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# iLovu Estuarine Management Plan: Situation Assessment Report


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KWAZULU-NATAL PROVINCE
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REPUBLIC OF SOUTH AFRICA

by

**DP CYRUS *Pr.Sci.Nat*, L VIVIER & C BURNE *Pr.Sci.Nat.***

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| **AUTHORS:** | DP Cyrus *Pr*.*Sci*.*Nat*, L Vivier & C Burne *Pr*.*Sci*.*Nat.* |



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# EXECUTIVE SUMMARY

## INTRODUCTION

The compilation of this Situation Assessment Report for the iLovu Estuary provides a framework of the relevant and available information that will provide the basis for the development of the Estuary Management Plan, as stipulated under the National Environmental Management: Integrated Coastal Management Act 2008 (As amended in Act No 36 of 2014) (the 'ICM Act'). The National Estuarine Management Protocol, promulgated under the ICM Act, provides guidance for the management of estuaries through the development and implementation of estuarine management plans. This report provides an overview of the spatial and physical characteristics of the iLovu Estuary, describes the current state of the estuary and provides a review of the legal framework relevant to the system. Also included is a summary of the social and economic background as well as information on land-use patterns; a description of the estuaries biophysical characteristics; details of assessments undertaken in relation to ecological water quality and quantity and flow rates. Finally, it provides a background related to ecosystems goods and services, related management recommendations, management opportunities and constraints as well as information gaps currently faced in the system.

## CATCHMENT CHARACTERISTICS

Located within the province of KwaZulu Natal on the east coast of South Africa, the iLovu Estuary is approximately 37km south of central Durban at 30°51'27.2700" South and 30°6'19.5552" East and lies within the boundary of the eThekwini Metropolitan Municipality. The estuary is fed by quaternary catchment U70D and receives water from a catchment which is some 951 $km^2$. The estuary is 1.1km in length from the mouth, which leads into the Indian Ocean, to its head, and the total estuarine area is approximately 39.5ha.

## ECOLOGICAL FUNCTION AND STATE OF THE ESTUARY

The 2018 National Biodiversity Assessment (NBA) defined the iLovu estuary as a "Large Temporarily Closed Estuary" which is one in which the mouth of the system is open to the sea more the 50% of the time. Records of the mouth condition from May 1978 to December 1982 indicated that, apart from the drought years of 1980 and 1982, the mouth of the iLovu Estuary was open some 95% of the time in 1979, 78% in 1981 against 45% in 1980 and 63% in 1982. No new data is available to suggest that in recent years it has deviated from this pattern and indications are that the mouth of the iLovu Estuary is open for some 77% of the time.

No fieldwork based Ecological Reserve Determination or Ecological Water Requirement (EWR) has to date been undertaken for the iLovu Estuary. However, the estuary been assessed during a classification of Water Resources and Resource Quality Objectives (RQO) study for the Mvoti

to Umzimkulu Water Management Area as well as for the 2011 and 2018 National Biodiversity Assessment (NBA). The iLovu Estuary's Present Ecological State (PES) is listed as "C" (Moderately Modified) with a Recommended Ecological Category (REC) of "A/B or BAS" (Best Attainable State). The Department of Water Affairs have made recommendations regarding the extent of protection required for the iLovu Estuary based on the determined PES and REC for the 2011 NBA and determined that there should be Partial Protection of the estuary covering 50% of the Undeveloped Margin.

It has also been gazetted that the Target Ecological Category (TEC) for the iLovu Estuary should be a "B/C" (Government Gazette 41306, Notice No. 1386 of 8 December 2017). This category represents an overall health score that ranges between roughly 67-83% of pristine estuarine health when the current state is between 40-60%. Achieving this mandated Ecological Category (EC) will require the improvement of several of the individual components of the estuarine system.

A previous assessment of pressures on the iLovu Estuary determined that Flow, Habitat Loss and Fishing Effort issues are causing the most pressure on the system, whilst several other pressures are rated as being Medium. Sand mining has also been identified as a major pressure point impacting on both the estuary as well as the coastal zone. A disturbing factor is that the Mean Annual Runoff (MAR) of the system has been reduced by some 30.5%. The iLovu Estuary is one of 122 national priority estuaries out of the 300 along our coastline that remains classified as a priority estuary in terms of biodiversity according to the 2018 National Biodiversity Assessment.

Water quality data is limited with reports from 1994 and 2000 indicating poor water quality in the system, whilst a 2008 report noted an improvement in overall water quality during 2007-2008. No records of metal or organic compound contamination in the iLovu Estuary were found. However, as noted in section 5.4, some microplastic pollution was reported in the system, albeit at much lower levels than in the estuaries around Durban. In terms of nutrients, elevated Chlorophyll-a levels (as high as 32 mg.m-3) and phytoplankton blooms have been recorded under low flow conditions. These are probably due to lower freshwater flows in winter, reducing the flushing of accumulated nutrients and causing longer retention times. Casual observations in the early 1990s revealed periodic phytoplankton blooms and blue green algae scums on exposed sand/mud banks, suggesting eutrophication due, in part, to nutrient enrichment from return flows from sugar cane fields. Sewage contaminated stormwater and accidental discharges from the sugar mill 3.5km up the estuary may also have been potential sources of nutrient enrichment. In addition, the microalgal component for the iLovu Estuary has been noted to be evaluated.

Whilst accurate figures are not available it would appear from statements on recent reports and consultation of aerial photo that the bulk of the iLovu floodplain has been lost to habitat

transformation, with the majority of the floodplain being altered by commercial sugarcane farming. In addition, a business park has been developed on the floodplain. Smaller estuaries, like the iLovu Estuary, which experience pollution pressure and eutrophication are vulnerable to the spread of invasive alien plant species and the diversity and abundance of invasive alien plants within the estuary must have increased over time.

Information on the macrobenthos of the iLovu Estuary is limited and dated. The most recent data comes from sampling of the lower, middle and upper reaches during August 2007 (low flow conditions) and February 2008 (high flow conditions). Species richness (number of taxa) was found to generally be low, with a total of 20 taxa recorded over the entire study period. The macrobenthic community was dominated in terms of species richness by Polychaetes (5 taxa) and Amphipoda (4 taxa). In terms of abundance, the benthos was dominated by the tanaid *Halmyrapseudes cooperi*, which accounted for 46% of all organisms recorded in the system. This abundant species accounted for 44% and 58% of all organisms in the lower and middle reaches under low flow conditions, respectively. It was concluded that, being a predominantly open system with a strong marine and tidal influence, the estuary was expected to support a greater diversity and abundance than what was recorded during the 2007-2008 survey. The ecological state of the macrobenthic community was rated as fair. Given the ecological importance of the macrobenthic community as a pivotal component of the biotic composition in the estuary, it is imperative that a more detailed and up-to-date assessment of the state of the macrobenthic community be included in future biomonitoring programs.

There has been intermittent sampling of the fish community, but it was last undertaken in 2007 again indicating the need for updated data from the system. The bulk of species present represent juvenile marine species which utilize the estuary as a nursery ground. Once they reach maturity, they leave the system and do not return. Included in this group are a number of Estuarine Dependant species which require an estuarine environment to complete their life cycle. Catch and species composition has been variable. It is noteworthy that in 1984 three *Pomadasys* species, viz. *P. hasta*, *P. multimaculatum* and *P. commersonnii* (55 individuals) made up 11% of the catch, while in the late 1990's sampling yielded only four individuals of *P. commersonnii* making up less than 1% of the catch and in 2006 only 18 of the latter were netted also contributed less than 1% of the catch. The proportion increased slightly in 2007/2008 to 4%. These are benthic feeding species and the low numbers after 2000 possibly reflect changes in the zoobenthos. It is also likely due to the loss of estuarine habitat, linked to the reduced saline intrusion (mouth condition) and declines in the water quality within the system.

There is even less data on the avifauna of the iLovu Estuary however the four know counts have recorded 39 species including two IUCN listed Red Data species, the African Finfoot which is

regarded as vulnerable and the Grey-crowned Crane is listed as Endangered. More recent and detailed data on the avifauna is required.

**ECOSYSTEM SERVICES**

Defined as “the benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth.” The list of ecosystem services provided by the iLovu Estuary is short, as the system is small and has already been subjected to anthropogenic impacts in the past. Services provided include the provision of raw materials, the breakdown of waste and detoxifying of pollutants, as well limited provision of refugia and nursery area, material and nutrient export as well as limited tourism and recreational value.

**IMPACTS OR POTENTIAL IMPACTS TO THE ESTUARY**

These revolve around several issues including the presence of bridges and causeways, sedimentation within the estuary, sand mining, micro plastics, alteration of the floodplain and invasive alien plants, and water quality and wastewater discharge. The estuary has been significantly modified and the ecological functioning and provision of ecosystem services has declined. The 2018 National Biodiversity Assessment rated items related to flow modification, habitat loss and fishing effort as High, causing the most pressure on the system whilst several other components are rated as causing Medium pressure. The presence of sand mining and the occurrence of unauthorised artificial breaching of the mouth are also impacting on the system, particularly the former. Additionally, the physical impacts acting on the system include the proliferation in the estuary riparian zone and floodplain of sugar cultivation and invasive alien plants and significantly the poor water quality within the estuary and impacts of wastewater discharges. The Department of Water Affairs also list significant flow modification, poor water quality, habitat destruction as being the major causes of pressure on the system.

**SOCIO-ECONOMIC CONTEXT**

The iLovu Estuary is situated in the KZN South Coast between Winkelspruit and Illovo South in wards 97, 98 and 109 of the eThekwini Metropolitan Municipality. The municipal area comprises both metropolitan and rural settings which include a wide range of formal and informal land uses. Rural areas and communal lands form the majority of the municipality with commercial agriculture, notably sugarcane, being the primary crop under cultivation across both the municipality and the province. The Illovo area itself is currently still driven by the agricultural sector where sugarcane is the primary land use activity along both the north and south banks of the iLovu River including parcels of land bordering the estuary. There were approximately 27 108

people residing in the Illovo South and Illovo North areas in 2013 with a likely increase to the present date by as much as 30% if comparing the average increase over a ~10-year period in terms of the overall national census figures. The eThekwini South Region is considered an important urban development node and corridor and a collective proposal to shift largely from agricultural land use towards other sectors of development, ultimately forming part of a Special Economic Zone, is currently underway. In terms of Gross Domestic Product, the secondary sector industry in the eThekwini South Region, particularly the manufacture of transport equipment, contributes more to the local economy in comparison to the same industry in the other municipal regions. Owing to an increasing population across the region, there is an overall demand for enhanced employment opportunities and social facilities in the Illovo area. In addition, the Covid-19 pandemic has further constrained the local socio-economy reducing the employment rate resulting in increased harvesting pressures on the estuary.

**OPPORTUNITIES AND CONSTRAINTS FOR CONSIDERATION IN EMP**

A SWOT analysis identified numerous opportunities (including strengths) and constraints (threats and weaknesses) related to the system that could be used in the planning process for developing the Estuary Management Plan. The positive factors are grouped together as ‘opportunities’ (external elements) and ‘strengths’ (usually internal elements). Constraints are grouped as ‘threats’ (external elements) and ‘weaknesses’ (generally internal elements that cannot be modified in the short-term).

**RECOMMENDATION TO ADDRESS INFORMATION GAPS**

There has been very little research or data collection conducted in the system over the last 10 years. Spatial and temporal replication of information is valuable for enabling researchers to map the changes that occur within a system over time and how the system is responding to human activities. A list of information identified as being needed to improve on future Ecological Water Reserves studies for the iLovu Estuary is provided.

**WHAT’S NEXT**

This Situation Assessment (as determined during a desktop study) provides the background to the current state and condition of the iLovu Estuary and its biota, as well as highlighting the deficiencies and necessities in terms of management that must be addressed, in order to maintain a functional estuarine system. Next, the local authorities and the general public from the surrounding communities will be consulted to gain their input and perspective on the potential issues, threats and information gaps associated with the estuary. The revised situation assessment will then serve as the basis and platform for the development of the Estuary Management Plan.

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# GLOSSARY

**Abiotic**
Not pertaining to living organisms; physical parameters and features such as temperature, rainfall, sediment etc.

**Abstraction**
Permanent removal of water from a stream or river.

**Algal Bloom**
The multiplication of one or more species of algae to high densities under certain environmental conditions.

**Alien**
A species that occurs outside of its natural range and dispersal potential.

**Anaerobic**
Environmental conditions where oxygen is not available.

**Aquatic**
Associated with and dependent on water e.g. aquatic vegetation.

**Aquatic ecosystem**
The abiotic (physical and chemical) and biotic components, habitats and ecological processes contained within rivers and their riparian zones and reservoirs, lakes, wetlands and their fringing vegetation.

**Benthic**
Bottom-dwelling organisms that live on the bottom of the rivers, estuaries and the ocean are called benthic organisms.

**Biodiversity**
The diversity of genes, species and ecosystems on Earth, and the ecological and evolutionary processes that maintain this diversity.

**Biodiversity priority areas**
Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: protected areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, focus areas for land-based protected area expansion, and focus areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future. The different categories are not mutually exclusive and in some cases overlap, often because a particular area or site is important for more than one reason. They should be seen as complementary, with overlaps reinforcing the importance of an area.

**Biodiversity target**
The minimum proportion of each ecosystem type that needs to be kept in a natural or near natural state in the long term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystem types.

**Biodiversity thresholds**
A series of thresholds used to assess ecosystem threat status, expressed as a percentage of the original extent of an ecosystem type. The first threshold, for Critically Endangered ecosystems, is equal to the biodiversity target; the second threshold, for Endangered ecosystems, is equal to the biodiversity target plus 15%; and the third threshold, for Vulnerable ecosystems, is usually set at 60%. Also see Ecosystem threat status.

**Biota/Biotic**
Refers to all living organisms (plants, animals, fungi and bacteria).

**Catchment Area**
The area from which rainfall flows/drains into the estuary.

**Collapsed (CO) (Red List category)**
An ecosystem type is Collapsed when it is virtually certain that its defining biotic or abiotic features are lost, and the characteristic native biota are no longer sustained.

**Community**
In ecology, a community is a group or association of populations of two or more different species occupying the same geographical area and in a particular time.

**Critical Biodiversity Area**
Areas required to meet biodiversity targets for ecosystems, species or ecological processes, as identified in a systematic biodiversity plan. May be terrestrial or aquatic.

**Critically Endangered**
An ecosystem type is Critically Endangered when the evidence indicates that it meets any of the criteria A to E for CR. It is then considered to be at an extremely high risk of collapse.

**Critically Endangered ecosystem**
An ecosystem type that has very little of its original extent (measured as area, length or volume) left in natural or near natural condition. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost.

**Degradation**
The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.

**Detritus**
Fallen organic material such as leaves.

**Ecological infrastructure**
Ecological infrastructure refers to naturally functioning ecosystems that generate or deliver valuable services to people.

**Ecological Support Area**
An area that is not essential for meeting biodiversity targets but plays an important role in supporting the ecological functioning of one or more Critical Biodiversity Areas or in delivering ecosystem services. May be terrestrial or aquatic.

**Ecosystem Protection Level**
Indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected, Moderately Protected, Poorly Protected, or Not Protected, based on the proportion of the biodiversity target for each ecosystem type that is included within one

or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems.

**Ecosystem services**
The benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth. Ecosystem services are the flows of value to human society that result from a healthy stock of ecological infrastructure. If ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish.

**Ecosystem Threat Status**
Indicator of how threatened ecosystems are, in other words the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function or composition. Ecosystem types are categorised as Critically Endangered, Endangered, Vulnerable or Least Concern, based on the proportion of the original extent of each ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. Critically Endangered, Endangered and Vulnerable ecosystems are collectively referred to threatened ecosystems, and may be listed as such in terms of the Biodiversity Act.

**Ecosystem type**
An ecosystem unit that has been identified and delineated as part of a hierarchical classification system, based on biotic and/or abiotic factors. Factors used to map and classify ecosystems differ in different environments. Ecosystem types can be defined as, for example, vegetation types, river ecosystem types, wetland ecosystem types, estuary ecosystem types, or marine or coastal habitat types. Ecosystems of the same type are likely to share broadly similar ecological characteristics and functioning. Also see National ecosystem classification system.

**Ecosystem-based adaptation** (to climate change)
The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. Includes managing, conserving and restoring ecosystems to buffer humans from the impacts of climate change, rather than relying only on engineered solutions. Combines socio-economic benefits, climate change adaptation, and biodiversity and ecosystem conservation, contributing to all three of these outcomes simultaneously.

**Endangered**
An ecosystem type is endangered when the evidence indicates that it meets any of the criteria A to E for EN, and is then considered to be at a very high risk of collapse.

