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Sout (Oos) Estuary Management Plan: Situation Assessment Report.

January 2022

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EXECUTIVE SUMMARY

The Sout (Oos) Estuary is a small (2km long and ± 52.2 ha in extent), dynamic, permanently open system located in the Tsitsikamma Section of the Garden Route National Park, ± 3 km west of Nature's Valley. There are no developments immediately surrounding the estuary, or in the upper catchment of the Sout River. The mid-catchment falls outside of the national park and supports various settlements (i.e. Kurland and The Crags) and associated enterprises, as well as agricultural areas and smallholdings.

The climate in the region is warm and temperate. Average daily temperatures range from 10°C in winter to 22°C in summer. Rainfall occurs year-round, with the highest typically occurring in August (average 80 mm), and lowest in February (average 28 mm). The upper reaches of the Sout River are underlain almost entirely with sandstones, whereas the lower reaches and estuary lie entirely in Gydo Formation shales.

The Sout River has a relatively small catchment area of 35.5 km^2. Flow is perennial, with the present day Mean Annual Runoff estimated to be 10.1 x 10^6 m^3, which is ± 90% of the estimated natural condition. The estuary is generally very shallow (< 1.0 m) with occasional pools up to 2 m deep. This shallowness results in water circulation being highly responsive to changes in both river and tidal inflows, and with ensuing abiotic properties such as salinity and temperature changing rapidly and substantially. A tidal amplitude of up to 1.7 m can occur near the mouth of the system.

Rocky headlands on both banks at the estuary mouth limit the ingress of marine sediments. In addition, the confined nature of the estuary channel, due to steep banks and a small floodplain, facilitates scouring of accumulated sediments during flood events. These features contribute to keeping the estuary mouth permanently open.

The Sout (Oos) Estuary is a typical black water, oligotrophic, acidic system. It is generally well-oxygenated (>7 mg l^{-1}) and does not carry heavy loads of organic matter. Turbidity is generally low, but can increase during periods of higher freshwater inflow. Salinity is likely to frequently be stratified, with the upper reaches being freshwater-dominated (<10 psu) during low tides, with pockets of higher salinity water (>20 psu) occurring in deeper (>1 m) areas in the middle reaches. Measured water quality is largely similar to expected reference conditions, however some limited nutrient enrichment is possible as a result of catchment activities. Elevated nutrient levels have periodically been recorded in the Sout River, and are suspected to result either from runoff from developments in the catchment, particularly following rainfall events, or from effluent discharges from the Kurland waste water treatment works.

The estuary is surrounded by Southern Afromontane Forest, with grasses, rushes and some salt marsh plant species occurring on the flatter banks. The dunes at the estuary mouth are stabilised by low scrubland and dune plants. There is little suitable substrate within the estuary that would facilitate the colonisation of Cape eelgrass. The estuary is largely natural, and the distribution and abundance of aquatic plants is assumed to not have changed significantly over time. Strong tidal flows regularly flush the estuary, thus not providing sufficient water residence time for a high phytoplankton biomass to develop. Species richness of the subtidal zoobenthic community is low, and only hardy species are able to tolerate the fluctuating environmental conditions. The biomass and density of subtidal macrobenthic species, such as prawns and crabs, is low. The fish community is dominated by juvenile marine estuarine-dependent species, with 74% of fish species being southern African endemics. Most of the fish species found within the estuary are benthic feeders. There appears to have been little change in the fish community in the estuary over time and the presence of both early recruits and larger size classes indicates that the Sout (Oos) Estuary serves a viable nursery function, with some species having extended utilisation of the system. Bird diversity in the estuary is low due to the small surface area and lack of foraging habitats. Up to 50 bird species are potentially resident, transient, or rare visitors, though only nine species have previously been recorded. Despite low bird diversity, the remote location and pristine condition of the estuary makes it an ideal sanctuary for birds.

The Sout (Oos) Estuary has been ranked 83rd, and in a later assessment 91st, out of 248 South African estuaries in terms of overall conservation importance. As the estuary occurs entirely within the Garden Route National Park it was included in the 2011 National Estuaries Biodiversity Plan's core set of priority estuaries in need of protection in order to achieve national biodiversity targets. The overall Ecological

Health Category of the estuary is an A (unmodified, near natural), and the Recommended Ecological Category (REC), or desired state, is also an A. Key interventions required to achieve the REC include maintenance of i) base flows during the dry season, and ii) good water quality throughout the system. There are various threats and pressures relevant to the estuary including climate change, exploitation of natural resources, land-use change and infrastructure development in the mid-catchment leading to flow reduction, and an increase in nutrient input from the catchment, impacting water quality.

The ecosystem services that visitors derive from the Sout (Oos) Estuary are mainly non-material or cultural. There are two broad motivations for visiting the estuary, namely appreciating nature and angling. The estuary and its catchment falls within the Bitou Local Municipality. In 2020 this municipal area had a population of ± 67 139 people at a density of 68 people km^{-2}. Kurland is the largest settlement in the Sout River catchment, with a population in 2011 of ± 4 033 individuals in 1 261 households. In 2018, the value of the local economy was R3.27 billion, which provided employment for close to 20 000 people in various sectors, including the wholesale and retail trades, catering and accommodation, agriculture, and forestry. Kurland and Covie are two of four communities that have the lowest income levels in the municipal area. The municipal region is considered to have an unemployment rate of ± 17.8%, the second highest for the Garden Route District. In the 2020/21 financial year, 99.6% of the Bitou Local Municipality budget was used to fund development of human settlements, of which 62% was used to improve basic services (access to water; sanitation; electricity; refuse removal), 19% for social infrastructure (sport and recreation; social development; health; public safety; environmental protection) and 15% for economic infrastructure (planning and development; road transport).

Legislation specific to estuarine management includes the National Environmental Management: Integrated Coastal Management Act and the accompanying National Estuarine Management Protocol. Key legal instruments that are applicable to estuarine management comprise national, provincial and local management documents, including the Garden Route National Park Management Plan compiled in accordance with the National Environmental Management: Protected Areas Act.

Information pertaining to the Sout (Oos) Estuary is generally poor, and no significant additional environmental research has been undertaken since the completion of the reserve determination studies in 2007. Although past studies remain relevant, almost any future research would provide valuable contributions to the knowledge base for this system. Priority fields of study would be those that address threats and weaknesses, and would include resource utilization, catchment land-use, hydrology, water quality, and disturbances from recreational activities.

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ACRONYMS AND ABBREVIATIONS

All references to legislation in this document include subsequent amendments

amsl	Above mean sea level
CBA	Critical Biodiversity Area
CES	Cultural Ecosystem Services
CMP	Coastal Management Programme
DEA	Department of Environmental Affairs (now DFFE)
DEAT	Department of Environmental Affairs and Tourism (now DFFE)
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DWS	Department of Water and Sanitation (now DHSWS)
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EMP	Estuarine Management Plan(s)
ESA	Ecological Support Area
GDPR	Regional Gross Domestic Product
GREMDF	Garden Route Environmental Management Development Framework
GRNP	Garden Route National Park
ICM Act	National Environmental Management: Integrated Coastal Management Act, 2004 (Act No. 24 of 2008)
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature and Natural Resources
LM	Local Municipality
MAR	Mean Annual Runoff
MLRA	Marine Living Resources Act, 1998 (Act No. 18 of 1998)
NBA	National Biodiversity Assessment
NEM:PAA	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
NEMP	National Estuarine Management Protocol (Published in 2013 and revised in 2021)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
psu	Practical salinity units
REC	Recommended Ecological Category
SANParks	South African National Parks
SAR	Situation Assessment Report
SDF	Spatial Development Framework
TOxN	Total Oxidised Nitrogen

1. INTRODUCTION

1.1. Background

The Sout (Oos) Estuary is located 3 km west of Nature's Valley in the Bitou Local Municipality (LM) (Figure 1) of the Garden Route (formerly Eden) District. The estuary and the lower portion of its catchment are located within the Tsitsikamma Section of the Garden Route National Park (GRNP), and is managed by South African National Parks (SANParks).

In accordance with the National Estuarine Management Protocol (NEMP), developed in line with the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) (ICM Act), an Estuarine Management Plan (EMP) must be developed for the Sout (Oos) Estuary. This document is the Situation Assessment Report (SAR), which provides information to inform the management planning process.

Figure 1: Location map of the Sout (Oos) Estuary within the Bitou Local Municipality.

1.2. Estuary Management Planning Process

The ICM Act was developed to facilitate the sustainable use and management of South Africa's coastline, coastal and estuarine resources. The ICM Act mandates the Minister responsible for the Environment, in concurrence with the Minister responsible for Water, to develop a NEMP as the tool to ensure co-ordinated and efficient management of estuaries. The NEMP was promulgated in 2013 and later revised in 2021.

In accordance with the ICM Act, and the NEMP, SANParks has created a timeline for development of EMPs for estuaries within National Parks. The development of this EMP takes cognisance of, and is written in accordance with, the National Guidelines for the Development and Implementation of Estuarine

Management Plans (DEA 2015), taking note of the framework for estuarine management as well as minimum requirements as per the NEMP. Figure 2 is a graphical representation of the Department of Environmental Affairs (DEA) (2015) framework. It highlights that successful management of the estuary requires, in the first instance, the setting of a "Vision" for the desired future state of the estuary, followed by the development of overarching management objectives, to achieve this state. As the Sout (Oos) Estuary falls within the Garden Route National Park, the EMP will be aligned with the GRNP Management Plan.

Spatially, the geographical boundaries of the estuary will be demarcated, reflecting the agreed estuarine functional zone (EFZ). The EFZ will be based on the best available information on the Sout (Oos) Estuary, in this case the EFZ description used is that defined by the 2018 National Biodiversity Assessment (NBA). The EFZ will thereafter be zoned by specifying and mapping activities that may or may not take place. Finally, and at a finer scale, management actions are then developed to address identified management priorities. Activities or actions included will reflect the relevant legislation informing such action, the responsible authority as well as measurable indicators to assess performance. These will include both activities within the EFZ as well as activities upstream that may affect the state or functioning of the Sout (Oos) Estuary. The Sout River catchment has an area of approximately 36 km^2, with a river length of approximately 14km. Any activity that may affect the river and its two tributaries, the Wit and Hol Rivers will form part of the EMP.

Once approved by the National Minister responsible for the Environment, implementation of the plan will be monitored from a resource, compliance as well as performance monitoring perspective. Successes, shortcomings, and the availability of new data (gleaned from both monitoring and research studies, where conducted), will be reflected upon and the EMP reviewed in the next five-to-ten-year cycle, as required. In future, revision of the EMP may be aligned with the revision period of the GRNP Management Plan, as provided for in the NEMP.

The development of an EMP is preceded by a scoping phase starting with the compilation of a SAR, this document, reflecting the current status of estuarine management in the specific estuary.

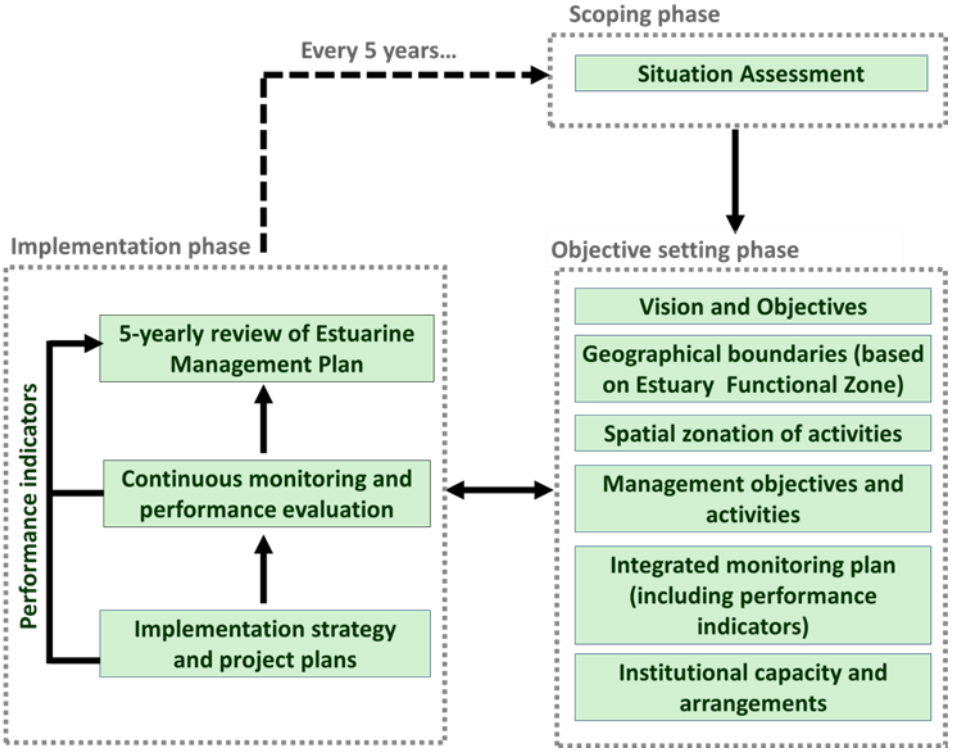

Figure 2: Framework for the development of estuarine management plans (DEA 2015).

1.3. Purpose of the Situation Assessment

The SAR gathers and interprets relevant available information that will serve as the basis for the development of a vision and applicable management objectives for the estuarine system.

As per the requirements of the NEMP this SAR:

- Provides a description of the structure, functioning, and present ecological state of the estuary – Sections 2 and 3.
- Identifies the ecosystem goods and services provided by the estuary – Section 4.
- Describes the current/potential impacts and threats to the ecological functioning of the system – Section 5.
- Describes the geographic socio-economic context of the system – Section 6.
- Describes the legislative instruments and management strategies applicable to the management of the estuary – Section 7.
- Highlights information gaps – Section 8.

2. CATCHMENT CHARACTERISTICS

2.1. Geomorphology

The Sout River is approximately 15 km long, originating in the Outeniqua Mountains and draining into the Indian Ocean close to the town of Natures Valley. The Sout (Oos) Estuary is a small black water system. The surrounding topography is gorge-like, with steep slopes dropping from the coastal plateau to the shores of the estuary. The upper reaches, where the river emerges from a narrow gorge about 700 m from the sea, are narrow, opening into a relatively broad sandy cove, approximately 80 m wide (Bornman *et al.* 2007). The mouth of the estuary is flanked by rocky headlands. The narrow beach on the adjacent coastline indicate limited transport and deposition of marine sediments in the region of the estuary mouth. The estuary is permanently open as a result of low closing forces (i.e. small wave action and limited sediment input (Bornman *et al*. 2007) coupled with strong tidal scour of sediments in the lower reaches (Morant & Bickerton 1983).

2.2. Geology

The upper reaches of the Sout River are underlain almost entirely by Arenites (CNdV 2017) (Figure 3), comprising mostly Peninsula Formation sandstones, and successively Tchando, Kouga and Baviaanskloof sandstones (Morant & Bickerton 1983). The lower reaches and estuary lie entirely in Gydo Formation shales (Morant & Bickerton 1983).

