" and around the road bridge at "Die Eiland". There is limited subsistence fishing effort in the estuary, mostly around "Witkopklip".

Illegal netting has been and remains a problem in the Gouritz River estuary.

3.4.3 Bait fishery

Bait organisms in the Gouritz River estuary are targeted by recreational boat, recreational shore and subsistence anglers. Of the bait organisms found in the estuary, mudprawn and mullet are most frequently harvested by anglers. Rock and surf anglers also collect bait (mostly live bait) in the estuary.

3.4.3.1 Distribution of effort

Bait collection effort is focused around the lower reaches of the estuary. Here recreational boat, recreational shore and subsistence fishers collect mudprawn and live bait. Recreational shore and subsistence fishers mostly collect bait from just below the slipway to Witkopklip on the western shore. Recreational boat anglers collect mudprawn wherever they occur. Sand prawns are mostly found and harvested in the upper reaches of the estuary. Mullet occur throughout the estuary with shore fishers mostly targeting them between the slipway and Witkopklip and boat anglers targeting them throughout.

3.4.4 Current fish and bait regulations

While the existing regulations have been implemented nationally in an attempt to maintain a healthy fishery, a history of disregard for the regulations is thought to be a major contributor to the poor fishing in the estuary. Anglers frequently retain undersize fish, exceed their bag limits and sell their fish. Recently, at least one boat has been recognized to be involved in illegal gillnetting and several reports of illegal gillnetting have been received by the Department of Agriculture, Forestry and Fisheries. Boat anglers were also recognized as the group mostly responsible for the illegal activities. Approximately 30% of all user groups fish without licenses.

3.4.5 Monitoring and enforcement

Enforcement and monitoring of living resource exploitation on the Gouritz River estuary is practically non-existent, with the DWAFF officers patrolling the system about twice a year.

The Hessequa Local Municipality has appointed a single River Control Officer to issue and enforce boat licenses and to monitor other by-laws. The officer is however not appointed in terms of the Marine Living Resources Act (Act No. 18 of 1998) (MLRA) and is thus unable to enforce the Act as it applies to living resource regulations. CapeNature is responsible for ensuring compliance with regulations pertaining to the construction of structures (slipways and jetties) on the estuary in terms of the Seashore Act (Act 21 of 1935; Amended 1993)(SA).

3.4.6 Angler and resident perceptions

Co-management of the estuary under the local management institution (Gouritz River Conservation Trust) with direct involvement all key stakeholders was seen as being a feasible option by most fishers. The lack of compliance to regulations by fishermen was not seen by them as a major factor contributing to the decline in fish catches. Overall, fishermen felt that silting caused by reduced flows and increased erosion, and the trawlers operating in the inshore marine environment were mostly responsible for the decline in the fishery.

3.4.7 The way forward

In the case of the Gouritz River estuary, local issues such as the removal of large dusky kob by fishers must be considered when developing a management plan. Estuary specific fishery regulations may therefore be addressed in the estuarine management plan. The problem of poor law enforcement capacity on the estuary should also be addressed in the management plan. The current size and bag limit regulations governing the exploitation of living resources are generally not considered effective in areas with poor enforcement capacity. Alternatively, closed areas and closed seasons are considered more effective and are therefore likely to be more suited to the Gouritz River estuary.

There are a number of potential fish and bait regulations, and proposals to enhance the monitoring capacity on the estuary. Given the poor stock status of dusky kob in South Africa, potential regulations for this species include a zero bag limit, a closed season, a window size limit, a ban on night fishing, and an estuarine protected area. For the bait fishery, a closed area or a harvesting rotation system are proposed. Furthermore, the potential for poverty alleviation in the form of a subsistence bait fishery during high effort months (April and December) could be investigated.

3.5 Water quantity and quality requirements

3.5.1 Catchment description

The Gouritz River Catchment drains an area of 45,134 km^2 and has a river length of 328 km. The catchment has two distinct areas: a large, dry inland area that is comprised mainly of the Karoo and Little Karoo; and the smaller humid strip of land along the coastal belt. There are four sub-catchments;

- The Gamka sub-Catchment comprising the catchment of the Gamka River upstream of the confluence with the Olifants River, downstream of which the river is known as the Gouritz River. The largest dams in this sub-catchment are Gamkapoort and Leeu-Gamka Dams. The total dam capacity is 80.4 million m^3, which represents 35% of the natural Mean Annual Runoff;
- The Groot sub-Catchment comprising the catchment of the Groot River down to its confluence with the Gouritz River. The largest dams in this sub-cacthment are Floriskraal and Bellair Dams. The total dam capacity is 82.4 million m^3, which represents 78% of the natural Mean Annual Runoff;
- The Olifants sub-catchment comprising the catchment of the Olifants River. The largest dams in this sub-catchment are Stompdrift and Kammanassie Dams. The total dam capacity is 112 million m^3, which represents 49% of the natural Mean Annual Runoff; and
- The Gouritz sub-catchment comprising the catchment of the Gouritz River downstream of the above catchments. There are no major dams in this catchment. The top end of the estuary is located about 10 km from the river mouth, within quaternary catchment J40E.

3.5.2 River health

The overall Present Ecological State of the lower Gouritz River appears to be in a Moderate condition. Detailed information on aquatic invertebrates in the Gouritz River Catchment is available from the National River Health Database. However, the lowest biomonitoring site for which data are available (J4Gour-Herbe) is located 37 km upstream of the top end of the estuary. The ecological conditions of the river where it enters the estuary are therefore unknown. Taxa recorded are typical of a shallow, sand-dominated substrate, and include baetid mayflies, hydropsychid caddisflies, Corixidae and Gomphidae.

A total of 12 species of indigenous fish are expected at biomonitoring point J4Gour-Herbe, a further seven species of exotic or translocated fish are known to occur. The overall present state for fish is rated as Poor, mainly because of the high proportion of exotic species.

3.5.3 Natural hydrology

The simulated natural mean monthly total flows at the lower end of the Gouritz Catchment show moderate seasonality, with highest total flows usually in March, and lowest total flows in July. The natural Mean Annual Runoff for the Gouritz River Catchment at the lower boundary of quaternary catchment J40E is estimated at 564.0 million m^3/a. The average annual rainfall over most of the catchment varies between 100 and 300 mm, while the coastal area has an annual rainfall of 400 to 500 mm/a.

Simulated monthly natural flows indicate that natural flows are highly flashy, as would be expected for a system that drains an area that is largely arid. The data indicate that the lower Gouritz River is naturally seasonal, with flow cessation occurring in January and February in most years.

3.5.4 Observed hydrology

The lower Gouritz River has two flow gauges at Bonavontuur and Zeekoeidrift. The gauge at Bonavontuur has no rating table, so there are no flow data available. This means that the only available flow data for flows entering the estuary are recorded at Zeekoeidrift. This rated cross-section is located 70 km upstream of the top end of the estuary in a pool under a bridge, so low flows are likely to be unreliable. There are a number of tributaries that enter the river between this gauge and the estuary, but these are small tributaries, so the impact on flows is likely to be small. Data from this gauge show that seasonal flow patterns have changed significantly compared to natural flows. Observed median monthly flows were typically 0.47 m^3/s, which is significantly lower than the comparable value of 2.187 m^3/s under natural conditions. These changes are not surprising, given the large number of dams that have been constructed in the catchment.

3.5.5 Ecological reserve

A desktop assessment of the Ecological Water Requirements of the lower Gouritz River, at the downstream boundary of quaternary J40D, was estimated at 98.649 million m^3/a, representing 18.04% of the natural MAR. This value is significantly higher than previous estimates. The lower boundary of catchment J40D is about 21 km upstream of the top end of the estuary. For the purposes of this study it was considered more appropriate to assess the Ecological Water Requirements (EWR) further downstream, and include the contributions of the tributaries in the lower reaches. A Desktop Reserve Model was therefore run cumulatively at the lower boundary of J40E, and recommended an EWR for a Category C management objective of 101.864 million m^3/a, which is comparable to the results of the EWR at J40D. These flows represent 18.06% of the natural MAR. The median EWR varies between 0 million m^3 per month (in January and February), to 2.903 million m^3 per month in March. The median low flow requirement in March is 0.292 million m^3, equivalent to a flow of 109 L/s.

In terms of the Gouritz River estuary, the ecological health and reserve were determined at an intermediate level as part of detailed reserve studies for water resources in the Breede-Gouritz water management area (WMA). The results indicate that the estuary is in a moderately modified state but is at risk of deteriorating further to a largely modified condition. Due to the high demand for water in the catchment, it is unlikely to fully restore the ecological status of the Gouritz River Estuary to its natural, pristine state. Thus the Recommended Ecological Category for the Gouritz Estuary was set as a Category B. This may be achieved by instating the Recommended Ecological Flow Scenario, which entails ensuring the present inflow plus restoring 25% of base flow (MAR of 440.85 million m^3), as well as additional non-flow related activities.

3.5.6 Water users

Irrigated agriculture is the biggest single user of water in the Gouritz River Catchment, estimated to use about 83% of the water requirements. The construction of illegal barriers in the lower reaches of the river also prevent freshwater from reaching the estuary and all the farms bordering the river pump water whenever it is available.

3.5.7 Water balance

Comparison of water availability and water requirements in 2000 indicates that that demands exceed availability. The efficiency of irrigation in some areas is very low, and substantial losses occur in some distribution networks. Water use by alien vegetation is also high.

3.5.8 Water storage

The total reservoir capacity within the catchment is estimated at 274.8 million m^3, equivalent to 49% of the natural mean annual runoff. However, a significant proportion of the capacity comprises sediment accumulation. The largest dams are located about 200 km upstream of the estuary. This means that the feasibility of releasing low flow estuarine requirements from existing dams is remote. Existing large dams could however play an important role in providing high flow requirements for the estuary.

3.5.9 Water quality

Water quality in the lower reaches of the Gouritz River is poor and unacceptable for most uses because of naturally high levels of salinity. Despite this, the Present Ecological State (PES) of the river is moderate, and this indicates that organisms have adapted to the high salinities.

3.6 Classification, economic value, protection and rehabilitation

3.6.1 Classification

The Gouritz River estuary is a warm temperate, medium/large permanently open, tidally dominated, barred estuary that displays a moderate ichthyofaunal community, good water quality and only moderate aesthetic appeal; overall condition has been rated as Good. The Gouritz River estuary is ranked as the 49th most important estuary in South Africa in terms of conservation importance, with ratings based on a combination of scores given to size, habitat importance, zonal type rarity and biodiversity importance. More importantly, the Gouritz River estuary is one of the core priority systems to be protected in order to meet the national estuarine biodiversity targets and thus requires partial protection by means of establishing a no-take fishing zone and ensuring 50% of estuary margin be undeveloped.

3.6.2 Estuarine goods and services

There is no legal fishery in the Gouritz River estuary but it has been considered to be an excellent fishing destination, with a significant amount of boat-based and shore fishing effort. There is no notable subsistence bait fishery and anglers mostly collect their own bait on site. There is also no recorded use of craft or building materials (e.g. reeds, sand) gathered from the estuary for subsistence or commercial purposes.

There is no information available as to the extent of the regulatory services that the estuary provides but an important service is water quality amelioration. At least part of the pollution loads from the catchment will be assimilated by the system, saving on water treatment costs. The estuary also plays a role as a nursery area for fishes. Different species are dependent on estuaries to different degrees for stages of their development and growth. It has been suggested that a sanctuary area be declared above the low road bridge to serve as nursery area for juvenile fish such as dusky kob, white steenbras and spotted grunter.

The Gouritz River Estuary provides the opportunity for various recreational activities include swimming, windsurfing, kite boarding, canoeing, boating, water skiing, hiking (along demarcated pathways), bird watching, dog walking and fishing/bait collecting. Several commercially-licensed deep-sea boats and many recreational ski-boaters use the slipway and the estuary as a launch site.

3.6.3 Economic value

- Subsistence - ranked 16th amongst temperate systems; valued at R137 867 per annum.
- Property – not ranked in the Top 20 in terms of property value related to estuaries; most systems fall into the R10 – 50 million range.
- Tourism – not rated in the Top 20 in terms of tourism value attributed to estuaries; most (probably including the Gouritz) are between R10 000 and R1 million.
- Nursery – not rated in the Top 20 in terms of nursery value attributed to temperate estuaries but valued at between R1 and R5 million per annum.
- Existence – is not ranked amongst the Top 40 temperate estuaries and only has a rating of Medium; existence value is largely associated with scenic beauty.
- Recreational – estimated at between R10 and 20 million per annum based largely on property value.

3.6.4 Protected area strategy and potential

The following can be said about the Gouritz River estuary with regards to requirements in terms of protection:

- The Gouritz is one of the core set of temperate estuaries required to meet the targets for biodiversity protection of estuarine resources; scores (out of 100) that contributed to the overall rating of 75 for the Gouritz were size (90), habitat importance (60), zonal type rarity (20) and biodiversity importance (88);
- The recommended extent of sanctuary protection is HALF the system;
- The recommended extent of undeveloped margin is 50%;
- The recommended minimum water requirement falls under the A/B management class which means a high priority and requirement; and
- The priority for rehabilitation is HIGH.

Preliminary thoughts on a spatial zonation plan for the Gouritz River estuary are that a sanctuary area be declared above the low road bridge and that the remainder of the

estuary be declared a conservation zone which will further be divided into specific management areas. The proposed sanctuary area would only comprise the estuary itself and not the adjacent land as this is mostly highly elevated above the channel. The rationale behind the sanctuary is the protection of a nursery area for juvenile fish such as dusky kob, white steenbras and spotted grunter. The conservation zone, which makes up most of the estuary, will comprise areas where activities are regulated to prevent over-exploitation, to ensure responsible non-consumptive recreational use and to ensure sustainable development.

Saltmarsh does not comprise a significant portion of estuarine habitat and is largely confined to the lower reaches. Large portions of what once was pristine saltmarsh have now been altered by farming activities and no longer fulfil their original function. Saltmarsh areas will need to be rehabilitated and this will require a change in mindset and farming practices. Mudbanks and sandbanks are found along much of the lower/middle and upper reaches respectively. Mudbanks do not need any special protection status and a portion of the sandbanks in the upper reaches will be protected within the proposed sanctuary area.

The greater catchment area is generally considered to be in good condition but there are serious issues relating to water supply and abstraction and soil erosion leading to increased sediment loads. The area will benefit through the Gouritz Initiative, but this may take some time. It is imperative that a dedicated catchment management plan run through a catchment management agency be implemented so that estuary-specific issues that rely on good catchment management can be addressed. The recently determined EWR or ecological reserves for the greater Gouritz WMA can be used to develop a programme that will ensure measured releases and pulses of freshwater that will not only help sustain farmers in the lower river regions but also help sustain ecological processes.

3.7 Potential for socio-economic development

As indicated in the Strategic Objectives of the Hessequa Local Municipality Integrated Development Plan (IDP), one of the key drivers is growth in coastal towns and this includes the growth in tourism. Tourism has shown substantial growth as the demand for prime coastal and inland resorts increases, as well as the opportunities created by eco-tourism, cultural tourism and adventure tourism. Tourism-based activities can make use of the Gouritz estuary and surrounding areas.

The Hessequa Local Municipality also has an environmental education and training strategy that centres on the need for awareness regarding policy and legal requirements and the role that education and training play in core local government functions. Environmental education and training can contribute to poverty reduction, economic development and job creation the sustainable use of the estuary should also be included in this strategy.

There are various other initiatives and organisations that have a vested interested in the Gouritz River estuary and surrounding areas and can provide a potentially mutually beneficial synergy for the sustainable development of the area.

3.8 Restoration/rehabilitation

Thirty-nine temperate estuaries, including the Gouritz have been given a HIGH priority status for rehabilitation. Requirements for rehabilitation on the Gouritz River estuary are water quantity and the clearing of alien vegetation.

3.9 The way forward: drafting the Estuarine Management Plan

This final section of the report provides a summary of what is to be accomplished in Phase II of the project, namely the formulation of the EMP. It provides details of what is required in terms of forming a local management institution which will be responsible for the implementation and long-term running of the EMP.

A description of the tasks to be undertaken during Phase II is provided. Essentially these tasks fulfil the requirements for formulating an EMP in accordance with framework for estuarine management in South Africa. These include the setting of a Vision, Management Objectives, preparing a Spatial Zonation Plan, identifying management actions, proposing an institutional structure and time-table for implementation, developing an integrated monitoring programme.

4 VISION & OBJECTIVES

The Situation Assessment Report provided a sound basis from which to set a realistic and achievable Vision, as well as key and detailed Management Objectives for the Gouritz River estuary. It also ensured that, at the time of the stakeholder workshop, expectations were aligned with the opportunities and constraints of the ecological and socio-economic environments prevailing at the time. The objectives are listed in priority order to guide subsequent management decisions and the detailed management objectives form the foundation for quantitative, operational specifications.

4.1 Vision

The Vision should be inspirational, representing a higher-level statement of strategic intent, and should take into account the overall Vision set for estuaries within the greater CFR.

The Vision for estuaries of the 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."***

The Vision for the Gouritz River estuary is as follows:

> ***"The Gouritz River estuary will continue to support ecological functioning and provide goods and services to all in a sustainable manner thereby ensuring the long-term survival of the system, its living resources and the physical, psychological and spiritual well-being of all its user groups."***

4.2 Key Objectives

The key or overarching management objectives are generally qualitative statements of the values defined in the Vision and should be statements of outcomes rather than means of achievement. The following sectors need to be specifically addressed in terms of the key objectives:

Figure 3: Objectives for the Gouritz Estuarine Management Plan

The overarching or key management objectives for the sectors/categories mentioned above are as follows:

4.2.1 Water Quantity & Quality

The Ecological Reserve requirements and Resource Quality Objectives (RQOs) are determined and implemented to ensure that all ecological processes are sustained.

4.2.2 Living Resources & Conservation

A sustainable balance between the conservation, protection and exploitation of living resources is achieved.

4.2.3 Land Use & Infrastructure

Development and associated activities within the designated estuarine area is controlled via legislation thereby ensuring the maintenance of estuarine ecosystem functioning and services.

4.2.4 Institutional & Management Structures

The Gouritz River estuary is managed cooperatively and effectively by relevant spheres of government and civil society.

4.2.5 Sustainable Livelihoods & Tourism

Existing activities are managed and additional opportunities promoted in a way that ensures compliance with legislation and the maintenance of ecosystem functioning and services.

The tourism potential of the Gouritz River estuary is exploited in a responsible manner so as to benefit all users while ensuring the maintenance of ecosystem functioning and services.

4.2.6 Education & Awareness

Public awareness and appreciation of the value of estuaries is created, which leads to a sense of ownership, and better understanding of the legal context and obligations with respect to estuarine management, and the need for integrated, informed and cooperative management that will ensure the maintenance of estuarine ecosystem functioning and services.