**Energy Subsidy**
Any physical or possibly chemical process which has the effect of reducing the amount of energy an animal has to expend in the process of obtaining food.

**Estuarine Functional Zone**
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.

**Estuarine wetland**
Wetlands broadly refer to the interface between strictly aquatic and fully terrestrial habitats. In the context of this report, wetlands will refer to partially enclosed ecosystems that are permanently or periodically connected to the ocean, which are influenced by tidal fluctuations and within which ocean water is at least occasionally diluted by fresh water derived from surface or subsurface land drainage.

**Eutrophication**
A process whereby nutrients (nitrogen and phosphorus) become over abundant in a waterbody often leading to algal blooms.

**Extralimital**
Situated, occurring, or originating from outside a particular region/estuary.

**Floodplain**
Low lying land adjacent to the river or estuary periodically flooded (timeframes may vary from annually to decadal) where river borne materials are deposited.

**Head (of estuary)**
The upstream part of the system where freshwater enters.

**Hydrological regime / flow regime**
The hydrological regime (also referred to as flow regime) includes all aspects relating to the flow of water, including: magnitude, frequency, duration, predictability and flashiness.

**Hypersaline**
Salinity well in excess of that of sea water.

**Impact**
A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

**Indigenous**
Species within the limits of their native range (Synonyms: native).

**In-situ**
In the natural habitat as opposed to in a laboratory or controlled situation.

**Invasive Alien**
A species whose natural range occurs outside of South Africa and which were transported to their current location by humans; where they are able to reproduce, spread and typically cause negative ecological impact.

**Invertebrate**
An animal without a backbone (e.g. a prawn, crab, or worm).

**Least Concern** (Red List category)
An ecosystem type or species that has experienced little or no loss of natural habitat or deterioration in condition.

**Legislation**
Laws, legal requirements or the process of making or enacting laws.

**Macrofauna**
Animals larger than 0.5 mm.

**Macrophytes**
Literally “large plants”, may refer to algae like seaweeds or higher plants.

**Mangroves**
Particular species of trees restricted to sheltered inter-tidal areas, typically between the high water spring and low water neap tide levels.

**Microphytobenthos**
In the context of this report these are single celled plants, often diatoms, living on or in the shallow surface layers on the bottom of estuaries, including inter-tidal and sub-tidal areas.

**Moderately Protected** (Red List category)
An ecosystem type that has between half of and its entire biodiversity target included in one or more protected areas.

**Near Threatened** (Red List category)
An ecosystem type is Near Threatened when it has been evaluated against the criteria but does not qualify for CR, EN or VU, but it is close to qualifying for or is likely to qualify for a threatened category in the near future.

**Not Protected** (Red List category)
An ecosystem type that has less than 5% of its biodiversity target included in one or more protected areas

**Oligohaline/Polyhaline**
The Venice system of describing salinities: euhaline 30-40; polyhaline 18-30; mesohaline 5-18 and oligohaline 0.5-5.

**Organic**
Pertaining to compounds containing carbon. Also refers to living things or the materials made by living things.

**Oxygen Saturation**
Expressed as a percentage, refers to the amount of dissolved oxygen relative to the maximum possible under a particular combination of water temperature and salinity.

**pH**
A measure or scale used to quantify how acidic or basic (alkaline) a water-based solution is.

**Phytoplankton**
Single celled plants living in the water column of any water body.

**Poorly Protected** (Red List category)
An ecosystem type which has between five percent and half of its biodiversity target included in one or more protected areas.

**Present Ecological State**
A set of categories for describing the ecological condition of rivers, wetlands and estuaries, developed by the Department of Water and Sanitation. Assessment of Present Ecological State takes into account a range of factors including flow, inundation, water quality, stream bed condition, introduced instream biota, and riparian or stream bank condition. The categories range from A (natural or unmodified) through to F (critically or extremely modified), with clear descriptions linked to each category.

**Priority estuary**
An estuary that is required to meet targets for representing estuarine ecosystems, habitats and estuarine-dependent species, as identified in the National Estuary Biodiversity Plan.

**Protected area**
An area of land or sea formally protected by law and managed mainly for biodiversity conservation. This is a narrower definition than the IUCN definition, which includes areas that are not legally protected and that would be defined in South Africa as conservation areas rather than protected areas.

**Protected area target**
A quantitative goal for how much of an ecosystem type should be included in the protected area network by a certain date. The National Protected Area Expansion Strategy 2008 sets five-year and twenty-year protected area targets for each terrestrial ecosystem type, based on a portion of its biodiversity target. Protected area targets are revised every five years.

**Residence Time**
The period of time during which a body of water remains stationary or trapped within a specific region of the system.

**Riparian**
The riparian zone is the interface between land and a flowing surface water body.

**River Estuary Interface**
Productive zone within an estuary where marine and freshwater meets, salinity is less than that of sea water and organic deposition due to reduced current speeds and flocculation occurs and is retained.

**Salt Marsh**
Herbaceous plants occurring typically in the upper intertidal levels in temperate estuaries but may also occur in temporary open/closed estuaries at the upper levels of flooding.

**Substrate**
A supporting surface on which organisms grow. The substrate may simply provide structural support, or may provide water and nutrients. A substrate may be inorganic, such as rock or soil, or it may be organic, such as wood.

**Threatened ecosystem**
An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function or composition. The Biodiversity Act allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the NBA can be used as an interim list in planning and decision making. Also see Ecosystem threat status.

**Threatened species**
A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

**Tidal Prism**
The volume of water exchanged between an estuary and the sea over a tidal cycle.

**Vulnerable**
An ecosystem type is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for VU, and is then considered to be at a high risk of collapse.

**Well Protected**
An ecosystem type that has its full biodiversity target included in one or more protected areas.

**Zooplankton**
Heterotrophic plankton which does not manufacture its own food by carbon fixation and therefore derives its intake of nutrition from other sources of organic carbon, mainly plant or animal matter.

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AIS | Alien Invasive Species |
| ASP | Automotive Supply Park |
| BOD | Biological Oxygen Demand |
| CA | Competent Authority |
| CARA | Conservation of Agricultural Resources Act |
| CBA | Critical Biodiversity Area |
| CBD | Convention on Biological Diversity |
| CBO | Community-based organization |
| CE | Critically Endangered |
| CERM | Consortium for Estuarine Research and Management |
| CML | Coastal Management Line |
| CMP | Coastal Management Programme |
| CO | Collapsed |
| COD | Chemical Oxygen Demand |
| COGTA | Department of Cooperative Governance and Traditional Affairs |
| CPZ | Coastal Protection Zone |
| CR | Critically Endangered |
| CSIR | Council for Scientific and Industrial Research |
| CSZ | Control Setback Zone |
| CWAC | Coordinated Waterbird Counts |
| CWDP | Coastal Waters Discharge Permit |
| DAFF | Department of Agriculture, Forestry and Fisheries |
| DALRRD | Department of Agriculture Land Reform and Rural Development |
| DD | Data Deficient |
| DEA | Department of Environmental Affairs |
| DEFF | Department of Environment, Forestry and Fisheries (merging of DAFF and DEA in June 2019) |
| DEFF: O&C | Department of Environment, Forestry and Fisheries: Oceans & Coasts |
| DFFE | Department of Forestry, Fisheries and Environment |
| DMR | Department of Mineral Resources |
| DE | Department of Energy |
| DHSWS | Department of Human Settlement, Water and Sanitation |
| D'MOSS | Durban Metropolitan Open Space System |
| DPWI | Department of Public Works and Infrastructure |
| DSI | Department of Science and Innovation (new departmental name in June 2019) |
| DST | Department of Science and Technology (former government department) |
| DSW | Durban Solid Waste |
| DTPC | Dube Trade Port Corporation |
| DWA | Department of Water Affairs |
| DWAF | Department of Water Affairs and Forestry (now DWS) |
| DWS | Department of Water and Sanitation (current) |
| EBSA | Ecologically or Biologically Significant Area |
| EC | Ecological Category |
| ECA | Environment Conservation Act |
| EDTEA | Department of Economic Development, Tourism and Environmental Affairs |
| EEZ | Exclusive Economic Zone |
| EFZ | Estuarine Functional Zone |
| EHI | Estuary Health Index |
| EIA | Environmental Impact Assessment |
| EKZNW | Ezemvelo KwaZulu-Natal Wildlife |
| EM | eThekwini Municipality |
| EMA | eThekwini Municipal Area |
| EMF | Environmental Management Framework |

| | |
|---|---|
| EMP | Estuarine Management Plan |
| EMPr | Environmental Management Programme |
| EN | Endangered |
| EW | Extinct In The Wild |
| EPL | Ecosystem Protection Level |
| ESA | Ecological Support Area |
| ETS | Ecosystem Threat Status |
| EWR | Ecological Water Requirement |
| EWS | EThekwini Water Services |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GVA | Gross Value-Added |
| Ha | Hectares |
| HWM | High Water Mark |
| IAP | Invasive Alien Plant |
| I&AP | Interested and Affected Party |
| IBA | Important Bird and Biodiversity Area |
| IEI | Integrated Environmental Importance |
| ICM | Integrated Coastal Management |
| ICMA | Integrated Coastal Management Act |
| IDP | Integrated Development Plan |
| IMO | International Maritime Organisation |
| IPCC | Intergovernmental Panel on Climate Change |
| IUCN | International Union for Conservation of Nature |
| KPI | Key Performance Indicator |
| KZN | KwaZulu-Natal |
| LAP | Local Area Plan |
| LC | Least Concern |
| LUMS | Land Use Management System |
| MAR | Mean Annual Runoff |
| MARISMA | Marine Spatial Management and Governance Programme |
| MCC | Municipal Coastal Committee |
| MCPP | Municipal Climate Protection Programme |
| MECs | Members of the provincial Executive Council |
| MLRA | Marine Living Resource Act |
| MMP | Mouth Management Plan |
| MOU | Memorandum of Understanding |
| MPA | Marine Protected Area |
| MSL | Mean Sea Level |
| NBA | National Biodiversity Assessment |
| NCMP | National Coastal Management Programme |
| NEMP | National Estuarine Management Protocol |
| NEsMP | National Estuarine Monitoring Programme |
| NDP | National Development Plan |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management: Biodiversity Act |
| NEMPAA | National Environmental Management: Protected Areas Act |
| NEMP | National Estuary Management Protocol |
| NFA | National Forests Act |
| NFEPA | National Freshwater Ecosystem Priority Area |
| NGI | National Geospatial Information |
| NGO | Non-governmental Organisation |
| nMAR | Natural Mean Annual Runoff |
| NMMU | Nelson Mandela Metropolitan University |
| NSBA | National Spatial Biodiversity Assessment |
| NT | Near Threatened |

| | |
|---|---|
| NWA | National Water Act |
| NWM | National Wetland Map |
| ORI | Oceanographic Research Institute |
| PCC | Provincial Coastal Committee |
| PES | Present Ecological State |
| PGDS | Provincial Growth and Development Strategy |
| PPP | Public Participation Process |
| pMAR | Present Mean Annual Runoff |
| RCP | Representative Concentration Pathways |
| RDM | Resource Directed Measures |
| REC | Recommend Ecological Category |
| REI | River Estuary Interface |
| RQO | Resource Quality Objective |
| RMA | Responsible Management Authority |
| SA | South Africa |
| SAAMBR | South African Association for Marine Biological Research |
| SAEON | South African Environmental Observation Network |
| SAIAB | South African Institute of Aquatic Biodiversity |
| SALGA | South African Local Government Association |
| SAMSA | South African Maritime Safety Authority |
| SANBI | South African National Biodiversity Institute |
| SANCOR | South African Network for Coastal and Oceanic Research |
| SAR | Situation Assessment Report |
| SCC | Species of Conservation Concern |
| SCI | Socio-Cultural Importance |
| SDG | Sustainable Development Goal |
| SDF | Spatial Development Framework |
| SDP | Spatial Development Plan |
| SEA | Strategic Environmental Assessment |
| SEMA | Specific Environmental Management Act |
| SEZ | Special Economic Zone |
| SIP | Strategic Infrastructure Project |
| SLR | Sea Level Rise |
| SOC | State Owned Company |
| SSDP | South Spatial Development Plan |
| TEA | Township Establishment Area |
| TEC | Target Ecological Category |
| UW | Umgeni Water |
| VU | Vulnerable |
| WMA | Water Management Area |
| WRUI | Water Resources Use Importance |
| WWTW | Waste Water Treatment Works |

# 1. INTRODUCTION

## 1.1 BACKGROUND

With the implementation of the Provincial Coastal Management Programme (adopted by the MEC in September 2019) that includes strategies and plans for the effective and co-operative management of the coastal zone, the KwaZulu-Natal (KZN) Department of Economic Development, Tourism and Environmental Affairs (EDTEA) has prioritised the better management of estuaries in the province. With the aim to mitigate the deterioration of KZN regional estuaries, an estuary prioritisation process was undertaken and the iLovu Estuary was prioritised for the development of an Estuarine Management Plan (EMP).

### 1.1.1. Location

Located within the province of KZN on the east coast of South Africa, the iLovu Estuary is approximately 37 km south of central Durban at 30°51'27.2700" South and 30°6'19.5552" East and lies within the boundary of the eThekwini Metropolitan Municipality (Forbes & Demetriades 2008) (Figure 1.1). The estuary is fed by quaternary catchment U70D (Figure 1.2) and receives water from a catchment which is some 951 km$^2$. According to Begg (1978) the estuary is 1.1 km in length from the mouth, which leads into the Indian Ocean, to its head, and the total estuarine area is approximately 39.5 ha (DWA 2013). However, from assessments of Google Earth photos it would seem that the tidal push into the estuary extends further than 1.1 km. Currently there is a loose rock weir some 4.1 km upstream (just east of the 4$^{th}$ road bridge) and this would certainly be a barrier to the incoming tide if it does reach that far.