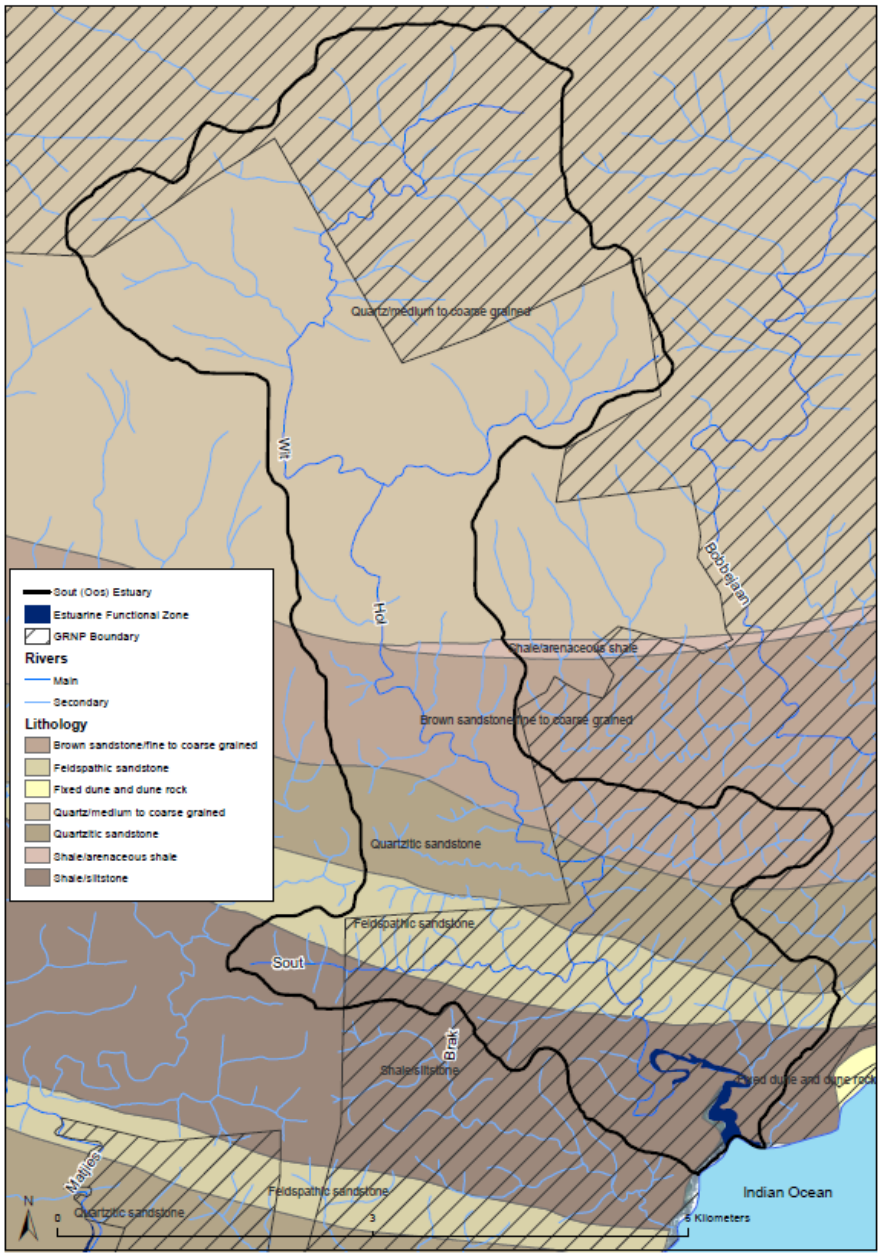

Figure 3: Geology of the Sout River catchment (after the Council for GeoScience) and GRNP boundary.

2.3. Climate

The closest weather station to the Sout (Oos) Estuary is in Plettenberg Bay, while very little meteorological data are available for the Sout River catchment (Bornman *et al.* 2007). The area experiences a typical austral climate with highest temperatures from December to March (average 22 to 24°C) and its lowest temperatures from June to August (average 10 to 11°C) (CNdV 2017). The climate is mild, frost is rare, and warm berg winds are infrequent (Morant & Bickerton 1983). The predominant wind direction is westerly, followed by west-south-westerly, west-north-westerly and easterly (CNdV 2017).

Rain falls throughout the year with a monthly average of 8 to12 rainy days and highs generally during spring (September to November) and late summer (February and March) (Morant & Bickerton 1983). Mean Annual Precipitation is estimated at 886 mm and Mean Annual Evaporation is 1260 mm (Bornman *et al.* 2007). Rainfall up to 1100 mm per annum can be expected in high altitude areas (Morant & Bickerton 1983).

2.4. Land-use

Approximately 50% of the Bitou LM is formally protected under the jurisdiction of SANParks (part of the Garden Route National Park), and CapeNature (Robberg Nature Reserve and Keurbooms River Nature Reserve) to a lesser extent. Smaller nature reserves in the region include the Wadrif Nature Reserve, Kiaruna Nature Reserve, Backenburn Nature Reserve and Annex Arch Rock Nature Reserve (CNdV 2017). The remaining 50% of the municipal area is allocated for agriculture use, and to a lesser extent wetland and river corridors, Critical Biodiversity Areas (CBAs) and urban development (CNdV 2017).

The upper and lower reaches (approximately 45%) of the Sout River catchment is conserved under the management of the GRNP whilst the middle catchment accommodates various other land uses. These include the Kurland Village where houses, roads, a school and the wastewater treatment works are situated. Kurland has been identified as a village, and development in this settlement is not encouraged (CNdV 2017). Small enterprises adjacent to Kurland include timber and brickyards, a local store, fuel station and a vehicle repair center. Other properties in the catchment primarily support agricultural activities including pasturelands, dairy, cattle and horse farms, lifestyle smallholdings, tourist facilities, polo fields and an equestrian center.

The Sout (Oos) Estuary is located 3 km west of Nature's Valley, which according to the Bitou Spatial Development Framework (SDF) (CNdV 2017) specifies that the area should remain as a low density and low intensity use residential area primarily for holiday purposes, with no further development due to the value of the unspoilt surrounding environment.

3. ECOLOGICAL FUNCTION AND STATE OF THE ESTUARY

3.1. Definition and Delineation

The ICM Act defines an estuary as "*a body of surface water - that is permanently or periodically open to the sea; 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 in respect of which the salinity is higher than fresh water as a result of the influence of the sea, and where there is a salinity gradient between the tidal reach and the mouth of the body of surface water*".

Similarly, the National Water Act 1998 (Act No. 36 of 1998) (NWA) defines an estuary as "*a partially or fully enclosed water body that is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land*".

The 2018 NBA: Estuarine Realm Technical Report (Van Niekerk *et al.* 2019) provides a more detailed definition of an estuary, that is, "*a partially enclosed permanent water body, either continuously or periodically open to the sea on decadal time scales, extending as far as the upper limit of tidal action, salinity penetration or back-flooding under closed mouth conditions. During floods an estuary can become a river mouth with no seawater entering the former estuarine area or, when there is little or no fluvial input, an estuary can be isolated from the sea by a sandbar and become fresh or even hypersaline*". Given this extended definition and the fact that it is not currently incorporated into or reflected in any legislation, Van Niekerk *et al.* (2019) noted the importance of updating the relevant legislation to include a broader definition of an estuary, which includes the EFZ.

Although inclusion of the EFZ in the description of an estuary is deemed important, the only legislated definition of an EFZ can be found in the 2014 Environmental Impact Assessment (EIA) Regulations, as amended, which defines the EFZ 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, as defined by the 5 m topographical contour (referenced from the indicative mean sea level)*".

Van Niekerk *et al*. (2019) notes the shortcomings of using a 5m topographical contour as a reference for all estuaries and instead provides for a broader definition of an EFZ as "*The open water area of an estuary together with the associated floodplain, incorporating estuarine habitat (such as sand and mudflats, salt marshes, rock and plant communities) and key physical and biological processes that are essential for estuarine ecological functioning*". The NEMP requires that a geographical description of the EFZ is provided as part of the EMP and that the definition of an EFZ as provided in the 2018 NBA (or subsequent revisions) is used.

The Sout (Oos) Estuary is a small permanently open estuarine system located within the warm temperate biogeographic region of South Africa. The size of the estuary, as defined by the EFZ, is approximately 52.2 ha, extending over a length of 2.5 km. The geographical boundaries of the Sout (Oos) Estuary, delineating the EFZ (Table 1), as well as the Sout River and tributaries are illustrated in Figure 5 and Figure 6 respectively.

Table 1: Geographical boundaries of the Sout (Oos) Estuary.

Downstream boundary	33°59'23.26"S; 23°32'10.97"E (Estuary mouth)
Upstream boundary	33°59'6.96"S; 23°31'47.76"E
Lateral boundaries	EFZ as described in the 2018 NBA

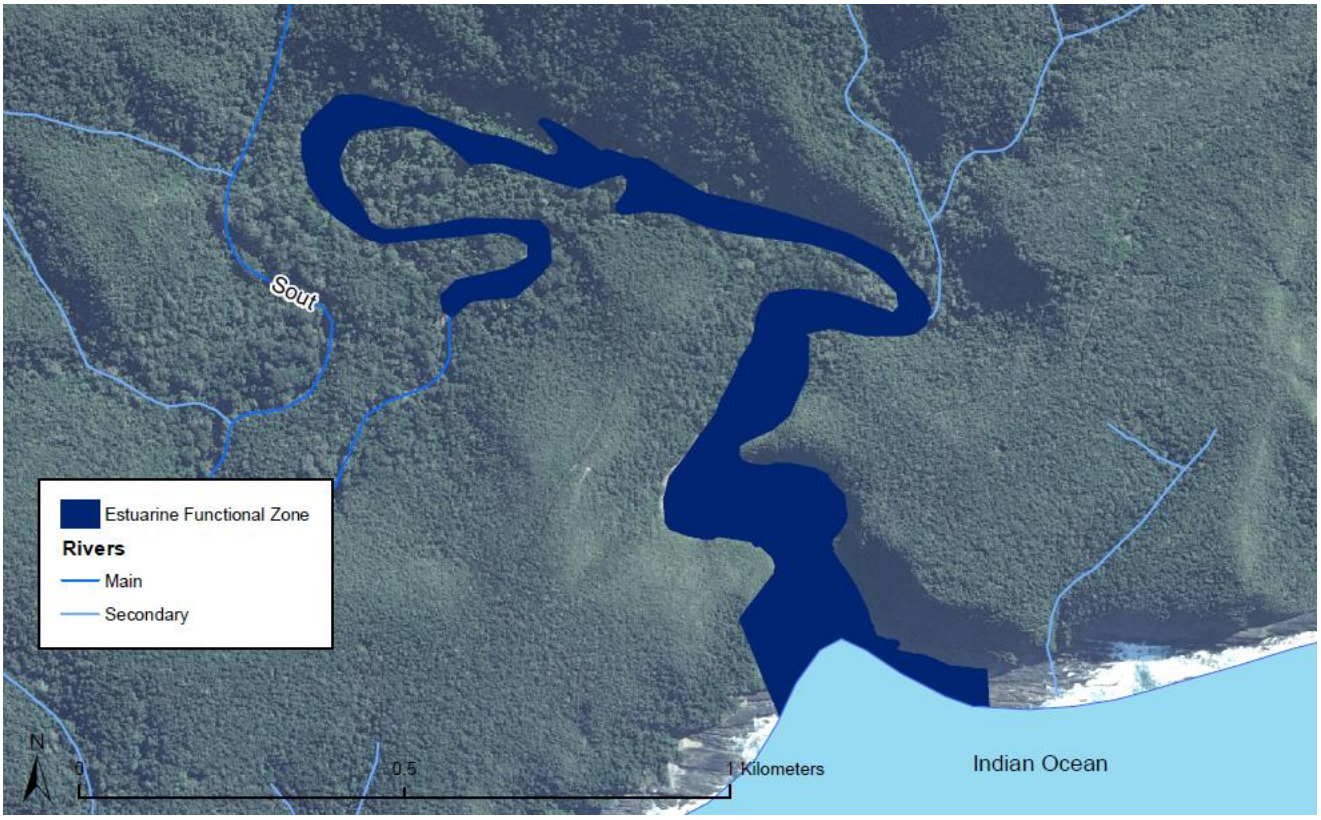

Figure 4: Geographical boundaries of the Sout (Oos) Estuary based on the EFZ based on the 5 m amsl contour (http://bgis.sanbi.org/SpatialDataset/Detail/2689).

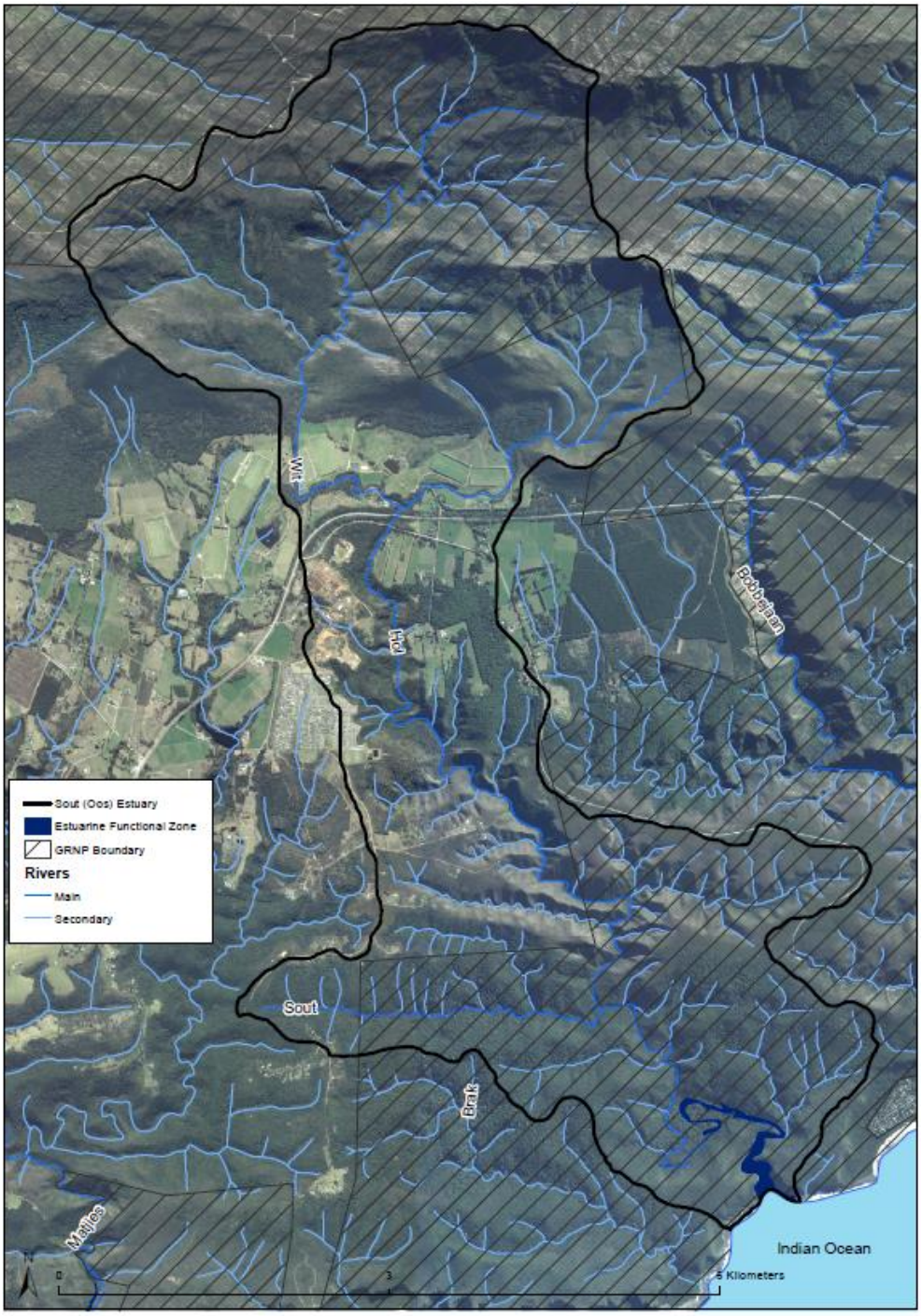

Figure 5: Geographical boundary of the Sout (Oos) Estuary and its contributing rivers as well as the Boundary of the GRNP. Note: hashed section denotes area within the GRNP.