5 DETAILED MANAGEMENT OBJECTIVES

The vision and overarching or key objectives may be achievable through various management approaches and these should be investigated and evaluated so as to optimally utilize financial and human resources that are detailed in the management action plans. The following detailed management objectives are available for achieving the key objectives for the various sectors /categories detailed in Section 5 (specific reference to relevant sections of legislation may be found in Table 3 - Table 11):

5.1 Water Quantity & Quality

- Enforce existing legislation in terms of the National Water Act (Act 36 of 1998)(NWA) with respect to water use (Chapter 4, Parts 1 to 6), catchment management (Chapter 2, Part 2) and water quality (Chapter 3, Part 4)[1] [2]

[1] The National Water Resource Strategy (NWRS; NWA Chapter 2, Part 1) provides a framework for the protection, use, development, conservation, management and control of water resources for the country as a whole and within defined water management areas such as specific catchments. This strategy is given effect by a water management institution such as a Catchment Management Agency (CMA) or Water User Association (WUA).

[2] A Catchment Management Strategy (CMS) developed by the CMA in accordance with the NWA (Chapter 2, Part 2) for the protection, use, development, conservation, management and control of water resources within its water management area. Specifically this will include the classification of the water resource and development of RQOs; NWA Chapter 3, Parts 1 & 2) aligned with that particular classification.

5.2 Living Resources & Conservation

- Investigate proclamation of Sanctuary Areas in terms of the National Environmental Management: Protected Areas Act (Act 57 of 2003)(NEM:PAA) that incorporate a variety of habitats (e.g. wetland, saltmarsh, sandbanks, mudbanks, open channel and surf zone adjacent to the estuary mouth) and species and which would be closed to most forms of human disturbance. In the case of the Gouritz River estuary, the zone above the bridge will afford protection to the open channel, sandbanks with sandprawn populations and juveniles of estuarine dependent fish such as dusky kob, spotted grunter, leervis and white steenbras.
- Apply local by-laws in conservation areas to protect habitats or resources, e.g. rotated bait collection areas that allow for recovery and which allow for changes in intertidal characteristics due to flooding, mouth closure or low water levels; restriction of bait collection to daylight hours to avoid trampling of substrate at night when larval release and post-larval settlement are at a peak; restrict number of boats according to carrying capacity within designated zones; and a moratorium on fishing competitions.
- Increase capacity of law enforcement officers, particularly in terms of MLRA, National Environmental Management Act (Act 107 of 1998)(NEMA) and ICMA.
- Enforce existing legislation that pertains to activities that impact on estuary ecosystems and their functioning, e.g. NEMA and the Environmental Impact Assessment (EIA) Regulations; ICMA; and the Conservation of Agricultural Resources Act (Act 43 of 1983)(CARA).
- Enforce existing legislation in terms of the MLRA; this includes quotas, closed seasons, size limits and collection methods for both fish and invertebrate species.
- If fishing competitions are allowed, these should be managed on a measure and release basis; no weighing of fish prior to release to reduce stress and damage.
- Protect and rehabilitate sensitive riparian areas by restricting access by boats, vehicles, people and cattle to reduce impacts and erosion; this should include all wetland or saltmarsh areas and a buffer zone of 10 m along the banks.
- Develop an Estuarine Zonation Plan (EZP) that denotes certain activities within certain zones, e.g. sanctuary area, fishing & bait collecting zone, jetties & slipways, water skiing & power boating and priority rehabilitation areas to control bank collapse and erosion.
- Consider alternatives to consumptive exploitation, e.g. low-impact, non-consumptive activities such as hiking, bird watching and canoeing.
- Retain the recreational and subsistence fisheries as the only forms of consumptive use; no commercial fisheries are to be considered for the Gouritz system.
- Remove alien vegetation within the catchment and estuarine area.

5.3 Land Use & Infrastructure

- Limit all forms of agricultural activity (cattle grazing and planting of crops) within a riparian buffer zone (100 m from high water mark) to protect sensitive habitats and prevent erosion. Develop best practice guidelines where appropriate.

- Implement an Estuarine Zonation Plan that regulates land use and development within the terrestrial portion of the designated estuarine area.
- Develop a climate change adaptation plan for Gouritz River estuary (in response to changes in freshwater flow, sea level rise, etc.).
- Enforce existing legislation that pertains to activities that impact on estuary ecosystems and their functioning, e.g. NEMA and the EIA Regulations; ICMA; and CARA.
- Ensure the SDF that is incorporated into the IDP specifically recognizes the Gouritz River estuarine area and regulates land-use in accordance with the recommendations of the EMP.
- Manage the road bridge in such a way as to prevent further bank erosion, siltation of the estuary and damage to the bridge during flood events.

5.4 Institutional & Management Structures

- Form a local estuarine forum, representative of all relevant spheres of government and civil society, to ensure the implementation of the EMP; this includes ensuring that relevant government departments fulfil their obligations (e.g. CapeNature, Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), DEA, DAFF and DWS – assisted by a CMA and WUA) and that the ideals of the EMP are captured within all relevant management and planning documents, e.g. SDF, IDP and a CMS that includes the setting of RQOs.

5.5 Sustainable Livelihoods (including Tourism)

- Ensure compliance of all existing activities with legislation and management plans that regulate against potential impacts on the estuarine area, its inhabitants and users.
- Promote the development of new initiatives that will benefit previously disadvantaged communities and that will comply with legislation and management plans that regulate against potential impacts on the estuarine area, its inhabitants and users.

5.6 Education & Awareness

- Facilitate educational workshops for local authorities, in particular town planners and municipal managers, about the value of estuaries (ecological, social and economic), the EMP and its context within the SDF and IDP, the ICMA, and the consequences of irresponsible development within the estuarine area.
- Facilitate training courses for estuarine managers, municipal authorities, estuarine advisory forum members, catchment management agencies and water user association members.

- Implement a public awareness campaign (estuary value/natural heritage, biodiversity, threats and conservation efforts) via pamphlets, notice boards, school tour groups and illustrated talks given by research scientists.
- Empower DAFF, DEA Oceans & Coasts Branch (DEA:O&C) and DEA&DP inspectors and municipal authorities (conservation officers; river control officer) through an education initiative involving relevant national and regional legislation, local by-laws, zoning of the estuary and general knowledge of fauna and flora within the estuarine area.
- Encourage research projects aimed at enhancing our existing knowledge and filling in knowledge gaps of the Gouritz system and thus the efficacy of the EMP through amended action plans and monitoring programmes.

6 SPATIAL ZONATION

Management objectives need to be translated into an Estuarine Zonation Plan (EZP) and applicable Operational Specifications. However, this is not applicable to all management objectives, as clearly the EZP cannot include the strategies for aspects of water quantity & quality, education & awareness programmes, institutional & management structures and sustainable livelihoods. As such, the EZP mainly reflects the objectives devised for living resources & conservation and land use & infrastructure.

6.1 Estuarine Zonation Plan

The EZP for the Gouritz River estuary is represented visually in Figure 4 - Figure 8 and comprises the following:

6.1.1 Estuarine boundaries

Historically, the C.A.P.E. Estuaries Programme considered the NWA definition of an estuary as the most appropriate. It read as follows; "*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*."

For the purposes of determining the Resource Directed Measures (RDM), DWS defines the geographical boundaries of an estuary as follows; "*the seaward boundary is the estuary mouth and the upper boundary the full extent of tidal influence or saline intrusion, whichever is furthest upstream, with the five meter above mean sea level (amsl) contour defined as the lateral boundaries*."

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

a) that is permanently or periodically open to the sea;
b) in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the body of surface water is open to the sea; or

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

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

The geographical boundaries of the Gouritz River estuary have also been defined within these parameters although the lateral boundary is proposed as the 1:100 year flood-line and not the 5 m amsl contour. This is because the full extent of the tidal influence extends as far as the Kranz about 10 km upstream from the road bridge, however this occurs infrequently and for the most part tidal waters extend only a few kilometers above the bridge; the exact position of this tidal and freshwater interface may vary depending on the tidal strength and the amount of freshwater inflow. It is therefore evident that the full extent of the EFZ is not considered in the current spatial zonation of the Gouritz River estuary (see below). **It is imperative that the subsequent version of the Gouritz EMP investigates and formalises the entire estuarine area, in alignment with the National Estuarine Management Protocol, and is amended accordingly.**

In addition, the default Coastal Protect Zone (CPZ) defined by the ICMA (Section 16) is 100 m for certain land-uses within urban areas and 1 000 m of the high water mark for all rural areas. However, the CPZ can be adjusted by the MEC. In the context of the Gouritz River estuary and all estuaries in the Western Cape, the CPZ is proposed as the 10 m topographical contour. Although the position of the Gouritz River mouth may be altered during episodic events, it is for the most part located to the east adjacent to the rocky headland. A line drawn between the east and west banks denotes the seaward extent; a lateral extension to the west and east of the mouth was not considered necessary.

6.1.2 Sanctuary & Conservation/Management zones

6.1.2.1 Sanctuary Zones

A single sanctuary area is proposed that extends from the Road Bridge upstream for several kilometers. This area will need to be proclaimed as a Protected Environment in terms of Chapter 3, Section 28 of the NEM:PAA. The management of this area will need to be assigned to a suitable institution or organ of state and will need to be managed in accordance with the requirements as laid down in Chapter 4 of the above Act.

The proposed area will afford protection to juveniles of estuarine dependent fish species and as a by-product, will also provide protection for a percentage of the sandprawn population inhabiting the sandbanks in the area.

6.1.2.2 Conservation/ Management Zones

The remaining zones or sections of the estuary water body, its associated habitats, and the riparian buffer area to a distance of 100 m back from amsl have been proposed as

conservation/management zones which need to be recognised by the RMA or local authority and administered either by them or a designated institution. Activities within these zones may be controlled either via local by-laws or in certain instances by national legislation, which includes but is not limited to the remaining portions of the Seashore Act assigned to the Western Cape Province, NEMA and the associated EIA regulations, CARA and ICMA. The 1:100 year flood line, which is used as a guideline to limit activities by Western Cape authorities and DWS will also need to be considered.

Activities that would need to be controlled or restricted to specific areas include fishing, bait collecting (to avoid trampling of mudbanks and vegetation), building of jetties and slipways, ploughing and planting of agricultural land, bird watching, power boating (speed), construction of permanent structures and access to the water's edge for people (and vehicles) and cattle.

6.1.2.3 Important bio-physical features

The EZP demarcates features such as major habitat types, the location of sandprawn and mudprawn beds, aquatic macrophytes, sandbanks, saltmarshes and wetlands.

6.1.2.4 Rehabilitation zones

Rehabilitation, primarily in the form of alien vegetation removal, bank stabilization and rehabilitation of degraded saltmarsh areas will need to be addressed. However, although the removal of alien vegetation within the riparian estuarine area is seen as a priority this must not be done to the detriment of bank stability. Many sections of the estuary bank from the middle reaches to beyond the extent of tidal influence show signs of severe erosion and collapse. While flood waters are partly responsible for this, the situation has been exacerbated through the removal of stabilizing vegetation, poorly designed structures that alter flow (Road Bridge), and the movement of people, vehicles (on agricultural land) and cattle along the top section of the bank close to the water's edge. It is not feasible to rehabilitate the entire estuary on both sides and priority areas must be identified. Potential sites have been indicated and include the area at the Road Bridge and sections of the middle reaches where misguided attempts have already been made. Rehabilitation of the saltmarsh on both sides of the slipway is already well underway and is considered to be successful. Similar strategies need to be put in place on the east bank where farming-related activities have severely degraded the saltmarsh-dominated floodplain.

6.1.2.5 Land-use and planning provisions

Current land-use patterns and zoning within the designated estuarine functional area are illustrated and are comprised, almost exclusively, of agricultural land on both sides of the system. A variety of high-intensity, irrigation dependant farming activities take place here and throughout the entire catchment. On the west bank, the town of Gouritsmond is located in the lower reaches and several privately-owned properties extend along the middle reaches towards the road bridge. A buffer zone, comprising public open space to the north and north-east of Gouritsmond, has prevented further development in this area. Gouritsmond is classified as a third order Regional node in the Hessequa SDF and ranked

only 97th out of 131 Western Cape towns in terms of growth potential at the time this situational assessment was originally drafted. No plans for significant expansion exist. There are currently no large-scale developments on the eastern side of the estuary and the resorts of Kanon, Fransmanshoek and Vleesbaai are located outside of the area of concern. Several large-scale residential developments adjacent to the estuary have been proposed in the past but these have been successfully opposed by the Gourits River Conservation Trust and the Municipality. The threat however still exists for large-scale development projects and this must be monitored carefully.

The 5 m contour amsl boundary, the 1000 m CPZ referred to in Chapter 2 (Section 16) of the ICMA and the 1:100 year flood line are seen as excessive in terms of a no-go area particularly with such a vast low-lying floodplain adjacent to the Gouritz on the east in the lower and middle reaches. This area between the 100 m management line and the 1:100 year flood line is potentially an area where activities should be permitted in accordance with land-use and environmental legislation.

A process is underway to delineate a formal CPZ and Coastal Management Line (CML) for the Eden District. This process aims to identify appropriate management lines in order to limit development in sensitive coastal areas. The various lines (including 1:100 year flood line that is yet to be defined for the Gouritz), must be taken into consideration when any applications for developments/activities are subject to the EIA process.

6.1.2.6 Infrastructure

All existing infrastructure in the form of towns, roads, public access points and parking areas, bridges, jetties, slipways, boat-houses, irrigation pipelines, sewage disposal units and solid waste dumpsites are illustrated on the EZP.

6.1.2.7 Recreational activities

All recreational activities such as fishing & bait collecting, swimming, power boating, wind surfing/kite boarding, canoeing and bird watching are currently not restricted within the Gouritz River estuary and may take place anywhere along its course. Water skiing is however restricted to an area between the slipway and just short of Witkopklip. For reasons of safety, a 20 m radius no-go area for people has been proposed around the slipway and a designated swimming area close to the mouth has been recommended. Under the new proposed zoning, fishing and bait collection will no longer be allowed within the sanctuary area.

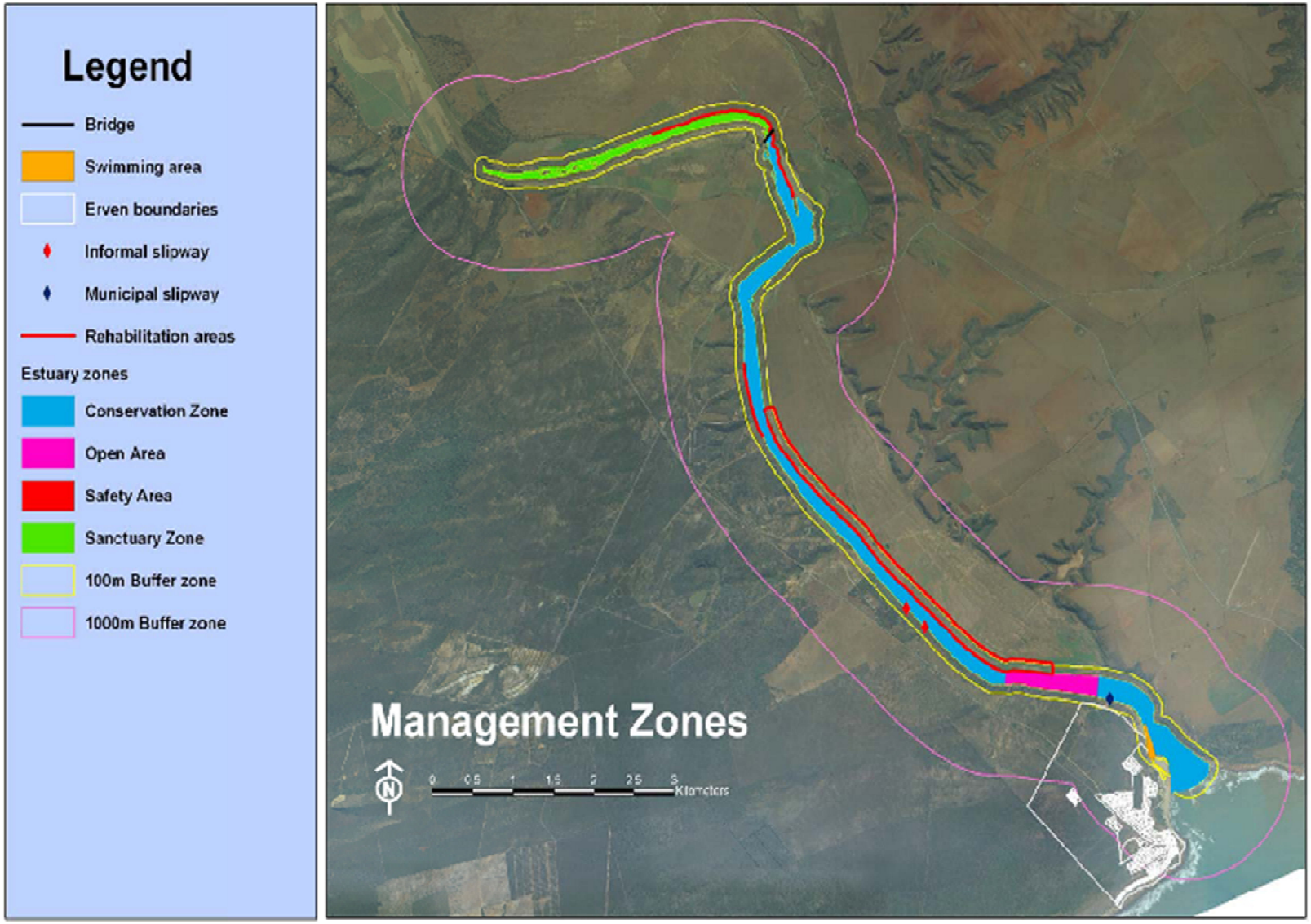
Legend
Bridge
Swimming area
Erven boundaries
Informal slipway
Municipal slipway
Rehabilitation areas
Estuary zones
Conservation Zone
Open Area
Safety Area
Sanctuary Zone
100m Buffer zone
1000m Buffer zone
Management Zones
N
0 0.5 1 1.5 2 2.5 3
Kilometers

Figure 4: The intended spatial zonation of the Gouritz River estuary showing the proposed sanctuary area, conservation / management areas, priority rehabilitation areas, a 100 m riparian buffer zone, a 1000 m default CPZ zone, skiing area (open area), swimming area and Gouritsmond urban boundary.


Legend
Swimming area
Erven boundaries
Estuary zones
Conservation Zone
Open Area
20m Safety Area
100m Buffer zone
Management Zones
N
0 01 02 03 04 05 06 07 08
Kilometers

Figure 5: Close-up of the lower reaches showing the proposed 20 m safety area at the slipway and the swimming area near the mouth. The urban boundary and 100 m buffer zone is also indicated.