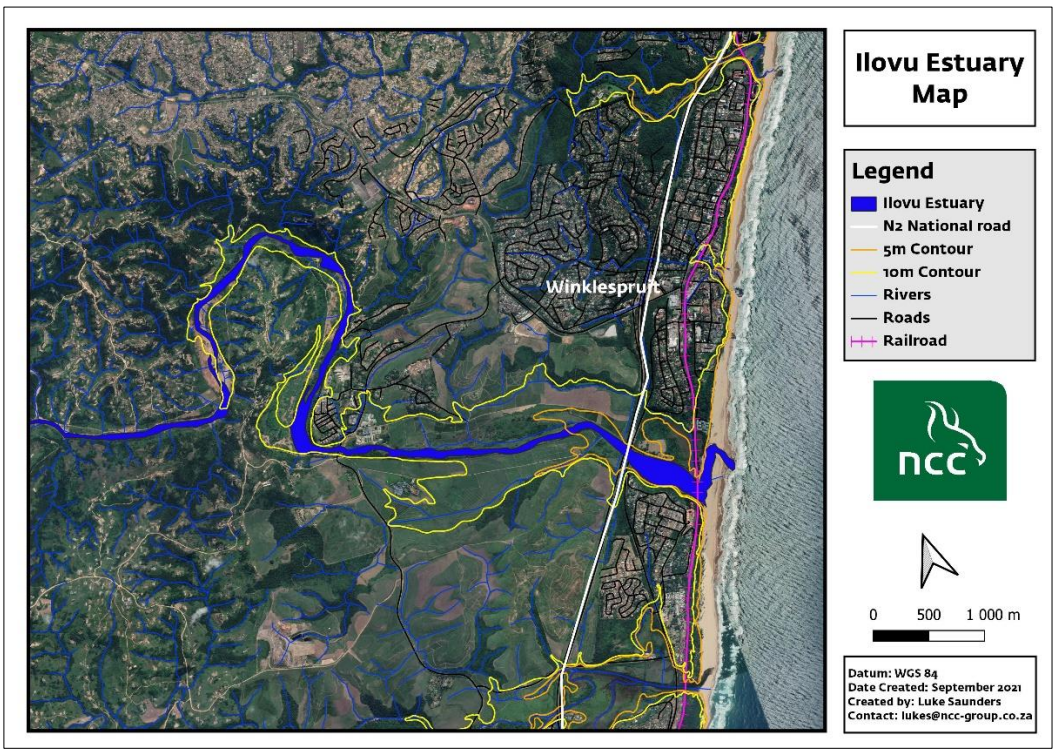


**Figure 1.1.** The iLovu Estuary.

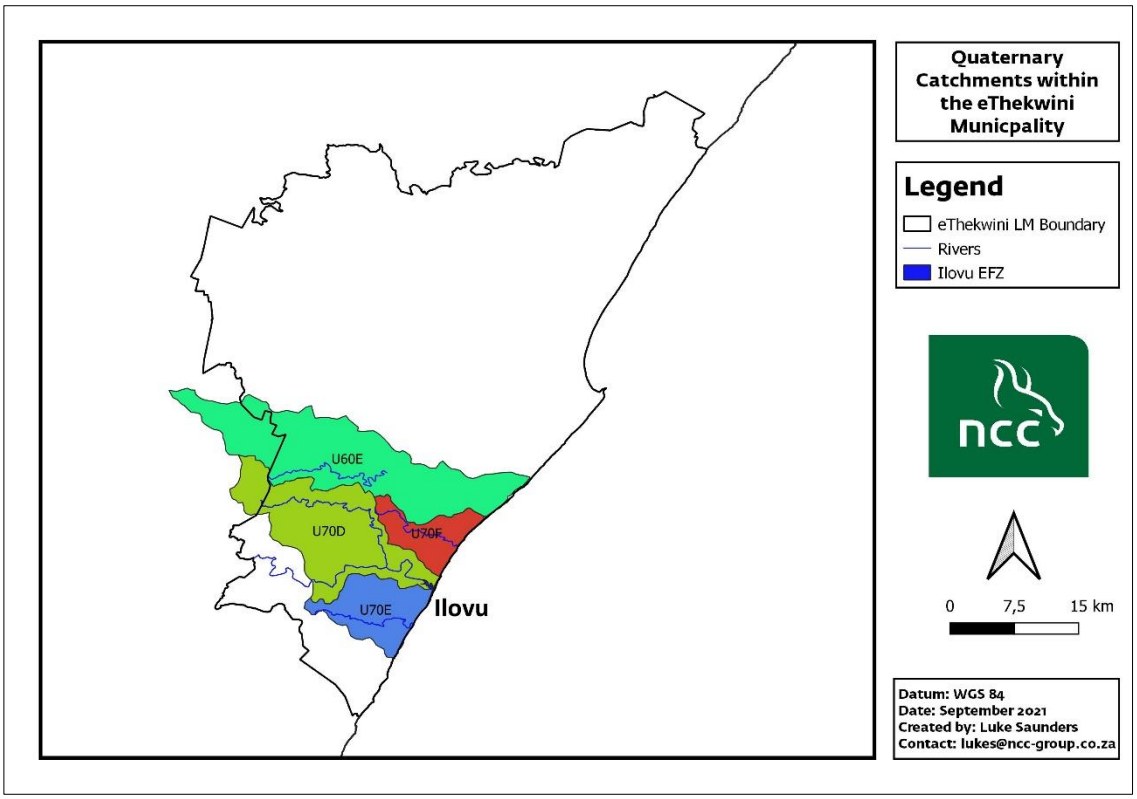


**Figure 1.2.** Location of the iLovu Estuary in quaternary catchment U70D in the EMA.

From a local geo-political perspective, the estuary is situated within wards 97, 98 and 109 (Figure 1.3) with the Toyana Tribal Authority bordering the western extremity of the estuary (Figure 1.4).

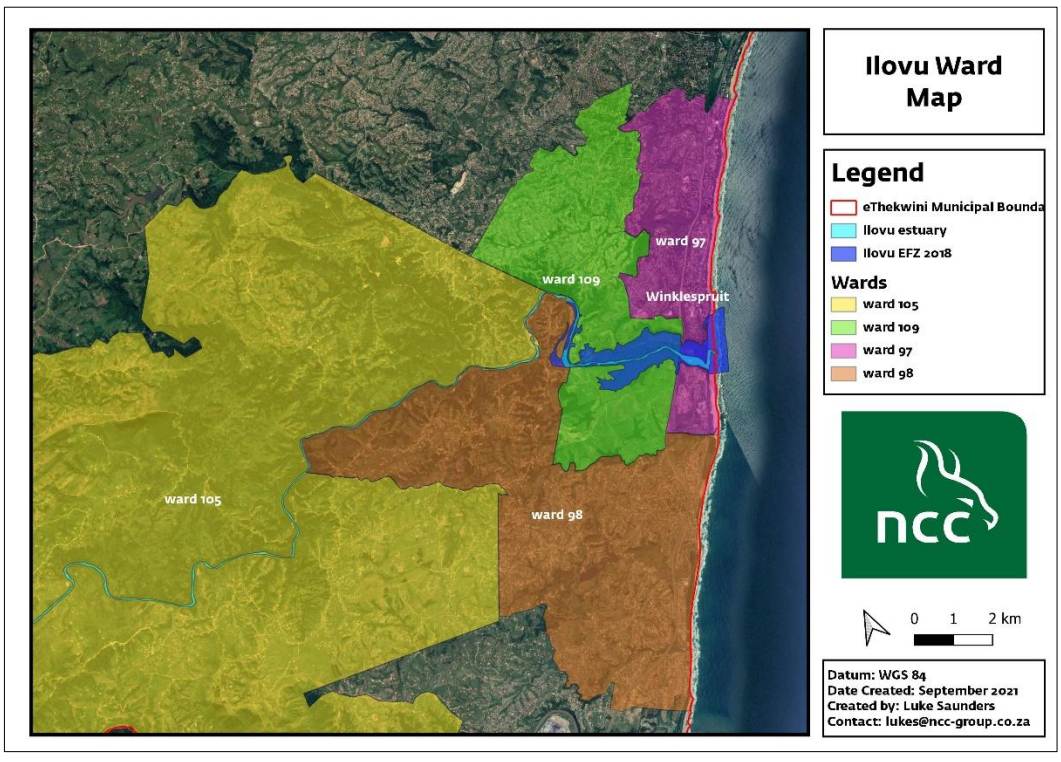


**Figure 1.3.** Wards in relation to the iLovu Estuary (Data source: eThekwini GIS).

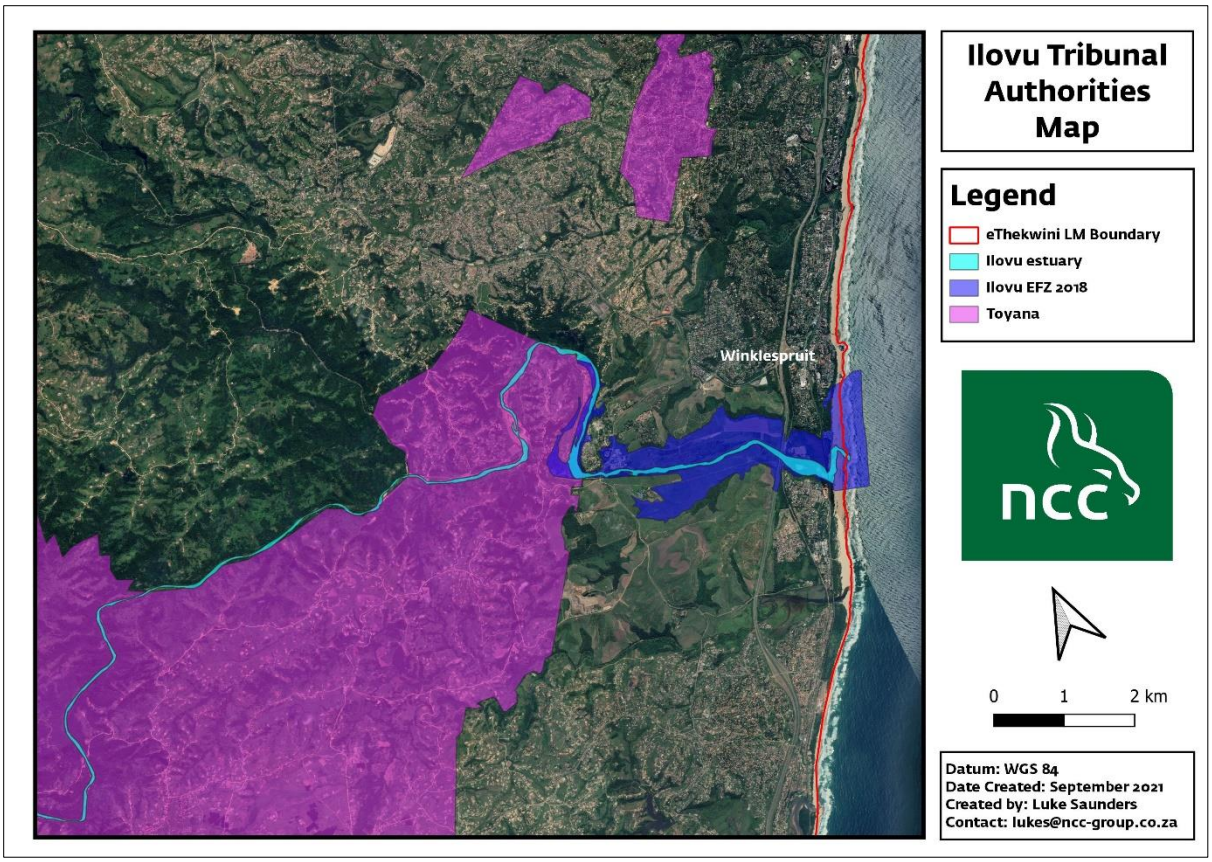


**Figure 1.4.** Tribal Authorities (Toyana) in relation to the iLovu Estuary and the associated estuarine functional zone (Data source: eThekwini GIS).

The newly revised estuarine classifications for South Africa, define a “Large Temporarily Closed estuary” as one in which the mouth of the system is open to the sea more than 50% of the time (Van Niekerk *et al.* 2019, 2020). According to MER (2019a) records of the mouth condition from May 1978 to December 1982 indicated that, apart from the drought years of 1980 and 1982, the mouth of the iLovu Estuary was open some 95% of the time in 1979, 78% in 1981 against 45% in 1980 and 63% in 1982. MER (2019a) also indicated that no new data were obtained during their work in 2007/2008 to suggest that mouth closure patterns had deviated significantly from the range encountered during the 1979-1982 observations. DWA (2013) indicated that the mouth of the iLovu Estuary is open for 77% of the time.

## 1.2 PURPOSE AND STRUCTURE OF THE SITUATION ASSESSMENT

The purpose of Estuary Management Plans (EMP), as stated in the protocol and development guidelines “*is to provide the mechanism that will enable coordination and alignment of management activities across sectors, underpinned by a shared vision – that is integrative estuarine management*.” (DEA 2015). The purpose of the Situation Assessment is to reflect on the current condition of the system and status of estuarine management for the specific estuary. The document therefore provides a framework of relevant and available information that enables

the development of the Estuarine Management Plan as well as highlighting any knowledge gaps that may impact the effective implementation of the EMP.

The following components are included in the Situation Assessment Report (SAR):

- A biogeographical description of the iLovu Estuary and comprehensive assessment of the structure (abiotic and biotic), functioning and state of the estuary.
- The National Biodiversity Assessments and ecological reserve studies for the greater water management area.
- Identification of the goods and services and/or human use activities and their impacts or potential impacts on the present ecological state.
- The geographic and socio-economic context of the estuary, including dependence of local communities on the estuary. Opportunities and Constraints within the ecological system considering the current and recommended ecological state and limits of acceptable change where possible.
- The legislative instruments currently applicable to the effective management of the iLovu Estuary – including existing and planned management strategies or plans (catchment management strategies, Integrated Development Plans, Spatial Development Frameworks, Coastal Management Programmes, Disaster Management Plans, Contingency Plans and Mouth Management Plans are examples).
- Identification of information gaps pertaining to the estuary.

## 1.3 HISTORICAL DATA AND INFORMATION ON THE ILOVU ESTUARY

In order to develop this Situation Assessment a wide range of historical literature and existing data were accessed and evaluated for inclusion. However, it was found that the information and data summaries contained in DWA (2013), Forbes & Demetriades (2008), MER (2019a & b), van Niekerk *et al.* (2019) plus the limited additional information since then provided sufficient information to cover a number of the sections in this report and as such relevant information have been extracted from these and other documents. At the same time the definitions and explanation of Ecosystem Services and Ecological Health provided by Dawson *et al.* (2021) more than adequately cover what is required for this report.

# 2. CATCHMENT CHARACTERISTICS

## 2.1 GEOLOGY AND GEOMORPHOLOGY

### 2.1.1. Geology

Geology is one of the primary drivers of estuarine typology and classification. The catchment in which the iLovu River traverses consists of rocks of the Beaufort, Ecca and Dwyka series as well as Table Mountain Sandstone and Granite. Nearer the coast the river flows over Dwyka tillite and Ecca shale (Brand *et al.* 1967). Coastal red sands (Berea red) are present above the 75m contour, at the base of which is a thick boulder bed (Chew *et al.* 1971). Valley alluvium can be up to 30m deep with Karoo sediments down faulted and tilted seawards (Chew *et al.* 1971).

The lithology of the Maputaland Group is characterised by sandy or clayey colluvial and alluvial sediments and palaeosols, red decalcified sand in inland dune cordons, conglomerate, coquina, calcarenite and redistributed sand. The lithology of the Pietermaritzburg formation is predominantly shale with thin siltstone and sandstone. The Dwyka Group consists of diamictite, varved shale, siltstone, mudstone with dropstones, fluvioglacial gravel and sandstone (Council for Geoscience, 2003). Figure 2.1 illustrates the geology of the study area whilst Figure 2.2 shows the lithostratigraphy (Council for Geoscience, 2003).