3.2. Abiotic Function

Hydrology

The Sout River system has a relatively small catchment of approximately 35.5 km^2. The only flow data available are 60 years (1934 to 1993) of simulated monthly data based on calibration parameters from the nearby Bloukrans River. (Bornman *et al.* 2007). Flow in the Sout River is perennial, with the volume fluctuating depending on the quantity and intensity of rainfall in the catchment. Inter-basin transfer of water

from the Sout to the adjacent Buffels and Matjies rivers occurs via a small canal in the upper catchment at Kurland Estate (Bornman *et al.* 2007). The present day mean annual runoff (MAR) is estimated to be 10.1 x 10^6 m^3 which is approximately 90% of the estimated natural MAR of 11.22 x 106 m^3 (Bornman *et al*. 2007).

Circulation and salinity profiles

Water circulation in the Sout (Oos) Estuary is very responsive to changes in both river and tidal inflows due to the shallowness of the estuary, with ensuing abiotic properties such as salinity and temperature changing rapidly and substantially. For example, during salinity surveys undertaken on 20 March 2007 during spring high tide, the Sout (Oos) Estuary was marine dominated, with high salinities (>30 psu) (practical salinity units) recorded up to 0.8 km inland from the mouth and with very little salinity stratification, whereas measurements taken on low tide on the same day showed salinity to be substantially lower (<10 psu) in most of the system, and with freshwater dominating the upper reaches (Bornman *et al*. 2007). During limited surveys undertaken in March 2007 salinity stratification was only recorded in the deeper portions (>1.0 m) of the estuary between 500 and 700 m inland from the estuary mouth. The rapid change in water salinity between low and high tides is an indication of a rapidly flushing, low retention system.

Bathymetry

Bathymetric surveys undertaken on 21 March 2007 during spring low tide showed the Sout (Oos) Estuary to generally be very shallow (< 1.0 m) with occasional pools up to 2 m deep along the tidal reach (Figure 6). Sediments in the deeper pools consisted mostly of fine sand and organic material from decaying plant matter (Bornman *et al*. 2007).

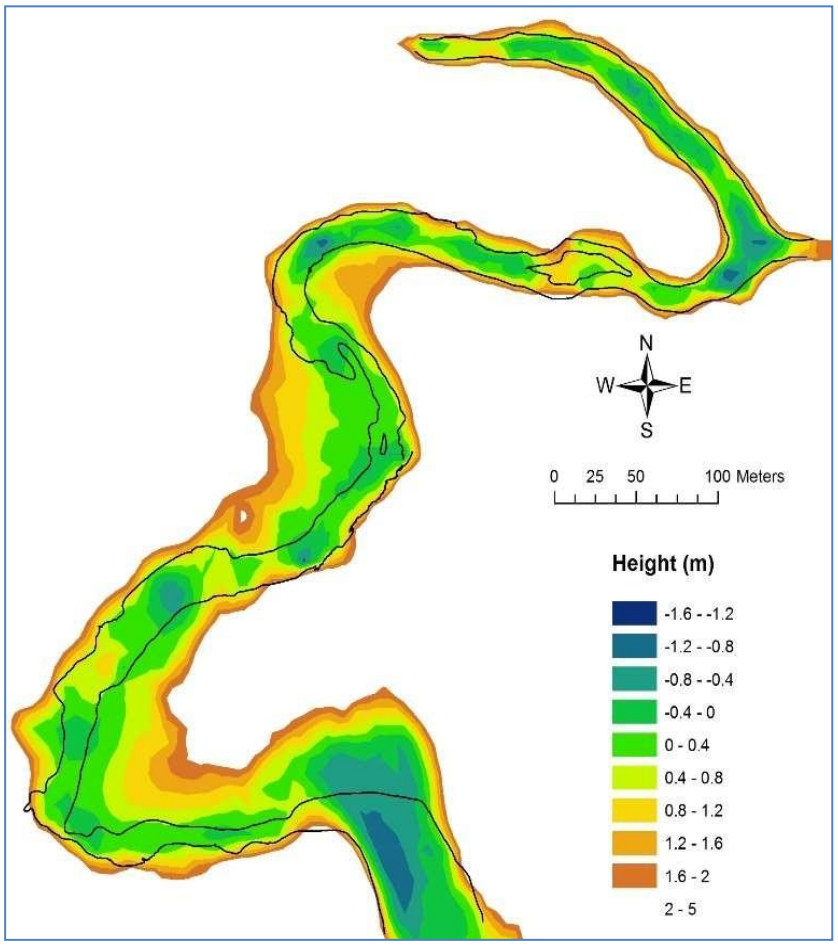

Figure 6: Interpolated surface plot showing the bathymetry of the Sout (Oos) Estuary (Bornman *et al*. 2007).

Water levels

Water level data collected during a spring and a neap tide demonstrated a surprisingly large tidal amplitude for such a small, shallow, perched system (Bornman *et al*. 2007), with a maximum of 1.7 m recorded near the estuary mouth (Figure 7). The difference between the predicted low and high tides for the day were 2.14 m, indicating a 0.5 m reduction in tidal amplitude as it enters the system from the sea. As the tidal wave travels upstream, it is dampened by about 0.5 m to ±1.2 m in the middle reaches of the estuary. This significant tidal exchange results in large fluctuations in salinity in the system.

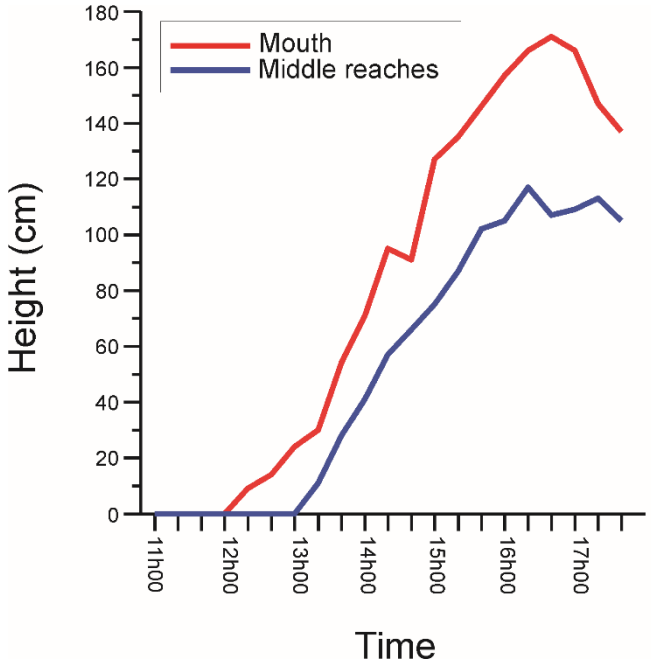

Figure 7: Water level fluctuations at two stations during spring tide on 20/03/2007 (modified from Bornman *et al.* 2007).

Sediment dynamics

The mouth of the Sout (Oos) Estuary has rocky headlands on both banks, which limit the ingress of marine sediments. The permanently open mouth is largely a result of low closing forces (i.e. small wave action and limited sediment input). Marine sediments only penetrate in significant amounts to above the first bend in the estuary (Figure 8). The sediment yield from the Sout River catchment is low and does not contribute significantly to the overall sedimentation rate in the system (Morant & Bickerton 1983). The confined nature of the estuary channel (steep banks and limited flood plain area) also facilitates efficient scouring of accumulated sediments during flood events, which contributes to keeping the estuary mouth permanently open.

Figure 8: Lower reaches of the Sout (Oos) Estuary.

Water quality

Very little information is available on the water quality of the Sout (Oos) Estuary with all data coming from once-off surveys undertaken in April 1981 (Morant & Bickerton 1983), November 1994, September 1995 (James & Harrison 2009), December 2006 and April 2007 (Bornman *et al*. 2007). The Sout (Oos) Estuary is a typical black water oligotrophic, acidic system.

Temperatures in the Sout (Oos) Estuary are expected to show a strong seasonal pattern, with summer temperatures typically being between 20 and 25°C and winter temperatures between 13 and 16°C (Bornman *et al*. 2007). Measured temperatures were relatively uniform throughout the system, ranging between 18.3 and 21.8°C (Bornman *et al*. 2007) and 17.3 and 18.6°C (Morant & Bickerton 1983). James & Harrison 2009 recorded spring temperatures of 21.7 and 21.5°C.

pH is expected to remain within the range 7.0 to 8.5 (Bornman *et al*. 2007), with the lower values occurring in the fresher (upper) reaches and higher values in the more saline (lower) reaches. Once-off pH ranges have been measured as 7.65 to 8.38 (Bornman *et al.* 2007), 8.1 to 8.2 (James & Harrison 2009) and 6.60 to 7.92 (Morant & Bickerton 1983).

The Sout (Oos) Estuary should generally be well-oxygenated (>7 mg l^{-1}) because the estuary is shallow, does not appear to carry a heavy load of organic matter, and is flushed rapidly and regularly (Bornman *et al.* 2007). However, James & Harrison (2009) recorded dissolved oxygen concentrations ranging from 5.0 to 5.8 mg l^{-1}, and Morant & Bickerton (1983) reported a low of 3.38 mg l^{-1} in bottom waters at one sample site in April 1981, though with a range of 5.51 to 6.47 mg l^{-1} at other sites. Thus lower than expected dissolved oxygen concentrations may occur on occasions, possibly as a result of a number of abiotic factors including higher water temperatures and salinity. Once-off surveys in 2007 showed the system to be well-oxygenated throughout (>80% saturation) (Bornman *et al.* 2007).

Turbidity in the Sout (Oos) Estuary is generally expected to be low, but can increase during periods of higher freshwater inflow. Measured secchi disk depths ranged between 40 and 80 cm (Bornman *et al*.

2007), and with Morant & Bickerton (1983) recording depths of up to 200 cm. The secchi disk was visible on the bed of the estuary during both surveys conducted by James & Harrison (2009).

Salinity in the Sout (Oos) Estuary is likely to frequently be stratified both vertically and horizontally. The residence time of water in the estuary increases as river flow decreases, but because the estuary mouth is permanently open, salinity will also be strongly influenced by tidal exchange. Rapid and substantial changes in salinity are likely due to variable marine inflows between low and high tides, and variability in river inflows. There is a large difference in volumes of water between the spring high (±60 000 m^3) and spring low tides (±5 500 m^3) so the estuary is likely to be mostly saline (average salinity >30 psu) during high tides and reverting to a more brackish stratified system during low tides (Bornman *et al.* 2007). During the low tides the upper reaches of the estuary is freshwater dominated (<10 psu), with pockets of more saline water (>20 psu) occurring in deeper (>1 m) areas in the middle reaches (±0.5 km from the mouth) (Bornman *et al.* 2007). Salinity stratification was also evident in the James & Harrison (2009) study, where salinity differences were noted between surface and bottom waters (29.8 and 30.2 psu respectively for measurements taken at the mouth) as well as between the mouth and further upstream.

Measured nutrients levels have differed substantially between surveys. Morant & Bickerton (1983) report ammonia (NH_3) concentrations ranging between 8.03 and 11.33 μM. Ammonium (NH_4+) concentrations in 2006 surveys were low throughout the estuary (0.5 ± 0.1 μM) particularly in the upper reaches, indicating that concentrations were low in river water, whereas surveys four months later showed significantly higher concentrations (3.9 ± 0.6 μM) (Bornman *et al*. 2007). Measured concentrations of Total Oxidized Nitrogen (TOxN= nitrate + nitrite) were generally low, ranging from 8.8 to 14.3 μM, and 1.0 to 4.0 μM in consecutive surveys (Bornman *et al.* 2007). Slightly higher surface concentrations indicate that, at times, river waters may be the primary source of TOxN. Measured Soluble Reactive Phosphorus (SRP) concentrations have been low, ranging from 0.9 to 1.6 μM and 0.7 to 1.1 μM in consecutive surveys, with gradual decreases in concentration from the head of the estuary to the mouth indicating that the river is the primary source of phosphorus (Bornman *et al.* 2007). Overall, measured water quality is largely similar to expected reference conditions, however some limited nutrient enrichment is expected as a result of catchment activities.

Elevated nutrient levels have periodically been recorded in the Sout River. De Moor & Bellingan (2010) recorded periodic significantly elevated levels of both TOxN and orthophosphate, with the highest concentrations (TOxN = 4.47 mg l^{-1}; orthophosphate 0.07 mg l^{-1}) being approximately ten times higher than the average for other rivers in the region. It has been suggested that elevated nutrient levels could be as a result of increased runoff from developments in the catchment, particularly following rainfall events, or else discharge of effluent from the Kurland wastewater treatment works into the Sout River (De Moor & Bellingan 2010).

3.3. Biotic Function

Microalgae

Average phytoplankton chlorophyll-*a* was low during December 2006 (0.55 ± 0.12 μg l^{-1}) and April 2007 (0.47 ± 0.10 μg l^{-1}) surveys (Bornman *et al.* 2007). Strong tidal flows regularly flush the estuary, thus not providing sufficient water residence time for a high phytoplankton biomass to develop. In addition, Dissolved Inorganic Phosphorus vs Dissolved Inorganic Nitrogen ratios suggest microalgae growth is N-limited. Flagellates and diatoms dominate the phytoplankton community (54% and 43% respectively) and low densities of cyanobacteria and dinoflagellates are present in the middle/upper reaches. Total cell density is low (<1000 cells ml^{-1}). Microalgal community structure and biomass is likely to be similar to the reference condition (Bornman *et al*. 2007).

Average benthic chlorophyll-*a* was 16.6 ± 1.9 μg l^{-1} and 8.4 ± 1.4 μg l^{-1} in April 2007 and December 2006 surveys respectively (Bornman *et al*. 2007). These concentrations are regarded as close to the average for permanently open estuaries in the area (13.9 ± 0.9 μg l^{-1}). The highest concentrations were measured in the middle reaches of the estuary (0.5 km from the mouth). Microalgal community structure and biomass is likely to be similar to the reference condition (Bornman *et al.* 2007).

Macrophytes

The Sout (Oos) Estuary is surrounded by Southern Afromontane Forest (Mucina *et al.* 2014) with grasses (*Stenotaphrum secundatum*, *Sporobolus virginicus*), rushes (*Juncus kraussii*) and some salt marsh habitat (including *Bassia diffusa*, *Cotula coronopifolia*, *Triglochin striata*, *Sarcocornia perennis*) occurring on the flatter banks. Terrestrial (coastal) species such as *Carpobrotus edulis*, *Chironia baccifera* and *Finicia nodosa* are also present. The dunes at the mouth of the Sout (Oos) Estuary are stabilised by a low scrubland of *Metalasia muricata* and dune plants. A small clump of Cape eelgrass (*Zostera capensis*) was found in the middle reaches in 2007 (Figure 9). There is very little substrate in the estuary that is likely to be suitable for colonisation by Cape eelgrass. Bornman *et al*. (2007) observed no invasive plant species in and around the estuary. The estuary is largely natural and it is not expected that the macrophyte communities have changed significantly over time.