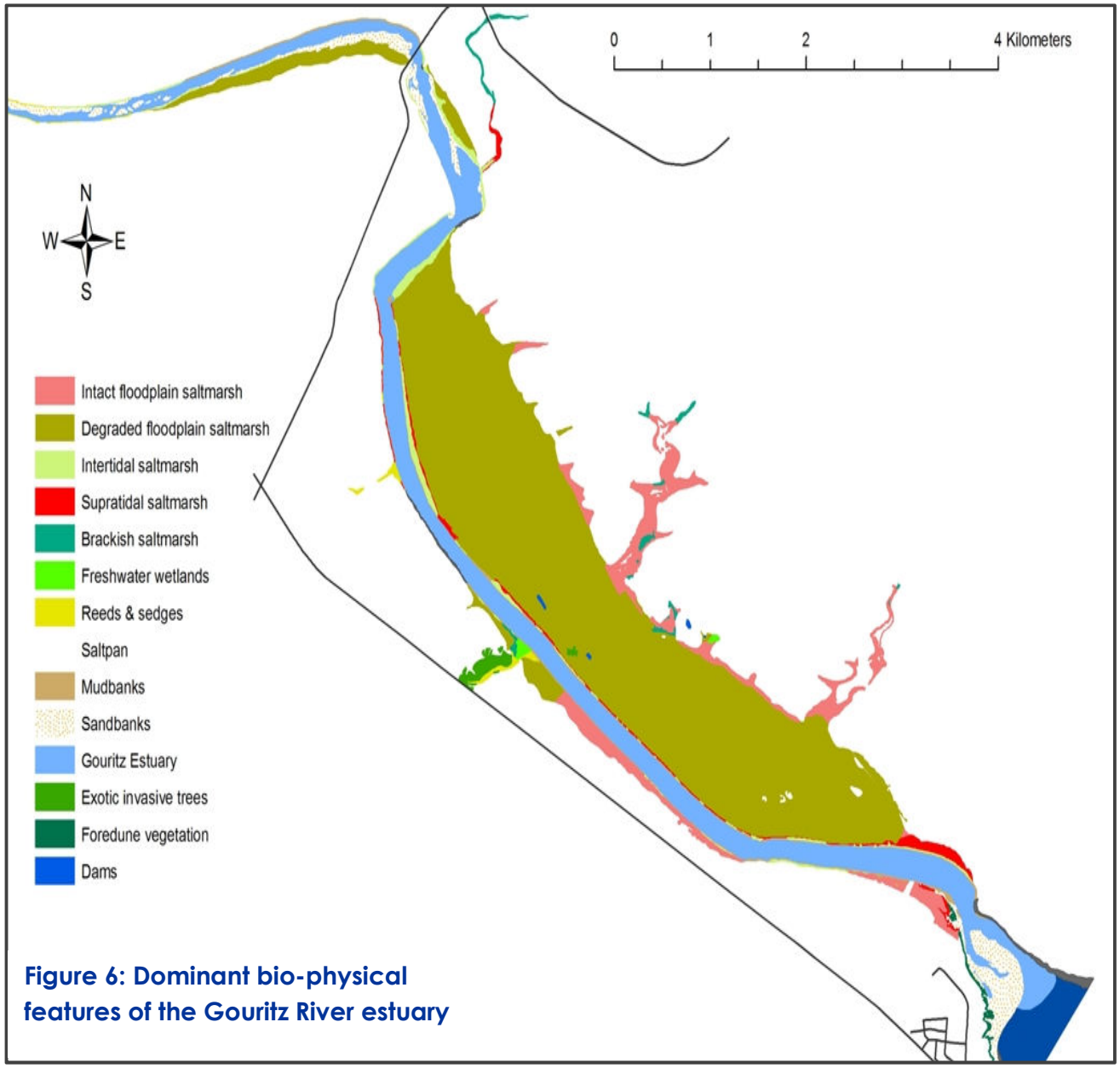

Figure 6: Dominant bio-physical features of the Gouritz River estuary

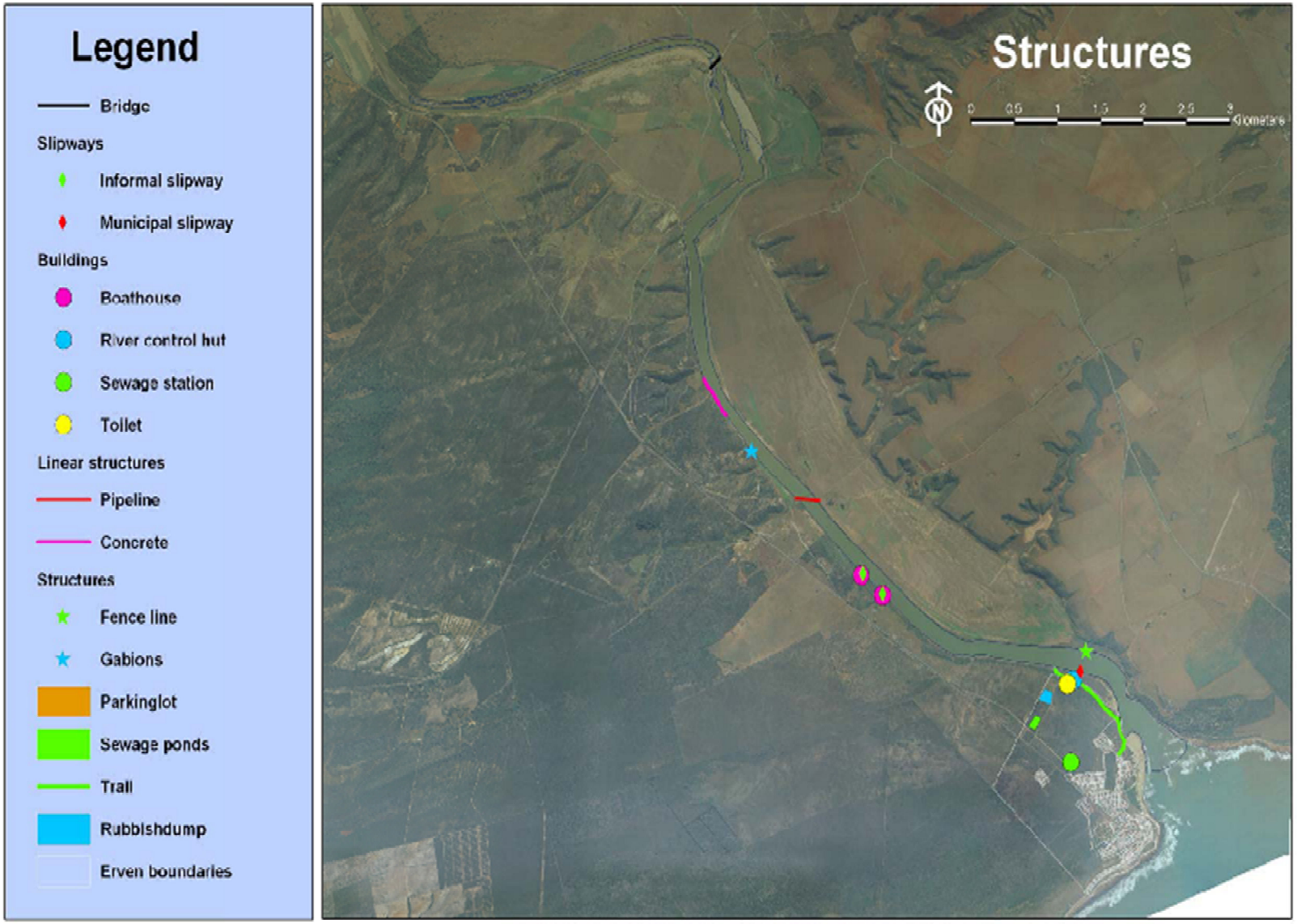
Legend
Bridge
Slipways
Informal slipway
Municipal slipway
Buildings
Boathouse
River control hut
Sewage station
Toilet
Linear structures
Pipeline
Concrete
Structures
Fence line
Gabions
Parkinglot
Sewage ponds
Trail
Rubbishdump
Erven boundaries
Structures
N
0 0.5 1 1.5 2 2.5 3
Kilometers

Figure 7: Infrastructure associated with the Gouritz River estuary

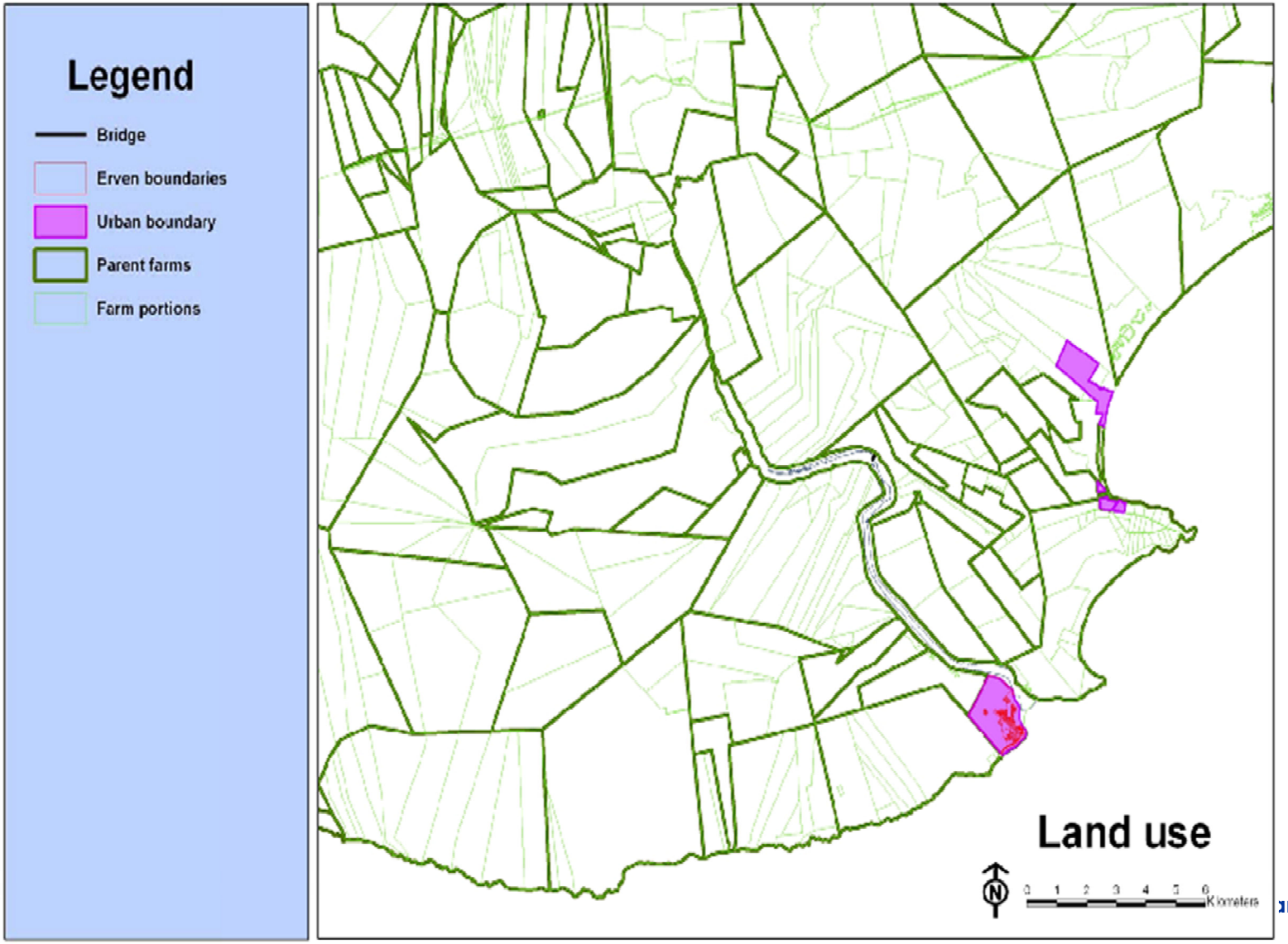
Legend
Bridge
Erven boundaries
Urban boundary
Parent farms
Farm portions
Land use
0 1 2 3 4 5 6
Kilometers

Figure 8: Land-use along the Gouritz River estuary. The dominance of agricultural land is clearly evident

6.2 Operational Specifications

The Operational Specifications detail quantitative, measurable standards, target values, limits, or thresholds of potential concern[3] (TPCs) for indicators relevant to the different zones and activities as per the EZP. These need to take into account any existing standards, regulations, operational policies or guidelines that have relevance to estuaries, as well as available resources.

6.2.1 Water quantity & quality

The National Water Resource Strategy (NWRS), which provides for the development of a catchment management strategy by a CMA or WUA, will ensure both the classification of the water resource (Gouritz system) and the required RQOs. The RQOs for a catchment and its associated riverine and estuarine systems relate to the following aspects:

- the water quantity of freshwater inflow into the estuary (ecological reserve); and
- the water quality of freshwater inflow at the head of the estuary and water quality within the estuary.

The Intermediate Ecological Reserve Assessment for the Gouritz River estuary classified the various components as follows:

- PES – Category C/D[4];
- Ecological Importance and Sensitivity (EIS) – Important; and
- Recommended Ecological Category (REC) – Category A as a desired protected area (Category A is unattainable due to high water demand in the catchment) or at least a Best Attainable State.

The following RQOs and associated Thresholds of Potential Concern (TPCs) were identified as representative of a Category B for the Gouritz Estuary.

Table 1: RQOs and TPCs for Water Quantity and Quality and related aspects

COMPONENT	RESOURCE QUALITY OBJECTIVES (RQOs)	THRESHOLD OF POTENTIAL CONCERN (TPCs)
Hydrology	Maintain flow regime as per recommended ecological flow	River inflow: • < 0.5 m^3/s for more than one month a year • < 5.0 m3/s for more than six months a year
Hydro-dynamics	Maintain connectivity with marine environment	• Average tidal amplitude < 30% of present observed data from the water level

[3] TPCs are defined as measurable end-points related to specific indicators that, if reached, prompt management intervention. In essence, TPC end-points should be defined in such a way that they provide early warning signals of potential non-compliance with operational specifications (Taljaard & Van Niekerk 2007a). Relevant indicators and recommended TPCs for many of the operational specifications detailed below have been taken from McGwynne & Adams (2004).

[4] Category C/D indicates a system that is between C (moderately modified) and D (largely modified); large loss of natural habitat, biota, and ecosystem functions and processes have occurred.

COMPONENT	RESOURCE QUALITY OBJECTIVES (RQOs)	THRESHOLD OF POTENTIAL CONCERN (TPCs)
		recorder in the estuary near the mouth during low flows (summer)
Sediment Dynamics	• Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) for biota • No significant changes in sediment grain size and organic matter distribution patterns for biota • No significant change in average sediment composition and characteristics • No significant change in average bathymetry	• Average sediment composition in any survey (% fractions) along estuary change from that of the Present State (2014 baseline, to be measured) by 30% • Average organic fraction in sediment along length of estuary > 5% • Average bathymetry along main channel in the estuary change by 30% in any survey from that of the Present State (2015 baseline, to be measured) (system expected to significantly fluctuate in terms of bathymetry between flood)
Water Quality	Salinity distribution not to cause exceedence of TPCs for biota (see below)	• Salinity > 0 at head of estuary • Average salinity in Site 11, 1 km upstream of bridge > 5 • Average salinity in Zone C > 20 • Average salinity 11 km upstream from mouth > 20 more than three months of the year • Salinity > 40 in saltmarsh sediments (linked to decrease in moisture and drying of floodplain habitat).
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedence of TPCs for biota (see below)	River inflow: • 7.0 < pH > 8.3 • DO < 5 mg/ℓ • Suspended solids > 5 mg/ℓ (low flow) Estuary: • Average turbidity > 10 NTU (low, calm condition flow, wind mixing can increase turbidity to 20-40 NTU) • Average 7.0 < pH > 8.5 (increasing with increase in salinity) • Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO3-N, NH3-N and PO4-P) not to cause exceedance of TPCs for macrophytes and microalgae (see below)	River inflow: • NOx-N > 100 µg/ℓ over two consecutive months • NH3-N > 20 µg/ℓ over two consecutive months • PO4-P > 20 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): • Average NOx-N > 100 µg/ℓ single concentration > 150 µg/ℓ • Average NH3-N > 20 µg/ℓ during survey, single concentration > 100 µg/ℓ • Average PO4-P > 20 µg/ℓ during survey, single concentration > 50 µg/ℓ
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedence of TPCs for biota (see	River inflow: • Trace metals (to be confirmed) • Pesticides/herbicides (to be confirmed)

COMPONENT	RESOURCE QUALITY OBJECTIVES (RQOs)	THRESHOLD OF POTENTIAL CONCERN (TPCs)
	below)	Estuary: • Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) • Concentrations in sediment exceed target values as per Western Indian Ocean (WIO) Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

6.2.2 Conservation

Operational specifications for conservation purposes should be targeted at protecting biodiversity within the Gouritz River estuary by ensuring that the diversity, distribution and abundance of plant, bird, fish and benthic invertebrate communities is maintained or restored. These objectives can be defined in terms of TPCs for a range of indicators that firstly reflect aspects of biodiversity itself, secondly are aimed at controlling human activities that may impact on habitats and living resources and thirdly deal with enforcement issues.

6.2.2.1 Biodiversity

- Presence and extent of plant communities, including submerged macrophytes, microalgae, saltmarshes and emergent reeds.
  The recommended TPC is a > 20% change in area covered by each salt marsh, reeds and sedges. This will include an increase in bare areas in the salt marsh (linked to decrease in moisture and increase in salinity drying of floodplain habitat), unvegetated, cleared areas along the banks caused by human disturbance and the loss and die-back of reeds fringing the estuary in the upper reaches (Zone D) (linked to salinity > 20 for three months). Baseline data on coverage can be obtained from aerial photographs or reference photographs from elevated vantage points along the estuary. The TPCs for microalgae are median phytoplankton chlorophyll-a and intertidal benthic chlorophyll-a concentrations > 3.5 µg/ℓ and > 42 mg/m^2, respectively.
- Infestation of riparian areas by alien vegetation.
  The TPC is > 5% of total floodplain area covered by invasive plants (e.g. *Eucalyptus*, prickly pear, *Tamarix*).
- Extent of natural area remaining per habitat type and the degree of habitat fragmentation.
  A loss of any habitat type of more than 10% is the recommended TPC. Baseline and reference data can be obtained from aerial photographs and on-site line transects.
- Densities of intertidal invertebrate species such as mudprawn and sandprawn.
  The TPC for mudprawns is that density should not deviate from average baseline levels (as determined in the eight visits undertaken quarterly in the first two years) by more than 25% in each season. In addition, the dominant species in the zone

(zooplankton and benthos) should not deviate from average baseline levels (as determined in the eight visits undertaken quarterly in the first two years) by more 40% in each season. Baseline data can be obtained from regular seasonal counts of burrows using random quadrats over an initial two-year period.

- Waterbird counts that include red-data species, those that are highly or partially dependent on estuaries, breeding aggregations or activity and the presence of nests.

  The TPC for birds other than gulls, terns and regionally increasing species is when numbers fall below 120 for three consecutive summer counts. The TPC for waterbird species richness is when the number of species drops below 20 for 3 consecutive summer counts. Since rare or specialized birds are usually the first to be affected by change, the TPC for species richness should be the loss of one or two species over a short period of time. Baseline data should be collected from twice yearly bird counts over a spring low tide and outside of peak disturbance periods. The Animal Demography Unit's (ADU; based at the University of Cape Town) Coordinated Waterbird Counts (CWAC) have compiled data for the Gouritz since 2000 from the mouth region to the low-water bridge (Site Code – 34212153), and can also be used.
- Fish abundance as measured by catch-per-unit-effort (cpue).