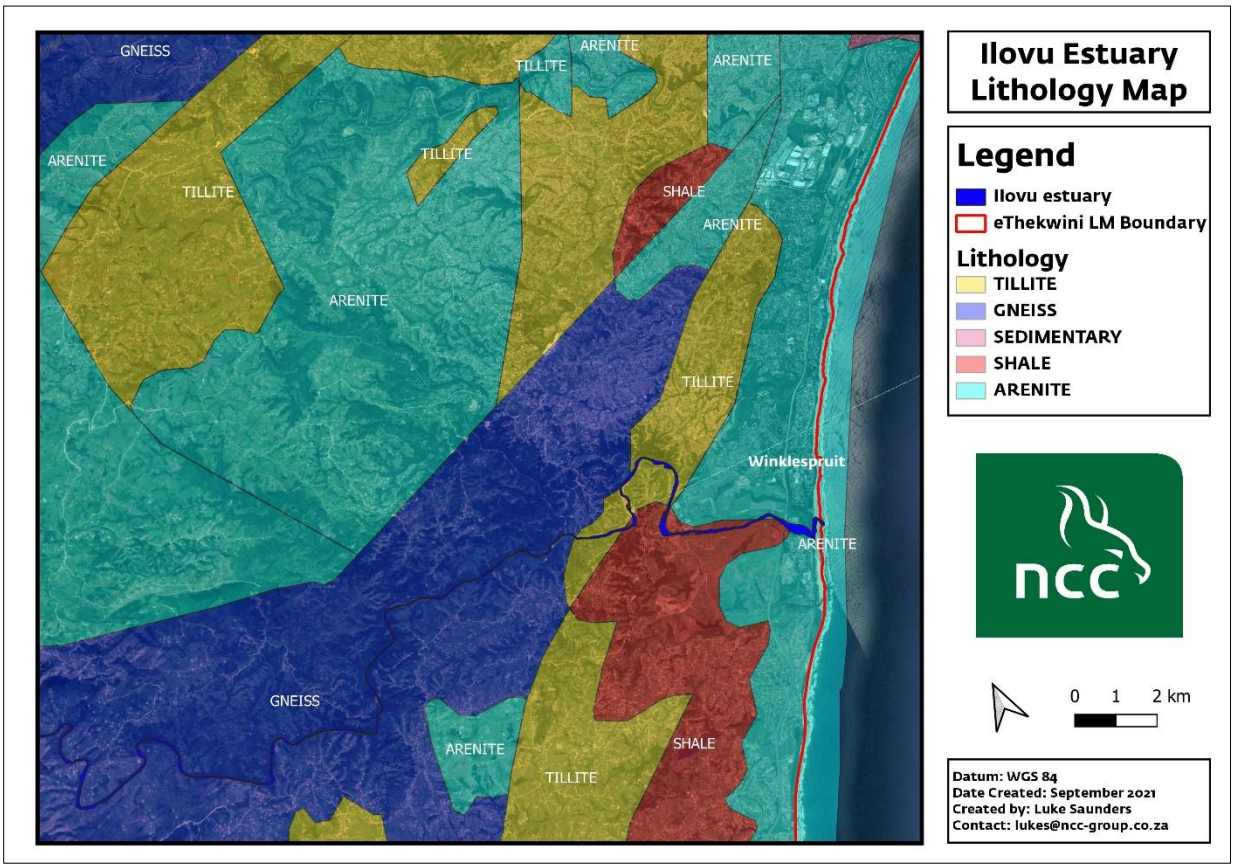


**Figure 2.1.** Geological map of the study area (Data source: Council for Geoscience, 2003).

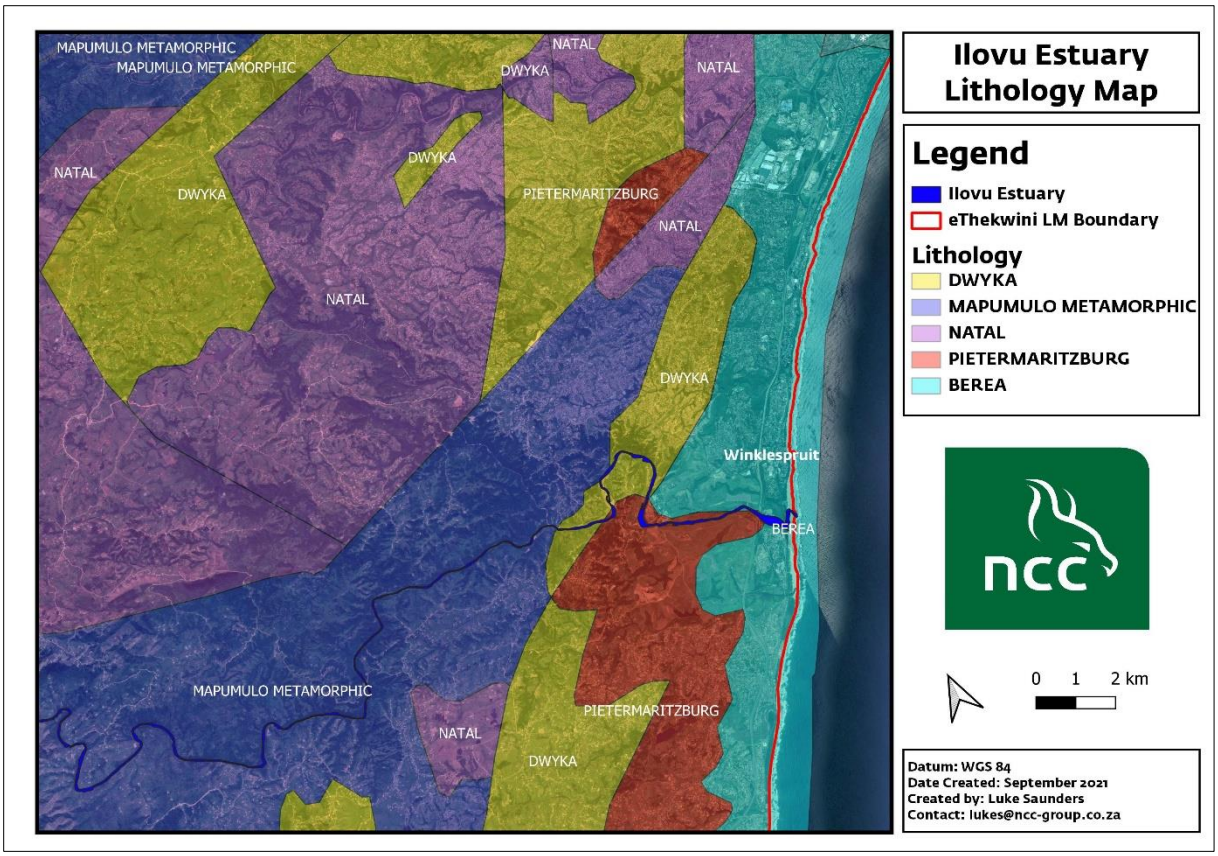


**Figure 2.2.** Lithology map of the study area (Data source: Council for Geoscience, 2003).

### 2.1.2 Geomorphology

Estuarine geomorphology can be defined as the link between estuary form and the processes that operate within it. It seeks to describe the morphology of individual estuaries and groups of estuaries and to examine variations in the present configuration of estuaries and to seek explanations of this variability in the potential controlling factors (Harrison *et al.* 2000). The range of controlling variables in South Africa estuaries is highly diverse as the subcontinent spans a number of climatic and morphological zones and is subjected to a range of marine conditions, however, there are several factors that may be regarded as virtually constant around the coast. These include the relatively low tidal range, high wave energy (although a gradient does exist), the predominantly bedrock coast (lacking a coastal plain) and a consistent sea level history. Variability in factors that contribute to estuary morphology arises from climatic variation (arid to humid and subtropical to cold temperate), discharge variation in rivers, hinterland gradient and coastal gradient, sediment supply rates from rivers, sediment type supplied from rivers and sediment availability in the coastal zone. The range of variation among these and other factors potentially produces a wide range of estuary types.

Geomorphologically, estuaries occupy a transitional position between land and sea and act as an interface between the terrestrial and marine realm and frequently are the focus of sand accumulations (sand barriers). As such they are affected by variations in the intensity of both sets

of processes. In terms of sedimentological processes, sediment that moves seaward from rivers must pass through an estuary and vice versa with estuary morphology likely reflecting the relative balance between these two competing sets of processes. These factors and processes render many estuaries highly dynamic environments in which geomorphological changes may occur at timescales that range from almost instantaneous (as for example during floods) to progressive change due to sediment infilling and sea level rise. In all estuaries, an interface exists between fluvial and marine processes, although the nature and intensity of processes operating at this interface may vary considerably. In some estuaries sea water may extend many kilometres upstream while in others, it may be restricted to inputs from barrier overwash and be confined to areas adjacent to the barrier. A strong seasonal imprint exists in some estuaries such that they may be tidal for long distances during the dry season and freshwater extends right to the barrier (or beyond) during floods (Day and Grindley 1981). In others a seasonal imprint is produced by variation between closed conditions in the dry season and open conditions during the rainy season Harrison *et al.* (2000).

The tidal range along the South African coast varies little compared with other coastal regions of the world, experiencing a spring tidal range between 1.8 and 2.0 m. Neap tides are typically between 0.6 and 0.8 m, rendering the coast microtidal (Davies 1980). Wave energy is consistently high with wave height diminishing generally from the southern Cape northward along both the east and west coasts. A common factor is that almost all estuaries in South Africa are laterally confined i.e. located in incised bedrock valleys Harrison *et al.* (2000).

According to the geomorphological classification of estuaries (after Harrison *et al.* 2000), the iLovu Estuary is a 'Type F' estuary i.e. barred, normally open with Mean Annual Runoff (MAR) being greater than $15 \times 10^5$ $m^3$. Where there was inadequate data to subdivide to finer levels of detail, barred open estuaries were subdivided according to their MAR. Barred estuaries (those with a supratidal barrier) vary markedly in size and in the volume of fluvial discharge. The volume of the bedrock valley in which the estuary is formed is largely dependent on the amount of fluvial discharge. A more detailed description and methods used for the geomorphological classification can be found in Harrison *et al.* (2000).

It has more recently been acknowledged in the recent NBA (SANBI, 2019) that ecosystem classifications are complex, and often hierarchical or nested, whilst typologies i.e. characterisation of estuary types according to shared key features, tend to be more straightforward based on general type. The level of classification depends mainly upon the number of criteria selected (e.g. biogeography, geomorphology and biology) and the spatial resolution required (e.g. local, regional or global) (Whitfield and Elliott 2011). Whilst there is room for debate and scope for research in terms of potentially refining the classification and description of estuaries, the iLovu Estuary is currently classified as a 'large temporarily closed subtropical

estuary' where geomorphological factors have been taken into consideration as part of the most recent classification.

## 2.2 CLIMATE AND RUNOFF

The iLovu Estuary is located within the warm, humid, frost-free climate of the subtropical Indian Ocean Coastal belt, where temperature and precipitation variability is low, which is kept fairly constant by the warm Mozambique current. The average monthly minimum and maximum temperatures do not vary considerably due to the close proximity of the site in relation to the ocean, with the minimum and maximum temperatures recorded as $13^0$C and $28^0$C respectively, Maximum temperatures generally occur between the months of January and April, with the coolest temperatures occurring between the months of June to September. The coolest month of the year is also recorded as the driest, with an average rainfall of 9 – 38 mm occurring during this period. Conversely, the wettest months of the year are the warmer months, with approximately 1,148 mm of precipitation occurring from March – February. Annually evapotranspiration is estimated to be ≤ 1,400mm (www.accuweather.com).

The iLovu Estuary is located in tertiary catchment U70 which has an annual runoff of 11.9 million $m^3$. The iLovu River drains quaternary catchments U70A, U70B, U70C and U70D with a total area of 950$km^2$. Its linear length is about 135 km and the catchment geometry is long and narrow with a slope of 0.088 (MER 2019b).

National Freshwater Ecosystem Priority Area (NFEPA) River data (Nel *et al.* 2011) shows that the iLovu River has been classified throughout its reaches as in a Present Ecological State (PES) Category C, indicative of rivers that have been Moderately Modified from their natural condition. NFEPA data also indicate that the upper reaches of the iLovu River are classified as a Fish Sanctuary for vulnerable or near threatened fish species. The species of concern is in fact *Amphilius natalensis* (Natal Mountain catfish).

## 2.3 LAND-USE

Catchment land-use is largely rural with only 5% impervious area and most of the floodplain remains intact. The remainder of the catchment and floodplain comprises rural settlement and sugarcane plantations. Two impoundments, (i) Beaulieu dam is situated in quaternary catchment U70A and (ii) Nungwane Dam in quaternary catchment U70D (MER 2019b). **Figure 2.3** shows the existing and proposed land uses surrounding the estuary based of spatial data from the eThekwini GIS.

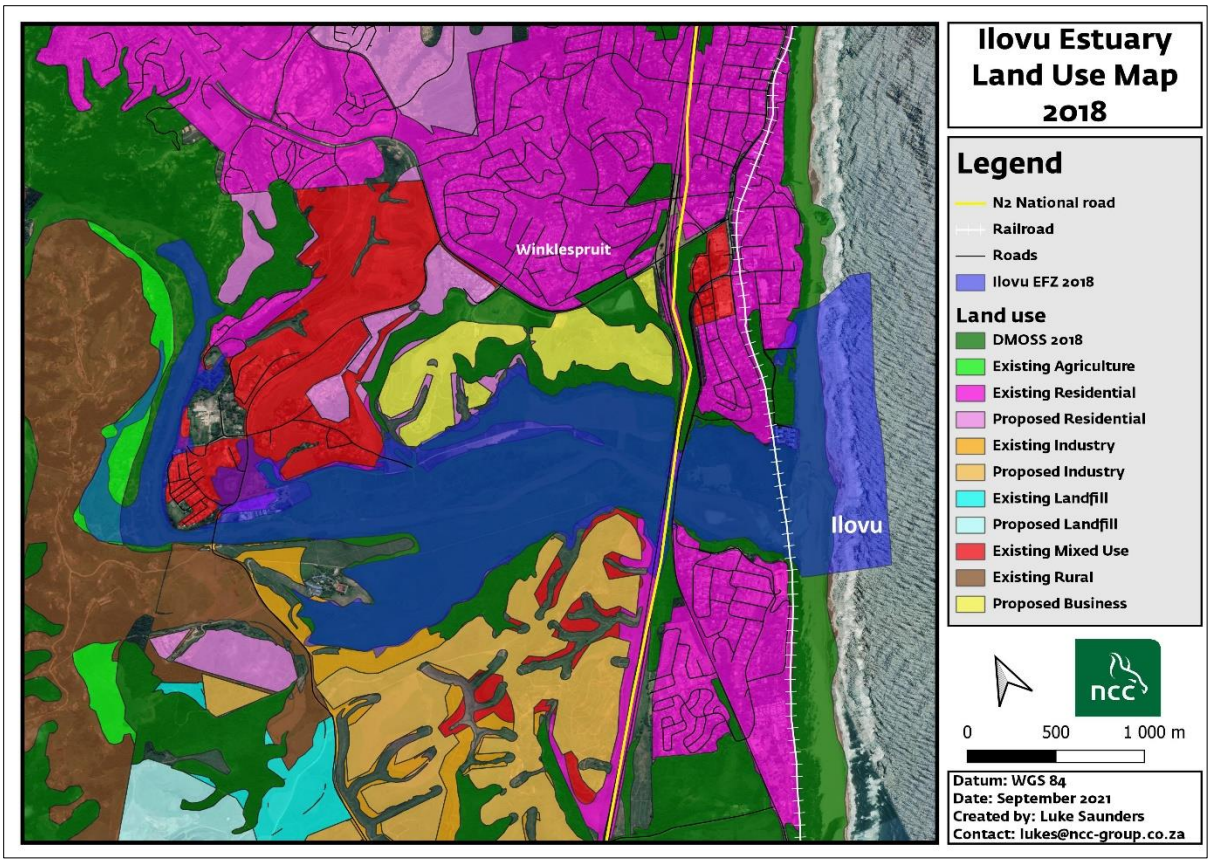


**Figure 2.3.** Existing and proposed land uses surrounding the estuary and functional zone.

# 3. OVERVIEW OF ECOLOGICAL FUNCTION AND STATE OF ESTUARY

## 3.1 ECOLOGICAL HEALTH STATUS

The National Water Act of 1998 requires the implementation of 'Resource Directed Measures' (RDM) for the optimal use of our country's water resources while minimising ecological damage. The main focus of the RDM is the determination of the 'Reserve', which is the water quality and quantity required for the protection of both basic human needs and the needs of aquatic systems. The 'Ecological Reserve' is the quality and quantity of water required for a specific aquatic system (e.g. river reach, wetland, estuary) to maintain a desired level of structure and function, or quality. The desired quality of the water resource is defined by its 'Ecological Category' which is assigned a letter on a health scale of A to F (Table 3.1). While scientists can make recommendations for this category, the "Recommended Ecological Category" (REC), the final decision will be based on ecological, social and economic criteria in a participative process called the National Water Resource Classification System's Classification Process (Dollar *et al.* 2010; gazetted in 2010). Ultimately the Department of Water Affairs {now Department of Human Settlement, Water and Sanitation (DHSWS)} will be responsible for the Classification of all significant water resources in the country, including estuaries, and these decisions will be re-evaluated at intervals (Turpie *et al.* 2012).

**Table 3.1.** Ecological Categories for South African Estuaries, the iLovu Estuary has been classified as a C status (DWA 2012, Van Niekerk *et al.* 2019).

| Condition (% of pristine) | Present Ecological state | General Description |
|---|---|---|
| ≥91 | **A** | **Unmodified, approximates Natural Condition:** The natural abiotic processes should not be modified. The characteristic of the resources should be determined by unmodified natural disturbance regimes. There should be no human induced risks to the abiotic and biotic processes and function. |
| 76 - 90 | **B** | **Near natural with few Modifications:** A small change in the natural habitats and biota may have taken place, but the ecosystem functions are essentially unchanged. |
| 61 - 75 | **C** | **Moderately Modified:** A loss and change of the natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. |
| 41 - 61 | **D** | **Heavily Modified:** A large shift in natural processes and ecosystem functions and/or loss of habitat, biota have occurred. |
| 21 - 41 | **E** | **Severely Modified:** The loss of natural habitat, biota and basic ecosystem functions is extensive. |
| ≤20 | **F** | **Critically Modified:** Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural abiotic processes and associated biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. |

### 3.1.1 Health and Importance of the iLovu Estuary

No fieldwork based Ecological Reserve Determination or Ecological Water Requirement (EWR) has to date been undertaken for the iLovu Estuary. However, the estuary been assessed during a classification of Water Resources and Resource Quality Objectives (RQO) study for the Mvoti to Umzimkulu Water Management Area (DWA 2013 & DWS 2015a, b, c), as well as for the 2011 and 2018 National Biodiversity Assessments (NBA) (van Niekerk and Turpie 2012, van Niekerk *et al*. 2019).

DWA (2013) made recommendations to the extent of protection required for the iLovu Estuary, this was based on the determined Present Ecological State (PES) and Recommended Ecological Category (REC) for the 2011 National Biodiversity Assessment (NBA) (Van Niekerk and Turpie 2012) (Table 3.2). From this it can be seen that both the PES and REC were then considered as a “C” (Moderately Modified) with Partial Protection of the estuary covering 50% of the Undeveloped Margin.

**Table 3.2.** National priorities, the extent of protection required for the iLovu Estuary (Full = full no-take protection (modified from Turpie *et al.* 2012), NBA '11 = 2011 National Biodiversity Assessment (Van Niekerk and Turpie 2012), PES = Present Ecological State & REC = Recommended Ecological State.

| NBA '11 PES | Recommended extent of protection | Recommended degree of undeveloped margin | NBA '11 REC |
|---|---|---|---|
| C | Partial | 50% | C |

The iLovu Estuary's PES is listed as "C" (Moderately Modified) with a REC of "A/B or BAS" (Best Attainable State) (DWA 2015a, b, Van Niekerk *et al*. 2019). The Estuarine Health Index (EHI) applied in Ecological Water Requirement (EWR) studies include a number of variables/categories laid out in DWA (2013) (Table 3.3). For each category, the conditions are estimated as a percentage (0 – 100%) of pristine health. Scores are then weighted and aggregated so that the final score reflects the present holistic health of the estuary as a percentage of the pristine state (DWA 2013).