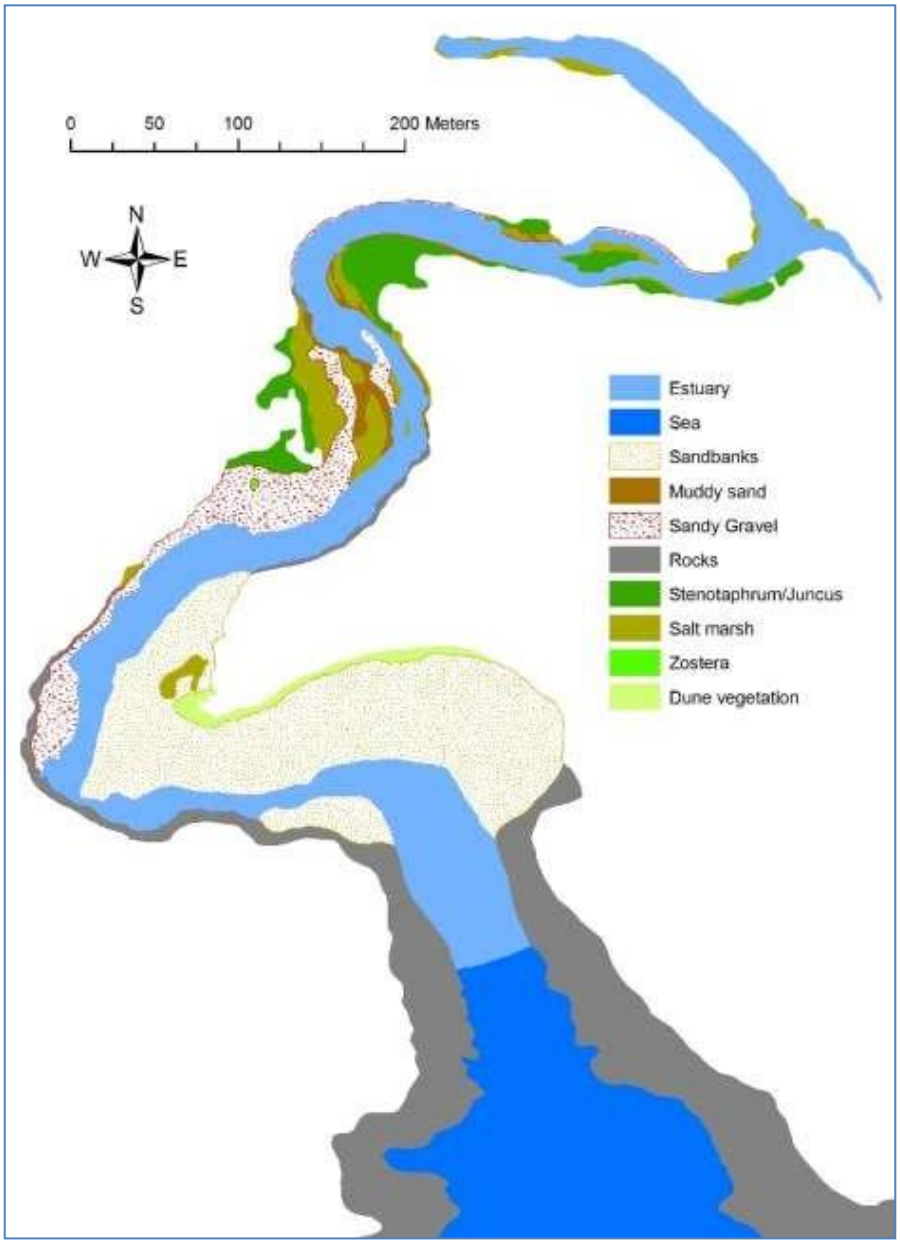

Figure 9: Distribution of macrophytes in the Sout (Oos) Estuary (Bornman *et al*. 2007).

Invertebrates

There are no data on the zooplankton of the Sout (Oos) Estuary, but biomass and species composition are likely to be very low, mainly because of the estuary is very shallow yet has a high exchange of marine water. Only deeper areas are able to retain water for more than a few days, thus preventing the establishment of a significant zooplankton community.

Invertebrate surveys undertaken in 2006 and 2007 recorded 20 subtidal macrobenthic species (Bornman *et al*. 2007). An earlier study by Gaigher (reported in Morant & Bickerton 1983) focused on the sandprawn *Kraussillichirus kraussi* and the mudprawn *Upogebia africana*, and reported relatively low to medium densities in sandy and muddy substrata respectively. Mudprawn were recorded in the upper reaches whereas sandprawn occurred throughout the estuary. There are few areas where intertidal species such as *U. africana*, *K. kraussi* and the saltmarsh crab *Parasesarma catenatum* can become established. Biomass and density are not considered to be high (Bornman *et al.* 2007).

Surveys of macrozoobenthos found Amphipods to be numerically dominant, with Tanaeids and Polychaete worms also abundant (Bornman *et al.* 2007). Polychaete worms and the amphipods *Corophium triaenonyx* and *Grandidierella lignorum* occur mainly in muddy substrates in the upper reaches, while sand-associated species such as *Gastrosaccus brevifissura* and *G. chelata* occur in sandy areas in the lower reaches. Species richness of the subtidal zoobenthic community is low (17 species recorded) and only hardy species are able to tolerate the fluctuating environmental conditions.

Fish

The state of knowledge regarding the Sout (Oos) Estuary fish fauna is limited with only three brief surveys having been conducted. The first in 1981 (Morant & Bickerton 1983), the second in 1994 (James & Harrison 2009) with the last being undertaken as part of the water reserve determination study in 2007 (Bornman *et al*. 2007). From these studies, 19 fish species representing 10 families have been recorded (Table 2). Five of these species are dependent on estuaries for breeding purposes, and include resident taxa such as the Cape silverside *Atherina breviceps* and prison goby *Caffrogobius gilchristi*. A total of three marine species, including the Cape stumpnose *Rhabdosargus holubi* and white steenbras *Lithognathus lithognathus*, are dependent on estuaries as nursery areas. A further seven marine species (e.g. blacktail *Diplodus capensis* and southern mullet *Chelon richardsonii*) are at least partially dependent on estuaries as nursery areas. Two of the remaining taxa were stenohaline marine species (evileye blaasop *Amblyrhynchotes honckenii* and zebra *Diplodus cervinus*) that occur in the lower and/or middle reaches where full seawater salinities prevail.

Table 2: List of fish species recorded in the Sout (Oos) Estuary and classified into the five major categories of estuarine-dependence (see Table 3). Southern African endemic taxa are indicated with an asterisk (*).

Family	Scientific name	Common name	Category
Ariidae	*Galeichthys feliceps**	White seacatfish	B
Atherinidae	*Atherina breviceps**	Cape silverside	E
Blenniidae	*Omobranchus banditus**	Bandit blenny	E
Gobiidae	*Caffrogobius gilchristi**	Prison Goby	E
Gobiidae	*Caffrogobius natelensis**	Baldy	E
Gobiidae	*Psammogobuis knysnaensis**	Speckled sandgoby	E
Monodactylidae	*Monodactylus falciformis*	Oval moony	C
Mugilidae	*Chelon dumerili*	Groovy mullet	C
Mugilidae	*Chelon richardsonii**	Southern mullet	C
Mugilidae	*Liza tricuspidens**	Striped mullet	B
Mugilidae	*Mugil cephalus*	Flathead mullet	C

Mugilidae	*Pseudomyxus capensis**	Freshwater mullet	F
Pomatomidae	*Pomatomus saltatrix*	Elf	B
Soleidae	*Heteromycteris capensis**	Cape sole	C
Spaidae	*Diplodus hottentotus**	Zebra	B
Spaidae	*Diplodus Capensis**	Blacktail	B
Spaidae	*Lithognathus lithognathus**	White steenbras	C
Spaidae	*Rhabdosargus holubi**	Cape stumpnose	C
Tetraodontidae	*Amblyrhynchotes honckenni*	Evileye blaasop	B

Table 3: South African classification of fish utilizing estuaries (as defined by Whitfield 2019).

Category	**Description of Category**
A	Marine straggler
B	Marine estuarine-opportunist
C	Marine estuarine-dependent
D	Solely estuarine
E	Marine & estuarine
F	Estuarine & freshwater
G	Estuarine migrant
H	Catadromous
I	Freshwater straggler
J	Freshwater estuarine-opportunist

In terms of estuarine association category (Table 3), three categories dominated with seven species (37%) falling within the marine estuarine-dependent category (category C) followed by six species (32%) falling within each of the marine estuarine-opportunist and marine & estuarine categories (categories B & F respectively). One species (freshwater mullet) is classified as Estuarine & Freshwater – category F. Within the marine estuarine-dependent category, catches were dominated numerically by Cape stumpnose numerically whilst the southern mullet dominated catches in terms of biomass (James & Harrison 2009). Due to the small body size of estuarine resident species, they contribute little to total fish biomass. The marine stragglers (blacktail and evileye blaasop) did not contribute substantially to overall abundance or biomass (James & Harrison 2009). Although no specimens of the catadromous anguillid eel *Anguilla mossambica* (category H) have been sampled in the estuary their presence in the Sout River indicates their use of the estuary as a conduit.

Based on their distributional ranges, 14 (74%) of the fish species recorded in the Sout (Oos) Estuary are southern African endemics. The high degree of endemism can be attributed to the locality of the estuary within the warm temperate biogeographic region. No rare or endangered fish species have been previously sampled within the system although the bandit blenny *Omobranchus banditus* has seldom been recorded in South African estuaries, possibly because of its preference for rocky habitat.

The food web structure of the Sout (Oos) Estuary fish community appears to be dominated by mugilids feeding on microphytobenthos and macrophytic detritus generated from catchment forests and nearshore marine macroalgae. The limited amount of submerged and emergent macrophyte species within the estuary resulted in relatively small populations of macrophyte associated fish species such as Cape stumpnose and oval moony *Monodactylus falciformis*. The clear estuarine waters appear to support very low populations of zooplanktivorous fish species (e.g.Cape silverside) and the estuarine roundherring

Gilchristella aestuaria appears to be absent from this system. Overall, the estuary had a benthic dominated food web structure with many fish species feeding predominantly on zoobenthos associated with the detritus food web. There is also a spatial separation of the family Gobiidae, with the speckled sandgoby *Psammogobius knysnaensis* occupying sandy areas in the lower and middle reaches, with prison goby *Caffrogobius gilchristi* and baldy *C. natalensis* found mainly amongst the boulders and pebbles of the middle reaches.

In summary, the previous surveys have sampled both early recruits (Cape stumpnose, white steenbras, elf *Pomatomus saltatrix* and southern mullet) and larger size classes indicating that the Sout (Oos) Estuary serves a nursery function, with some species having extended utilisation of the system. Likewise the presence of both estuarine-resident and estuarine-associated marine species indicates that the system serves as a viable habitat for fishes (James & Harrison 2009). The input of macro-detritus from both the river catchment and adjacent coastal zone appears to be an important driver of the food web within this estuary, especially the zoobenthos. Most of the fish species found within the estuary are associated with the benthos, feeding either on the microphytobenthos and detritus in the case of mugilids or the zoobenthos in the case of carnivorous sparids. Poor planktonic food resources as a result of clear, nutrient poor river inflow have contributed to low abundance, biomass and diversity of planktivorous fish species within this system.

The similarity in abiotic conditions between the natural and present state (Bornman *et al*. 2007) suggests that little change in the fish community is likely to have occurred within this estuary. Some deviation in community composition may have occurred due to over-exploitation of selected fish species (e.g. white steenbras) in other parts of South Africa. Slight reduction in benthic microalgae will result in lower mugilid fish stocks. Reduced river flow is likely to result in marine conditions penetrating further upstream, resulting in expanded marine migrant and marine straggler fish components within the system.

Birds

Following studies undertaken in the early 1980s (Underhill *et al*. 1980, Morant & Bickerton 1983), no further dedicated research has been focused on the bird community in the Sout (Oos) Estuary. Nine species were recorded in those studies (Table 4) indicating that bird diversity in the estuary was low. Morant & Bickerton (1983) attributed the low bird diversity to the limited surface area and the lack of foraging habitat due to there being a narrow shoreline especially during high tides. It is likely that bird populations are transient, moving intermittently between the Groot (West) Estuary (to the east) and the Sout (Oos) Estuary.

Table 4: List of birds recoded from the Sout (Oos) Estuary (from Underhill (1980) and Morant & Bickerton (1983)).

Species	Number recorded
Whitebreasted Cormorant	2
Black Oystercatcher	4
Fish Eagle	2
Whitefronted Plover	7
Whimbrel	1
Kelp Gull	11
Giant Kingfisher	1
Halfcollared Kingfisher	1
Cape Wagtail	2

A search of the Roberts VII Multimedia Birds of Southern Africa application (Android Edition Version 3.14) for bird species with a distributional range that includes the Sout (Oos) Estuary identified 50 species that are potentially resident, transient and/or rare visitors to the estuary (Table 5). This suggests a much higher potential biodiversity for the estuary albeit with temporal constraints. The distributions however require verification in order to produce a dedicated list of bird species for this estuary.

Table 5: List of birds whose distributional range include the Sout (Oos) Estuary as recorded in the Roberts VII Multimedia Birds of Southern Africa application.

Pied Avocet	Grey Plover
Cape Cormorant	Kittlitz's Plover
White-breasted Cormorant	Lesser Sand Plover
Eurasian Curlew	Three-banded Plover
African Fish Eagle	White-fronted Plover
Greater Flamingo	Sanderling
Lesser Flamingo	Common Sandpiper
Great Frigatebird	Curlew Sandpiper
Cape Gannet	Marsh Sandpiper
Bar-tailed Godwit	Terek Sandpiper
Black-necked Grebe	Black-winged Stilt
Great Crested Grebe	Little Stint
Common Greenshank	Arctic Tern
Franklin's Gull	Caspian Tern
Grey-headed Gull	Common Tern
Kelp Gull	Little Tern
Giant Kingfisher	Roseate Tern
Pied Kingfisher	Sandwich Tern
Red Knot	Swift Tern
Western Osprey	Spotted Thick-knee
African Black Oystercatcher	Water Thick-knee
African Penguin	Ruddy Turnstone
Chestnut-banded Plover	Palm-nut Vulture
Common Ringed Plover	African Pied Wagtail
Greater Sand Plover	Whimbrel

A search using the keyword "birds" on iNaturalist, an online platform that maps people's observations of biodiversity around the world, yielded 22 observations of 15 species of birds for the Sout (Oos) Estuary, Salt River hiking trail as well as the estuary mouth and adjacent beach. The earliest record was added in April 2010 with the most recent logged in July 2021. Dates of multiple observations are reported in Table 6. This indicates a higher diversity than that documented historically (Underhill *et al*. 1980) and includes 10 species not previously listed. These sightings, especially multiple observations, help validate records and can contribute to building a reliable database on birds for locations like the Sout (Oos) Estuary where less effort is dedicated to counts.

Table 6: Observations of birds along the Sout (Oos) Estuary including at the estuary mouth and adjacent beach as recorded by citizen scientists, naturalists and biologists on iNaturalist (www.inaturalist.org).

Common Name	**Dates Observed**	**Location**
African Black Oystercatcher	Apr 23, 2010	Salt Estuary (beach)
	Apr 23, 2011	Salt Estuary (mouth)
	Jan 12, 2021	
African Dusky Flycatcher	Apr 8, 2020	Salt Estuary
African Fish-Eagle	Sep 24, 2017	Salt Estuary
	Jul 10, 2019	
African Penguin	Aug 10, 2020	Salt Estuary (beach)
African Pied Kingfisher	Jul 10, 2021	Salt Estuary
African Reed Cormorant	Jul 10, 2021	Salt Estuary
Grey Heron	Jul 6, 2021	Salt Estuary (beach)
Kelp Gull	Jan 3, 2020	Mermaids Cove
	Apr 8, 2020	Salt Estuary (mouth)
Southern Collared Sunbird	Apr 12, 2020	Salt Estuary
Southern Greater Double-collared Sunbird	Sep 24, 2017	Salt River Trail

Common Name	Dates Observed	Location
Southern Knysna Turaco	Aug 14, 2018	Salt Estuary
Western Little Egret	Sep 24, 2017	Salt Estuary
White-breasted Cormorant	Jul 21, 2012,	Salt River Trail
	Dec 14, 2020	Salt Estuary (beach)
White-fronted Plover	April 23, 2010	Salt Estuary,
	Nov 25, 2012	Salt Estuary (beach)
	Sep 25, 2017	
White-necked Raven	Aug 12, 2020	Salt Estuary (beach)

Global and local pressures, including the overexploitation of estuarine fish as well as damaged and/or transformed habitats, have caused the loss of >265 000 waterbirds from estuaries worldwide, the majority of which are waders from larger estuaries (Van Niekerk *et al*. 2019). Additional pressures identified for estuarine systems include human disturbance from recreational activities, sediment pollution (toxic and heavy metals), effluent discharge from aquaculture and desalination plants as well as emerging pressures from micro-plastic pollution and underwater noise (Van Niekerk *et al*. 2019).