  This indicator and its associated TPC is also relevant to the operational specifications for exploitation of living resources. It is recommended that a decrease of >10% from baseline values for dusky kob and white steenbras. In respect to the proportions of fish communities, the following TPCs apply:
  - Estuarine residents < 50% or > 80% (represented only by *G. aestuaria*)
  - Marine and estuarine breeders < 10%
  - Obligate estuarine-dependent < 10% (exploited species in very low numbers or absent)
  - Estuarine associated species < 5%
  - Marine opportunists < 20%
  - Marine vagrants > 5%
  - Indigenous fish < 1%
  - Catadromous species < 1%
  - REI species represented only by *G. aestuaria, Myxus capensis* absent

  Baseline data can be collected from a dedicated fisheries survey of the estuary over a minimum of two years.
- Location and proportion of estuary habitat type under formal protection (sanctuary area).

  TPCs and baseline data for this objective are not available but the recommendation from Turpie & Clark (2007) is that half the system be formally protected. This is unrealistic given the user dynamics and land-use of the Gouritz River estuary, but the proposed sanctuary area covers a total of 299 041 m^2 and comprises the water body and extensive sand banks. The remaining water body areas total 1 755 958 m^2 which means 17.03% of the estuary will be under protection. There are no mudbanks in the proposed sanctuary area but this habitat type is not considered to be under threat. Saltmarshes in the lower and middle reaches will be afforded protection through by-laws limiting access and promoting

rehabilitation. A preliminary TPC would be any decrease in the total sanctuary area taking into account the level of habitat protection in other estuaries.

6.2.2.2 *Human Activities*

- Number of persons visiting the estuary and their activity, i.e. carrying capacity.
  The physical, social (includes cultural and psychological aspects) and ecological carrying capacities (together grouped as recreational carrying capacity) have not been calculated for the Gouritz and a comprehensive study is required to determine these values; once calculated the TPCs for each would be any value in excess of that capacity. Baseline data can be collected during a survey that records the different types of activities and the respective number of participants on the water and on the bank and the number of registered and unregistered boats on the water. Carrying capacity for boats can be calculated according to a DWS model (see State of Play Report; may also be regulated by estuary stakeholders in line with the estuary Vision).
- Bait collecting, including number of collectors, collecting methods, rate of removal, number of licensed operators and adherence to bag limits.
  The TPC for any bait organism is a 30% reduction in population size due to collecting activities, which include legal methods (pumps are not recommended for mudprawn as they cause too much damage to the consolidated sediment), digging and trampling of habitats. The TPC for licensed operators or compliance should be very high, i.e. a single person operating outside the law should be cause for concern. Baseline data can be collected as part of a more detailed fishery survey and should include numbers of collectors, collecting sites, methods used, number of bait organisms taken and bait collecting licenses. This aspect is also dealt with under operational specifications for living resource exploitation.
- Number of fishing competitions.
  There is no defined TPC for this indicator as a reduction in fish and bait organism populations may not be as a result of fishing competitions alone. However, given the national status of many target fish species, a TPC should be any increase above the baseline in the number of competitions or else the number of participants. Baseline data can be collected over a period of a year where the number of competitions and participants are recorded. This particular operational objective may prove unnecessary however as competitions have not been held on the estuary for a number of years. A Hessequa municipal by-law prohibits people from holding or arranging any fishing competition without permission from the Municipality and the Gourits River Conservation Trust.
- Litter (solid waste) accumulation.
  Each estuary is different and the sources of litter vary considerably. Sources on the Gouritz are both residents (riparian landowners and Gouritsmond) and day-visitors. It is also acknowledged that litter may be blown into the system from distant sources or even the dumpsite located on the outskirts of the town. There should be a zero tolerance for litter, so the TPC should be any visible increase in the volume of solid waste in or adjacent to the estuary when compared to baseline data. Baseline data can be collected for the first year and should be measured as

volume collected in standard garbage bags after certain activities or times, e.g. peak holidays.

6.2.2.3 *Law Enforcement*

- Number of law enforcement officers assigned to an estuary, the frequency of patrols and number of offences, arrests and convictions in terms of the MLRA.
  Effective patrolling and adequate numbers of enforcement officers should act as a deterrent to illegal activities and promote compliance. Competent enforcement should also ensure a high conviction rate for offenders.
  The TPCs for this objective should therefore be the incidence of offenders, with a designated number per month or per patrol being set as the threshold and the rate of convictions in relation to arrests made. The aim would be to reduce the number of offenders to zero such that the TPC would be a single offender at any given time and to achieve a higher conviction rate than that which exists at present. Baseline data would be in the form of existing arrest and conviction rates, frequency of patrols, type of offences (e.g. bag limits, size limits, licenses) and the number of offenders. This aspect is also dealt with under operational specifications for living resource exploitation.
- Enforcement and monitoring of conditions in terms of Environmental Authorisations (EA) for developments as the result of the EIA process.
  Due to the sensitive nature of estuarine systems, all development will have some degree of a negative impact (direct and indirect) on their functioning, irrespective of intentions. The TPC for this objective must be very high and even a single offence must be seen as unacceptable. Baseline data is set out in the form of recommendations as a part of the conditions of the EA; these recommendations must be complied with and enforced by independent environmental site officers in order to reduce impacts.

6.2.3 Exploitation of living resources

Operational specifications for the exploitation of living resources should be targeted at enforcing a sanctuary area which is designed to protect a variety of habitats and species, local by-laws to protect habitat or resources, existing legislation detailed in the MLRA, and the regulation of fishing competitions.

6.2.3.1 *Sanctuary Area*

- All exploitation of living resources is prohibited in the sanctuary area.
  The TPC for compliance to this regulation should be very high, i.e. a single person operating outside the law should be cause for concern.

6.2.3.2 *Exploitation of bait organisms*

- All individuals exploiting bait organisms in the estuary must adhere to regulations stipulated in the MLRA (bag limits, collection methods & licenses) and any estuary specific by-laws within the conservation areas.
  The TPC for compliance should be very high, i.e. a single person operating outside the law should be cause for concern, while the TPC for populations of bait organisms should be a 30% reduction in baseline values (see also biodiversity and

human activities operational specifications above). The permissible method of collection must be strictly adhered to and enforced.

6.2.3.3 *Exploitation of fish*

- All fishermen must be in possession of valid licenses and adhere to all regulations specified in the MLRA.
  The TPC for compliance to these regulations should be very high, i.e. a single person operating outside the law should be cause for concern.
- Maintenance of fish abundance; measured by catch-per-unit-effort (*cpue*; see also biodiversity conservation above).
  It is recommended that a decrease of >10% from baseline values for dusky kob and white steenbras be adopted as the TPC. The TPC for other species varies according to the fish categories. See Biodiversity above.

6.2.3.4 *Fishing competitions*

- If competitions are authorized at any stage in the future, the competitive angling structures hosting the event must adhere to the specifications (number and format of competitions) determined by the RMA.
  There is no defined TPC for this indicator as fishing competitions alone are unlikely to be the direct cause of the reduction in fish populations on a national scale. However, the TPC for compliance to the MLRA and estuary specific regulations during competitions should be very high, i.e. a single person operating outside the law should be cause for concern, possibly resulting in a moratorium on all future events. There is no defined TPC for compliance to the rules of participation during fishing competitions and these would need to be determined through consultation between angling bodies and the Municipality.

6.2.4 Land-use & infrastructure

- Formalise the boundaries of the Gouritz River Estuary.
  The TPC for this objective is if this action is not undertaken. It is critically important that the boundaries of the estuarine functional zone are mapped and formalised as this estuarine area has specific reference not only in terms of estuarine management, according to the ICMA Protocol but also in terms of the NEMA EIA regulations. The boundaries must be formalised by incorporating the estuary, as delineated by the 5m topographical contour, into the district and municipal IDPs and SDFs, and any other planning and management tools.

- Nature and extent of land use and infrastructure associated with the estuary and catchment.
  The TPCs for this objective are not in the form of target values or quantitative, measurable standards but are instead broad statements of intent are detailed as follows:
    - Planning should allow for the maintenance of a riparian zone along the length of the estuary; the proposed width of this zone is 100 m or as identified by the Provincial CML process (ICMA Section 25) which will be inclusive of sensitive habitats such as supratidal saltmarshes;

- Preferably no additional development on the floodplain (below 1:100 year flood line) for safety reasons, and sense of place;
- Planning should take into account the risks and impacts associated with climate change (e.g. sea level rise, flood events, and erosion);
- Development and land use in the catchment and estuarine area should not lower water quality or interfere with normal hydrodynamic or sedimentary processes and cycles; the issue of the Road Bridge would be dealt with under this statement; and
- Development proposals should be evaluated through the EIA procedure and guided by the EMP specifically and the broader catchment management plan.

Baseline data would be in the form of town planning schemes or development frameworks (e.g. SDF and IDP) that would need to be compared to a visual display (map) of all activities and infrastructure within the defined estuarine area to ascertain compliance and conformity with the estuary Vision.

- Number of applications for new development and/or rezoning of land associated with the estuary.

  There is currently no quantitative value defining a TPC for this objective's indicator but any increase in the number of applications compared to the last five years should be cause for concern. It is recommended that all applications be subject to the EIA process and the local Estuarine Advisory Forum be registered as an Interested & Affected Party (I&AP) to have sight of processes and comment of the applications. Should applications receive a favourable EA, the development should be assessed by an independent environmental auditor approved by both the DEA&DP to ensure compliance. Any deviations from the EA conditions should be regarded as unacceptable. Baseline data in the form of development/rezoning applications can be obtained from the local municipality; ideally the number of applications should decrease, as the Vision of the estuary becomes a reality.
- Use of planning and management tools such as EMPs, SDFs, IDPs, Strategic Environmental Assessments (SEA), CMS and Integrated Environmental Management in the form of EIAs to guide planning and development.

  The TPC for this objective indicator would be if estuaries were not considered at all in planning and management documents. The functioning and value of the Gouritz River estuary needs to be reflected in any regional SEA that is conducted and must be represented in the SDF and IDP and should be a significant factor in any EIA assessment. All decisions regarding development and planning in the estuarine area need to be guided by these planning and management tools. Baseline data is available in the form of current SDF and IDP documents, this EMP and records showing the extent to which development and planning in the estuarine area have been guided by these tools in the past.

6.2.5 Institutional & management structures

- Establishment of a local Estuarine Advisory Forum (EAF) to engage government (at all levels) on planning and management issues. Ideally local EAFs should be established at all estuaries where human activities and development impact on the

system and should serve in an advisory capacity on issues threatening the integrity of the estuary.

The TPC for the Gouritz would clearly be the absence of such a local EAF. Any such forum needs to reflect the needs and aspirations of all stakeholders and should be based on democratic principles to represent all stakeholder groups including groups such as the Gouritz Initiative and local, regional and national government institutions where applicable.

- Establishment of a CMA, WUA and catchment forum to manage water resources and water related activities in the catchment. Essentially CMAs develop and implement strategies for water resource use according to the NWRS; this would include the EcoSpecs/RQOs needed to manage water quantity & quality aspects of the EMP. The WUA falls under the CMA and comprises a management committee whose role it is to effectively manage water resource activities on behalf of its members. The TPC for the Gouritz catchment would be the absence of any such institutions or bodies. Any such agency or association needs to reflect the needs and aspirations of all stakeholders and should be represented by all stakeholder groups including local, regional and national government institutions where applicable.
- Degree of interaction and cooperation between the management of estuaries and the management of catchments.

  The TPC for this objective would be if the local EAF and the CMA, WUA, catchment forum and Gouritz Initiative did not interact to ensure the management of the catchment and estuarine area as a single ecological entity. Once these institutions have been formed a record needs to be kept of the number and type of projects or initiatives that require cooperation; the more cooperative ventures there are, the more successful this objective will be.

6.2.6 Sustainable livelihoods (including tourism)

- Existing activities all comply with legislation, management plans and planning documents that regulate against potential impacts on the estuarine area, its inhabitants and users.

  The TPC should be a single activity that does not comply with legislation, management plans or planning documents. Baseline data would need to be acquired from a variety of sources including DEA&DP (for environmental authorisations for developments), local municipality (for land-use authorizations, conformity with the SDF and IDP, tourism ventures and infringements of estuarine by-laws), DWS (water quality) and DAFF (catch monitors and aspects pertaining to living resources). An audit of all activities and developments should be conducted by an independent assessor to determine compliance and the need for corrective measures.
- Encourage the initiation of non-consumptive activities (canoe trails, bird watching, hiking trails, tours of historical & cultural interest etc.) that involve previously disadvantaged communities (PDCs) and that comply with legislation, management plans and planning documents.

  The TPCs would be if no activities involving PDCs were initiated and if those that were initiated failed to comply with legislation, management plans or planning

documents. The local EAF would need to involve communities in combination with the municipality, civic based organizations and the tourism industry

6.2.7 Education & Awareness

- Educational workshops hosted by the RMA should be organized at least once a year in order to educate local authorities, in particular town planners, municipal managers and estuarine managers about the value of estuaries, the EMP and its context within planning strategies, the ICMA and the consequences of irresponsible development within the estuarine area.
  Potential TPCs would be no workshops, poor attendance at workshops and ongoing poor decision making with regards issues affecting estuaries. A simple questionnaire for local authorities would provide baseline data as to their current awareness level with regards estuarine management.
- An interactive public awareness campaign should be introduced and aimed at all user groups and age groups.
  The TPCs would be a continued lack of easily accessible information (sign boards, pamphlets), poor participation by school groups and a general poor level of understanding of estuaries by the general public. Baseline data should comprise the extent of visual aids within the estuarine area and any public interaction with the local EAF or estuary managers.
- Tertiary and research institutions as well as government departments (e.g. DWS and DEA&DP) need to be involved in research projects that will address specific management concerns, monitoring requirements and gaps in knowledge.
  The TPCs would either be a lack of research, a decrease in the number of research projects or the continued lack of data required to inform monitoring programmes. Baseline data should comprise the number of tertiary institutions involved in research, the areas of research and the aspects that need to be addressed through directed research. Monitoring must take RQO's into account and be done in accordance with RDM methods.

Table 2 overleaf provides a summary of the operational specifications described above.

Table 2: Summary of Operational Specifications

Water Quantity & Quality
WQ1: Implement Ecological Reserve and minimum flow requirements
WQ2: Reduce incidents of pollution and poor water quality
Biodiversity (Conservation)
B1: Maintenance of plant communities
B2: Control of alien vegetation
B3: Maintenance of invertebrate populations (mudprawn, sandprawn, and bloodworm)
B4: Maintenance of waterbird populations
B5: Maintenance of fish populations
B6: Maintenance of estuarine habitats

B7: Protect estuarine habitats in formally protected area.
Human Activities (Conservation)
HA1: Ensure carrying capacity of estuary is not exceeded
HA2: Control human activities that impact on invertebrate (bait organism) populations
HA3: Protect linefish and bait organism populations by restricting fishing competitions
HA4: Reduce the amount of solid waste within the estuarine area
Law Enforcement (Conservation)
LE1: Improve law enforcement capacity
LE2: Compliance with EAs issued as part of EIA process
Exploitation of Living Resources
E1: Ensure sanctity of sanctuary area through compliance monitoring
E2: Ensure maintenance of bait organism populations
E3: Maintenance of fish populations
E4: Restrict number of competitions and participants and maintain high level of compliance with MLRA regulation and competition specific rules
Land Use & Infrastructure
LU1: Formalise the estuarine functional zone
LU2: Maintenance of riparian zone
LU3: Restrict additional development on the floodplain or 100-year floodline
LU4: Minimise the risks of climate change
LU5: Maintenance of water quality and normal hydrodynamic & sedimentary cycles
LU6: Land-use & development proposals evaluated through EIA procedure and guided by EMP and CMP. Record number of applications for development or rezoning
Institutional & Management Structures
IMS1&2: Establishment of EAF and catchment institutions such as CMA, WUA and catchment forum
IMS3: Interaction between EAF and other institutional structures
Sustainable Livelihoods & Tourism
SL1: Ensure all existing activities and livelihoods dependant on the estuary comply with legislation and frameworks
SL2: Develop non-consumptive enterprises that involve the estuary and previously disadvantaged communities
Education & Awareness
EA1: Increase awareness of estuaries and their value amongst municipal workers and managers
EA2: Increased public awareness of estuaries and their value
EA3: Research projects initiated that fill knowledge gaps and provide information for monitoring programmes

7 MANAGEMENT PRIORITIES

A full range of management actions have been identified in order to facilitate the achievement of the operational specifications within the sectors of water quantity & quality, conservation, exploitation of living resources, land-use & infrastructure and social issues (management & institutional arrangements, sustainable livelihoods, and education & awareness).

Within each of these sectors, the following actions plans include:

- A prioritized list of management actions required;
- All related legal, policy and/or best practice requirements of relevance to specific management actions;
- Monitoring plans to measure effectiveness of actions. If TPCs are brought under control then management actions can be considered effective, however if they continue to be exceeded then changes need to be made to management actions, the EZP or operational specifications;
- A work plan identifying when each action should be initiated and by whom; and
- A resource plan detailing the human resources and the sources of funding or finances required to achieve these actions.

The action plans for water quantity and quality, conservation, living resources, land-use & infrastructure, management & institutional arrangements, sustainable livelihoods and education & awareness are detailed in Table 3- Table 11.

Table 3: Management Actions for Water Quantity and Quality

Management Actions	Legal Requirements	Monitoring Plans	Work Plan	Resource Plan
Operational Specification WQ1: Ecological Reserve and instream flow; TPC is < 71% of combined MAR enters the estuary, and <0.5m³/s for more than 1 month, <5.0m³/s for more than 6 months				
Ensure that the minimum flow requirement (specifically baseflow) for the estuary is restored in accordance with the RDM process and RQOs	NWA - Ch. 3 (Parts 1 and 2)	Flow station to be constructed at the head of the estuary and data monitored monthly. All water use activities and licenses in the catchment to be assessed for compliance with Reserve requirements. All future water use licenses and dam proposals to be considered in the context of the Reserve requirements.	DWS is responsible; should be initiated immediately due to drought conditions and development (demand) pressure.	**Human** - DWS: Resource Protection. **Financial** - DWS (Resource Protection).
In the event that the Ecological Reserve requirements are not being met, abstraction activities may be declared as streamflow reduction activities and temporarily controlled, limited or prohibited.	NWA – Chapter 4 (Section 36); Schedule 3 (Item 6).			
Eradicate/control invasive alien plant species from the Gouritz floodplain to increase base flow	NWA (Section 21); NEM: BA Chapter 5, Part 2); NEMA; CARA (Sections 6 & 8)	Ensure eradication of alien vegetation to levels below the TPC (aerial photographs and transects).	As soon as TPC is attained; DWS, DEA & DAFF responsible for alien eradication.	**Human** - DWS, DEA & DAFF personnel (or land owners). **Financial** - national government.
Operational Specification WQ2: Pollution and Poor Water Quality; TPC will varying according to pollutants and DWAF (now DWS) water quality guidelines				
Identify sources[5] of pollution within the estuary and broader catchment and take steps to remedy or mitigate.	NWA – Chapter 3 (Part4); NWA (Sections 19 & 21); ICMA (Chapter 8, Section 74), CARA (Sections 6, 8 & 12) DWAF Water Quality Guidelines (Recreational Use-marine); Municipal by-laws (Waste Management and	Regular water quality monitoring and at set stations along the length of the estuary (including point sources) and in the rivers above the head of each estuary; toxic substances (from agriculture) in sediment; recovery period (aerial & reference photographs).	As soon as TPC is attained. Eden DM is responsible for identification; Monitoring is ongoing and needs to be done monthly or if contamination is visible. DWS responsible for water & sediment quality; DEA&DP	**Human** - DWS: Water Quality / Pollution; DEA & DAFF Eden DM: Municipal Health & Environmental Services; forum members from conservation working group; research students. **Financial** - DWS to assist with start up funding, provincial government, supported by Eden DM, independent research funds
Design and implement a water quality monitoring programme for the Gouritz River estuary in line with RDM methods and				

[5] Sources may include WTW discharge contaminated runoff, storm water, agricultural return flows, fertilizers and pesticides from residential properties and estates), outboard engines and fuel spills.