A breakdown of the individual components assessed, and the scores given to each within the iLovu Estuary is provided below. This shows that despite the overall ecological category being Moderately Modified ("C") with seven of the individual scores also being a "C", the other four are rated as being Heavily Modified ("D"). The overall Biological Score is also a "C" but the overall Habitat Score is rated as being Heavily Modified ("D").

Table 3.4 lists the estuary importance scores allocated to the iLovu Estuary in terms of the components listed. The iLovu Estuary scored highest for habitat (80) and biodiversity (70) importance. The estuarine importance of the iLovu Estuary in a Regional and National context were scored by DWA (2013). This shows (Table 3.5) that National Biodiversity and Conservation Importance scored high whilst fish were of regional importance. The overall importance of the system was also highlighted by its high score. DWA (2013) rated the iLovu Estuary as a 3 out of 4 in its Hot Spot scoring for estuaries in the Mvoti to Umzimkulu Water Management Area, with high scores for ecological and integrated environmental importance (Table 3.6).

Based on the assessment of pressures on the iLovu Estuary determined by Van Niekerk *et al*. (2019) (NBA 2018), Flow, Habitat Loss and Fishing Effort issues are causing the most pressure on the system (Table 3.7), whilst several other pressures are rated as being Medium. Another disturbing factor is that the Mean Annual Runoff (MAR) of the system has been reduced by some 30.5%. This figure, despite differences in the determined natural and present MAR values of DWA (2013) and van Niekerk *et al*. (2019) (NBA 2018) shows the same 30% decrease in annual runoff. DWA (2013) lists significant flow modification, poor water quality, habitat destruction as being the major causes of pressure on the system.

**Table 3.3.** Ecological categories associated with individual components of the estuary (DWA 2013).

| DWA (2013) Condition Status | | | |
|---|---|---|---|
| Present Ecological State (2013) | D | Microalgae | C |
| Hydrology | D | Macrophytes | D |
| Hydrodynamics | C | Invertebrates | C |
| Water Quality | C | Fish | C |
| Physical habitat | D | Birds | C |
| Habitat Score | D | Biological Score | C |
| | | Present Ecological State | C |

**Table 3.4.** Estuary importance scores on a national scale for the iLovu Estuary. The overall importance score (I) is calculated from the size score (S), habitat importance score (H), zonal type rarity score (Z) and the updated biodiversity importance score (B) (DWAF 2008, Turpie and Clark 2007, Turpie *et al.* 2002), NBA '11 refers to the 2011 National Biodiversity Assessment (van Niekerk and Turpie 2012).

| S | H | Z | B | I | National Biodiversity Importance | Formal Protected Area | Planned PA | Conservation Importance |
|---|---|---|---|---|---|---|---|---|
| 40 | 80 | 10 | 78 | 56.5 | **3** | No | NBA '11 Partial | **5** |

**Table 3.5.** Importance Rating of the iLovu Estuary (DWA 2013).

| National Importance | | Regional Importance | | | Overall importance |
|---|---|---|---|---|---|
| **Biodiversity** | **Conservation** | **Macrophytes** | **Fish** | **Birds** | |
| 3 | 5 | 0 | 3 | 1 | 5 |

**Table 3.6.** iLovu as an Estuary Hotspot in Mvoti to Umzimkulu Water Management Area (DWA 2013), SCI = Socio-Cultural Importance, IEI = Integrated Environmental Importance & WRUI = Water Resources Use Importance.

| Ecological Importance (rated 1- 5) | SCI (rated 0 - 5) | IEI (rated 1 - 5) | WRUI (rated 0-4) | Hotspot (rated 1- 4) |
|---|---|---|---|---|
| 5 | 2.49 | 4 | 2 | 3 |

**Table 3.7.** Pressure Assessment on the iLovu Estuary based on Van Niekerk *et al*. (2019) (NBA 2018) (M= Medium, H = High, VH = Very High, U = Unknown, N = None, MAR = Mean Annual Runoff, MCM = Million Cubic Meters, WW = Waste Water & t = tons).

| Cumulative | Flow | Pollution | Habitat loss | Fishing Effort | Artificial Breaching | Invasive Aliens: Plants | Invasive Aliens: Fish | Natural MAR (MCM) | Present MAR (MCM) | WW volume | Fish Catches (t) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M | H | M | H | VH | U | M | N | 119.1 | 82.5 | 0 | 3.4 |
| | | | | | | DWA (2013) | | 105.8 | 73.5 | | |

MER (2019b) extracted natural monthly flows from the WR2012 database for the iLovu catchment and used it to simulate present day flows (Figure 3.1). This modelling took into account two dams, three abstractions accounting for 0.42 Ml/month and discharges and return flows of 0.05 Ml/month. Their simulated flows suggest that there has been an average reduction of 25% in inflows from natural to present-day conditions over the simulation period.

In terms of the Physical Habitat of the iLovu Estuary, DWA (2013) rated the condition as a “C” (Moderately Modified). The major impacts on the Physical Habitat was identified as Sand Mining (7 Sites identified), Bridges (5 major ones, including a double lane freeway and railway bridge) and Artificial Breaching of the Estuary Mouth (Table 3.8).

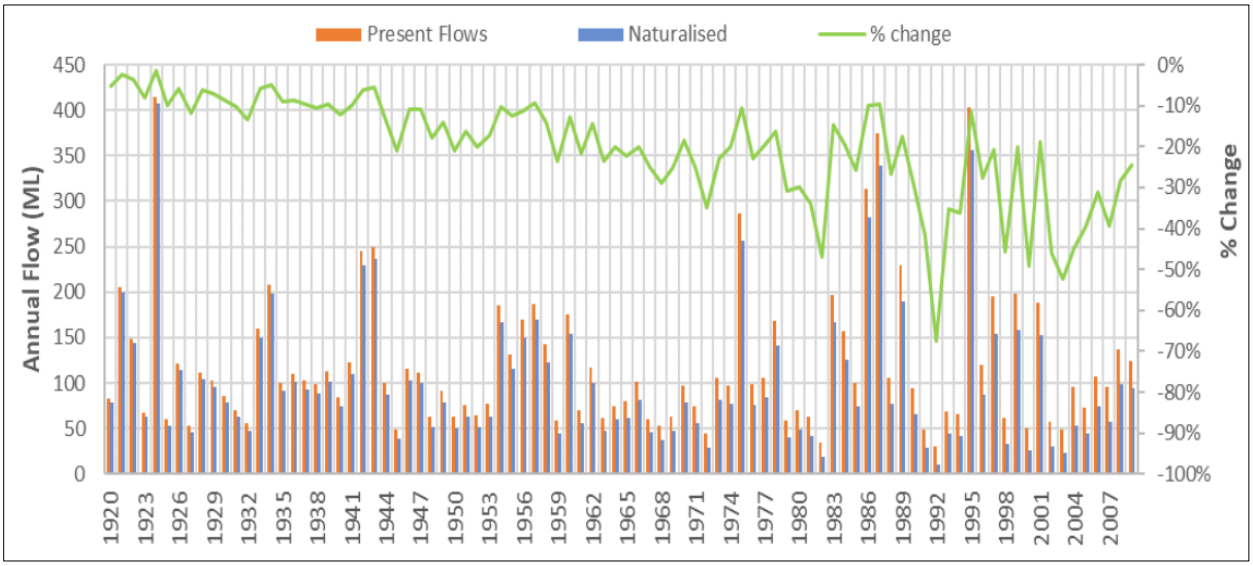


**Figure 3.1.** WR2012 flows for the iLovu catchment under present and natural conditions. The percentage change for each year is also included and indicated on the secondary Y-axis (reproduced from MER 2019b).

Van Niekerk *et al*. (2019) assessed the iLovu Estuary in terms of its condition and the importance of its biodiversity related to conservation (Table 3.9). Whilst the estuary only has a 'low to average' biodiversity rating it is ranked as a priority estuary of National Importance within the 'Core Set' of priority estuaries to maintain Biodiversity, it also has a High Priority rating by DAFF as a Fish Nursery habitat. However, despite this and all the above the estuary has no formal protection.

**Table 3.8** Assessment of the Physical habitat of the iLovu Estuary (DWA 2013).

| Physical Habitat Condition | Mining | Bridges | Breaching |
|---|---|---|---|
| **D** | Sand (7 sites) | Bridges | Y |

**Table 3.9.** iLovu Estuary Condition and Biodiversity (Conservation) Priorities (van Niekerk *et al*. 2019) (NBA 2018), EBSA = Ecologically or Biologically Significant Area.

| Biodiversity Importance Rating | Biodiversity priority core set (National) | Biodiversity Priority Rating (5 = High priority) | EBSA | DAFF Important Fish Nurseries (5 =Very High priority, 3= Priority) |
|---|---|---|---|---|
| Low to Average Importance | SA/KZN | Priority | Adjacent | High |

In addition, it has been gazetted that the Target Ecological Category (TEC) for the iLovu Estuary should be a "B/C" (Government Gazette 41306, Notice No. 1386 of 8 December 2017). This category represents an overall health score that ranges between roughly 67-83% of pristine estuarine health when the current state is between 40-60%. Achieving this mandated Ecological Category (EC) will require the improvement of several of the individual components of the estuarine system (van Niekerk *et al*. 2019). The 2018 NBA lists the restoration measures needed to improve the estuary's condition and productivity; these include;

- Restore/protect base flows,
- Manage/reduce stormwater & drainage from flood plain urban,
- Improve mouth management,
- Rehabilitate riparian areas/wetlands,
- Remove alien vegetation, and,
- Remove/reduce fishing pressure/bait collection.

In order to address the requirements as outlined by Driver *et al.* (2012) in the 2011 National Spatial Biodiversity Assessment with regard to protecting the estuaries of high biodiversity importance within KZN, Ezemvelo KZN Wildlife (EKZNW) (2014) identified a list of the priority 20% of each of the KZN estuary types for consideration for proclamation. This consisted of 21

estuaries they considered as being of high priority for conservation, included in this list is the iLovu Estuary.

Based on all the above it is clear that although the iLovu Estuary's ecological functioning has been impacted on resulting in it being considered as Moderately Modified, it is still considered as an important estuary in a National and Regional context. In order to maintain this the above restoration challenges await, at the same time the recommended 50% of habitat should be proclaimed as conservation area.

National legislation makes provision for identifying Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with accompanying land-use guidelines that are compiled into Biodiversity Sector Plans. Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan. Ecological Support Areas (ESAs) play a vital role in supporting the ecological functioning of Critical Biodiversity Areas and Protected Areas and/or in delivering ecosystem services. The iLovu Estuary has been identified as a CBA which is irreplaceable in the conservation planning matrix at both a local and provincial level. Any accompanying coastal forests and wetland complexes are considered to be important ecological support areas and are critical to the health status of the estuary.

### 3.1.2 The Estuarine Functional Zone and its importance

The promotion of wise use of estuarine resources and the protection and conservation of estuarine biodiversity require not only the protection of estuarine habitat and biota, but also the protection of the physical processes/functions that sustain ecological and evolutionary processes. Therefore, to ensure the present and future health of estuaries, it is necessary to define the 'space' within which estuaries function over longer time scales – these areas are known as the 'Estuarine Functional Zone' (EFZ) (van Niekerk *et al.* 2012, 2013).

The National Biodiversity Assessment (van Niekerk *et al.* 2019) defines the EFZ as "*the area that not only encapsulates the estuary waterbody, but also the supporting physical and biological processes and habitats necessary for estuarine function and health. It includes all dynamic areas influenced by long-term estuarine sedimentary processes, i.e. sediment stored or eroded during floods, changes in channel configuration, aeolian transport processes, and changes due to coastal storms. It also encompasses all the multiple ecotones of floodplain and estuarine vegetation that contribute detritus (food source) and provide refuge from strong currents during high flow events.*"

The iLovu Estuary's EFZ was initially delineated by van Niekerk and Turpie (2012) (Figure 3.2), however based on recent information the EFZ was re-defined in the recent 2018 NBA (van

Niekerk *et al*. 2019) and moved to what is essentially the 10m contour, this can be seen in Figure 3.3. This area is based on the premise that currently the majority of estuarine functions will be protected within this area and if 50% of that area were designated as conservation area this would go a long way to protecting the estuary, its ecological functioning and biodiversity and ensuring that it will remain a priority estuary of National Importance within the 'Core Set' of priority estuaries identified to maintain South African Biodiversity.

The EFZ stretches to a point 6 km upstream which is the current head of the estuary. The lateral boundaries of the estuary are demarcated by the 10m amsl contour. The estuary mouth is the downstream boundary of an estuary. However, to allow for the highly dynamic nature of estuary inlets on the eastern seaboard an area known as the 'Estuarine Shore' has been introduced in the NBA 2018 to reflect the dynamic nature of the interface between estuaries and the coast (Harris *et al.* 2019). This is shown in Figure 3.3 as the red bounded rectangle running up the beach and extending a short way out to sea. This revised EFZ is also shown on Figure 3.4 in the context of the NWM5 Wetland Map, whilst Figure 3.5 shows various water resources where the iLovu Estuary falls within the Mvoti-uMzimkulu WMA and the Pongola-uMzimkulu Proto-CMA.

The extent of the current EFZ also represents 'climate change accommodation space' as it allows for estuaries to retreat under sea level rise scenarios of between +0.5 and +2.0m projected for South Africa in the short to medium term (MER 2019b). However, the Oceanographic Research Institute (ORI) are assisting KZN EDTEA with planning and developing coastal management lines (CMLs) in relation to Sea Level Rise (SLR) and climate change scenarios (present day to worst case scenarios for the next century) using the Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP). Should their preliminary findings (preliminary at this stage) be accepted by KZN EDTEA then it is highly likely that the EFZ will be extended well beyond the 5m contour and in some places also the 10m contour, the latter of which is shown in Figure 3.6. The current estuarine delineations are available to view on the Coast KZN website (http://www.coastkzn.co.za). The SLR scenarios used to inform the process of systematically delineating the CMLs are illustrated in Appendix 3.

### 3.1.3 Priority Estuaries

As part of the 2011 NBA, three hundred estuaries along the South African coast were assessed where biodiversity targets were set for estuarine ecosystem and habitat types, estuarine species and large-scale ecological processes (e.g. connectivity between estuaries) (van Niekerk and Turpie, 2011). Priority estuaries were identified using systematic biodiversity planning methods with input data including plant, fish and bird distribution data, estuarine health assessment data and data on ecological processes (e.g. importance of estuary as a nursery area for fish). River condition and estuary condition do not always coincide as some estuaries linked to rivers in poor

condition are resilient and able to recover as a result of marine influences, while other estuaries linked to good condition rivers are negatively influenced by local impacts such as coastal developments. In some cases, therefore an estuary is identified as a priority but the river upstream is not a freshwater ecosystem priority area (FEPA), and vice versa. The iLovu Estuary is one of 122 national priority estuaries (Nel *et al.* 2011) and remains classified as a priority estuary in terms of biodiversity after the 2018 NBA (van Niekerk *et al.* 2019).