Even nature-based activities e.g. hiking, trail running, cycling, canoeing, horse riding, etc. that require limited environmental modification and are therefore assumed to have little impact on the natural surroundings, have been shown to have adverse effects on birds (Steven *et al*. 2011). Impacts from these activities were reported to alter bird behaviour (feeding, foraging); physiology (heart rate, temperature, stress); reproductive success (reduced numbers of nests and eggs as well as the hatching and fledging of chicks); in addition to changing abundance and distribution patterns through displacement, all with varying ecological consequences ranging from short-term and local-scale to much larger population scale impacts (Steven *et al*. 2011).

Apart from maintaining and improving the overall health of estuaries, management plans need to include sanctuary areas that are large enough to protect birds and their prey from human disturbance and exploitation. Despite its low diversity, the remote location and pristine condition of the Sout (Oos) Estuary renders it an ideal sanctuary for birds.

3.4. Ecological State

The Intermediate Level Sout (Oos) Estuarine Health Assessment was reviewed as part of a Water Research Commission study (Van Niekerk *et al*. 2015) and incorporated in the Department of Water and Sanitation (DWS) Reserve Determination Studies for the Gouritz Water Management Area (DWS 2015). The method used was a standardized approach developed for determining the Ecological Water Requirements of South Africa's estuaries (DWAF 2008). The overall ecological condition of the Sout (Oos) Estuary has been determined as an A Category, with the individual component categories summarised in Table 7 (Bornman *et al.* 2007).

The ecological state (referred to as the Present Ecological State (PES)) of an estuary, defined as the similarity of its current condition to an estimated natural condition, is described using six categories, ranging from natural (A) to critically modified (F). Expert knowledge and available information were used to build a "picture" of the probable pristine state of the Sout (Oos) Estuary and the changes under current conditions. For each variable the conditions are estimated as a percentage (0 to 100%) of the supposed pristine ecological state. Scores are then weighted and aggregated so that the final score reflects the present condition of the estuary as a percentage of the pristine state. Both abiotic (hydrology, mouth condition, water quality, physical habitat) and biotic (microalgae, macroalgae, invertebrates, fish, birds) variables are included as the relationships between the abiotic and biotic variables are often not well understood, and the biotic response to certain abiotic variables can be lagging.

Table 7: Ecological condition (out of 100) of the Abiotic and Biotic Components of the Sout (Oos) Estuary (Bornman *et al.* 2007).

VARIABLE	SCORE	CATEGORY
Hydrology	97	A
Hydrodynamics	100	A
Water quality	90	B
Physical habitat	95	A
Overall Habitat Health	95	A
Microalgae	90	B
Macrophytes	100	A
Invertebrates	100	A
Fish	90	B
Birds	95	A
Overall Biological Health	95	A
Overall Estuary Health score	95	A
PRESENT ECOLOGICAL STATE (PES)		A
OVERALL CONFIDENCE		Medium

Recommended Ecological Category

The Recommended Ecological Category (REC) of the Sout (Oos) Estuary is an A (DWA 2014; Van Niekerk *et al*. 2019, Bornman *et al*. 2007, DWS 2018). Key interventions required to maintain the REC at A include (Bornman *et al*. 2007):

- Maintenance of base flows in the dry season.
- Maintenance of good water quality in the system.

3.5. Environmental Reserve Assessment

An intermediate level reserve assessment was undertaken for the Sout (Oos) system by Bornman *et al*. (2007) and incorporated in the DWS reserve determination studies for the Gouritz Water Management Area (DWS 2015). The following assumptions and limitations applied during quantification and description of the hydrology of the Sout River:

- There are no measured flow data available for the Sout River. All flow data are simulated.
- The simulation parameters used in the study were transferred from the Bloukrans River.
- Very little rainfall data exist in the mountainous areas.
- The confidence in the flow was of a medium level with low confidence in the low flows.
- There is a flow gauge in the Sout / Wit River but no flow data because there is no rating curve for the station.
- The (then) current land use in the catchment was considered negligible with regards to its effect on water quantity. Land development in the catchment was restricted to water transfer to the Matjies River

via a small canal and some 13 km^2 of indigenous forests.
- The natural MAR was estimated to be 11.22 million m^3 and was 10.10 million m^3 at the time of the assessment (2007).

For the purpose of scoring the future scenarios, it was assumed that all off-take of flows occurs through off-channel developments. Any in-channel development would have a significant impact on the sediment balance of the system as it is sediment starved (very little marine sediment enters the system).

Future Scenario 1 (Table 8) was considered to enable maintenance of the Sout (Oos) Estuary in the recommended ecological condition as it differs very little in reduction of runoff from the state at the time of the assessment (2007). Scenario 1 was selected as the Recommended Ecological Flow Requirement.

Table 8: Quantification of Ecological Reserve Scenarios (modified from Bornman *et al.* 2007).

Name	Description	MAR (10^6 m^3 s^{-1})	% remaining
Reference	Reference Condition	11.22	100
Present	Present State	10.10	90.00
Future Scenario 1	Reference Conditions – 0.05 m^3 s^{-1} abstraction	9.69	86.40
Future Scenario 2	Reference Conditions – 0.10 m^3 s^{-1} abstraction	8.27	73.68
Future Scenario 3	Reference Conditions – 0.20 m^3 s^{-1} abstraction	5.92	52.74
Future Scenario 4	River Class A/B	4.85	43.21

Before any additional abstraction from the Sout River is permitted the following recommendations need to be considered (Bornman *et al*. 2007):

- Improved flow data are required.
- The exact amount of water that will be abstracted must be quantified.
- Capping flows need to be investigated (0.02 m^3 s^{-1}).
- No effluent may be pumped back into the river.
- No in-stream dam developments should be permitted.

3.6. Estuarine Conservation and Biodiversity Importance

Conservation Importance

The 2011 NBA (Van Niekerk & Turpie 2012; Turpie *et al*. 2012) developed a biodiversity plan for the estuaries of South Africa by identifying which estuaries should be assigned partial or full Estuarine Protected Area status. The biodiversity plan followed a systematic approach that took pattern, process and biodiversity persistence into account. Although social and economic costs and benefits were not explicitly taken into consideration, ecosystem health was used as a surrogate. This is because estuaries where the opportunity costs of protection are likely to be high are also likely to be heavily-utilised systems that are in a lower state of health.

The plan suggested that, on a national scale, the protection of 133 estuaries would be required to meet biodiversity targets (61 requiring full protection and 72 requiring partial protection, which includes those already protected) (Turpie *et al*. 2012). Due to the Sout (Oos) Estuary falling within the GRNP and being protected in its entirety, it formed part of the core group of priority estuaries that need to be protected.

The 2018 NBA (Van Niekerk *et al*. 2019) included a number of key refinements and initiatives including determining estuarine ecosystem threat status according to International Union for Conservation of Nature and Natural Resources (IUCN) criteria and calculating estuarine ecosystem protection levels. The estuary

ecosystem threat assessments were based on the 2018 estuary ecosystem classification, updated estuary spatial delineation as captured by the EFZ, and the updated ecosystem condition results (derived from individual health assessments). The health of individual estuaries matters as it contributes to the overall resilience of the network of estuaries along a section of coast. Within the warm temperate bioregion, only 3% (by area) of predominantly open estuaries are in a natural condition (Van Niekerk *et al*. 2019) with the Sout (Oos) Estuary contributing to this percentage. As an ecosystem type, and following the IUCN Red List of Ecosystems assessment process, the overall ecosystem threat status for predominantly open estuaries in the warm temperate bioregion attained a rating of Vulnerable (Van Niekerk *et al*. 2019).

Biodiversity Importance

In a prioritisation exercise of South African estuaries based on their potential importance to estuarine-associated fish species, the Sout (Oos) Estuary was ranked 149 out of 248 estuaries (Maree *et al*. 2003). Based on overall importance scores (incorporating size, habitat importance, zonal type rarity and biodiversity scores) the estuary was ranked 83 in terms of overall estuarine conservation importance by Turpie *et al*. (2002) whilst a re-assessment a few years later ranked the estuary at 91 (Turpie & Clark 2007). The Estuary Importance Score for an estuary takes size, the rarity of the estuary type within its biographical zone, habitat diversity and biodiversity importance of the estuary into account (DWAF 2008). Biodiversity importance, in turn is based on the assessment of the importance of the estuary for plants, invertebrates, fish and birds, using rarity indices. These importance scores ideally refer to the system in its natural condition. The Sout (Oos) Estuary attained a low to average importance score (Table 9).

Table 9: Sout (Oos) Estuary importance rating.

CRITERION	WEIGHT	SCORE
Estuary Size	15	70
Zonal Rarity Type	10	20
Habitat Diversity	25	50
Biodiversity Importance	25	67.5
Functional Importance	25	40
Weighted Estuary Importance Score		52
Importance rating	Low to Average Importance	

4. ECOSYSTEM SERVICES

Ecosystem services refer to the material and non-material benefits that people derive from nature. Various classifications of ecosystem services typically distinguish between provisioning services (e.g. food and timber), maintenance and regulating services (e.g. climate regulation, water purification, nutrient dispersal and soil formation) and cultural services (e.g. recreational and spiritual experiences that people have with nature). An ecosystem services framework is useful for highlighting the connections between people and nature, and for mapping flows of services (and sometimes disservices) as well as identifying trade-offs, synergies and tensions between different services.

The Sout (Oos) Estuary is accessible via the Salt River Hiking Trail, which can be started from either Nature's Valley or the R102 (western access road to Nature's Valley). Visitors to the estuary are restricted to some degree by the relatively strenuous nature of the hike. There are two broad motivations for visiting the estuary, namely appreciating nature and angling. The latter takes place mainly from the rocks on either side of the mouth. The ecosystem services that these visitors derive from the estuary are mainly non-material or cultural ecosystem services, as outlined in Table 10.

Table 10: Classes of cultural ecosystem services (based on Roux *et al*. 2020) and their relevance to the Sout (Oos) Estuary. The relevance listed here is based on personal observation and communication with SANParks staff members.

Class of cultural ecosystem service	Relevance to Sout (Oos) Estuary
Aesthetic value – appreciation of natural scenery/landscape beauty	From reviews on Google maps, the hike to the estuary (with various lookout points) and the estuary itself rate high among visitors from an aesthetic value perspective.
Recreation – enjoyment of nature through activities such as walking, dog walking, horse riding, swimming, angling and mountain biking	Hiking the trail to the estuary; Trail running to the estuary and back; Swimming and snorkelling in the estuary and mouth; and Angling from the rocks on either side of the bay (note that angling can also be regarded as a provisioning service, when fishing for food).
Sense of place – spiritual or sensory experiences fostering a sense of authentic or emotional attachment and belonging	The relatively secluded estuary provides visitors with a sense of being-one-with-nature; Solitude, time for reflection, emotional attachment; and The mystical name of Mermaid's Cove.
Scientific knowledge – gathering of scientific knowledge from the study of ecosystems	The Salt River has been studied because of its unique aquatic fauna and similarly the estuary could be a valuable source of scientific study.
Social relations – socialising with friends and meeting people	Groups or families hiking to the estuary, or a parent and child fishing together.
Cultural heritage – appreciation of local history and culture	Small fishing community used to live near the mouth of the Salt River (area known as Die Rug), from the late 1800s to about 1950s. Their boat shed remained in use until the 1970s. The shed has since been dismantled and the foundations of the houses are overgrown and hardly visible (NVT, 2002).
Environmental education – instruction in ecological processes; raising of awareness about biodiversity and ecosystem services in visitor centres or educational activities	N/A

The realisation of cultural ecosystem services (CES) is complex, with several interrelated factors playing a role in mediating the experiences that people have in nature. Firstly, the inherent features of the landscape/seascape provide the potential for CES to be delivered. This potential can be made available or mobilised through built infrastructure, such as the hiking trail to the estuary and through enabling rules and regulations. The maintenance of the trail (or lack thereof) will play a mediating role in the overall nature experience of visitors and the degree to which CES are realised. Interaction with other visitors may also have a positive or negative influence on how CES are derived. Further, individuals are likely to "appropriate" the CES on offer from a visit to the estuary based on factors such as their overall nature orientation, awareness of the estuary (including the availability of information on how to access it), and previous experiences from visiting this estuary or similar places.

Further consideration that relate to CES delivery through visits to this estuary include:

- The estuary can be accessed at no cost to visitors i.e., visitors do not contribute directly to expenses related to maintaining the trail and cleaning the estuarine beach of pollution.
- There may be a trade-off between higher visitor numbers and the quality of nature experiences enjoyed by visitors. In some parks it has been found that relatively low visitor numbers is an enabler of aesthetic experiences and high numbers as well as diverse user groups could result in trade-offs (Roux *et al*.

2020). For example, trail runners may detract from the experiences of hikers when passing them along the narrow trail; users who pollute the beach or rocks (e.g. by leaving plastic bags behind) may lessen the aesthetic experience of some; and too many visitors may affect the sense of place experiences of other visitors.

SANParks has dual objectives: achieving biodiversity conservation and contributing to societal well-being. Having access to CES contributes to people's well-being. However, insensitive use of CES will likely have a negative impact on the ability to conserve biodiversity. For example, visitors to the Sout (Oos) Estuary are likely to influence bird behaviour and indiscriminate fishing will impact on the fish community and associated dynamics.

5. IMPACTS AND THREATS TO THE ESTUARY

The Sout (Oos) Estuary is an unmodified, largely natural estuary currently in good condition, which has been allocated a PES/TEC category of A (Bornman *et al*. 2007). However, there are various threats and pressures relevant to the Sout (Oos) Estuary including climate change, land-use change and infrastructure development leading to flow reduction and an increase in nutrient input from the catchment, and the exploitation of natural resources.

5.1. Climate Change

Climate change stressors, including sea level rise, ocean acidification, terrestrial hydrological processes, coastal storms and changes in ocean currents and temperature regimes, are expected to impact estuarine processes and influence biotic responses (Van Niekerk *et al*. 2019, SANParks 2021). However, the degree of impacts is likely to vary between estuaries and will be dependent, in part, on individual system characteristics (e.g. estuary type, catchment size, etc.). Average river flow conditions are predicted to remain largely unchanged along the southern Cape (Van Niekerk *et al*. 2019) whilst rising nearshore and land temperatures will result in niche changes and shifts in species distribution, where both cool temperate and subtropical species will see a shift in distribution towards the warm temperate South Coast. Increased upwelling events along the Garden Route coastline may also increase the use and importance of estuaries as thermal refuge areas. An increase in the frequency and severity of coastal storms is predicted to lead to an increase of marine sediments that may prolong mouth closures for intermittently open estuaries, and lead to temporary closure of previous permanently open estuaries such as the Sout (Oos) Estuary (SANParks 2021).