Management Actions	Legal Requirements	Monitoring Plans	Work Plan	Resource Plan
taking RQOs into account.	Municipal Health).		responsible for ICMA; DAFF responsible for agricultural pollution; EAF or tertiary institutions.	

Table 4: Management Actions for Biodiversity (Conservation)

Management Actions	Legal Requirements	Monitoring Plans	Work Plan	Resource Plan
Operational Specification B1: Plant communities; TPC of 20% change in surface area of any plant community type is exceeded.				
Human disturbance - enforce by-laws and EZP to reduce trampling; enforce national legislation to prevent clearing of indigenous forests, riparian vegetation and damage to saltmarsh.	Municipal by-laws (for EZP); NEMA (Chapters 1 & 5; EIA Regulations); Seashore Act (SA) (Sections 3 & 10); National Forests Act (Act 84 of 1998) (NFA) (Chapter 3, Section 1); NEM: BA (Chapter 4, Part 1).	Compliance w.r.t. by-laws and national legislation; recovery period (aerial & reference photographs).	As soon as TPC is attained. Responsible agents are DWS, DEA&DP, DAFF and local authority; EAF or tertiary institutions.	**Human** - National & provincial government personnel; municipal departments; forum members from conservation working group; research students. **Financial** - national & provincial government; municipal; EAF, independent research funds.
Operational Specification B2: Alien vegetation infestation; TPC of >5% of floodplain infested by alien vegetation is exceeded.				
Initiate clearing of vegetation in affected areas.	NWA (Section 21); National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM: BA) Chapter 5, Part 2); NEMA; CARA (Sections 6 & 8)	Ensure eradication of alien vegetation to levels below the TPC (aerial photographs and transects).	As soon as TPC is attained; DWS, DEA & DAFF responsible for alien eradication.	**Human** - DWS, DEA & DAFF personnel (or land owners). **Financial** - national government.
Operational Specification B3: Invertebrate species; TPC is densities deviation > 25% for mudprawn and >40 for zooplankton and benthos from baseline counts.				
Human disturbance - enforce by-laws and EZP to reduce trampling; enforce national legislation to limit bait collection according to quotas and collection methods.	Municipal by-laws; MLRA (Chapter 3, Section 14); NEM: BA (Chapter 4, Part 1).	Compliance w.r.t. by-laws and national legislation; recovery period (quadrat counts).	As soon as TPC is attained. Responsible agents are DEA:O&C and local authority; EAF or tertiary institutions.	**Human** - national government personnel; municipal departments; forum members from conservation working group; research students. **Financial** - national government; municipal; EAF, independent research funds.

Operational Specification B4: Waterbirds partially or highly dependent on estuaries; TPC for waterbird species richness is <20 for three consecutive summer counts; numbers of birds other than gulls, terns and regionally increasing species <120 for three consecutive summer counts.				
Loss of habitat and food source due to human interference - enforce national legislation and municipal by-laws pertaining to EZP and human activities.	MLRA (Sections 14 & 43); NEM: Protected Areas Act (Chapter 4); NEM: BA (Chapter 4, Part 1); Sea Birds and Seals Protection Act (Act 46 of 1973; Section 3b); NEMA (Chapters 1 & 5; EIA Regulations); Municipal by-laws (pertaining to EZP); SDF/IDP	Compliance with national legislation, SDF/IDP and municipal by-laws; recovery of populations (bi-annual bird counts)	As soon as any of the TPCs are attained. Responsible authorities are DEA, DEA&DP CapeNature and municipal; EAF and tertiary institutions (e.g. UCT).	**Human** - Government personnel; forum members from conservation working group; research students or personnel from Coordinated Waterbird Counts (CWAC) at UCT. **Financial** - national government; municipal; independent research funds (CWAC).
Operational Specification B5: Fish abundance; TPC for dusky kob & white steenbras is >10% decrease from baseline values. TPCs vary for other fish categories.				
Address levels of fishing effort (including poaching and illegal gillnetting), bag limits and extent & location of sanctuary areas.	MLRA (Sections 14 & 43); NEM: BA (Chapter 4, Part 2); NEM: Protected Areas Act (Chapter 3, Section 28).	Compliance with legislation; levels of effort and cpue to be measured (catch monitors and fishery survey).	Continuous from implementation of EMP. DEA:O&C is responsible national authority; tertiary institutions to conduct fishery survey.	**Human** - DEA:O&C catch monitors; research students. **Financial** - national government; boat registration/launch and competition levies; independent research funds.
Operational Specification B6: Extent of habitat types and habitat loss; TPC is the loss of 10% or more of any habitat type.				
Remove invasive plants (see above) and agricultural levees from the floodplain to restore ecological processes and promote habitat restoration	Municipal by-laws pertaining to EZP; IDP; NEMA (Chapters 1 & 5; EIA Regulations); NEM: BA (Chapter 4, Part 1); NEM: Protected Areas Act (Chapter 3, Section 28; Chapter 4); MLRA (Section 43); CARA (Section 6); Seashore Act (sections 3 & 10); NFA (Chapter 3, sections 1& 2)	Compliance with legislation restricting activities below the coastal management line, the 1:100 flood line and/or EFZ; monitor applications for activities within the floodplain; monitor changes in landform using aerial photography and satellite imagery.	As soon as TPC is attained. Responsible agents are DWS, DAFF CapeNature, DEA&DP, DEA:O&C and local authority; EAF or tertiary institutions.	**Human** - National & provincial government personnel; municipal departments; forum members from conservation working group; farmland owners; research students. **Financial** - National & provincial government; EAF; municipal; independent research funds.

Human interference - ensure compliance with EZP and associated by-laws governing human activities and national legislation; consider additional sanctuary areas to protect habitats if degradation occurs.		Compliance w.r.t. by-laws, IDP and national legislation; recovery period and efficacy of sanctuary areas (aerial & reference photographs).		
Operational Specification B7: Extent and location of formally protected estuarine habitat; TPC is the decline in terms of surface area of sanctuary areas.				
Enforce legislation pertaining to protected areas; ensure compliance with EZP and other legislation pertaining to human activities.	NEM: Protected Areas Act (Chapter 3, Section 28; Chapter 4); NEM: BA (Chapter 4, Part 1); MLRA (Section 43); ICMA (Chapter 2, Sections 23 & 24); NEMA (Chapters 1 & 5; EIA Regulations); NFA (Chapter 3, Section 2)	Compliance with relevant legislation to ensure sanctity of protected areas (aerial photographs and active patrols)	Continuous from implementation of EMP. DEA, CapeNature and DEA&DP are responsible national authority; EAF can conduct visual surveys on a daily basis to monitor non-compliance.	**Human** – DEA, DEA&DP & CapeNature personnel; Forum members from conservation working group. **Financial** - National & provincial government; EAF; levies from boat registration or angling competitions.

Table 5: Management Actions for Human Activities (Conservation)

Management Actions	Legal Requirements	Monitoring Plans	Work Plan	Resource Plan
Operational Specification HA1: Carrying capacity (to be determined by EAF based on DWS models); TPC is when numbers exceed carrying capacity.				
Regulate number of boats launching or taking part in a specific activity (e.g. angling competitions).	Operational Policy for Recreational Water Use (DWS; August 2004)	Visual counts of boats on the water or at each launch site; counts of numbers of users engaged in recreational activities.	Number of users should be monitored all the time; restrictions come into play when carrying capacity is exceeded; Municipal river control officer at launch site, municipal estuarine managers and EAF are responsible.	**Human** – DEA&DP; Municipal estuarine managers, river control officer and EAF members. **Financial** - Municipal funds augmented by boat registration/launch levies.
Operational Specification HA2: Bait collecting; TPC is a 30% decrease in population size of any bait organism; and a single user that is non-compliant.				
Enforce MLRA regulations to ensure compliance.	MLRA (Section 14; Chapter 6)	Fishery survey to include collectors; random quadrats for population density; inspections of bait collectors catch.	Ongoing from time of EMP inception; responsible authority is DAFF and DEA:O&C (MPA) for compliance; tertiary institutions for fishery survey with help from EAF.	**Human** - DAFF catch monitors; research students, CapeNature and EAF members. **Financial** - National government; EAF; independent research funds; boat registration/launch levies.
Police sanctuary area in accordance with the EZP.	NEM: Protected Areas Act (Chapter 4); MLRA (Chapter 6); Municipal by-laws pertaining to EZP.			
Consider additional sanctuary areas or control collection activities (e.g. method employed, daytime only or rotate sites).	NEM: Protected Areas Act (Chapter 3, Section 28); NEM: BA (Chapter 4, Part 1); MLRA (Section 43); Municipal by-laws pertaining to EZP.			
Operational Specification HA3: Number of fishing competitions and participants; TPC is an increase from current number of competitions and participants.				
Regulate number of fishing competitions and participants.	Municipal by-laws (regulating recreational activities on estuary); policies of EAF and angling clubs.	Monitor number of competitions and count number of participants.	Use records from last year to set standard; municipal nature conservation, EAF and river control officer.	**Human** - Municipal nature conservation; river control officer and EAF members. **Financial** - Municipal; boat registration & launch levies; competition levy.

Operational Specification HA4: Waste accumulation; TPC is an increase in volume from baseline values.				
Initiate clean-up operations on a regular basis; draft by-laws to prevent offal disposal; monitor solid waste dump site; all boats to return to launch site with litter in plastic bags; and consider implementing punitive measures for responsible individuals or organizations.	NEMA (Chapter 1); NWA (Section 19) Municipal by-laws (regulating disposal of fish offal within the estuary)	Monitor volume of litter collected by the number of standard garbage bags filled. Monitor fish cleaning and offal disposal particularly after fishing competitions.	Ongoing from time of EMP inception during peak periods, during the year and after fishing competitions; inspections and clean ups can be done by DEA&DP, / DEA / local authority, inspections can be carried out by catch monitors and river control officer during patrols and general public; clean-up operations by angling club members	**Human** - DAFF catch monitors; municipal river control officer; DEA&DP; all estuary users and EAF members. **Financial** - National government; municipal; boat registration & launch levies; competition levy.

Table 6: Management Actions for Law enforcement (Conservation)

Management Actions	Legal Requirements	Monitoring Plans	Work Plan	Resource Plan
Operational Specification LE1: Law enforcement capacity; TPCs are non-compliant users and a low conviction rate.				
Increase presence of law enforcement personnel on estuary; education & awareness programmes for enforcement officers and users.	MLRA (Chapter 6); White Paper for Sustainable Coastal Development (Section C, Chapter 10); ICMA (Chapter 5, Section 37).	Monitor number of patrols and non-compliant users; survey to assess effectiveness of education & awareness programme.	Ongoing from time of EMP inception; DEA:O&C is the responsible authority with help from municipal environmental conservation, river control officer and EAF (education & awareness).	**Human** - MLRA appointed officials; municipal nature conservation and river control; EAF members. **Financial** - National and local government.
Operational Specification LE2: Enforce & monitor developments in the context of their EAs; TPC is any non-compliance with the EA conditions.				
Enforce compliance with EA conditions and report any infringements.	All legislation referred to in EA - this will vary according to nature of development or activity.	Inspections of all sites where activities or developments are taking place; ensure independent environmental control officer is appointed.	Regular (weekly) from the time an activity or development is authorized; responsible authority is mostly DEA&DP but may include other government agencies such as DWS; independent environmental control officer; estuary stakeholders (I&APs).	**Human** - DEA&DP and DWS personnel; public & EAF members; environmental control officer. **Financial** - National & provincial government; developer responsible for activity.

Table 7: Management Actions for Exploitation of Living Resources

Management actions	Legal Requirements	Monitoring plans	Work plan	Resource plan
Operational Specification E1: Protection of living marine Resources in Sanctuary Area; TPC in the number of non-compliant individuals annually.				
Enforce no take zone in the sanctuary areas.	NEM: PAA (Chapter 4); MLRA (Chapters 4 & 6); ICMA (Chapter 2, Section 24).	Compliance with relevant legislation to ensure sanctity of protected areas.	Continuous from implementation of EMP. DAFF and DEA: O&C (CapeNature) are responsible national authority. All MLRA appointed enforcement personnel to operate on a daily basis to monitor non-compliance; estuary users can assist by reporting incidents of non-compliance.	**Human** – DAFF, CapeNature and MLRA appointed personnel; estuary users. **Financial** - National government; levies from boat registration or angling competitions.
Operational Specification E2: Protection of bait organisms; TPC for any bait organism is a 30% reduction (from baseline) in the bait organism.				
Enforce legislation and by-laws pertaining to bait collection.	MLRA (Section 14 & Chapter 6); Municipal by-laws controlling bait collection areas as per EZP.	Inspection of activities and collectors to ensure compliance with MLRA regulations and by-laws.	Continuous from implementation of EMP. DAFF is responsible authority. All MLRA appointed enforcement personnel to operate on a daily basis to monitor non-compliance by active patrols and point access checks; estuary users can assist by reporting incidents.	**Human** - DAFF and MLRA appointed personnel; estuary users. **Financial** - National government; levies from boat registration or angling competitions.
Operational Specification E3: Protection of fish populations; TPCs are noncompliant individuals; a decrease of >10% from baseline cpue values for dusky kob & white steenbras; and a decrease off >20% from baseline cpue values for all other species.				
Enforce legislation in the form of MLRA regulations.	MLRA (Section 14 & Chapter 6); Municipal by-laws controlling bait collection areas as per EZP.	Inspection of activities and fishermen to ensure compliance with MLRA regulations.	Continuous from implementation of EMP. DAFF is responsible authority. All MLRA appointed enforcement personnel to operate on a daily basis to monitor non-compliance by active patrols and point access checks; estuary users can assist by reporting incidents.	**Human** - DAFF and MLRA appointed personnel; estuary users. **Financial** - National government; levies from boat registration or angling competitions.

Operational Specification E4: Regulate number and format of competitions. TPCs are increase in competitions and non-compliance with the rules of participation.				
Maintain a limited and predetermined number of well structured, regulated fishing competitions	MLRA (Section 14 & Chapter 6); EMP and angling club policies. Municipal by-laws (regulating disposal of fish offal within the estuary)	Number of competitions to be determined and monitored; participants to be assessed for compliance with MLRA competition rules. Monitor fish cleaning and offal disposal particularly after fishing competitions.	Continuous from implementation of EMP. The Municipality (MLRA appointed officer) and EAF are the responsible authority with help from angling club structures and appointed specialists to recommend competition formats and assist in measure & release effort	**Human** - Municipality (DAFF inspector), EAF and angling club members; specialist fisheries personnel from tertiary institute. **Financial** - municipal and DAFF; levies from boat registration or angling competitions; research funds from tertiary institute

Table 8: Management Actions for Land Use & Infrastructure

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
Operational Specification LU1: Formalise the boundaries of the Gouritz Estuary; TPC is if this is not done				
Delineate and formalise the Gouritz Estuarine Functional Zone according to the 5m topographical contour	ICMA (Chapter 4 Section 33 - Protocol); NEMA (Chapter 5; EIA Regulations)	Compliance with legislation restricting activities in this zone; monitor applications for activities within the zone.	Initiate as soon as EMP is implemented and integrate with IDP and SDF; RMA (Eden DM) is responsible; EAF can monitor infringements and register as I&APs in any applications.	**Human –** Eden DM. **Financial -** part of normal responsibilities for municipal departments in terms of natural water resources
Operational Specification LU2: Nature & extent of land-use & infrastructure; TPCs are broad statements of intent.				
Maintenance of a riparian zone along the length of the estuary - enforce a zone that is 100 m wide or inclusive of sensitive habitats.	NEM: BA (Chapter 4, Part 1); NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 2 Section 16); SDF/IDP	Compliance with legislation restricting activities in this zone; monitor applications for activities within the zone.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, Cape Nature & Municipality (conservation and planning) are responsible; EAF can monitor infringements and register as I&APs in any applications.	**Human** - DEA&DP, Cape Nature and Municipal planning and conservation departments; EAF members. **Financial** - DEA&DP; Municipal; EAF.

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
No additional development on the floodplain (1:100 flood line) - enforce recommendations in planning frameworks; difficult to implement due to size of area and demand for developments.	NEM: BA (Chapter 4, Part 1); NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 2, Section 16; Chapter 3, Section 28); SDF/IDP; CARA (Section 6).	Compliance with legislation restricting activities in this zone; monitor applications for activities within the floodplain.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DAFF DWS, Cape Nature, Municipality and planning consultants are responsible; EAF can monitor infringements and register as I&APs in any applications.	**Human** - DEA&DP, DWS, DAFF Cape Nature, farmland owners; Municipality and consultants; EAF members. **Financial** - Municipal (for integration with SDF).
Develop and implement a climate change adaptation plan for Gouritz (in response to changes in freshwater flow, sea level rise, etc.)	National Climate Change Response Strategy; Western Cape climate change strategy and action plan; NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 2, Section 16; Chapter 3, Section 28); SDF/IDP.	Compliance with legislation restricting activities below the coastal management line, the 1:100 flood line and/or EFZ; monitor applications for activities within the floodplain; monitor changes in landform using aerial photography and satellite imagery.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DAFF, DWS, Cape Nature, Municipality and planning consultants are responsible; EAF can monitor climate change effects, and development infringements and register as I&APs in any applications.	**Human** - DEA&DP, DWS, DAFF Cape Nature, farmland owners; Municipality and consultants; EAF members. **Financial** – Municipal
Developments and land use in the catchment and estuarine area should not lower water quality or interfere with normal hydrodynamic or sedimentary processes - ensure all developments do not impact negatively on water quality by enforcing relevant legislation	NWA (Sections 19 & 21); NEMA (Chapter 5; EIA Regulations); CARA (Sections 6 & 12); SDF/IDP	Monitor EIA process to ensure all impacts are adequately mitigated; ensure compliance with EA conditions; monitor water quality parameters according to RQOs; ensure compliance with legislation and planning frameworks.	Initiate as soon as EMP is implemented and integrate with SDF; DEA&DP, DWS, DAFF Eden District Municipality* & local Municipality are responsible; EAF, CMA and WUA can monitor infringements and register as I&APs for any applications within estuarine area. DWS and BGCMA to develop and implement Catchment Management Plan and ensure that estuary ecological flow requirements are considered	**Human** - DWS, DEA&DP, DAFF local and district municipality; EAF/CMA/WUA members. **Financial** - National & provincial government; district & local municipality; CMA; developers and landowners responsible for activity.
Development proposals should be evaluated through the EIA procedure and guided by the EMP specifically and the broader catchment management plan - register as	All legislation controlling aspects of development within the EIA process - this will vary according to nature of development or activity but will include	Monitor the EIA process for each application and ensure compliance with all legal requirements.	Initiate immediately - for all new applications and review of applications currently under consideration; EA issuing authority, EAF and Municipality are responsible	**Human** - Representatives of EA issuing authority, Municipality and EAF members. **Financial** - Municipal and CMA (for EAF members).