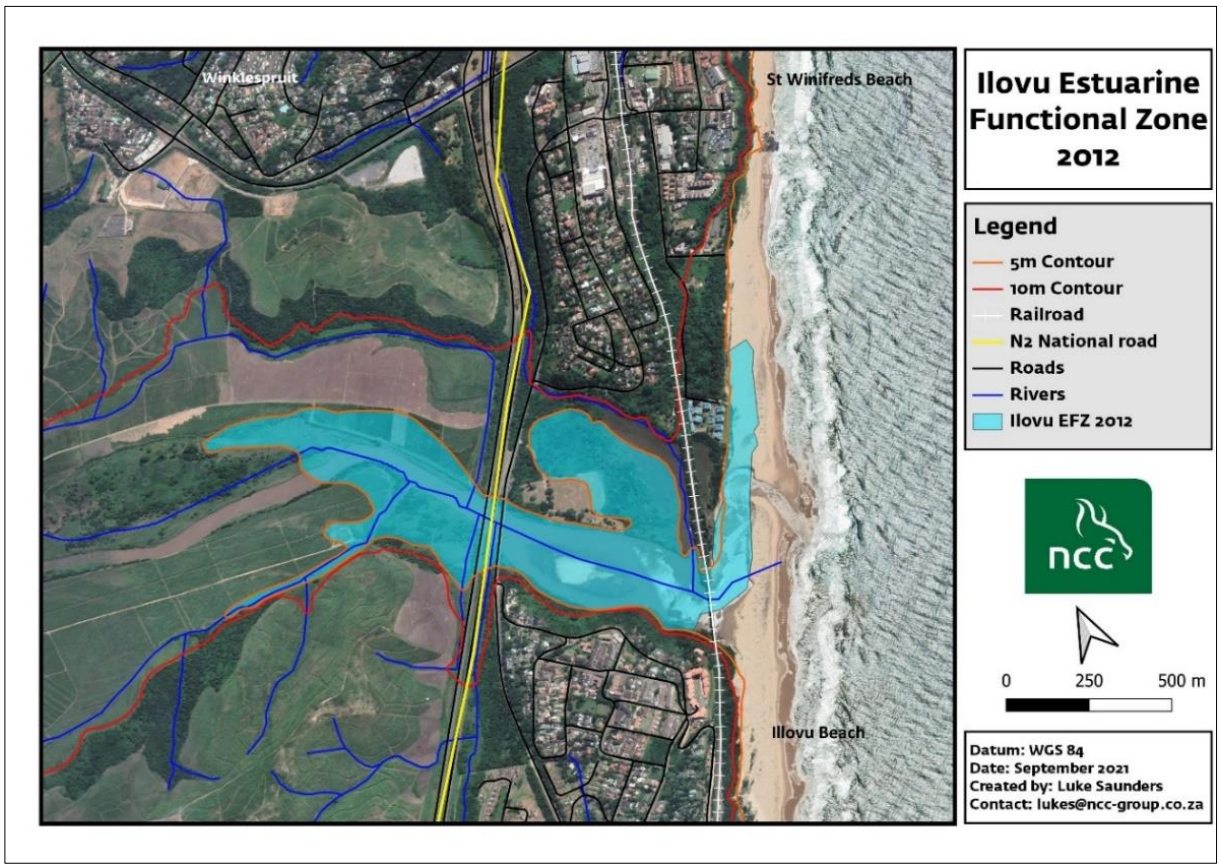


**Figure 3.2.** iLovu Estuary showing the EFZ based on the 5m contour as delineated in the 2011 NBA. The 10m contour is also shown (Data source: Van Niekerk and Turpie, 2012).

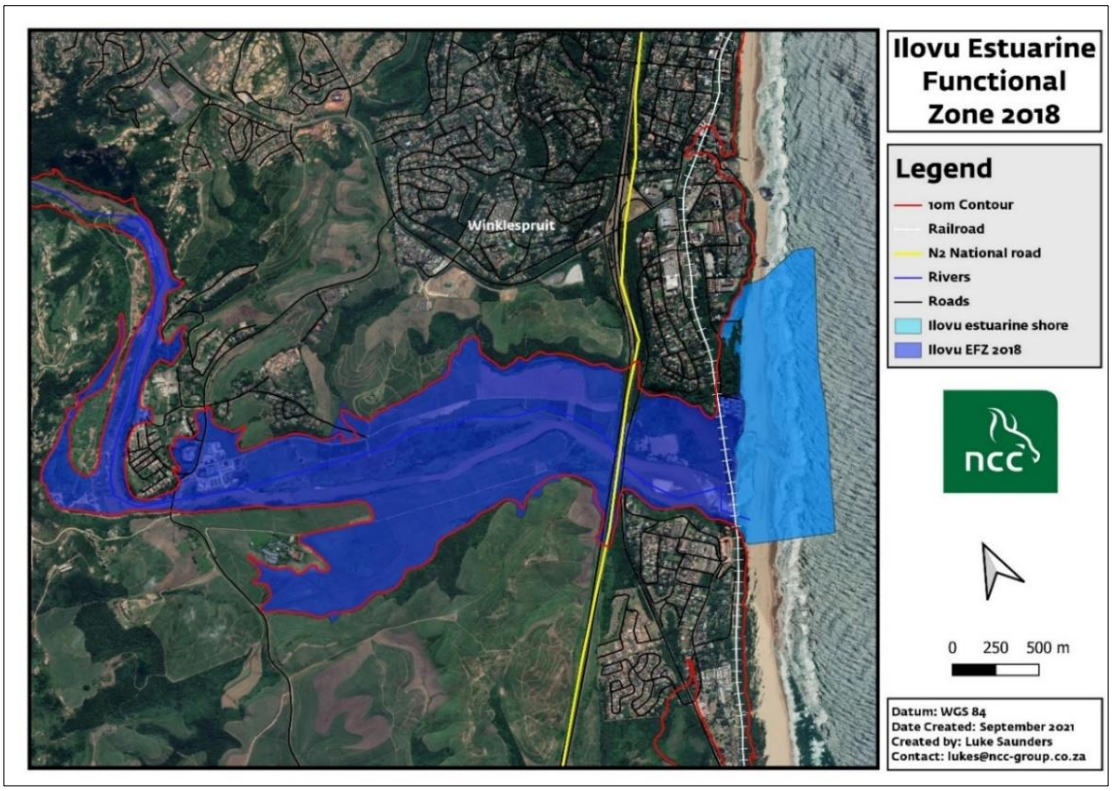


**Figure 3.3.** The iLovu Estuarine Functional Zone set at the 10m contour and the 'Estuarine Shore' zone on the coast (Data source: van Niekerk *et al*. 2019).

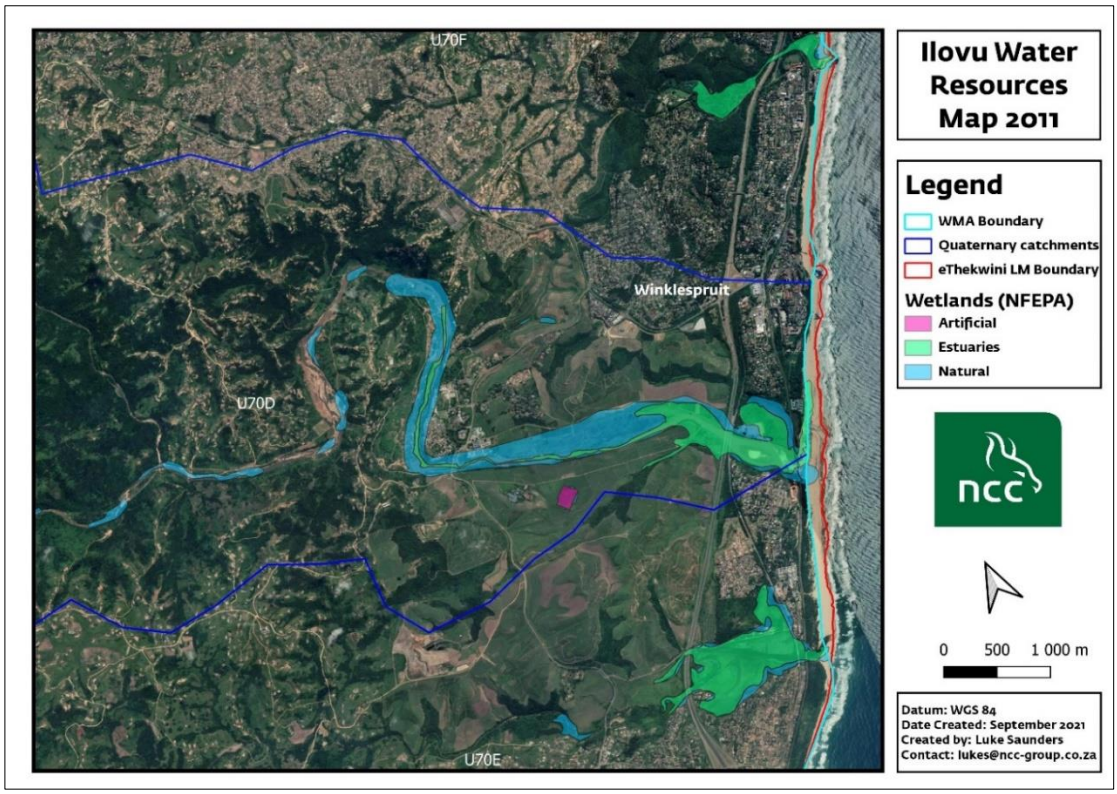


**Figure 3.4.** Illustration of various water resources (river, NFEPA wetlands and estuary) where the iLovu Estuary falls within the Mvoti-Umzimkulu WMA and the Pongola-uMzimkulu Proto-CMA (Data source: CSIR 2011).

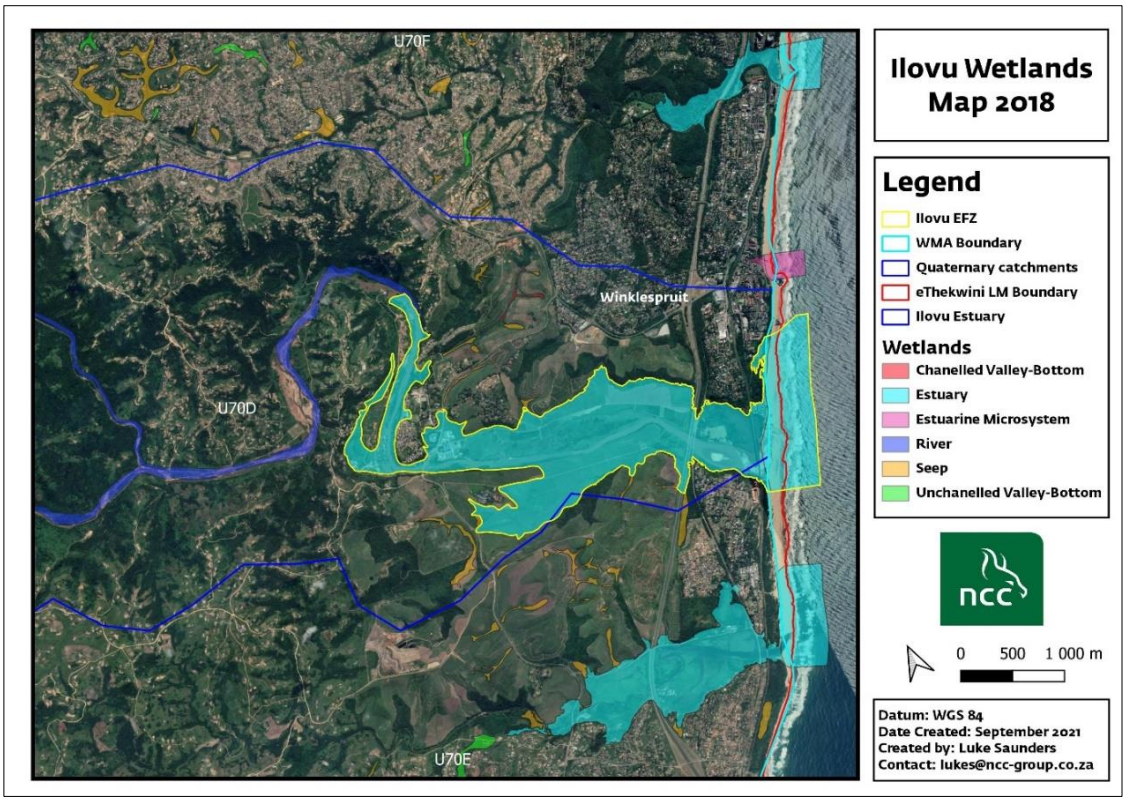


**Figure 3.5.** The iLovu Estuary and functional zone in the context of the NWM5 wetland map (Data source: van Niekerk *et al.* 2019).

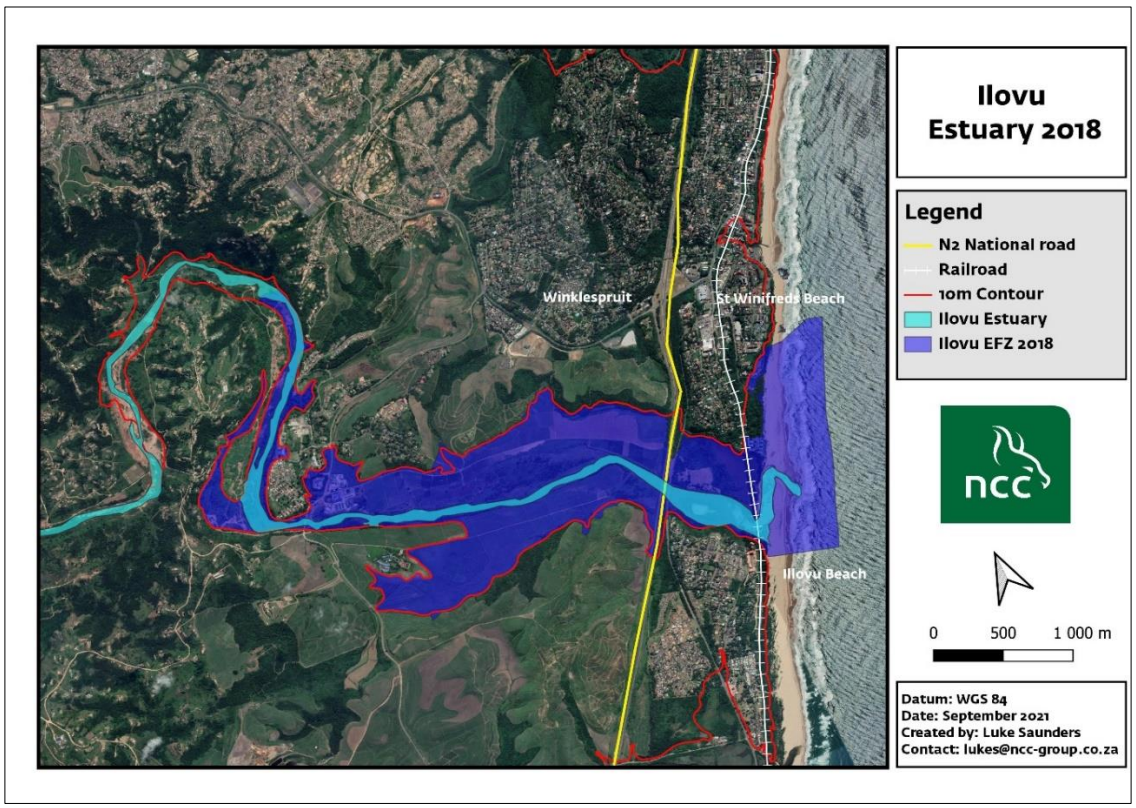


**Figure 3.6.** The iLovu Estuary and EFZ showing the extent of the 10m contour (Data source: Coast KZN).

## 3.2 ABIOTIC FUNCTION

### 3.2.1 Hydrodynamics and Sediment

The iLovu Estuary is classified as a large temporarily closed system (Van Niekerk *et al.* 2020), which is only closed for ~18% (records suggest between 17-20%) of the time. Being a predominantly open system, it is marine dominated with a strong tidal influence most of the year. Begg (1984) noted that the estuary mouth was open for 75% of the time, although this varied considerably during normal vs drought years, ranging from being open 95% of the time in 1979 to 45% in 1980. Closed mouth conditions typically coincide with low flow conditions during winter, i.e. from April to August. CSIR (2016a) noted that recent Ezemvelo KZN Wildlife records suggest that the system remains open for about 80% of the time, with closure typically occurring from May to August.

Van Niekerk *et al.* (2020) stated that a large temporarily closed estuarine system is typically >15ha in size, is closed for less than 50% of the time, has a highly restricted inlet, shows an average tidal range of 0.25-0.5m and a salinity range of 1-60, suggesting that hypersaline conditions can develop. In addition, mixing in such systems is typically driven by a combination of tidal, riverine and wind action (Figure 3.7).

The iLovu Estuary has a water surface area of 10.5 ha (based on the 5m contour, see Figure 1.2), an axial length of 1.1 km and a shoreline length of 3.8km (van Niekerk *et al.* 2019). The total estuarine habitat is 39ha, which comprises of 48% reeds and sedges, 13% sand banks and 27% open water. Much of the original estuarine associated wetlands, including the mangroves, were lost due to sugar cane, road construction and reclamation (Begg 1978, CSIR 2016a).

The estuary has a well-developed catchment with a river length of 135 km and a catchment size of 1,036 $km^2$. Impoundment and water abstraction in the catchment resulted in a present-day MAR of 82.5 x 106 $m^3$, compared to a natural MAR of 119.1 x 106 $m^3$, a net loss of 31%. Although this loss of flow is expected to affect the frequency of mouth closure, it is unlikely to have a significant effect on mouth dynamics and estuarine functionality due to the size of the catchment and the fact that the system is presently still open for ~80% of the time. Forbes and Demetriades (2008) noted that the iLovu Estuary is situated in a semi-rural situation with some residential development on the south bank, but with the floodplain and immediate catchment dominated by sugarcane fields.