The Ecological Water Requirement ("Reserve") has been determined for the system and this should be applied to help ensure the conservation of the system. Reduced river flow will influence land-derived biogeochemical inputs and is likely to result in marine conditions penetrating further upstream, resulting in expanded marine migrant and marine straggler fish components within the system. As a tidally driven system, the Sout (Oos) Estuary is particularly sensitive to changes in marine conditions. Thus climate change impacts that affect sea level rise, upwelling and increase the propensity for storm surges, will have a significant impact on the configuration and functioning of the estuary (e.g. influence on nutrients and primary production; potential influx into or removal of marine sediment from the system).

5.2. Land Use and Infrastructure Development

Land use and development impacts within the lower catchment is negligible as there is no development around the estuary. However, issues identified in the mid-catchment include: 1) The Kurland industrial development and in particular the Kurland Saw Mill which has numerous small impoundments that are a potential source of pollution; and 2) the Kurland Village housing development and associated waste water treatment works as a potential source of pollution.

5.3. Water Quantity and Quality

Although there are no measured flow data available for the Sout River the present mean annual runoff of ±10.10 million m^3 is estimated to be very similar to natural conditions (Bornman *et al*. 2007). The water transfer canal between the South and Matjies River is notable but is deemed to have a negligible impact with regards to water quantity (Bornman *et al*. 2007). There is some evidence of water quality impacts related to developments in the catchment.

5.4. Exploitation of Natural Resources

Fishing within the Sout (Oos) Estuary is permitted under the Marine Living Resources Act, 1998 (Act No. 18 of 1998) (MLRA). Fishing effort in the estuary was classified by Van Niekerk *et al*. (2019) as Low with annual catches estimated at 0.5 tons. The mouth of the Sout (Oos) Estuary and adjacent rocky shoreline has been included in previous shore-based linefishery assessments. In a two year study, (Smith 2015) estimated that subsistence fishers comprised 4.2% of all fishers found along the Natures Valley coastline. Within the EFZ most fishing effort occurs from the rocky headlands surrounding the estuary mouth. This area is a popular fishing spot for local and visiting fishers (recreational and subsistence) with both day and night effort occurring. Retention rates are high whilst rubbish left behind by anglers is an ongoing issue. Target species include elf (shad), kob, yellow tail, blacktail, and zebra. Minimal fishing occurs further into the estuary.

5.5. Non-Extractive Uses

The Sout (Oos) Estuary is a popular hiking destination and the beach at the mouth is a popular sunbathing and picnicking area, in particular during the summer holiday period. Disturbance caused by hikers has been flagged as a concern for birds utilising the system, and from a pollution perspective, especially since there are no ablution facilities or refuse bins.

6. SOCIO-ECONOMIC CONTEXT

6.1. Demographics

The Garden Route (Eden) District Municipality (DM) is made up of seven LMs: Kannaland, Hessequa, Oudtshoorn, Mossel Bay, George, Knysna and Bitou. As the second most populous municipal district in the Western Cape, in 2019 the Garden Route DM had an estimated population of 663 179 people with an annual growth rate of 1.99% (Garden Route District Municipality 2020). The approximate number of households in 2019 was 198 000, with the average household size decreasing over the previous 10 years from 3.5 to 3.3 individuals per household.

The Bitou LM has seven wards of which the Sout (Oos) Estuary and its catchment fall within Ward 1 comprising the following sub-places: Covie, Natures Valley, Kurland, Crags and Keurbooms. As of 2020 the Bitou LM had an estimated population of 67 139 individuals at a density of 68 people km^{-2} (Bitou Municipality 2020). Despite having the smallest geographical area (991.84 km^2) of the seven LMs, it is placed as the fifth most populace municipality in the Garden Route District, with the fasted annual growth rate of 4.1% (Garden Route District Municipality 2020), however this is predicted to decline to 2.9% by 2024 (Bitou Municipality 2020).

The last census (2011) delineated the demographic profile of the Bitou LM as 45.2% black African, 31.2% coloured and 16.9% white, with the remaining 6.7% comprising other population groups, and with a ratio of 51% women to 49% men. Number of households was estimated at 21 914 (Statistics South Africa 2018) with an average of 3.0 individuals per household, although this is predicted to decline to 2.9 by 2024 due to factors such as *inter alia* declining fertility rates, rising prevalence of divorce and an ageing population (Bitou Municipality 2020). Percentages of households with access to the following basic services were: water 92.4%; refuse removal 88.0%; electricity 94.1%; and sanitation 83.7% (Bitou Municipality 2020).

Of people aged 20 years and older 32.5% had completed matric, while 9.2% had acquired higher education (Statistics South Africa 2018), and overall Bitou LM in 2019 had a 90.2% functional literacy rate (Garden Route District Municipality 2020). The economically active age category of 18 to 64 years comprises 64.3% of the population. Sixty three percent of households in the Bitou LM fall within the low income bracket while unemployment rates have been on a steady rise over the last decade, increasing from 17.1% in 2008 to 23% in 2018.

The town of Kurland is the largest settlement in the Salt River catchment, and at the last census (2011) had a population of 4 033 individuals in 1 261 households.

6.2. Economic Profile

Seventy five percent of the population in the Garden Route DM is concentrated in three principal urban centres i.e. Mossel Bay, George and Knysna with the remaining 15% dispersed within other towns in the district (Garden Route District Municipality 2020). The DM has been classified according to the following functional areas:

- Agricultural Service centres: Calitzdorp, Ladismith, Riversdale, Uniondale
- Regional service centres: George, Oudtshoorn, Mossel Bay
- Residential centres: Dysseldorp, Kranshoek, Kurland
- Residential/Tourism: Groot Brakriver, Herolds Bay, Sedgefield, Stilbaai, Wilderness
- Tourism: De Rust, Knysna, Nature's valley

Inland areas within the Garden Route District are largely rural compromising farms and small towns, which are isolated and have limited access to transport and services.

The Bitou LM had a GDPR (Regional Gross Domestic Product) of approximately R3 billion in 2016 equating to 7.4% of the Garden Route District GDPR and displaying an overall growth over a four year period (2013-2017) (Bitou Municipality 2021). In 2018, the value of the Bitou economy was estimated at R3.27 billion realizing an average annual growth of 1.3% from 2014 due mainly to a 1.5% growth in the secondary sectors of manufacturing, electricity, gas and water, and construction. Growth was further supported by contributions from the finance, insurance, real estate and the business services sectors (25.3%), and the wholesale and retail trade, catering and accommodation sectors (18.7%) under which tourism is placed (Figure 10) (Bitou Municipality 2020). Economic activity in the above sectors had declined in 2019, particularly in construction, which saw a reduction of 3.4%.

The economy provided employment to close to 20 000 people in 2018, and the wholesale and retail trade, and catering and accommodation sector remaining key employers, creating 159 new positions in 2019. The agriculture and forestry sector is also a primary employer in the municipality but experienced below-average economic performance between 2014 and 2018, and a contraction of 5.5% in 2019. This was likely due to challenges experienced as a result of the drought in the preceding years, and consequential loss of jobs. Kurland along with Kranshoek, Kwanokuthula and Covie have the lowest income levels in the municipality (Bitou Municipality 2020).

An estimated 19 948 people living within the Bitou LM were employed in 2019, consisting of formal employment of 72.8% (14 524) and 27.2% (5 424) in the informal sector (Bitou Municipality 2020). Formal employment comprised 34.6% low-skilled and 44.4% semi-skilled workers, with skilled labour contributing 21.1% and outgrowing the other two categories by 3.4% between 2015 and 2019. For the same period, low and semi-skilled labour grew by 1.8 and 2.2% respectively, while formal employment increased by 1.3% in the municipality. The Bitou LM is considered to have an unemployment rate of 17.8%, which is the second highest for the Garden Route District after Knysna (19%) (Bitou Municipality 2020).

For the 2020/21 financial year, the Western Cape Government had allocated 99.6% of its budget to funding

development of human settlements within the Bitou municipal area, with the remaining budget allocated towards education (0.4%) and R8 000 towards health (Bitou Municipality 2020). In order to support business activities and improve living conditions the Bitou LM prioritized most of its budget (62%) to improve basic services (access to water, sanitation, electricity and refuse removal). Nineteen percent was earmarked for social infrastructure (sport and recreation; social development; health; public safety and environmental protection) while economic infrastructure (planning and development; road transport) was allocated 15%. These allocations were made in an attempt to stimulate the sluggish economy and improve the quality of life of those living in the municipal area (Bitou Municipality 2020).

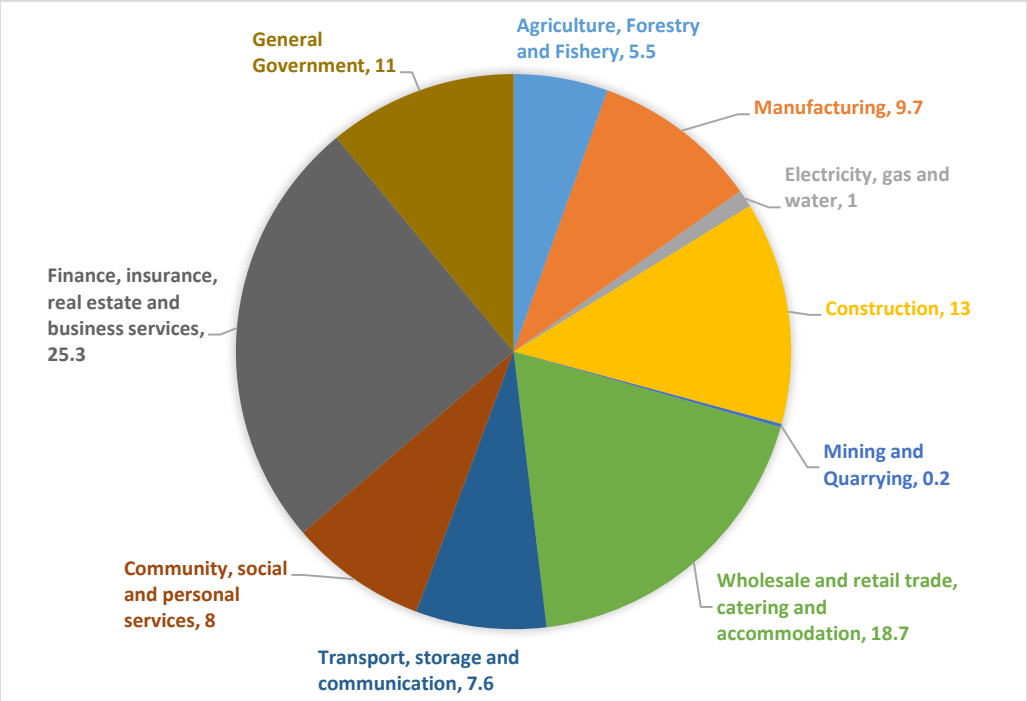

Figure 10: Contribution to GDPR performance in the Bitou Municipality in 2016 per economic sector (Bitou Municipality 2020).

The Sout (Oos) Estuary is formally protected within the Tsitsikamma section of the GRNP and as such, no developments are proposed for the lower catchment area. The towns of Kurland and the Crags are located in the mid-catchment, where intensive agriculture (particularly dairy farming), brick and timber manufacturing are dominant (CNdV 2017). Other enterprises at Kurland include the Kurland hotel and polo estate, shops, a garage, post office and village. There are a number of tourist facilities and resorts in the area indicating its appeal to this sector. Kurland was identified as a settlement with high social and low development needs, however specific employment generating initiatives are required (CNdV 2017). The Bitou Municipality SDF identified tourism as a key role player in alleviating unemployment, and proposed focusing on development of features unique to the Bitou Municipality to increase tourism with secondary derivatives benefiting the larger community as opposed to just select sections of the population. This would require promoting a favourable environment to attract potential investors through allocation of resources to address unfavourable socio-economic conditions, poor municipal services, and crime (CNdV 2017).

6.3. Social Considerations

The socio-economic challenges identified for the Bitou LM (after Bitou Municipality 2021) are:

- Large concentrations of poor households in urban and rural locations.
- High levels of unemployment.
- Poorly performing residential property markets.
- Slow household income growth.

- Limited income retention.
- Undiversified and marginal local economies.
- Limited private sector investment.
- Considerable fiscal burden.

Given its high ecological capital, the Bitou LM benefits directly and indirectly from estuarine ecosystem services through measurable income and employment as well as resource use and extraction of commodities. The Sout (Oos) Estuary contributes to coastal productivity, biodiversity and fisheries in the region, forms part of one of the last remaining stands of intact protected coastal forests, and attracts regional and international tourists. Its inaccessibility and lack of infrastructure while adding to its charm limits its socio-economic value and livelihood opportunities for neighbouring communities. Any tourism infrastructure or developments should be designed to integrate with the natural features of the area and maintain a low environmental footprint while preserving the sense of place as remote and unspoiled.

7. LEGISLATIVE INSTRUMENTS AND RELATED STRATEGIES AND PROGRAMMES

A list of legislation relevant to the management of the Sout (Oos) Estuary is set out below. The list is comprehensive but not exhaustive. As the estuary and EFZ and both lower and upper portions of the catchment are situated entirely within a National Park, though portions of the mid-catchment fall outside of the park, the list includes both legislation applicable within the National Park, as well as legislation applicable to the section of the coastal zone, river and catchment outside the National Park (where administration of National, Provincial and Municipal legislation may indirectly impact the estuarine environment). A brief description of each instrument is provided in Tables 11 to 14, and include international obligations and treaties (Table 11), national, provincial and local/municipal legislation (Table 12), plans and policies (Table 13) and other legislation, policies, plans and strategies that may impact the marine environment, catchment, and rivers outside the Garden Route National Park (Table 14). All references to the legislation listed below include any amendments to those legislation.

International agreements and obligations applicable to the Sout (Oos) Estuary:

- Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) (World Heritage Convention).
- Convention on International Trade in Endangered species of Wild Fauna and Flora, 1973 (CITES).
- Convention on the Conservation of Migratory Species of Wild Animals (1979) (Bonn Convention).
- The Convention for Co-operation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern African Region (1981) (Abidjan Convention).
- The Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean (1985) (Nairobi Convention).
- United Nations Convention on Biological Diversity (1992).
- Agenda 21 (1992) as reaffirmed at the United Nations World Summit on Sustainable Development - Johannesburg Summit (2002) and Rio+20 (2012). The Sustainable Development Summit (2015) also added onto the Agenda 21 goals.
- United Nations Framework Convention on Climate Change (1992).
- Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (1995).

National legislation applicable to the Sout (Oos) Estuary:

- The Constitution of the Republic of South Africa, 1996.
- National Environmental Management Act, 1998 (Act No. 107 of 1998).

- National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008).
- National Water Act, 1998 (Act No. 36 of 1998).
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
- Marine Living Resources Act, 1998 (Act No. 18 of 1998).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999).
- Sea Fishery Act, 1988 (Act No. 12 of 1988).
- Disaster Management Act, 2002 (Act No. 57 of 2002).
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
- National Forests Act, 1998 (Act No. 84 of 1998).
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).
- National Health Act, 2004 (Act No. 61 of 2004).
- Water Services Act, 1997 (Act No. 108 of 1997).
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).

Plans and programmes applicable to the Sout (Oos) Estuary:

- National Coastal Management Programme.
- National Estuarine Management Protocol.
- Garden Route National Park Management Plan.