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
I&AP for all development applications and ensure compliance with all legislation.	aspects covered by the NWA (Section 19; Chapter 4), NFA (Chapter 3, Section 1), NEMA (Chapter 5; EIA Regulations); CARA (Sections 6 & 12);		for ensuring developers adhere to EIA procedures. DWS and Breede-Gouritz CMA to develop and implement Catchment Management Plan and ensure that estuary ecological flow requirements are considered	
Operational Specification LU3: Number of applications for development and/or rezoning of land within estuarine area; there are no quantitative TPCs but an increase in applications over a five-year period should be cause for concern.				
Register as I&AP for all development and rezoning applications and ensure compliance with all legislation and planning frameworks.	All legislation controlling aspects of development within the EIA process - this will vary according to nature of development or activity but will include the NWA (Section 19 & Chapter 4), NFA (Chapter 3, Section 1), NEMA (Chapter 5; EIA Regulations), CARA (Sections 6 & 12);	Record numbers of new applications for comparison to recent years; monitor the EIA process for each application to ensure it fulfils legal requirements.	Register as I&AP for all new applications and check municipal records for compliance regarding older applications; DEA&DP are responsible for ensuring correct procedures are followed.	**Human** – DEA&DP, Municipality and EAF members. **Financial** - Municipal (for EAF members).
Operational Specification LU4: Use of planning and management tools to guide development; TPC would be the exclusion of estuaries in any of these frameworks.				
Ensure that the estuarine area is specifically addressed in all planning and management frameworks.	ICMA (Chapter 4); SDF/IDP (in the form of specific management plans such as EMP and CMS); regional SEAs.	Review of all existing planning and management frameworks; monitor progress of all new management & planning documents through direct participation.	Initiate immediately and register EAF, CMA and WUA as civic organizations that must be consulted; EAF is responsible for input; planning and management consultants together with the municipality are responsible for addressing estuarine area in frameworks. Estuarine requirements included in the catchment classification process.	**Human** - EAF; DEA&DP; municipal planning division; planning and management consultants. **Financial** - District & local Municipality

Table 9: Management Actions for Institutional & Management Structures

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
Operational Specification IMS1: Establishment of a local EAF (forum); TPC would be the absence of such an institution.				
Form a local Estuarine Advisory Forum	ICMA (Chapter 4)	Monitor progress of EAF and ensure it fulfils its obligations.	Initiate immediately - assemble members and elect chairman and appoint technical working groups; constitute EAF and set mandate and responsibilities. Municipality is responsible authority together with specialist consultants.	**Human** – DEA&DP; specialist consultants; representatives from all relevant stakeholder groups (civic & government). **Financial** - Municipality
Operational Specification IMS2: Establishment of CMA, WUA and catchment forum; TPC would be the absence of any such institutions.				
Form CMA & WUA and associated forum and integrate with the EAF.	NWA (Chapter 2, Part 2; Chapter 8); ICMA (Chapter 4)	Monitor progress of CMA, WUA and catchment forum and ensure they fulfil their obligations; ensure their integration within the EAF.	Initiate immediately - assemble all interest groups and form CMA (WUA already exists); set mandate and responsibilities. DWS is responsible authority together EAF and specialist consultants.	**Human** - DWS, WUA representative and Cape Nature; specialist consultants; representatives from all relevant stakeholder groups. **Financial** - DWS.
Operational Specification IMS3: Interaction between EAF, CMA, WUA and catchment forum; TPC would be if no integration and interaction existed between these institutions.				
Integrate CMA, WUA and catchment forum representatives with EAF and host regular meetings.	NWA (Chapter 2, Part 2; Chapter 8); ICMA (Chapter 4)	Ensure integration and keep record of number and types of projects or management scenarios that are resolved or addressed cooperatively.	Initiate immediately; integrate CMA, WUA and catchment forum representatives within the EAF (water quality & quantity working group) and identify opportunities to interact. Institutions are themselves responsible for integration assisted by DWS. Ensure that estuary flow requirements are embedded in catchment classification process.	**Human** - CMA, WUA, catchment forum and EAF representatives; DWS; Cape Nature **Financial** – DWS, CMA, and Municipality.

Table 10: Management Actions for Sustainable Livelihoods & Tourism

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
Operational Specification SL1: Existing activities compliant with all forms of legislation and planning frameworks; TPC would be any activity not complying with these regulations.				
Engage relevant government authorities to address activities that do not comply with legislation and planning frameworks.	Applicable legislation is contained in the NWA (Sections 19 & 21); NEMA (Chapter 5; EIA Regulations); NFA (Chapter 3, Sections 1&2); ICMA (Chapter 2, Section16; Chapter 3, Section 28); CARA (Section 6); National Heritage Resources Act (Act 25 of 1999) (NHRA) (Chapter 2, Parts 1&2); NEM: BA (Chapter 4); NEM:PAA (Chapter 4), SDF/IDP; municipal by-laws and local management plans	Review all existing activities for compliance with legislation and planning frameworks; monitor all proposed new activities for compliance; monitor reparation where applicable.	Initiate immediately; members of EAF to engage municipality (town planning), tourism industry and government departments such as DEA&DP, DWS, DAFF and DEA to enforce applicable legislation and planning frameworks.	**Human** - EAF working groups and DEA&DP, DWS, DEA, DAFF & municipal representatives responsible for ensuring compliance; tourism representative. **Financial** - EAF and Municipality; developers, landowners or service providers responsible for act
Operational Specification SL2: Promote non-consumptive enterprises involving previously disadvantaged communities which are compliant with all forms of legislation and planning frameworks; TPC would be no new initiatives and non-compliance with these regulations				
Engage community representatives, municipality, civic organizations, birding clubs and tourism industry to identify opportunities and ensure they are compliant with all forms of regulation.	Applicable legislation is contained in the NWA (Sections 19 & 21); NEMA (Chapter 5; EIA Regulations); NFA (Chapter 3, Sections 1&2); ICMA (Chapter 2, Section 16; Chapter 3, Section 28); CARA (Section 6); NHRA (Chapter 2, Parts 1&2); NEM:BA (Chapter 4); NEM:PAA (Chapter 4), SDF/IDP; municipal by-laws and local management plans	Monitor progress with regards initiation of new activities and their compliance with regulations; monitor reparation where applicable.	Initiate immediately; local government and EAF to engage all stakeholders to identify opportunities and draft operational frameworks to ensure compliance.	**Human** - EAF working groups and representatives from communities, municipality (community services), civic organizations and tourism. **Financial** – EAF and possibly government (e.g. poverty alleviation fund); service providers (e.g. hiking & canoe trails

Table 11: Management Actions for Education & Awareness

Management actions	Legal requirements	Monitoring plans	Work plan	Resource plan
Operational Specification EA1: Educational workshops on value of estuaries, their context within planning frameworks and legislation and consequences of poor decision making; TPCs would be no workshops, poor attendance or continued poor decision making that				
Initiate series of workshops (with help from DEA&DP) and get buy-in from Municipality to ensure attendance.	White Paper for Sustainable Coastal Development (Section C, Chapter 10); ICMA (Chapter 5, Section 37).	Keep record of number of workshops and attendance by municipal staff and managers; participants to submit to a questionnaire to test awareness, understanding and effectiveness of workshop.	Initiate immediately. DEA (Working for the Coast Programme) is responsible for education on a national level, but the workshops can be hosted by RMA; EAF can make use of in-house expertise or specialists from tertiary or research institutions to give presentations.	**Human** - DEA representative to supply suitable content material for workshop; Municipal representative; EAF working groups; Cape Nature, specialists from tertiary and research (e.g. CSIR, SAIAB) institutions. **Financial** – DEA&DP and municipal.
Operational Specification EA2: Interactive public awareness campaign; TPCs would be no visual aids, lack of public interest and poor level of understanding of estuaries and the regulations that govern their well-being.				
Ensure that visual aids (notice boards) are erected at key points (launch sites and resorts); host school groups for interactive tours of the estuary.	White Paper for Sustainable Coastal Development (Section C, Chapter 10); ICMA (Chapter 5, Section 37).	Monitor placing of notice boards and ensure their content is relevant to the Gouritz scenario; provide school groups and general public with a questionnaire to determine effectiveness of the programme.	Initiate immediately. DEA (Working for the Coast Programme) is responsible for education on a national level and should supply the visual material; EAF or Municipal Community Services can host school groups and make use specialists from tertiary or research institute on occasions to give informal talks	**Human** - DEA to supply notice boards; EAF working group members; specialists from tertiary and research (e.g. CSIR, SAIAB) institutions. **Financial** - DEA, municipal.
Operational Specification EA3: Research projects by tertiary & research institutions and government departments; TPCs would be no research projects or the continued lack of information/data required for monitoring programmes.				
Identify key areas where research efforts should be concentrated (e.g. water quality & quantity; fishery survey; rehabilitation areas/methods); actively engage government and	None	Monitor progress of all research activities concerned with the Gouritz and ensure that outcomes are practical and effectively used in long term monitoring programmes that will guide the implementation of the	Initiate immediately; EAF can interact with government and tertiary & research institutions. Government departments such as DWS and DEA may initiate projects on their own and institutions such as CSIR and SAEON can be	**Human** - EAF working groups to identify research needs; specialists from tertiary & research (e.g. CSIR, SAIAB & SAEON) institutions. **Financial** - DWS, DEA, DEA&DP, NRF, and

tertiary & research institutions to initiate projects.		EMP.	involved in long term monitoring projects	independent research funds.

8 IMPLEMENTATION

8.1 Institutional Arrangements

8.1.1 Key Role Players

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

Co-management and effective governance has already been identified as the keystone to the efficient and effective management of the Gouritz River Estuary.

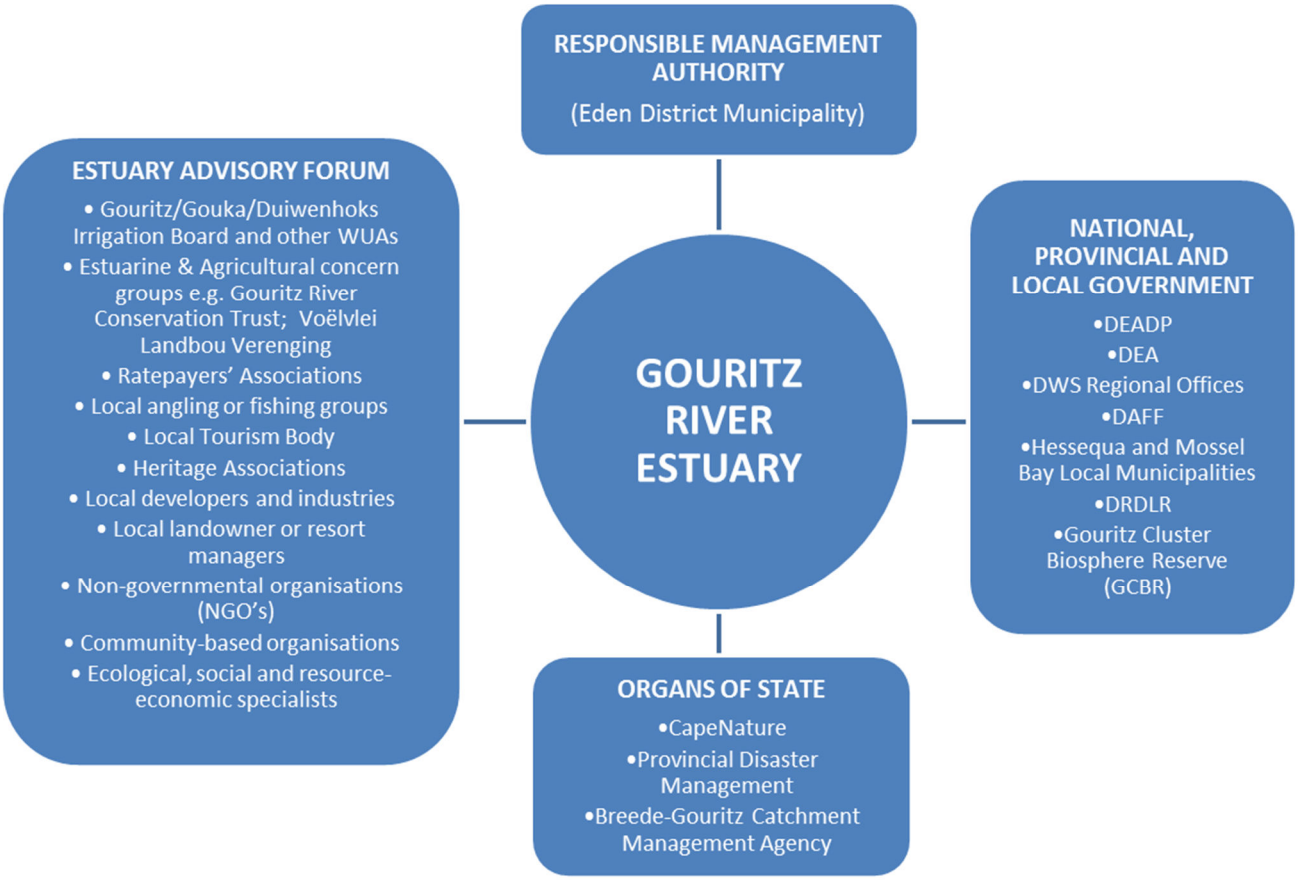

Figure 9: Key role players for the management of the Gouritz River Estuary

8.1.2 Responsible Management Authority

The Protocol identifies the **Eden District Municipality**, or its assigned representative, as the **Responsible Management Authority** responsible for the development of the Gouritz River

EMP as well as being responsible for the co-ordination of its implementation. This implementation function can be effected through a range of different forums and actors.

8.1.3 Gouritz River Estuary Advisory Forum (GREAF)

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

8.1.4 Government Departments and organs of state

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

- **Western Cape Government departments**: Responsible for legislative support, including compliance, funding, research and monitoring;
- **Hessequa and Mossel Bay Local Municipalities**: Responsible for legislative support and funding;
- Relevant **National government departments**, especially Department of Environmental Affairs, Department of Water and Sanitation (via the regional office), Department of Forestry and Fisheries, Department of Rural Development and Land Reform;
- Organs of State (SANparks, CapeNature, Breede-Gouritz GCMA).

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

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

8.2 Recommend Priority Actions

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

- Establish a local EAF that is democratic and representative of all stakeholders, interest groups and relevant government departments.
- Ensure that the EMP is accepted by all Municipalities and incorporated into their SDFs and IDP frameworks.
- Establish zoning of the estuary in accordance with the EZP.
- Apply for the establishment of the proposed sanctuary area in terms of Chapter 3 of the NEM: PAA, and draft a management plan in terms of Chapter 4 of the Act.
- All aspects relating to land-use & infrastructure within the estuarine area.
- Identification of monitoring and research requirements, including the design of the road bridge and a detailed fishery survey.

The following aspects of the EMP should be addressed within the time frames indicated:

- Investigate the feasibility of using locally generated funds for management and EAF activities, e.g. boat launching or competition levies used for river patrols or monitoring of fishing activities by the end of the **second year**.
- Initiate all other monitoring programmes and coordinate with research projects where appropriate within the **next three years**.
- All outstanding aspects pertaining to the action plans for all conservation, living resources and management & institutional arrangements within the **next three years.**
- The education & awareness programmes within the **next three years.**
- Regulation of existing livelihoods and the identification of additional opportunities involving members of previously disadvantaged communities within the **next four years.**

The EMP in its current form will be reviewed **after five years**. It will be the responsibility of the RMA to revisit the Situation Assessment Report. This will be followed by a round of revision and/or refinements of the Objective-setting and Implementation phases as and where necessary, e.g. it may be necessary to adjust aspects of an action plan or monitoring programme.

9 MONITORING AND EVALUATION

9.1 Monitoring

There are two components to monitoring, namely baseline measurement programmes and long-term monitoring programmes, and it is important to note the difference between them in the context of the EMP framework (Taljaard & van Niekerk 2007b). **Baseline measurement programmes** usually refer to short-term or once-off, intensive investigations of a wide range of parameters to obtain a better understanding of ecosystem functioning; they may also involve the investigation of non-ecological data to determine an existing situation with regards to compliance, land-use patterns, institutional & management structures, alternative livelihoods and education & awareness initiatives. These programmes would normally be a part of the Situation Assessment and the Objective-Setting Phases within the framework. In the context of this EMP, baseline data is required in order to determine the TPCs for the management actions described in the action plans.

Long-term monitoring programmes refer to ongoing data-collection programmes that are done to evaluate continuously the effectiveness of management strategies and management actions within action plans that are designed to maintain a desired environmental state. Data from these programmes are used to determine or anticipate when particular TPCs have been or will be exceeded so that responses to potentially negative impacts, including cumulative effects, can be implemented in good time. Long-term programmes usually involve biotic and abiotic components concerned with the bio-physical aspects such as water quantity & quality, conservation and living resources. However, accumulated data from baseline programmes associated with land-use & infrastructure, management & institutional structures, sustainable livelihoods and education & awareness can be analysed over the long-term as well to ensure that the Vision for the Gouritz River estuary is achieved and maintained. Long-term programmes often form part of detailed scientific surveys or research projects conducted by tertiary and research institutions, but they may also take the form of less complex initiatives such as fisheries regulations compliance and activities in the context of the EZP or municipal by-laws.

9.1.1 Baseline measurement programmes

A detailed description of the baseline requirements, spatial and temporal scales, required resources and sampling & analysis techniques with regards the TPCs referred to in the action plans (Section 7; Table 3 - Table 11) is provided in Appendix 1: Table 12 - Table 21 (see McGwynne & Adams 2004). Some aspects of these baseline programmes, e.g. cpue and population (invertebrates and birds) monitoring will also form part of long-term programmes (see Section 9.1.2 below).

9.1.2 Long-term monitoring

The long-term monitoring programmes described in Appendix 2 (Table 22 - Table 24) were initially developed to determine the requirements for the ecological reserve and then to

assess the effectiveness of the prescribed reserve (see Taljaard & Van Niekerk 2007b). However, in most instances data from these programmes can also be used as indicators of other management concerns where the ecological reserve specifically is not responsible for the observed pattern or scenario. For example, the long-term monitoring of fish could reveal a decline in biodiversity or species richness that could be due to RQO parameters but could equally be due to human activities such as fishing, episodic events causing habitat change, seasonal migrations, national trends in fish populations or large-scale fluctuations in climate.