**Figure 3.7.** Onshore view of the iLovu Estuary, with the railway bridge across the mouth and the N2 road bridge towards the back (Coast KZN).

Begg (1978) stated that water depths in the estuary ranged between 1.0-1.6 m under open mouth conditions. Begg (1984) found that water depth in the estuary ranged between a maximum of 2.3 m when the mouth was closed to about 1.25 m under open mouth conditions, with the average depth of less than 1 m. These observations were confirmed by Forbes and Demetriades (2008) in 2007-2008.

The strong marine influence and low frequency of mouth closure are clearly evident in the extent of seawater penetration into the system, under low and high flow conditions. Although the EFZ is estimated to extend only 1.1 km up the estuary, seawater penetrates much further up the system. Forbes and Demetriades (2008) observed seawater penetration at least 3.6 km upstream, at which point well-defined salinity stratification was evident, with a surface salinity of 0.2 and a bottom salinity of 14.5 in August 2007 and a surface salinity of 0.3 and a bottom salinity of 28.5 in February 2008, in 1 m of water. No information is available on the characteristics and duration of the different salinity states during a typical annual open/close cycle.

Although Forbes and Demetriades (2008) reported the estuary to be mildly turbid during their survey, with turbidity ranging between 15.0 - 15.5 NTU and 16 - 27 NTU at the bottom of the water column during August 2007 and February 2008, respectively, the system is periodically

subjected to much higher turbidities. These authors mentioned unpublished data from February 2007 which showed extremely high turbidities, reaching a maximum of 883 NTU in the lower estuary during high flows. The turbid events were considered to be caused by sand mining operations in the lower river reaches (See section 5.3 on Sandmining). According to Gibb (2019a), improper farming practices and overgrazing in the catchment of the iLovu River increasingly result in soil erosion, which causes the system to be highly turbid during high flow conditions.

Forbes and Demetriades (2008) characterised the granulometry of the iLovu Estuary as follows:

- Mouth Area: a mix of medium (0.25 mm) to very fine sands (0.125 mm),
- Middle Reaches: a mix of medium (0.25 mm) to coarse (0.5 mm) sands, and
- Upper Reaches: a mix of very coarse (1 mm) to medium (0.25 mm) sands.

### 3.2.2 Water quality

Comments on the historical water quality of the iLovu Estuary by Forbes and Demetriades (2008), CSIR (2016a) and MER (2019) all refer to reports by Begg (1978 and 1984) of water quality issues in the system. These were largely related to thermal and organic pollution from the sugar mill 3.5 km up the estuary, as well as pollution from leachate from the old municipal dump site. Accidental discharges from the mill as well as sewage seepage from settlements in close proximity to the estuary and river all contributed to water quality issues. Improved waste management by Illovo Sugar has since addressed the waste spillage from the sugar mill (CSIR 2016a).

Demetriades and Forbes (2008) noted an improvement in general water quality in the system during 2007/2008, which was thought to be due to lower levels of contamination from the dumpsite leachates and fewer sugar mill spillages into the system. The generally low nutrient concentrations recorded in the estuary was regarded as indicative of the general improvement in water quality in the system since the Begg (1978) report. Furthermore, it was noted that the observed nutrient concentrations were comparatively low compared to the other 16 KZN estuaries surveyed at the time.

CSIR (2016a) and MER (2019a) noted that, despite low nutrient concentrations, elevated Chlorophyll-a levels were periodically observed, which lead to localised algal blooms. Forbes and Demetriades (2008) reported elevated Chlorophyll-a levels and associated algal blooms under low flow conditions in August 2007, which were related to increased retention time of estuarine waters during winter.

Earlier records (Begg 1978) suggested considerable bacterial contamination from sewage seepage in the catchment, with *E.coli* counts as high as 120 000/100 ml being recorded. Forbes

and Demetriades (2008) recorded much lower levels of bacterial contamination during 2007 and 2008, with maximum *E. coli* values of 300 counts/100 ml, which were deemed to be within target water quality guidelines for intermediate recreational contact.

Cooper *et al.* (1994) scored the water quality of the iLovu Estuary at 6.8/10 as part of an Estuarine Health Index assessment, while Harrison *et al.* (2000) rated the water quality of the system as poor. These reports of the poor water quality in the system prior to 2000 is cause for concern, although Forbes and Demetriades (2008) noted an improvement in overall water quality during 2007-2008.

No records of metal or organic compound contamination in the iLovu Estuary were found. However, as noted in section 5.4, some microplastic pollution was reported in the system, albeit at much lower levels than in the estuaries around Durban.

## 3.3 BIOTIC FUNCTION

### 3.3.1 Microalgae

Forbes and Demetriades (2008) analysed water samples from the iLovu Estuary from the upper, middle and lower reaches during low flows in August 2007 and high flows in February 2008 and concluded that nutrient levels throughout the system remained low. Elevated Chlorophyll-a levels (as high as 32 mg.m-3) and phytoplankton blooms were however evident under low flow conditions, probably due to lower freshwater flows in winter, reducing the flushing of accumulated nutrients and causing longer retention times (MER 2019a).

CSIR (2016a) noted that to date no detailed studies have been done on phytoplankton species or microalgal community composition for the iLovu. Casual observations in the early 1990s revealed periodic phytoplankton blooms and blue green algae scums on exposed sand/mud banks, suggesting eutrophication due, in part, to nutrient enrichment from return flows from sugar cane fields. Sewage contaminated stormwater and accidental discharges from the sugar mill 3.5km up the estuary may also have been potential sources of nutrient enrichment. The microalgal component for the iLovu Estuary was evaluated by DWA (2013) as shown on Figure 3.10.

**Table 3.10.** Summary of the microalgae component condition in the iLovu Estuary (DWA 2013).

| Microalgae Condition | Comment |
|---|---|
| **C** | Significant flow modification, poor water quality, macrophyte cover changes |

### 3.3.2 Vegetation

The current distribution of vegetation type in the area as mapped by EKZNW (2016) is shown on Figure 3.8. By 1937 both banks of the estuary had been impacted by urban development at the mouth and by the cultivation of sugar cane in the upper reaches. It would appear that a fair proportion of the northern flood plain in the region of the R102 had been "reclaimed" for agriculture by 1937 and the estuary deflected south by the construction of a levee and reinforcing structures west of the R102. The sports field east of the R102 on the northern bank was present in 1937 but persists today only as a cleared area overlying the original wetland. Begg's 1984 description of the flora indicated a "dense fringe of lagoon hibiscus" (*Hibiscus tiliaceus*) on the steep southern bank of the estuary but otherwise there was little of note "due to extensive encroachment of sugar cane and the general reclamation of wetland areas" (Begg 1978). A plan to fill in the reed swamp on the seaward side of the railway line on the north bank to create a parking area was mooted but did not materialise.

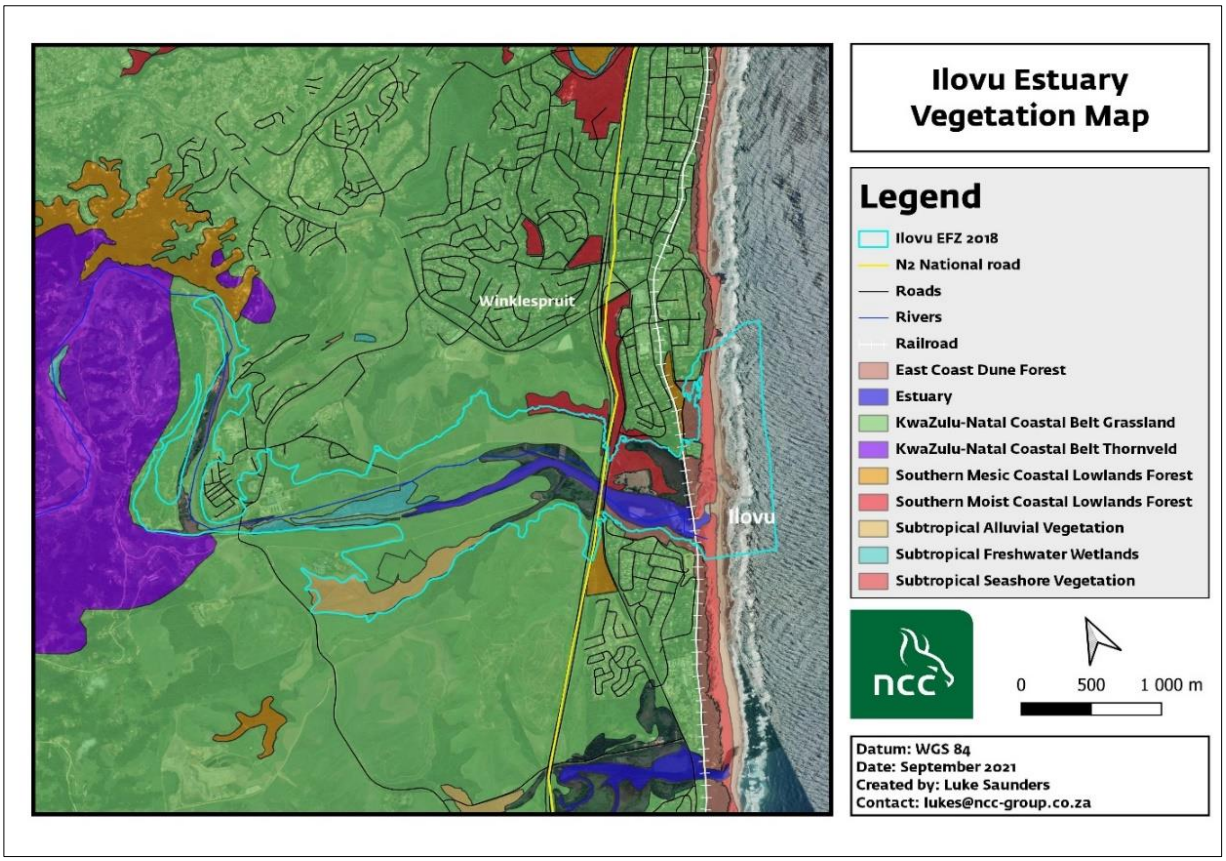


**Figure 3.8.** Vegetation map of study area (EKZNW, 2016).

The riparian zone on both banks has been substantially invaded by alien plants, especially *Schinus terebinthifolius* on the northern bank which have been used as shade trees in the picnic area. Extensive areas of riparian vegetation have been removed on the northern bank for the construction of this picnic area and associated car park. The banks of the river immediately west of the R102 have been radically transformed by removal large areas of the floodplain and riparian

zone and infilling to raise the level of the land to possibly protect the road bridge and / or allow the planting of sugar cane. The edge of the river is now comprised of a gabionised embankment. Illegal sand-winning has removed a substantial area of riparian vegetation on the northern flood plain west of the R102 (see example below). According to DWA (2013) the area occupied by the reeds and sedges comprises 19 ha, which is 48.1% of the total estuarine area. The loss of estuarine habitat can be seen in Figure 3.9, whilst the condition of and estuarine health index for the macrophytes of the iLovu Estuary from DWA (2013) are shown on Table 3.11.

**Table 3.11.** A summary of the macrophyte conditions of the iLovu Estuary based on available information (DWA 2013). The following historical assessments are summarised below: Begg (1978) condition (G=Good, F=Fair, D=Degraded, HD=Highly disturbed); Forbes and Demetriades (2009) Pressure (H=High, M=Medium, L=Low); Harrison (2000) Aesthetic score (G=Good, M=Moderate, P=Poor).

| Begg | Forbes & Demetriades | Harrison | Loss of habitat | Loss of mangroves | Sedimentation & reed expansion | Macrophytes | Comments |
|---|---|---|---|---|---|---|---|
| *F* | *L* | *M* | *30* | *5* | *5* | **D** | *Loss of mangroves, 2 ha. Agricultural and residential developments within floodplain, 4 bridges (Cooper et al. 1993). 2013 Google images: loss of habitat due to floodplain disturbance, possibly some reed encroachment* |

**Figure 3.9.** Loss of habitat /reduction of the estuarine area due to infilling and levee construction (from MER 2019a).

### 3.3.3 Invertebrates

3.3.3.1 Macrobenthic invertebrates

Benthic macroinvertebrates (i.e. benthic and epi-benthic invertebrates, >0.5mm in size) form a very important biotic component of the soft substrate habitat of estuarine ecosystems due to their close association with the sediment and are amongst the most reliable and sensitive biotic indicators of habitat quality in estuarine and marine ecosystems (Borja *et al.* 2009). Macrobenthos is routinely used for assessing ecosystem integrity in coastal and estuarine aquatic ecosystems worldwide (Rosenburg and Resh 1993; Borja et al. 2009; Izegaegbe 2020). In particular, the relatively sessile nature and long-life cycle of macrobenthos allows them to be effective representatives of the substrate condition and health of the location being sampled. Macrobenthic communities thus reflect local sedimentary conditions, while their close intimacy and habitation in the sediment allow monitoring of spatial and temporal variation caused by perturbations (Rosenberg and Resh 1993). Most importantly, different macrobenthic taxa display different sensitivities to habitat disturbance and pollution and the analysis of temporal and spatial changes in community structure and diversity is routinely used to assess the health of estuarine habitat. In addition to their overall importance in ecosystem structure and function, macroinvertebrates are therefore effective indicators of estuarine health in biomonitoring studies (Dauvin *et al.* 2006; Borja *et al.* 2009; MacKay *et al.* 2010). As an important component of estuarine food webs, macrobenthos serves as a vital food resource for many larger crustaceans, birds and fish and changes in their diversity can influence the abundance and species composition of the full spectrum of tertiary consumers, with negative consequences for ecosystem productivity (Forbes and Demetriades 2008).

Estuarine monitoring programmes aimed at assessing spatial and temporal changes resulting from both natural and anthropogenic impacts in the estuarine environment should therefore incorporate analysis of macrobenthic communities as an essential metric (Borja *et al.* 2009). This is not only applicable to the anthropogenic influences of past human related activities, but also to the potential impact of proposed new development. Increasingly, biotic indices based on macrobenthic community changes related to anthropogenic pressures are being developed and used in biomonitoring assessments (Borja *et al*. 2009).

Information on the macrobenthos of the iLovu Estuary is limited and dated. Begg (1978) merely noted that the estuary is poorly endowed with macrobenthic organisms, and that bait collection of sand prawns (*Kraussillichirus kraussi*) was observed. It was also noted that due to organic pollution from the sugar mill, the upper estuary showed a very low species diversity and was dominated by the oligochaete *Dero sp*. Begg (1984) also noted that the benthic mudcrab species, *Paratylodiplax blephariskios*, was recorded. This macrobenthic crab is often regarded as a

keystone species (i.e. of ecological high importance) in muddy reaches of estuaries due its high contribution to biomass and its bioturbation capacity (Izegaegbe *et al.* 2021).

The most detailed description of the macrobenthic community, to date was provided by Forbes and Demetriades (2008) as part of the Estuaries of Durban 2009 report, who conducted grab sampling of the lower, middle and upper reaches during August 2007 (low flow conditions) and February 2008 (high flow conditions). Species richness (number of taxa) was generally low, with a total of 20 taxa recorded over the study period. Under low flow conditions, 18 taxa were recorded, compared to 15 taxa under high flow conditions. Highest species richness was recorded in the middle reaches (19 taxa), followed by the lower (16 taxa) and upper (10 taxa) reaches. There was a marked difference in abundance between seasons i.e. total abundance under high flow (February) conditions was only 18% of that under low flow conditions (August). This suggests that the higher-salinity, more stable conditions during low flows promote higher macrobenthic diversity and stability. Highest macrobenthic abundance was generally observed in the middle reaches, with abundance in the lower and upper reaches being only 58% and 15% of that in the middle reaches. The upper reaches were generally characterised by low species richness and abundance throughout.

The macrobenthic community was dominated in terms of species richness by Polychaetes (5 taxa) and Amphipoda (4 taxa). In terms of abundance, the benthos was dominated by the tanaid *Halmyrapseudes cooperi*, which accounted for 46% of all organisms recorded in the system. This abundant species accounted for 44% and 58% of all organisms in the lower and middle reaches under low flow conditions, respectively.

The lower reaches community was characterised by an abundance of the polychaetes *Composetia keiskama* and *Desdemona ornata*, the amphipod Grandidierella *sp,* the isopod *Leptanthura leavigata* and the above-mentioned tanaid. The middle reaches showed an abundance of *C. keiskama*, *D. ornata*, and Grandidierella *sp,* while the upper reaches were characterised by an abundance of oligochaetes, spionid polychaetes and the invasive gastropod *Tarebia granifera*. The potential proliferation of this invasive snail in the freshwater dominated upper reaches is a concern. The relatively high salinity observed in the system, due to the predominantly open mouth, is expected to prevent colonization of this species of the middle and lower reaches.