Legislated instruments and related documents applicable to the coastal zone, river and catchment:

- Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA).
- Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013).
- Western Cape Housing Development Act, 1999 (Act No. 6 of 1999).
- Western Cape Planning and Development Act, 1999 (Act No. 7 of 1999).
- Western Cape Land Use Planning Act, 2014(Act No. 3 of 2014).
- Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000).
- Nature and Environmental Conservation Ordinance, 1974 (Ordinance No. 19 of 1974).
- Land Use Planning Ordinance, 1985 (Ordinance No. 15 of 1985).
- Western Cape Provincial Spatial Development Framework.
- Western Cape Provincial Coastal Management Programme.
- Western Cape Provincial Biodiversity Spatial Plan.
- Garden Route District Municipality Coastal Management Programme.
- Garden Route District Municipality Integrated Development Plan.
- Integrated Garden Route Environmental Policy.
- Garden Route District Municipality Climate Change Adaptation Plan.
- Bitou Local Municipality Integrated Development Plan.
- Bitou Local Municipality Spatial Development Framework.

Various strategies developed by the government departments responsible for implementing the above legislative instruments. These include, but are not limited to:

- Breede-Overberg Catchment Management Strategy.
- Western Cape Provincial Climate Change Response Strategy.
- Garden Route DM Integrated Coastal Zone Strategy.
- Garden Route DM Integrated River and Estuarine System Strategy.
- Garden Route DM Integrated Biodiversity Strategy.
- Garden Route DM Energy and Climate Change Strategy.

Table 11: International obligations and treaties relevant to SANParks-managed estuaries.

Name	Description and applicability to SANParks' Estuary Management Plans
Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) (World Heritage Convention)	The World Heritage Convention links the concepts of nature conservation and the preservation of cultural properties by recognising the way in which people interact with nature as well as the fundamental need to preserve the balance between the two concepts. The Convention sets out the duties of state parties and defines the kind of sites which can be considered for inscription on the World Heritage List (this may include estuaries) as well as the state parties' role in protecting and preserving those sites. As an implementing agent of the Department of Forestry, Fisheries and the Environment (DFFE), SANParks is responsible for identifying natural and cultural assets within National Parks (including estuaries) as well as managing those assets.
Convention on International Trade in Endangered species of Wild Fauna and Flora, 1973 (CITES)	CITES is a treaty protecting endangered plants and animals. The treaty recognises that *"wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth which must be protected for this and the generations to come"* as well as the "*ever-growing value of wild fauna and flora from aesthetic, scientific, cultural, recreational and economic points of view*". It also recognises that "*peoples and States are and should be the best protectors of their own wild fauna and flora*" and that "*international co-operation is essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade"*.
Convention of Migratory Species of Wild Animals (1979) (Bonn Convention)	The Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their range (across or outside national boundaries), with special emphasis on endangered species. This is achieved by range states acknowledging the importance of migratory species and agreeing to take action to conserve such species and their habitat whenever possible and appropriate.
The Convention for Co-operation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern African Region (1981) (Abidjan Convention)	The Abidjan Convention covers the marine environment, coastal zones and related inland waters and obligates the contracting parties to take all necessary measures to prevent, reduce, combat and control pollution as well as ensuring sound environmental management of natural resources in the convention area. This includes pollution from ships and aircraft, land-based sources, activities related to exploration and exploitation of the sea bed and from the atmosphere. The convention requires contracting parties to undertake to prevent, reduce, combat and control coastal erosion and to protect and preserve rare or fragile ecosystems, as well as the habitat of depleted, threatened or endangered species and other marine life in specially protected areas. Additionally, it provides for co-operation in emergency situations and in the fields of scientific research, monitoring and the assessment of pollution and requires the development of national policies and legislation, including those that incorporate the polluter pays principle.
The Nairobi Convention for the	The Nairobi Convention offers a regional legal framework and coordinates the efforts of the member

Name	Description and applicability to SANParks' Estuary Management Plans
Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean (1985) (Nairobi Convention)	states to plan and develop programmes that strengthen their capacity to protect, manage and develop their coastal and marine environment in a sustainable manner. It also provides a forum for inter-governmental discussions that lead to better understanding and protection of the member states' shared marine environment and promotes sharing of information and experiences between member states.
United Nations Convention on Biological Diversity (1992)	The Convention's three main goals are the conservation of biological diversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources, achieved by developing suitable national strategies. SANParks' management strategies for estuaries in the GRNP include aspects of all three main goals as provided for under the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) and the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
Agenda 21 (1992) as reaffirmed at the United Nations World Summit on Sustainable Development - Johannesburg Summit (2002) and Rio+20 (2012). The Sustainable Development Summit (2015) also added onto the Agenda 21 goals.	Agenda 21 is a non-binding United Nations action plan for sustainable development. The goals of Agenda 21 were expanded upon to a total of 17 Sustainable Development Goals in 2015. These deal mainly with combating poverty, especially in developing countries, changing consumption patterns, promoting health, achieving a more sustainable population, and the introduction of sustainable settlement patterns in decision making. It also deals with atmospheric protection, combating deforestation, protecting fragile environments, conserving biodiversity, control of pollution and the management of biotechnology, and radioactive wastes as well as the roles of children and youth, women, NGOs, local authorities, business and industry, and workers; and strengthening the role of indigenous peoples, their communities, and farmers in sustainable development. To achieve the goals, the roles of science, technology transfer, education, international institutions and financial mechanisms are also included.
United Nations Framework Convention on Climate Change (1992)	The United Nations Framework Convention on Climate Change objective is to *"[stabilize] greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*" by "*enacting effective environmental legislation, that environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply, and that standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries*". Additionally, "*such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner".*
Global Programme of Action for the Protection of the Marine	The international community, recognising that the impacts of land-based activities on the marine environment was a local, national and regional problem with global ramifications, initiated the GPA to

Name	Description and applicability to SANParks' Estuary Management Plans
Environment from Land-based Activities (GPA) (1995)	manifest their commitment to preventing the degradation of the marine and coastal environments from land based activities, by initiating actions at the national level and co-operation at the regional level. The primary objective of the GPA is to facilitate "*the realization of the duty of States to preserve and protect the marine environment. It is designed to assist States in taking actions*". The GPA aims at preventing the degradation of the marine environment from land-based activities by facilitating the realization of the duty of States to preserve and protect the marine environment. It is designed to assist States in taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction, control and/or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities. Achievement of the aims of the Programme of Action will contribute to maintaining and, where appropriate, restoring the productive capacity and biodiversity of the marine environment, ensuring the protection of human health, as well as promoting the conservation and sustainable use of marine living resources.

Table 12: National legislation relevant to SANParks-managed estuaries.

Name	Description and applicability to SANParks' Estuary Management Plans
The Constitution of the Republic of South Africa (Act No. 108 of 1996)	The constitution is the supreme law of the Republic of South Africa and provides the legal framework for legislation regulating environmental management as outlined in the Bill of Rights, Chapter 2:24. This section applies to estuaries; and states: *"Everyone has the right* *(a) to an environment that is not harmful to their health or wellbeing; and* *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that* *(i) prevent pollution and ecological degradation;* *(ii) promote conservation; and* *(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."* Section 24 therefore guarantees the people in South Africa the right to an environment that is not harmful to their health or well-being, and requires the State to promulgate legislation and take any other reasonable steps that ensure that the right is upheld. This lays the basis for environmental law in South Africa and is a very important justification for the wise use of estuarine biodiversity.
National Environmental Management Act, 1998 (Act No.	The principles of NEMA apply throughout the Republic to the actions of all organs of state that may significantly affect the environment. It also states that environmental management must place people

Name	Description and applicability to SANParks' Estuary Management Plans
107 of 1998) (NEMA)	and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably; development must be socially, environmentally and economically sustainable; the consideration of all relevant factors in decision making (e.g. disturbance of ecosystems, loss of biological diversity, pollution and degradation of the environment, disturbance of landscapes and sites that constitute the nation's cultural heritage and waste are avoided, or, where they cannot be altogether avoided, are minimised and remedied; the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource and that such resource use does not exceed the level beyond which their integrity is jeopardised. NEMA also provides for co-operative environmental governance and for the incorporation of environmental principles in decisions affecting the environment. NEMA, through mechanisms such as the EIA Regulations provides for assessment of human resource usage and development impacts on sensitive, vulnerable, highly dynamic or stressed ecosystems (which includes estuaries). NEMA also provides for the promulgation of specific environmental management acts that are designed to be implemented to protect a specific aspect of the environment e.g. the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)and the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008).
National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) (ICM Act)	The ICM Act was promulgated to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable. It also defines rights and duties in relation to coastal areas; determines the responsibilities of organs of state in relation to coastal areas; prohibits incineration at sea; controls dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; and gives effect to South Africa's international obligations in relation to coastal matters. Chapter 4 of the ICM Act deals with estuarine management; with Section 33 providing for the publication of a NEMP and Section 34 stipulating the need for EMPs to be developed. Additional provisions of the ICM Act applicable to estuarine management (and which impacts SANParks' management strategy of estuaries) relate to the coastal zone (which includes Coastal Public Property and the Coastal Protection Zone) (Chapter 2), determination of boundaries of coastal areas, including

Name	Description and applicability to SANParks' Estuary Management Plans
	Coastal Management Lines (Chapter 3), protection of coastal resources (which includes coastal leases and environmental authorisations) (Chapter 7), marine and coastal pollution control (which includes discharges into estuaries) (Chapter 8), and miscellaneous matters (specifically existing leases on and rights to coastal public property, unlawful structures on coastal public property and existing lawful activities in the coastal zone) (Chapter 12).
National Water Act, 1998 (Act No. 36 of 1998) (NWA)	Fundamental principles of the NWA is to recognise the basic human needs of present and future generations, the need to protect water resources, the need to share some water resources with other countries, the need to promote social and economic development through the use of water. Additionally, sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. Objectives of the NWA include ensuring the protection of South Africa's water resources (i.e. the aquatic ecosystems, including estuaries) by establishing ecological water requirements as well as measures to ensure that these base flows are retained. It also deals with activities and water uses that may negatively impact stream-flow and water quality. The NWA requires that estuaries are assigned a "class" using a gazetted classification process, aimed at determining the amount of abstraction or protection a river would be assigned. For systems that have yet to be classified, the environmental reserve is determined on the basis of recommendations emanating from a reserve determination study using the Resource Directed Measures methodology in conjunction with considerations of the demand for water in the catchment (the classification process described above will effectively standardise the way this is done). In the absence of reserve determination studies for individual estuaries, the ecological state of South Africa's estuaries was predicted at a desktop level as part of the estuary component of the 2018 National Biodiversity Assessment. The ICM Act, however, provides for the authorisation of discharge of effluent into coastal waters via a coastal waters discharge permit but such permit is required to be issued in consultation with the Minister responsible for Water Affairs in respect to estuarine discharges. To maintain the ecological integrity of estuaries, proper management of the fresh water inflow and knowledge of the ecological water requirements of the estuary is needed. Ongoing engagement between SANParks and the Department responsible for Water Affairs is therefore crucial to ensure that the

Name	Description and applicability to SANParks' Estuary Management Plans
	estuary maintains a healthy ecological state.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM:PAA)	The NEM:PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas. Chapter 4 of the NEM:PAA sets out the management requirements for protected areas and includes the development and subsequent periodic review of management plans. The object of a management plan is to ensure the protection, conservation and management of the protected area; which includes estuaries within those protected areas. The Act also requires that marine and terrestrial protected areas with common boundaries must be managed as an integrated protected area by a single management authority. As this is the primary legislation governing the protected areas managed by SANParks, estuary management principles and management interventions must be in accordance with the provisions of the NEM:PAA.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)	The NEM:BA provides for the conservation of biological diversity. It requires identification of important landscapes, ecosystems, ecological processes and species for biodiversity conservation, and promotes monitoring of these. It also provides for the proclamation of protected areas, recognising South Africa's obligations to international conventions. Estuaries are important fish nursery areas and provide a source of food for many fish and migratory bird species. They also provide a source of food and recreation for people and must therefore be managed in accordance with the provisions of the NEM:BA.
Marine Living Resources Act, 1998 (Act No. 18 of 1998) (MLRA)	The MLRA provides for the conservation of the marine ecosystem (which includes estuaries), the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefit of all citizens of South Africa. The MLRA defines species that can be exploited, and protection measures for those species, such as closed areas, closed seasons and size and bag limits. Various types of resource-use permit systems

Name	Description and applicability to SANParks' Estuary Management Plans
	are also defined under this Act.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	The NHRA introduces an integrated and interactive system for the management of national heritage resources (which include landscapes and natural features of cultural significance). One of the important elements of the Act is that it provides the opportunity for communities to participate in the identification, conservation and management of cultural resources. The NHRA requires that, in areas where there has not yet been a systematic survey to identify conservation-worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected. Anyone who intends to undertake a development must notify the heritage resources authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the developer's cost. Thus developers will be able to proceed without uncertainty about whether work will have to be stopped if a heritage resource is discovered.
Sea Fishery Act, 1988 (Act No. 12 of 1988)	This act includes estuaries and the estuary bed and has been used to proclaim marine reserves along certain sections of our coast. Collection of shells and shell-grit is regulated under this Act.
Disaster Management Act, 2002 (Act No. 57 of 2002) (DMA)	The DMA aims to provide an integrated and co-ordinated disaster management policy with a focus on the prevention and reduction of the risk of disasters, the mitigation of severity of disasters, emergency preparedness, as well as a rapid and effective response to disasters and post-disaster recovery. The Act provides for the establishment of national, provincial and municipal disaster management centres as well as disaster management volunteers to assist metropolitan or district municipalities. At the local level, the Act prescribes that each metropolitan and district municipality establish a disaster management framework in consultation with local municipalities aimed at ensuring an integrated and uniform approach to disaster management. Each metropolitan and district municipality must also establish a disaster management centre for its municipal area which must educate and promote formal and informal prevention, mitigation and response initiatives to encourage risk-avoidance behaviour in all spheres of government, non-governmental organisations and community based organisations. In addition, each municipal entity in the respective framework, must prepare a disaster management plan that must be incorporated into the municipal integrated development plan. With an emphasis on prevention and mitigation, the disaster management plan must, *inter alia*: • Identify potential risks in the municipal area; • Identify areas and groups of people at risk to disasters;

Name	Description and applicability to SANParks' Estuary Management Plans
	• Have contingency and mitigation measures in place to reduce the effects of disasters on these areas and groups both before and after disasters; and • Provide for the allocation of responsibilities to various role players and co-ordination of carrying out those responsibilities.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The MPRDA makes provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. The MPRDA affirms the State's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources and to promote economic and social development. Chapter 4 of the Act deals with Environmental Management principles as set out in section 2 of the NEMA. The MPRDA requires Environmental Management Programmes that identify a mine's impact on the environment and provide a clear programme on how these will be managed, based on an EIA to be developed. The Act also stipulates that the holder of a right or permit is responsible for any environmental damage, pollution or ecological degradation resulting within or outside the boundaries of the mining activity. To ensure compliance with environmental issues, the MPRDA requires consultation with each department charged with administration of any law that relates to any matter affecting the environment before an EMP may be approved.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA)	The NEM:WA aims to reform the laws regulating waste management to protect health as well as the environment by providing reasonable measures for: pollution prevention, ecological degradation and to secure ecologically sustainable development. The NEM:WA provides for: • institutional arrangements and planning matters; • national norms and standards for regulating the management of waste by all spheres of government; • specific waste management measures; • the licensing and control of waste management activities; • the national waste information system; • compliance and enforcement. The NEM:WA covers a broad range of waste issues ranging from sustainable use of natural resources to pollution prevention, with the following objectives: • to protect health, well-being and the environment by providing reasonable measures for the following: • minimising natural resource use; • avoiding/minimising accumulation of waste; • reducing, reusing, recycling and recovering waste;

Name	Description and applicability to SANParks' Estuary Management Plans
	• treating and safely disposing of waste (as a last resort); • preventing pollution and ecological degradation; • securing ecological sustainable development while promoting justifiable economic and social development; • promoting and ensuring waste service delivery; and • remediating land where contamination presents, or may present, significant risk to health/environment. • ensuring people are aware of impacts of their waste on their health and the environment; and • ensure compliance with the aforementioned points.
National Forests Act, 1998 (Act No. 84 of 1998) (NFA)	The NFA recognises that natural forests and woodlands form an important part of the environment, and need to be conserved and developed according to the principles of sustainable management. A "natural forest" is defined as any group of indigenous trees whose crowns are largely contiguous and applies to riparian vegetation in the Cape Floristic Region. A licence is required to disturb natural forests.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	The objects of CARA is to provide for the conservation of the natural agricultural resources of South Africa by the maintenance of the production potential of land; the combating and prevention of erosion and weakening or destruction of the water sources (including estuaries); and the protection of the vegetation and the combating of weeds and invader plants.
National Health Act, 2004 (Act No. 61 of 2004) (NHA)	While the Department of Health is the lead agent for the NHA, the implementation of this act is delegated to the local municipal and provincial authorities. Every metropolitan and district municipality must ensure that appropriate municipal health services are effectively and equitably provided in their respective areas. These include (insofar as it influences human health, except in ports): • water quality monitoring; • waste management; and • environmental pollution control.
Water Services Act, 1997 (Act No. 108 of 1997)	The main aspects of the Water Services Act, relevant to infrastructure development, are to provide for: right of access to basic water supply and basic sanitation necessary to secure sufficient water and an environment not harmful to human health or well-being; management and control of water services, in general, including water supply and sanitation; and preparation and adoption of Water Services Development Plans (refer to Section 13 of Act) by water services authorities that should form part of Integrated Development Plans (IDPs).
National Veld and Forest Fire Act,	The National Veld and Forest Fire Act intends to reform the law on veld and forest fires to prevent and

Name	Description and applicability to SANParks' Estuary Management Plans
1998 (Act No. 101 of 1998)	combat veld, forest and mountain fires. It also provides for the establishment of fire protection associations and the establishment of firebreaks.