Unlike many of the baseline programmes where data can be gathered and in many instances analysed by EAF members, long-term monitoring programmes tend to be the responsibility of government departments such as DWS and DEA who usually contract the services of tertiary & research institutes such as CSIR, SAIAB, SAEON and Universities. However, at all times the EAF should be involved so as to ensure that programmes will be beneficial to the effective implementation of the EMP.

Long-term monitoring programmes for the following components are proposed, namely hydrology, sediment dynamics, hydrodynamics, water & sediment quality, microalgae, macrophytes, invertebrates, fish and birds. The protocols for carrying out these programmes has been taken from Taljaard & Van Niekerk (2007b) and adapted to suit the Gouritz scenario where applicable.

9.2 Review and evaluation

Evaluation of the EMP will become the responsibility of the RMA (Eden DM), supported by the Gouritz River EAF, to be undertaken on a five-yearly basis to assess whether that vision, objectives and targets are being achieved. This 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. In a situation where these targets have not been achieved, the RMA and EAF will need to determine which aspects of the EMP need to be altered in order to rectify these shortfalls. Usually this will involve the adaptation of management strategies and objectives or aspects of the action plans themselves, although the problem may be with implementation (capacity and finance). Monitoring programmes may also be altered to supply specific data to fill existing knowledge gaps.

Ideally, representatives of the major components, namely conservation & living resources, social & cultural issues, land-use & infrastructure, and water quantity & quality, should evaluate the efficiency of the EMP in the context of their area of responsibility. It is essential that representatives from the Catchment Management Forum (CMF) are included within the EAF structure to address the RQO-related issues.

An audit should be undertaken alongside the evaluation to determine and grade the success and failures with the implementation of the management plan according to the specified performance indicators.

10 RESEARCH

The following research needs that should fill the knowledge gaps and provide supplementary data for monitoring programmes have been identified and should be initiated as soon as possible. The local EAF may approach tertiary and research institutions such as Universities, CSIR, SAIAB and SAEON to create an awareness of what is required. There may be a degree of overlap with the long-term monitoring programmes defined in Section 9 above.

- Fishery survey comprising both bait and fish. Key elements include fishing/collecting effort, *cpue*, user dynamics, target fish species, catch composition, bait utilization in relation to existing regulations (waste), motivation for using resource, economic value of the fishery, degree of compliance and conflict between different fishing fraternities.
- Invertebrate organisms primarily used for bait. Key elements should include densities (in and outside sanctuary areas and in control areas), recovery periods after disturbance (collecting and trampling that alter habitat), community structures before and after disturbance, effect of pollutants in the sediment, mortality due to birds foraging after collection activities, effect on birds by bait collectors (both use same area at low tide) and larval settlement times & location along the tidal cross-section (avoid these areas at specific times).
- The carrying capacity of the estuary needs to be determined so that the EAF can make an informed decision about the numbers of users utilizing the system at any given time. Some data can be collected as part of the fishery survey, but some aspects such as sense of place, pollution due to engine emissions and incidents of confrontation between all user groups will need to be addressed by a dedicated project.
- A social based project to determine the effectiveness of the education & awareness programme and the attitude toward the EMP and those management actions which have directly affected users, e.g. restrictions on developments and restricted access to sanctuary area.
- A comparison between biodiversity and habitat health within the sanctuary areas compared to the conservation areas in the rest of the system. An aspect that should be included is the response of communities (plant and animal) to freshwater pulses, instream flows and contaminants in order to monitor the efficacy of the recommended RQOs.
- Long-term monitoring of habitats and community structures (see
- Table 23 and Table 24) in relation to RQOs to determine requirements and effectiveness of ecological reserve.
- A project aimed at resolving the road bridge issue needs to be initiated.

11 RECOMMENDATIONS

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

- **It is imperative that the entire estuarine area be formalised and included in subsequent versions of the Gouritz EMP, in alignment with the National Estuarine Management Protocol. Spatial zonation of the entire system must be established through the RMA, in consultation with the EAF and the respective municipalities.**
- The abutment on the eastern side of the bridge across the river will fail under flood, and therefore requires the construction of appropriate open spans/culverts and suitable erosion defence/protection.
- The water supply pipe (along western bank in the middle reaches of the estuary) should be protected by hard infrastructure (e.g. stone gabions have short life span in salty conditions) but preferably an alternative location should be investigated.
- Alternative means of compliance enforcement must be ensured to alleviate the constraints on CapeNature and DAFF capacity and resources.
- Obstructions to flow (e.g. berms, causeways etc.) which result in habitat reduction and barrier to organism movement within the estuary must be investigated and mitigated.
- Appropriate dune management and setback along coast adjacent to mouth should be implemented as it affects mouth dynamics.
- Actively encourage stewardship programmes that promote alternative farming practices (i.e. using less water).
- In respect to recreational activities management, the RMA should consider options for peak user days regulation.
- Given the status of the Gouritz River estuary as one of the national priority estuarine systems and the encompassment of the estuary within the Gouritz Cluster Biosphere Reserve, formal protected area status should be investigated for the entire, or part of, the estuarine area.

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APPENDIX 1: RECOMMENDED INTEGRATED MONITORING PROGRAMMES

Table 12: Baseline monitoring programmes for Water Quantity & Quality

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
WQ1: Ecological Reserve and instream flow.	Recommended inflow according to Reserve determination; TPC is inflow volume less than the recommendation; or unseasonal change in sedimentation patterns or mouth dynamics.	**Human** - DWS. **Budget** – DWS - cost of flow gauging station installation and analysis of data.	Flow gauging station above head of estuary; various sites along estuary and at the mouth for sedimentation patterns and mouth dynamics.	Data is logged daily; sedimentation and mouth dynamics monitored seasonally.	Flow data logged daily and collected bi-annually for analysis; sedimentation and mouth dynamics monitored seasonally. XY graphs off low against time; reference photos of mouth and sediment patterns. Decrease flow could indicate increased abstraction or impoundment but could be natural cycle.
WQ2: Pollution and Poor Water Quality **Riverine input**	Levels of sediment (silt), nutrients and pollutants. TPCs are specific to each estuary with none defined for Gouritz at present.	**Human** - DWS. **Budget** - DWS- cost of water sampling and analysis from above head of estuary.	Sample station at a site above the head of the estuary.	Varies, but water quality parameters are measured regularly by DWS.	Water sample analysis and presentation of data in XY graphs to show temporal fluctuations of each parameter. Values outside the norm can indicate pollution or contamination of water.
Estuary	All water quality parameters, e.g. oxygen, salinity, nutrients, coliforms, ammonia. No TPCs for estuaries established yet; each system to be evaluated separately.	**Human** – Municipal Community Protection Services and local municipal laboratory staff. **Budget** - operating budget from Community Protection Services.	Several stations (every 1-2km) along estuary including mouth and head region.	At least seasonally (monthly if possible); at high tide during neap tide cycle allowing for tidal lag for stations upstream of the mouth.	Natural variability to be determined over 5-year period. Plot data as XY graph against time for each station and constituent. Increased levels of most constituents could indicate or lead to increased eutrophication, algal blooms or contamination. Low oxygen could lead to or explain mass mortalities and indicate eutrophication.

Table 13: Baseline monitoring programmes for Biodiversity (Conservation)

Objective	Indicator & TPC	Resources	Spatial Scale	Temporal	Sampling & Analysis
B1: Maintenance of plant communities	Area of cover; TPC is more 20% change in area covered by any plant community	**Human** – member of EAF or municipal environmental officer. **Budget** – cost of aerial and/or reference photographs.	The designated estuarine area, should include sand and mudbanks for sediment distribution patterns	Aerial photographs every 5 years for Situation Assessment Report; reference photographs bi-annually for seasonal variation at selected sites	Aerial photos from Dept. of Surveys & Mapping; reference photos from fixed elevated positions at low tide. Surface area of each community type plotted on a map; habitat type and plant cover at reference sites plotted; XY graphs of plant community area for each season over 5-year period
B2: Control of alien vegetation	Area of cover; TPC is if more than 5% riparian area is infested with alien vegetation	**Human** – DWS. **Budget** – cost of aerial photographs and reference transects.	Riparian region within the designated estuarine area and the greater catchment	Aerial photographs every 5 years for Situation Assessment Report; reference transects at disturbed sites annually	Aerial photos from Dept. of Surveys & Mapping; reference transects at disturbed or cleared sites. Surface area of indigenous & alien vegetation plotted on a map every 5 years; XY graphs of vegetation type against year in disturbed areas to track recovery
B3: Maintenance of invertebrate popoulations (mudprawn, sandprawn, and bloodworm)	Population densities; TPC is density variations > 25% for mudprawn and > 40% zooplankton and benthos from baseline counts	**Human** – members of EAF, more likely students or staff from tertiary or research institute. **Budget** – research funding from tertiary or research institutions	Several representative habitats for major invertebrate species; including control sites where human activities are excluded	Seasonal; recommendation for mudprawn is January, June & September	Random quadrats above low spring tide level where number of burrows are counted; seasonal sampling to include breeding and recruitment seasons. Baseline data set may be set up after 2 years; plot XY graphs of number of burrows again time of year. Reasons for decrease may not be human induced and could be due to natural variation
B4: Maintenance of waterbird populations	Species richness: waterbird species <20 for three consecutive summer counts; Bird numbers: Birds other than gulls, terns and regionally increasing species, <120 individuals for three consecutive summer counts	**Human** – members of EAF, more likely students or staff from tertiary or research institute. **Budget** – research funding from tertiary or research institutions; subsidy from CWAC at UCT	Reference sites in the mouth region, floodplain in middle reaches above road bridge in sanctuary area	Twice yearly in winter (June-July) and summer (January-February)	Counts to be done over spring low tide period and outside peak disturbance periods and record prevailing conditions; counting areas mapped and representative of a range of estuary habitat types. Plot species richness, diversity and number again time of year and habitat type; long term period (5-10 years) is required to allow for detection of natural fluctuations; detailed to be done by CWAC
B5: Maintenance of fish populations	CPUE: TPC for dusky kob & white steenbras is 10% reduction in baseline values; TPCs vary for other fish categories	**Human** – DAFF catch monitors; student or staff from tertiary or research institute. **Budget** – research funding from tertiary or research institutions; funding from DAFF for increased catch monitor	Water body within the designated estuarine area	Ongoing for catch monitors; research project comprising fishery survey to be conducted every 5 years	Boat inspections and shore patrols in the form of roving creel surveys; access point inspections; weekdays, weekends and holidays to be included; catch (number & weight) and time fished is relevant data. CPUE to be plotted against time for each species; analysis of research data and catch monitors data can be combined.

Objective	Indicator & TPC	Resources	Spatial Scale	Temporal	Sampling & Analysis
		capacity			
B6: Maintenance of estuarine habitats	Area of cover and degree of fragmentation: TPC is 10% reduction in area covered by any habitat type (overlap with B1 as this includes floral habitats)	**Human** – members of EAF or municipal environmental officer. **Budget** –cost of aerial and/or reference photographs (already accounted for in B1)	Designated estuarine area	Aerial photographs every 5 years for Situation Assessment; reference photographs bi-annually for seasonal variation at selected sites	Use same photos described for B1. Data is analysed and presented as for B1, i.e. habitat types plotted on map and XY graphs for each habitat type for each season over 5 year period. Loss of habitat may be due to human activities or natural cycles.
B7: Protect estuarine habitats in formally protected area.	Proportion of various habitat types under protection: TPC would be a reduction in this proportion on a National Scale	**Human** – DEA:O&C or municipal environmental officer, specialist consultant for analysis. **Budget** – DEA funding for cost of survey, annotated maps or photo and specialist analysis.	Designated estuarine area and sanctuary areas in other CFR estuaries	Annotated maps or aerial photographs every 5 years	Aerial photos from B1 and B6 can be used and annotated with habitat type and extent within formally protected areas. Analysis needs to be done in the context of habitat types protected in other CFR estuaries and should be done by DEA

Table 14: Baseline monitoring programmes for Human Activities (Conservation)

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
HA1: Ensure carrying capacity of estuary is not exceeded	Number of recreational users in each sector; TPC is when carrying capacity is exceeded	**Human** – members of EAF or municipal environmental / river control officer. **Budget** – counts can be done as part of normal daily activities or responsibilities, i.e. no additional cost.	Designated estuarine area; can be limited to specific zones based on type of activity in accordance with EZP	Twice a month outside of peak periods (weekday and weekend day) and once a week during peak holiday periods	Count number of people engaged in each activity, record number of activities and associated users. Plot number of users in each activity against time of year and compare to carrying capacity values
HA2: Control human activities that impact on invertebrate (bait organism) populations	Population densities: TPC is 30% reduction in population densities from baseline values. Compliance with regulations (bag limits, collecting methods, licenses, closed areas);	**Human** – MLRA appointed personnel; members of EAF; students or staff from tertiary or research institute. **Budget** – research funding from tertiary or research institutions	Designated estuarine area	Once a week during the neap and spring-tide cycles for population density, and daily compliance	Weekly surveys over low tide to record number of collectors, collection methods, adherence to bag limits and licenses; random quadrats to determine densities (use data from B3 research surveys). Plot XY graph of densities to time of year and relate to number of users and level of compliance; plot XY graph of instance of non-compliance with time of year and

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
	TPC is continued instances of non-compliance				bait organisms
HA3: Protect linefish and bait organism populations by restricting fishing competitions	Number of competitions and participants; TPC is an increase in current numbers	**Human** – members of EAF; DAFF catch monitors; municipal environmental officer; launch site managers; and angling club committees. **Budget** – counts can be done as part of normal daily activities or responsibilities, i.e. no additional cost	Water body within designated estuarine area	Once a year when applications to hold competitions are submitted to municipality	Record number of competitions and number of participants (boar and anglers). Plot XY graph of each against time year over a 5 year period
HA4: Reduce the amount of solid waste within the estuarine area	Volume of litter measure in standard garbage bags. Number of fishers cleaning/disposing of offal in the estuary	**Human** – members of EAF; municipal environmental officer. **Budget** –can be done as part of normal daily activities or responsibilities, i.e. no additional cost	Designated estuarine area, in particular the water body and immediate riparian area	During or after each organised event, at least once a month during peak periods, and twice during the year outside of peak periods	Record number of standard garbage bags filled with litter and fisher cleaning their catch or weight of offal after organised events, during peak periods and during the year. Plot XY graph of volume and weight (respectively) against time of year and related activity

Table 15: Baseline monitoring programmes for Law Enforcement (Conservation)

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
LE1: Improve law enforcement capacity	Incidence of non-compliance and high conviction rates; TPC is an increase in incidents of non-compliance with MLRA and a decrease in conviction rate	**Human** – MLRA appointed officials. **Budget** – can be done as part of normal daily activities or responsibilities, i.e. no additional cost	Designated estuarine area	Once a year	Record type of offence, number of offences, number of arrests and successful convictions. Plot these incidences again each year over a 5 year period
LE2: Compliance with EAs issued as part of EIA process	Incidence of non-compliance; TPC is any form of non-compliance	**Human** – DWS & DEA&DP officials independent environment control officer appointed in terms of EA. **Budget** –part of normal responsibilities for government depts.; developer pays for environmental control	Designated area	Depends on number of developments and EAs issued	Record number and type of developments approved; note activities of environmental site officer and incidents of non-compliance with EA conditions. Data should be tabulated and presented to authorities for analysis and further action against non-compliant developers

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
		officer			

Table 16: Baseline monitoring programmes for Exploitation of Living Resources

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
E1: Ensure sanctity of sanctuary area through compliance monitoring	Incidence of non-compliance; TPC is any form of non-compliance	**Human** – DAFF and MLRA appointed personnel; EAF member to report incidents. **Budget** – part of normal responsibilities for DAFF and appointed inspectors; no additional cost	Designated sanctuary within estuarine area	Daily by MLRA appointed personnel and EAF members	All MLRA appointed personnel and EAF member can monitor compliance during daily activities or responsibilities. Incidents of non-compliance can be recorded for each month and plotted against years for a 5 year period. Analysis can be done by EAF or fishery researcher as part of fishery survey
E2: Ensure maintenance of bait organism populations	Population densities; TPC is densities below 70% of baseline counts. Compliance with regulations; TPC is continued instance of non-compliance	**Human** – MLRA appointed personnel, EAF members and research students. **Budget** – part of responsibilities for MLRA personnel; research funds	Water body within designated estuarine area	Population densities once a week during the neap and spring tide cycles; compliance daily	Weekly surveys over low tide to record number of collectors, collection methods, adherence to bag limits and licenses; random quadrats to determine densities (use data from B3 research surveys). Plot XY graph of densities to time of year and relate to number users and level of compliance; plot XY graph of instance of non-compliance with time of year and bait organism
E3: Maintenance of fish populations	CPUE; TPC for dusky kob & white steenbras is10% reduction in baseline values; TPC for all other species is 20% reduction in baseline values	**Human** – DAFF catch monitors and other MLRA appointed staff; students or staff from tertiary or research institute. **Budget** – research funding from tertiary or research institutions; funding from DAFF of increased catch monitor capacity	Water body within designated estuarine area	Ongoing for catch monitors and MLRA staff; research project comprising fishery survey to be conducted every 6 year	Boat inspections and shore patrols in the form of roving creel surveys; access point inspections; weekdays, weekends and holidays to be included; catch (number & weight) and time fished is relevant data. CPUR to be plotted again time for each species; analysis of research data and catch monitors can be combined
E4: Restrict number of competitions and participants and maintain high level of compliance with	Number of competitions & participants; TPC is an increase above existing levels. Compliance; TPC would be any incidents	**Human** – EAF; RMA; MLRA appointed staff, angling club committee members **Budget** – part of current responsibilities no	Water body within designated estuarine area	Compliance during each competition; number of competitions to be decided at the start of each year	Compliance with regulations to be recorded for each competition and plotted again years over a 5-year period. Record number of competitions and number of participants (boat and

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
MLRA regulation and competition specific rules	of non-compliance with MLRA and competition specific rules	additional funds required; any expenses by EAF to be covered by competition levies			anglers). Plot XY graph of each again time of year over a 5- year period. Data can be analysed by a research as part of the 5-yearly fisher survey.