Table 13: Plans, programmes and polices relevant to SANParks' managed estuaries.

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
Programme	National Coastal Management Programme	South Africa's National Coastal Management Programme (CMP) was released in 2014, and provides the direction and guidance towards a structured and standardised approach to coastal management in South Africa, including an appropriate cooperative governance framework (DEA, 2014). It is strongly founded on the initial precepts of the White Paper (DEAT, 2000) such that the vision and principles of integrated coastal management are the same as well as the national mandate, in terms of the ICM Act. The National CMP was developed using a framework of key components of an integrated CMP, where nine key priorities for coastal management were determined (DEA, 2014). These priorities, together with the Vision, function as the pillars of this primary policy directive on coastal management for South Africa. Each is bolstered by a primary goal, specific management objectives, actions and performance indicators to give direction for planning implementation. Collectively, these elements constitute national government's commitment to implementing the ICM Act for a five-year period (2013-2017). Integrating management in estuaries is among these priorities (Priority 3) and the overarching goal echoes that of the ICM Act. The National CMP concludes with a process towards implementation that provides the template for Implementation Plans that should be developed up for each individual action. A second generation National CMP is currently being developed which will replace the 2014 National CMP and provide updated objectives and priorities.
Protocol	National Estuarine Management Protocol (NEMP)	The NEMP, promulgated in 2013 and amended in 2021, provides the national policy for estuary management and guides the development of individual EMPs. In so doing, it stipulates the minimum requirements for the content of an EMP, prescribes the procedures to be followed in developing an EMP and any potential institutional arrangements. Importantly, the NEMP provides clarity as

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		to which authorities are responsible for the development, coordination, and implementation of an EMP. Where an estuary is within a protected area or is identified as part of a protected area expansion strategy, the management authority responsible for the protected area must develop an EMP in consultation with relevant government departments. Where there is an estuary which crossed the boundary of a protected area, the protected area management authority must work together with other relevant government departments or agencies to develop a coordinated estuarine management plan. Strategic objectives for effective integrated management of estuaries as outlined in the NEMP include the following: • To conserve, manage and enhance sustainable economic and social use without compromising the ecological integrity and functioning of estuarine ecosystems; • To maintain and/or restore the ecological integrity of South African estuaries by ensuring that the ecological interactions between adjacent estuaries, between estuaries and their catchments, and between estuaries and other ecosystems, are maintained; • To manage estuaries co-operatively through relevant organs of state across all spheres of government; and to engage the private sector and civil society in estuarine management; • To protect a representative sample of estuaries (such protection could range from partial protection to full protection) in order to achieve overall estuarine conservation targets as determined by the NBA of 2011 and the subsequent updates; • To generate awareness, education and training that relate to the importance and value of South African estuaries; and • To minimize the potential detrimental impacts of predicted climate changes through a precautionary approach to development in and around estuaries and with regard to the utilization of estuarine habitat and resources.

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		The following management standards are prescribed under the NEMP: • An estuary must be managed according to the allocated management class and the set of both resource quality and quantity attributes as prescribed in terms of the NWA. In the absence of the allocated class, an estuary must be managed in its current state and/or improved state in order to achieve national biodiversity targets as outlined in the most recent National Biodiversity Assessment and subsequent updates. The assessment includes a list of national priority estuaries, their current health; recommended extent of protection and degree of undeveloped margins; • An estuary must be managed to avoid, minimize or mitigate significant negative impacts that include but are not limited to reduced water flows and loss of habitat or species. This will require the participation of Departments responsible for utilization of estuarine resources; • Promoting the integration of land use planning and natural resource management outcomes with estuarine management outcomes; • Management actions should be based on sound scientific evidence and, where lacking, the precautionary approach should prevail; and • The adoption of risk management approaches to address issues such as climate change and associated impacts, must be promoted. An EMP must be in line with the National CMP, and where applicable, the Provincial CMP and the Municipal CMP. Where the estuary is located in a protected area, the estuarine management plan must be developed in line with the requirements for the protected area's management plan.
Plan	Garden Route National Park Management Plan	The GRNP is a complex of protected areas managed as a single entity, SANParks. The management area includes the previously proclaimed Tsitsikamma and Wilderness National Parks, state forests and mountain catchment areas and the Knysna National Lake Area. The area is zoned and programmes outlined for identified objectives, with actions, indicators and responsibilities. Management of the marine and estuarine environments have been highlighted in the GRNP with programmes developed for each outlining management

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		interventions and strategies planned for the Park. The Sout (Oos) Estuary is situated in a quiet zone of the park, where only non-motorised access is permitted, and the area is protected from infrastructure development and excessive tourist impacts. Activity in 'quiet zones' is limited to visitor's access on foot via hiking trails.

Table 14: Provincial and municipal legislation implemented by other authorities that may affect the management of estuaries within National Parks.

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
Act	Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA)	Although many of the provisions of this Act have been repealed by NEMA, the Regulations in terms of the ECA regulating the Outeniqua and Sensitive Coastal Area remain in force until replaced by new regulations.
Act	Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA)	The primary aim of the SPLUMA, insofar as it relates to estuarine management, is for the provision of a framework for spatial planning and land use management as well as to: • Provide for monitoring, coordination and review of spatial planning and land use management systems; • Provide for inclusive, developmental, equitable and efficient spatial planning at different spheres of government; • Provide a framework for policies, principles, norms and standards; • Address past spatial and regulatory imbalances; • Promote greater consistency and uniformity in the application procedures and decision-making processes by local authorities responsible for land use decisions and development applications; • Provide for establishment, functions and operation of Municipal Planning Tribunals; and • Provide for facilitation and enforcement of land use and development measures.
Act	Western Cape Housing Development Act, 1999 (Act No. 6 of 1999)	The Western Cape Housing Development Act determines general principles applicable to housing in the province of the Western Cape and defines the role of the provincial and local spheres of government in housing development. It

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		also needs to ensure that housing development is integrated with all other facets of development in a holistic way.
Act	Western Cape Planning and Development Act, 1999 (Act No. 7 of 1999)	This Act lays down guidelines for the future spatial development in the Western Cape Province in such a way as will most effectively promote the order of the area as well as the general welfare of the community concerned.
Act	Western Cape Land Use Planning Act, 2014 (Act No. 3 of 2014) (LUPA)	The development objectives entrenched in SPLUMA have been assimilated into the LUPA, which in turn sets out a framework for the adjudication of land use planning applications in the Province and requires that local municipalities have due regard to at least the following when doing so: Applicable spatial development frameworks; Applicable structure plans; Land use planning principles referred to in Chapter VI (Section 59); Desirability of the proposed land use; and Guidelines that may be issued by the Provincial Minister regarding the desirability of proposed land use.
Act	Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000) (Municipal Systems Act)	The Municipal Systems Act (Chapter 5) deals with Integrated Development Planning (which municipalities are obliged to prepare and to update regularly). An IDP is intended to encompass and harmonise planning over a range of sectors such as water, transport, land use and environmental management. It requires each local authority to adopt a single, inclusive plan for the development of the municipality which: Links, integrates and coordinates plans and takes into account proposals for the development of the municipality; Aligns the resources and capacity of the municipality with the implementation of the plan; Forms the policy framework and general basis on which annual budgets must be based; Is compatible with national and provincial development plans and planning requirements that are binding on the municipality in terms of legislation.
Ordinance	Nature and Environmental Conservation Ordinance, 1974 (Ordinance No. 19 of 1974)	CapeNature is the lead agent for Nature and Environmental Conservation Ordinance in the Western Cape.
Ordinance	Land Use Planning Ordinance, 1985	LUPO provides for decision-making regarding land use and planning issues,

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
	(Ordinance No. 15 of 1985) (LUPO)	including applications for rezoning, sub-division and the amendment of relevant structure and/or spatial plans promulgated in terms of LUPO.
Plan	Garden Route District Municipality Integrated Development Plan	The Garden Route IDP advocates the conservation of the environment, natural resources, biodiversity, CBAs and ecosystem services. The IDP clearly reflects the importance of the municipal areas pristine natural assets, which are seen as key to securing the future of the region, as they add to the identity and aesthetic appeal of the region and are large contributors to tourism. Accordingly, protection of the environment features in the first and fourth key strategic objectives.
Plan	Bitou Local Municipality Integrated Development Plan	In alignment with the broader scale plans of the district and province, the Bitou LM IDP (Bitou IDP 2017-2022) encompasses seven strategic objectives to aid in the delivery of its vision: • Strategic planning for transformation; • Economic development; • Community and social development; • Infrastructure development; • Institutional development; • Financial sustainability; and • Public participation. Although environmental issues are not listed in the seven strategic objectives, environmental protection is inherent throughout the IDP as it underpins tourism, Bitou's primary economic driver. Environmental protection projects and goals such as a recycling and water conservation project, and the goal of attaining blue flag status for beaches are examples of such initiatives that are incorporated in the seven objectives. The IDP highlights the main developmental needs of the community of Ward 1, where the Sout (Oos) Estuary is located, in order of priority; electricity, water, economic development, industrial development, waste removal, parks, recreation, roads, safety and security, sewerage and education. Elements of the 'water' and 'parks, recreation, environment and sports' development focuses that may impact on the estuary include alien vegetation clearing, compulsory

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		rain tanks for each property for rainwater harvesting and the implementation and enforcement of the Keurbooms River Catchment Management Plan.
Framework	Bitou Local Municipality Spatial Development Framework	A SDF is prepared, approved and implemented within the legislative context of the Local Government: Municipal Systems Act and the subsequent Local Government: Municipal Planning and Performance Management Regulations (Section 4), 2001 promulgated under Section 120 of the Local Government: Municipal Systems Act, and the Western Cape Planning and Development Act. The SDF indicates, in relation to a relevant, or future, IDP, the spatial implications of the IDP, and spatially reflects the integration of the various strategies of the IDP; and ensures sustainability. The SDF further gives effect to Council's vision for development (spatial planning) and Council's objectives and strategies with respect to land development, use and management. The SDF needs to be aligned with, amongst others, the Provincial SDF (see below), the Garden Route's SDF and Spatial Development Plans.
Framework	Western Cape Provincial Spatial Development Framework (WCPSDF)	The WCPSDF is pitched at a very broad level, encapsulated in the vision "a home for all in the Western Cape". While the WCPSDF serves primarily as a provincial planning framework for guiding environmentally sustainable development and use of natural resources whilst promoting socio-economic development, it reports and defines policy statements on, *inter alia*, the state of inland waters as well as oceans and coasts within the Province.
Programme	Western Cape Provincial Coastal Management Programme	The 2016 Western Cape CMP is a transversal initiative which needs to be implemented through partnerships between all sectors and spheres of government and other stakeholders. It focuses on growing the blue and green economies through unlocking the economic potential of the Western Cape's coastal assets. It aims to enable a resilient, sustainable, quality and inclusive living environment through improved coastal spatial and development planning, access, protection and Local Government support. Estuary Management is one of the Priority Areas of the CMP, which aims for a "co-ordinated and integrated estuarine management which optimises the ecological, social and economic value of these systems on an equitable and sustainable basis"

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
Plan	Western Cape Provincial Biodiversity Spatial Plan	The 2010 Western Cape Biodiversity Framework, including subsequent updates integrates all existing biodiversity planning products for the Western Cape into a common, user-friendly framework to guide land-use decision-making. Importantly, it provided a clear indication of all CBAs and Ecological Support Areas (ESAs) identified across the province, covering both the terrestrial and freshwater realms, as well as major coastal and estuarine habitats. These areas require safeguarding as they are crucial for conserving a representative sample of biodiversity and maintaining ecosystem functioning. ESAs, while not essential for meeting biodiversity targets, play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services.
Programme	Garden Route District Municipality Coastal Management Programme	The Garden Route DM: CMP was developed in accordance with the requirements of the ICM Act. The vision for the Garden Route's coastal zone is included as "*The coastal zone is the Garden Route's most significant asset and must be nurtured through innovative and integrated cooperative management interventions that will ensure both the environmentally sustainable functioning and enhancement of the natural systems, while optimising economic and social benefits, protecting the diverse cultural heritage, maintaining its unique sense-of-place, increasing awareness through education and ensuring the spiritual well-being of all its users*".
Policy	Integrated Garden Route Environmental Policy (IGREP)	The IGREP is adopted in 2009, along with its implementation strategy, the Garden Route Environmental Management and Development Framework (GREMDF). The GREMDF requires that the Garden Route develops detailed sectoral strategies to meet the commitments made in the sectoral approaches by giving effect to the environmental principles in IGREP. During the IGREP development process six priority strategies were identified, of which five have been developed
Plan	Garden Route District Municipality Climate Change Adaptation Plan	As part of the Climate Change Municipal Support Programme, the Garden Route District Municipality Climate Change Adaptation Plan (Eden DM, 2014) aims to create an enabling environment which will support a district-wide and a coordinated response to climate change in the Garden Route District. Through a series of workshops, the key vulnerabilities, impacts and strategies to address these vulnerabilities and impacts were identified.

Legislation type	Name	Description and applicability to SANParks' Estuary Management Plans
		The plan acknowledges that rivers and estuaries are areas which pose serious disaster risk, particularly in the face of climate change. Furthermore, coastal areas were identified as one of several priority areas for intervention strategies. The key outcomes of the plan include current and proposed climate adaptation interventions identified by each local municipality.

8. INFORMATION GAPS

Information pertaining to the Sout (Oos) Estuary is poor. Almost any future research would contribute to the knowledge base for this system. Priority fields of study would be those that address threats and weaknesses and would include:

- Resource utilization, particularly biological resources.
- Changes in catchment land-use.
- Hydrology.
- Water quality or biomonitoring proxies.
- Disturbances from recreational activities.

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