Table 17: Baseline monitoring programmes for Land Use & Infrastructure

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
LU1: Formalise the boundaries of the Gouritz River Estuary.	Compliance with ICMA Protocol; TPC is if this is not done.	**Human** – Eden DM. **Budget** - part of normal responsibilities for municipal departments in terms of natural water resources	Entire estuary relative to the catchment	Once off	Boundaries of estuary according to the 5m topographical contour to be mapped. Estuarine boundary to be incorporated into district and local IDPs and SDFs.
LU2: Maintenance of riparian zone.	Compliance with legislation and 100m buffer zone; TPC is any infringements within this zone.	**Human -** DEA&DP, DWS &DEA officials; Environmental Control Officer (ECO) appointed in terms of the EAs; municipal environmental officer and town planning; members of EAF. **Budget** -part of normal responsibilities for government departments; developer pays for ECO and rehabilitation	Estuarine waterways and 100m buffer zone adjacent to banks.	Visual monitoring can be done on an ad hoc basis during normal daily activities or responsibilities.	Land-use patterns adjacent to the estuary to be mapped; records kept of applications for activities that will infringe on this riparian zone and registration of the EAF as an IAP; amount of bank erosion and habitat degradation in the vicinity of existing developments to be noted; non-compliance with regards the buffer zone to be noted and plotted against each year over a 5-year period.
LU3: Restrict additional development on the floodplain or 100-year floodline.	Number of applications for new developments within the floodplain or100-year flood line; TPC is any new applications for development.	**Human** – Municipal environmental officer and town planning; members of EAF. **Budget** - part of normal responsibilities or daily activities for municipal departments;	Flood plain or100-year flood line within the designated estuarine area.	Visual monitoring can be done on an ad hoc basis during normal daily activities or responsibilities.	Land-use patterns adjacent to the estuary to be mapped; records kept of applications for activities that will infringe on the flood plain area and registration of the EAF as an IAP. Number of new developments to be plotted against each year over a 5-year period.
LU4: Minimise the risk of climate change impacts	Compliance with legislation, national and provincial strategies; TPC is lack of adaption strategy and any infringements below the coastal management line, EFZ, or 1:100 year	**Human** – Municipal environmental officer and town planning; members of EAF. **Budget** - part of normal responsibilities or daily activities for municipal departments.	Flood plain or100-year flood line within the designated estuarine area.	Visual monitoring can be done on an ad hoc basis during normal daily activities or responsibilities, but intensified during/after extreme climate events.	Changes in estuarine processes to be mapped, particularly after extreme events (e.g. flooding); records kept of applications for activities that will infringe on the flood plain area; records of erosional damage to infrastructure and coastal property.

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
	flood line.				
LU5: Maintenance of water quality and normal hydrodynamic & sedimentary cycles.	RQOs parameters; TPC would be any activity that negatively impacts on the RQOs.	**Human** - DEA&DP and DWS personnel; environmental control officer appointed in terms of the EAs. **Budget** – part of normal responsibilities for government departments.	Designated estuarine area and catchment.	Bi-annual for DWS (may form part of more detailed long-term monitoring programme) and ongoing for DEA&DP and ECO as activities are approved and EA issued.	DWS to perform regular sampling of RQOs and analyse in the context of activities that may have negative impacts DEA&DP and ESO to ensure conditions and mitigation detailed in EAs are complied with.
LU6: Land-use & development proposals evaluated through EIA procedure and guided by EMP and CMP. Record number of applications for development or rezoning.	Compliance with EIA procedure and adherence to EMP and CMP ideals; TPC is non-compliance in this regard and lack of regard for management framework recommendations. Number of applications; TPC is an increase in applications for development or rezoning.	**Human** - DEA&DP, DWS & DAFF personnel; representatives of EAF and CMF/WUA. **Budget** - part of normal responsibilities for government departments; costs for IAP registration and participation by EAF and CMA/WUA from levies charged for recreational activities.	Designated estuarine area and catchment.	Ongoing; exact timing will depend on when applications for activities are received by DEA&DP, DWS or DAFF	All activities to be reported to DEA&DP, DWS or DAFF to determine whether they comply with EIA requirements. Register as IAP for all proposed activities to ensure procedure is followed and ideals of EMP and CMP are considered in assessment and decision-making process. Number of applications to be plotted against year over a 5-year period and number of applications approved without adhering to management framework recommendations to be plotted against year over a 5-year period.

Table 18: Baseline monitoring programmes for Institutional & Management Structures and Sustainable Livelihoods

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
Institutional & Management Structures					
IMS1&2: establishment of EAF and catchment institutions such as CMA, WUA and catchment forum.	Presence of institutions; TPC would be the absence of such institutions.	**Human** - DWS personnel. **Budget** – part of normal responsibilities for DWS;	Estuarine area for EAF and catchment for CMA, WUA and catchment forum.	Must happen immediately.	Institutions need to be formed and constituted with the help of DWS, and specialist consultants within a year of this EMP being drafted.

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
IMS3: Interaction between EAF and other institutional structures.	Integration and interaction between institutions; TPC would be institutions operating in isolation.	**Human** – Cape Nature and institutional representatives (chairpersons). **Budget** -	Designated estuarine and catchment area.	Assess once a year.	Representatives from the catchment institutions need to be integrated with the EAF as part of the water quantity & quality working group. The number of regular meetings that are held where common management issues are discussed and action plans implemented must be recorded and plotted against years over a 5-year period.
Sustainable Livelihoods					
SL1: Ensure all existing activities and livelihoods dependant on the estuary comply with legislation and frameworks.	Compliance with legislation and planning & management frameworks; TPC would be any non-compliance or conformity.	**Human** – Various municipal departments; tourism representatives; home owner's association representative; EAF. **Budget** – Part of normal responsibilities for municipality, home owners and tourism operators;	Designated estuarine and catchment area.	Must happen immediately.	Assess all existing activities in the context of legislation (e.g. NEMA & EIA regulations, NWA, NFA, CARA, NHRA) and frameworks (e.g. SDF/IDP, EMP and CMP). Record are as of non-compliance and report to responsible authorities (e.g. municipal planning, DWS or DEA&DP) then monitor response from authorities.
SL2: Develop non-consumptive enterprises that involve the estuary and previously disadvantaged communities.	Number of new initiatives and compliance with legislation and planning & management frameworks; TPC would be no new initiatives and non-compliance or lack of conformity.	**Human** – Tourism operators; community representatives; EAF. **Budget** -National government as part of poverty alleviation programme	Designated estuarine and catchment area.	Assess once a year.	Record all new non-consumptive activities associated with the estuarine area and catchment and level of compliance with legislation and frameworks. Plot XY graphs of number of initiatives or incidences of non-compliance against years over a 5-year period. Numbers of activities should show an initial increase and then stabilize while non-compliance incidents should show a decrease.

Table 19: Baseline monitoring programmes for Education and Awareness

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
EA1: Increase awareness of estuaries and their value amongst municipal workers and managers.	Attendance at workshops and questionnaire; TPC would be poor workshop attendance and failure to complete questionnaire.	**Human** - DEA:O&C with assistance from EAF and specialists from tertiary & research institutes. **Budget** – National government (DEA)	Eden District Municipality	Once a year.	Attendance at workshops and successful completion of questionnaires to be recorded once a year and plotted against years over a 5-year period. Analysis should show a steady attendance record and an increase in the level of understanding estuaries and

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
					their importance.
EA2: Increased public awareness of estuaries and their value.	Number of public notice boards, number of school groups and questionnaire; TPC would be no visible notice boards, few school tour groups and continued public ignorance.	**Human** - DEA:O&C with assistance from municipal environmental staff and EAF and specialists from tertiary & research institutes. **Budget** – National government (DEA)	Designated estuarine area.	Once a year.	Assess placement of notice boards and their content; record number of school tour groups; and assess completion of questionnaires. Analysis should show an increase level of understanding through successful completion of questionnaires and a steady attendance by school groups (includes return visits from schools each year).
EA3: Research projects initiated that fill knowledge gaps and provide information for monitoring programmes.	Number of research projects; TPCs would be few research projects and continued lack of data for monitoring programmes.	**Human** – EAF. **Budget** -	Designated estuarine and catchment area.	Once a year.	Number and type of research projects to be recorded and related to areas of concern with regards knowledge gaps and monitoring data. Must ensure interaction between EAF and tertiary & research institutions and a sharing of knowledge.

Table 20: Baseline monitoring programmes for Hydrodynamic & Sedimentary processes

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
WHS1: State of estuary mouth (usually applies to temporarily open/ closed systems but is included here as Gouritz may close under extreme conditions).	State of mouth at low tide: TPC would be uncharacteristic levels of sedimentation and even the threat of possible closure, i.e. deviation from established patterns.	**Human** - EAF. **Budget** – no cost to EAF directly but may require specialist to interpret observations- could be funded by Municipality, CapeNature or DWS.	Local-the immediate mouth area.	Observations can be made daily at low tide if capacity allows or at least over spring tide period at low tide.	Record state of mouth as open, closed or semi-closed and establish frequency of closed events over 5/6 year period. Closure of Gouritz or deviation from normal cycles could indicate abnormal conditions (drought) or reduced freshwater inflow.
WHS2: Frequency and duration of episodic events.	Type of event (flood) and duration; this is a natural phenomenon and TPCs are not relevant.	**Human** – EAF and Municipal Environmental officer. **Budget** – no cost to EAF; part of environmental officer's official duties	The estuarine area.	Whenever the events occur.	Record the event, its duration and time of year. These data are important as they help explain sedimentation patterns, scouring, duration periods for recovery and mouth dynamics.
WHS3: Changes in bathymetry as a measure of long-term sedimentation processes.	Depth profile of estuary at selected sites; TPC is a bathymetric profile that varies significantly from the natural range.	**Human** – estuarine sediment dynamics specialist (consultant or from tertiary/ research institution). **Budget** - research funding from tertiary institutions; possibly	Water body within the designated estuarine area.	Every three years or after episodic flood events.	Graphic display of bathymetry at sites overtime. Sediment accumulation could indicate increased erosion due to bad land-use practises or increased input from marine and Aeolian origins; could ultimately lead to mouth closure.

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
		CapeNature or DWS.			

Table 21: Additional Baseline monitoring programmes for Water Quality

Objective	Indicator & TPC	Resources	Spatial	Temporal	Sampling & Analysis
WQ3: Frequency and location of fish & invertebrate kills; macro- and micro-algal blooms; non-natural floating objects and surface contaminants; and areas with bad smells.	Observe the occurrence and location of these aspects. TPCs are not defined per se but are exceeded when indicators are visible.	**Human** - EAF, river users and river control officer. **Budget** - none for observations; DWS or Municipal for investigation of cause.	Designated estuarine area.	Observations can be made during normal activity.	Occurrence and location to be recorded; cause to be investigated by DWS or Municipal Community Services. Analysis could show pollution by effluent discharge, nutrient enrichment or low oxygen levels; cause may also be natural, e.g. low temperature.
WQ4: Salinity distribution patterns.	Baseline salinity distribution patterns from historical data or expert predictions. TPC is a deviation from natural patterns.	**Human** – Municipal environmental protection services or research/ tertiary institution. **Budget** – Municipal or funding from tertiary or research institutions.	Several stations (every 1-2km) along estuary including mouth and head region.	At least seasonally; at high tide during neap tide cycle allowing for tidal lag for stations upstream of the mouth.	XY graphs of salinity vs depth at each station, and salinity vs station along the length of the estuary. Increased penetration of saline water up the estuary length could mean reduced freshwater inflow; halocline could indicate closed mouth or reduced mixing.
WQ5: Water transparency.	Secchi disc readings are an indicator of water transparency. TPCs are variations from natural variability; floating matter that reduced light penetration; and absence of a protected riparian zone.	**Human** – Municipal Community Protection Services or river control officer. **Budget** – no additional budget; sampling to be carried out as part of normal responsibilities.	Several stations (every 1-2km) along estuary including mouth and head region.	Preferably weekly and at least seasonally; during high tide over neap tide cycle allowing for tidal lag for stations upstream from mouth.	XY graphs of Secchi disc readings vs station along length of estuary. Also record observations of type, concentration, duration and extent of floating material, surface contaminants and submerged materials. Decrease in transparency could indicate increased silt loads (erosion) or domestic pollution but may also be natural after heavy rains.
WQ6: Concentration of bacteriological contaminants.	Total coliform (*E.coli*) counts. TPC for estuary- counts in 80% of samples over time should be <100counts/100ml; counts in 95% of samples <2000 counts/100 ml.	**Human** – Municipal Community Protection Services and local municipal laboratory staff. **Budget** – operating budget from Community Protection Services.	Waterbody within the designated estuarine area.	Weekly samples during peak holiday periods; seasonally; when bad odours or sewage spills are noticed.	Plot *E.coli* counts as XY graphs against time for each station. Increase in counts to above the TPC indicates contamination and hence a health hazard to estuary users.

APPENDIX 2: RECOMMENDED LONG-TERM MONITORING PROGRAMMES

As per the Reserve Determination Study (DWS, 2015), the following long-term monitoring programme is recommended. Items in bold will help to improve confidence of EWR study; priority components for DWS are highlighted in grey.

Table 22: Long-term monitoring programmes for hydrology, sediment dynamics, hydrodynamics and water & sediment quality.

Sampling	Spatial Scale	Temporal Scale	Comments
Hydrodynamics			
Record freshwater inflow into estuary at flow gauging station	Near the head (to be confirmed)	Continuous	Construction of flow gauging weirs must not impede migratory movements of aquatic organisms.
Record water level	Near the mouth (to be installed)		
Aerial photographs (spring low tide)	Entire estuary if possible, otherwise mouth area	Baseline then every 3 years	
Sediment Dynamics			
Monitoring berm height using appropriate technologies	Mouth	Quarterly	Difference between long-term equilibrium patterns and short-term variations need to be determined. Sediment processes are better monitored over the long-term and floods may be infrequent and their effects only recorded in the long-term.
Bathymetric surveys: Series of cross section profiles and a longitudinal profile	**Entire estuary; collected at fixed 500 m intervals, but in more detail in mouth including berm (every 100 m). Vertical accuracy at least 5 cm**	**Every three years (and after large resetting event)**	
Collect sediment grab samples (at cross section profiles) for analysis of particle size distribution (and ideally origin, i.e. Microscopic observations)	**Entire estuary; 50m intervals at mouth and 1000m intervals elsewhere**	**Every three years**	
Water & Sediment Quality			
Collect data on conductivity, temperature, suspended solids, pH, inorganic nutrients (N, P and Si) and organic content (TP and Kjeldahl N) in river inflow	Near head of estuary (current station too far upstream)	Monthly, continuous	Water quality parameters depend on riverine and marine waters and biochemical processes. Toxic substances accumulate and integrate over time; therefore sediments would provide the best evidence of elevated levels or build
Collect samples for pesticides/herbicide and metal determinations in river inflow	Near head of estuary	Every 3 – 6 years if baseline shows contamination	

Sampling	Spatial Scale	Temporal Scale	Comments
Record longitudinal in situ salinity and temperature pH, DO, turbidity profiles	Entire estuary (12 stations)	Seasonally, every year	up. Data collection can coincide with biological monitoring programmes to help with interpretation of biotic data.
Collect surface and bottom water samples for inorganic nutrients (and organic nutrient) and suspended solid analysis, together the in situ salinity, temperature, pH, dissolved oxygen and turbidity profiles	Entire estuary (12 stations)	Every three years (high flow and low flow) or when significant change in water quality expected	
Measure pesticides/herbicides and metal accumulation in sediments (for metals investigate establishment of distribution models – see Newman and Watling, 2007)	Entire estuary, including depositional areas (i.e. muddy areas)	Once-off, then every 3 – 6 years, if results show contamination	

Table 23: Long-term monitoring programmes for microalgae, macrophytes and invertebrates

Sampling	Spatial Scale	Temporal Scale	Comments
Migroalgae			
• Record relative abundance of dominant phytoplankton groups, i.e. Flagellates, dinoflagellates, diatoms, chlorophytes 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. Spectrophotometer, HPLC, fluoroprobe. • Intertidal and subtidal benthic chlorophyll-a measurements (four replicates each) using a recognised technique, e.g. Sediment corer or fluoroprobe.	Along length of estuary minimum five stations	Every 3 years thereafter.	Combine sampling times when water & sediment quality studies are done; also coincide with invertebrate sampling to help with interpretation of zooplankton data.
Macrophytes			
• Ground-truthed maps to update the map produced for 2013 and to check the areas covered by the different macrophyte habitats. • Record boundaries of macrophyte habitats and total number of macrophyte species in the field • Assess extent of invasive species within the 5 m contour line • Check for loss of reed and sedge area in the upper reaches • Check for increase in bare areas in supratidal salt marsh habitat from mapping	Entire estuary for mapping (transect sites in the lower reaches on the west bank)	Summer survey three years	The following plant habitat types are relevant to the Gouritz: open surface water intertidal sand and mudbanks, submerged macrophytes beds, macroalgae, intertidal & supratidal salt marsh and reed and sedges

Sampling	Spatial Scale	Temporal Scale	Comments
• Measure macrophyte and sediment characteristics along transects in the lower salt marsh. Percentage plant cover measured in duplicate 1 m^2 quadrats along the transects and an elevation gradient from the water to the terrestrial habitat • Duplicate sediment samples collected in three zones along each transect to represent the different supratidal salt marsh zones. Analysed in the laboratory for sediment moisture, organic content, electrical conductivity, pH and redox potential. In the field measure depth to water table and ground water salinity			
Invertebrates			
• Collect duplicate zooplankton samples at night from mid-water levels using WP2 nets (190 um mesh) along the estuary at five sites. • Collect grab samples (five replicates) (day) from the bottom substrate in mid-channel areas at same sites as zooplankton (each sample to be sieved through 500 um). • Collect sled samples (day) at same zooplankton sites for hyper benthos (190 um) • Collect sediment samples using the grab for particle size analysis and organic content (at same sites as zooplankton) • Intertidal invertebrate hole counts using 0.25 m^2 grid (five replicates per site) on eastern shore in Zone B. Establish the species concerned using a prawn pump	Minimum of five sites along length of entire estuary For prawn hole counts – minimum of five intertidal sites	Every two year's mid-summer	High variability in vertebrate response to flow and rapid changes in community composition and species abundance requires a long-term data set for baseline data. Sampling stations should try overlapping macrophytes sites to link invertebrate patters to habitat types. Co-ordinate sampling with water and sediment quality surveys for cost effectiveness and interpretation of patters.

Table 24: Long-term monitoring programmes for fish and birds

Sampling	Spatial Scale	Temporal Scale	Comments
Fish Community			
Record species and abundance of fish, based on seine net and gill net sampling: Sampling gear needs to suit habitat types. Seine and gill nets will be primary gear, but also otter trawls (deep channels) cast nets and Fyke nets (strong flow and dense vegetation). Record species composition, abundance, distribution and length frequencies. Sub-samples may be required for feeding, reproduction and genetic studies.	Entire estuary (12-15 stations)	Summer and winter survey every three years	Non-destructive sampling to be carried out where possible, i.e. measure and release. Multiple gears are required to ensure entire community is sampled. Sampling should coincide

Bird Community			
Undertake counts of all non-passerine waterbirds, identified to species level. Divide estuary into sections based on habitat type and within each section at low tide record species and abundance (special note of rate or endangered species), state of habitat, level of human activity/ disturbance, breeding activity and nesting sites.	Entire estuary: Seven sections, mouth, section 2, Abov ski-zone, above tributary, above shallow area, above road bridge, and above cliffs.	Annual winter and summer surveys	Sections where counts take place must be labelled as "distance from mouth"; summer counts to be done outside of holiday period, preferably February/March; annual counts are required to detect cycles of variability which may have three-year periodicity; seasonal counts required for migratory species; CWAC analyses and collates data but counts can be done by St Francis Bird Club or EAF members; birds are good indicators species for large permanently open estuaries