Forbes and Demetriades (2008) concluded that, being a predominantly open system with a strong marine and tidal influence, the estuary was expected to support a greater diversity and abundance than what was recorded during their 2007-2008 survey. They rated the ecological state of the macrobenthic community as fair.

Given the ecological importance of the macrobenthic community as a pivotal component of the biotic composition in the estuary, it is imperative that a more detailed and up-to-date assessment of the state of the macrobenthic community be included in future biomonitoring programs.

#### 3.3.3.2 Macrocrustacea

As is the case with macrobenthic invertebrates, limited data is available on the macrocrustacea of the iLovu Estuary. Two primary groups are of interest here, the crabs and the prawns. In terms of the crab community, Begg (1978) mentioned that *Varuna* and *Sesarma* crabs were abundant. Begg (1984) reported four species of crabs from the system, which included *P. tylodiplax*, the migrating mudcrab *Scylla serrata*, the epibenthic crown crab *Hymenosoma orbiculare* and the species *Rhyncoplax bovis*. No details of distribution and abundance were provided. The genus *Hymenosoma* (previously only one species: *H. orbiculare*) was recently reviewed and found to comprise 5 species, of which *H. projectum sp. nov*. was shown to occur along the east coast from the uMzimvubu Estuary northwards.

Subtropical estuaries serve as critical nursery areas for a variety of prawn species, which include both marine and freshwater forms (Forbes and Forbes 2013). Three groups of prawns generally utilise estuaries:

- The marine prawns of the families Penaeidae (e.g. *Penaeus indicus*), Palaemonidae (e.g. *Palaemon peringueyi*) and Sergestidae (e.g. *Acetes erythraeus*) that migrate into estuaries from the sea.
- The freshwater prawns of the families Atyidae (e.g. *Caridina nilotica*) and Palaemonidae (e.g. *Macrobrachium* species) (Forbes and Forbes 2013; Collocott *et al.* 2014).
- Palaemonid prawns also include some estuarine resident species, which spend most of their time in estuaries (e.g. *Palaemon concinnus*) (Ronnback *et al.* 2002).

Many marine prawns have an obligate estuarine phase in their life cycle, during which post-larvae need to migrate to nursery areas in estuaries or shallow coastal areas for development and maturation, after which they return to the marine environment to spawn (Figure 3.10) (Forbes and Forbes 2013, Vance and Rothlisberg 2020). Thus, both marine and estuarine phases are required for completion of the life cycle. Some freshwater species (e.g. *Macrobrachium equidens*) also have an obligate estuarine phase, migrating into the brackish reaches of estuaries in order to breed and to complete their larval development (Tweddle *et al.* 2016). As in the marine species, both the freshwater and estuarine phases are required for completion of the life cycle. The absence of suitable estuarine nursery habitat will ultimately result in a decline in the prawn breeding populations as they cannot complete their life cycle.

Begg (1984) provided a comprehensive list of prawns recorded in the system, from 46 trawl samples. These records provide the basis of all subsequent reviews of this biotic component since 1984, which is an indication of the lack of recent and relevant biotic data from the system. These included four marine penaied species (*Penaeus indicus, P. monodon, P. japonicus* and *Metapenaeus monocerus*), two palaemonid species (*Monobrachium equidens, Palaemon concinnus*) and one sergestid species (*Acetes natalensis*). No indication of relative abundance, distribution or habitat preference was stated. The presence of four of the seven penaeid species regularly observed in estuaries along the KZN coastline (Forbes and Forbes 2013) is an indication of the importance of the system as nursery habitat. Six of the seven species recorded in the system have an obligate estuarine phase during their life cycle, while *P. concinnus* is an estuarine resident species which also requires brackish water to complete its life cycle. It is surprising that the marine breeding palaemonid *Palaemon peringueyi* was not reported in the system and will in all probability be recorded in future surveys.

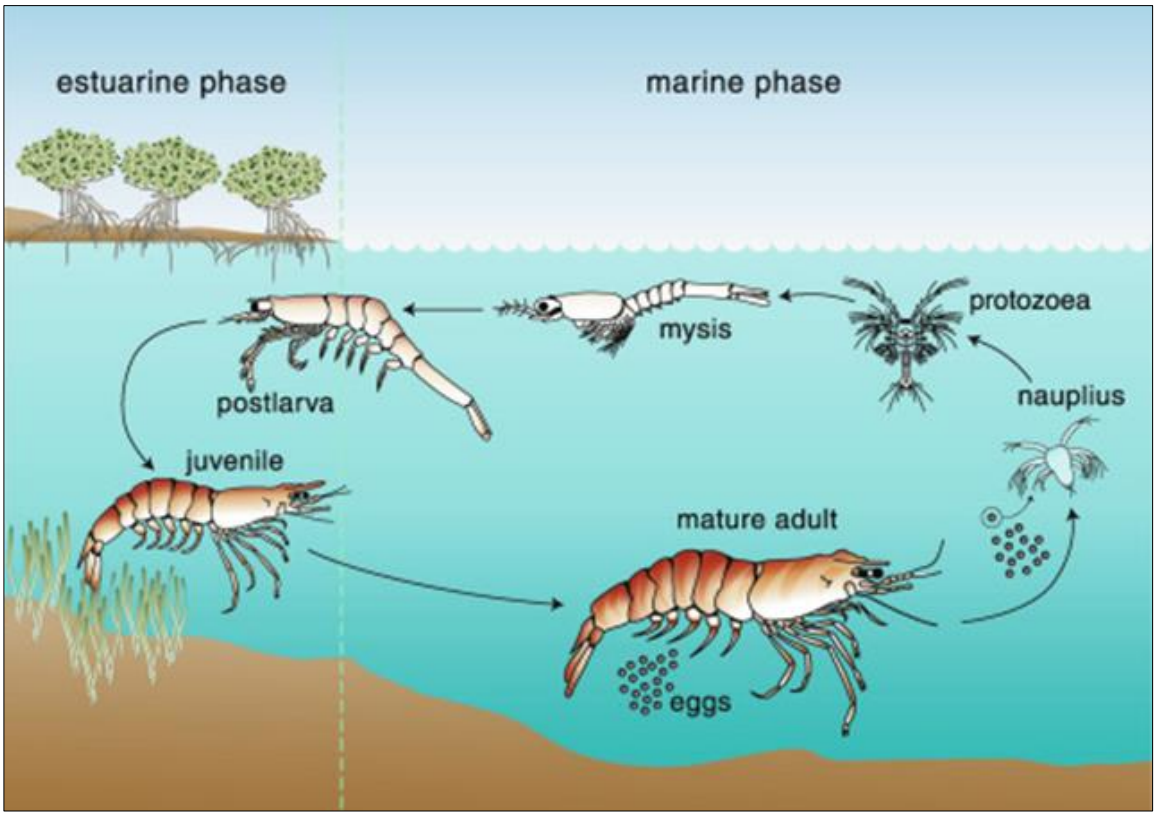


**Figure 3.10.** Life cycle involving a marine and estuarine phase of a typical penaeid prawn. Image: Vance and Rothlisberg 2020.

Nursery habitat in coastal areas preferentially inhabited by prawns includes mangroves, eelgrass beds (e.g. *Zostera capensis*) and intertidal sand- and mudflats. Many commercially important Penaeid and Palaemonid prawns show preference for nursery areas within coastal systems that offer eelgrass and mangrove habitat (Macia 2004, Collocott *et al.* 2014). Given that mangroves

have disappeared from the iLovu Estuary and there are no records of Zostera in the system, it is expected that the nursery habitat in the estuary will be sub-optimal, compared to larger predominantly open estuaries with greater diversity of prawn nursery habitat.

### 3.3.4 Fish

Begg's (1984) trawl samples produced 475 individuals of 27 species. There were 11 single records and in total 16 species were represented by fewer than five individuals. The remaining 11 species were dominated by the gobies *Glossogobius giuris* and *Oligolepis acutipennis* (35% combined), the estuarine roundherring *Gilchristella aestuaria* (18%) and the freshwater Mozambique tilapia *Oreochromis mossambicus* (17%). Begg (1984) commented that the mullet were probably underestimated and that the pollution event of August 1981 added the following species to the list, viz. river snapper *Lutjanus argentimaculatus*, honeycomb ray *Dasyatis uarnak*, thornfish *Terapon jarbua*, halfbeaks *Hyporamphus* sp. and the freshwater *Tilapia rendalli* and *Clarias gariepinus*.

Ramm *et al.* (1986) collected 61 fish of 14 species. Eight species were represented by fewer than five individuals and there were five single records. Seven species of mullet contributed 79% of the individuals and these were in turn dominated by the freshwater *Pseudomyxus capensis* (35%) and flathead *Mugil cephalus* (23%). Harrison (unpublished), during national estuarine surveys in the late 1990s, recorded 32 species, 11 occurring as single records and 19 as five or fewer individuals, leaving a total of 13 which corresponds roughly with the number of generally occurring species recorded by Begg (1984). Harrison's unpublished data are probably more representative of the fish community due to the different gear used. Of the 859 fish caught, 54% was made up by seven mullet species, and 29% by the estuarine roundherring *Gilchristella aestuaria*. The mullet were dominated by the robust *Osteomugil robustus* which contributed 47% of the mullet catch. The status of the fish fauna was rated as moderate (Harrison *et al.* 2000).

Seine and gill netting in early 2006 (summer) and mid-year (winter) produced 4,397 individuals of 22 taxa (McLean *et al.* 2006 as quoted in MER 2019b). There were three single records, viz. the river goby *Glossogobius callidus*, the estuarine bream *Acanthopagrus vagus* and great barracuda *Sphyraena barracuda* and a total of nine species represented by five or fewer individuals. Five species of mullet plus unidentified juveniles provided 76% of the total catch. The identified mullet were in turn dominated by the flathead *Mugil cephalus* which contributed 71%. The less common species were dominated by the longspine glassy *Ambassis* (formerly *productus*) (627 individuals), thornfish *Terapon jarbua* (234 fish) and Cape stumpnose *Rhabdosargus holubi* (91 fish).

Sampling of the iLovu in 2007/2008 produced only 118 individuals of 16 taxa (Table 3.12) which was the second highest ratio of taxa to individuals in the survey. Eight species were represented

by five or fewer individuals. Seven identified species of mullet plus unidentified juveniles contributed 75% of the catch. The mullet catch consisted mainly of the generally uncommon diamond *Planiliza alata* (36%) and the large scale *Paniliza macrolepis* (18%). The diversity can be attributed to the relatively large size of the system and the fact that the mouth was open during the survey thereby allowing fish movement between the estuary and the sea.

It is noteworthy that Begg (1984) recorded three *Pomadasys* species, viz. *P. hasta*, *P. multimaculatum* and *P. commersonnii* (55 individuals) making up 11% of the catch, while Harrison (unpublished) recorded only four individuals of *P. commersonnii* making up less than 1% of the catch. The 18 recorded by McLean *et al.* (2006) as quoted in MER 2019b, also contributed less than 1% of the catch. The proportion increased slightly in 2007/2008 to 4%. These are benthic feeding species and the low numbers after 2000 possibly reflect changes in the zoobenthos although this was not reflected in the wading birds.

The bulk of species present represent juvenile marine species which utilize the estuary as a nursery ground. Once they reach maturity, they leave the system and do not return. Included in this group are a number of Estuarine Dependant species which require an estuarine environment to complete their life cycle.

**Table 3.12.** Fish species recorded in the iLovu estuary during 2007 – 2008 (after MER 2019a).

| Family | Genus and species | Common name | Winter 2007 | Summer 2008 |
|---|---|---|---|---|
| Ambassidae | *Ambassis ambassis* | Longspine glassy | 23 | 2 |
| Carangidae | *Caranx sexfasciatus* | Bigeye kingfish | | 2 |
| Clupeidae | *Gilchristella aestuaria* | Estuarine roundherring | 2 | |
| Gerreidae | *Gerres methueni* | Evenfin pursemouth | | 5 |
| Gobiidae | *Glossogobius callidus* | River goby | | 2 |
| Haemulidae | *Pomadasys commersonnii* | Spotted grunter | | 5 |
| Leiognathidae | *Leiognathus equula* | Slimy | 2 | |
| Mugilidae | *Moolgarda cunnesius* | Longarm mullet | 1 | 5 |
| | *Mugil cephalus* | Flathead mullet | | 1 |
| | *Osteomugil robustus* | Robust mullet | 4 | 6 |
| | *Planiliza alata* | Diamond mullet | 2 | 22 |
| | *Planiliza dumerilii* | Groovy mullet | 3 | 2 |
| | *Planiliza macrolepis* | Largescale mullet | 10 | 2 |
| | *Pseudomyxus capensis* | Freshwater mullet | 3 | 5 |
| | Mugilidae | Mullet | 22 | |
| Teraponidae | *Terapon jarbua* | Thornfish | 2 | 3 |
| | | **Total individuals** | **74** | **62** |
| | | **Total taxa** | **11** | **13** |

### 3.3.5 Birds

There was no mention of the bird fauna in the Begg (1984) report but the earlier review (Begg 1978) quotes records of 16 species of “estuarine associated birds”, “primarily various types of waders”. There was also reference to 48 species of which 24 were estuary associated but no indication of the actual species involved. Table 3.13 lists the limited count data that is available for the system, a total of 39 species have been recorded from the four known counts. These include a mixture of invertebrate feeders and piscivorous species. Tidal conditions and an open mouth as well as an availability of a suitable food supply, as indicated by the benthic data, suggests both a reasonable water quality and a need for added protection of the area. The data does indicate that the estuary does plays a role as a habitat for migratory wading birds as well as a roosting area (at the mouth) for terns and gulls. Of note is the fact that two IUCN (2021) listed Red Data species have been recorded in the iLovu Estuary, the African Finfoot is regarded as vulnerable whilst the Grey-crowned Crane is listed as Endangered.

**Table 3.13.** Water birds recorded in the iLovu estuary (* = IUCN Red Data Species).

| *Common Name* | *Species name* | *Winter 2007 MER (2008)* | *Summer 2007/2008 MER (2008)* | *April 2021 This Study* | *May 2021 MacKay (pers com)* |
|---|---|---|---|---|---|
| Egyptian Goose | *Alopochen aegyptiacus* | 7 | 2 | 2 | 31 |
| Spur-winged Goose | *Plectropterus gambensis* | | | 5 | |
| African Finfoot * | *Podica senegalensis* | | | | 1 |
| Giant Kingfisher | *Megaceryle maxima* | | 2 | 1 | |
| Pied Kingfisher | *Ceryle rudis* | 2 | 4 | | 6 |
| Malachite Kingfisher | *Corythornis cristatus* | | | | 1 |
| Grey Crowned Crane * | *Balearica regulorum* | | | | 4 |
| Common Greenshank | *Tringa nebularia* | | 2 | | |
| Wood Sandpiper | *Tringa glareola* | | 1 | | |
| Common Sandpiper | *Actitis hypoleucos* | | 6 | | |
| Sanderling | *Calidris alba* | | 53 | | |
| Curlew Sandpiper | *Calidris ferruginea* | | 2 | | |
| Water Thick-knee | *Burhinus vermiculatus* | | 1 | | |
| Grey Plover | *Pluvialis squatarola* | | 1 | | |
| Common Ringed Plover | *Charadrius hiaticula* | | 22 | | |
| Three-banded Plover | *Charadrius tricollaris* | 1 | 1 | 1 | 7 |
| White-fronted Plover | *Charadrius marginatus* | | 3 | | |
| Blacksmith Lapwing | *Vanellus armatus* | | 2 | 4 | |
| Kelp Gull | *Larus dominicanus* | 16 | | 1 | |
| Swift Tern | *Sterna bergii* | 25 | 25 | | |
| Sandwich Tern | *Sterna sandvicensis* | | 8 | | |
| Arctic Tern | *Sterna paradisaea* | | 1 | | |
| African Fish-Eagle | *Haliaeetus vocifer* | 1 | 1 | | 2 |
| Wooley-necked Stork | *Ciconia episcopus* | | | 21 | 1 |
| African Darter | *Anhinga rufa* | 3 | | | |
| Reed Cormorant | *Phalacrocorax africanus* | 2 | 1 | | |

| | | | | | |
|---|---|---|---|---|---|
| White-Breasted Cormorant | *Phalacrocorax lucidus* | | | 4 | 7 |
| Little Egret | *Egretta garzetta* | 1 | 1 | | |
| Grey Heron | *Ardea cinerea* | | 4 | 1 | |
| Goliath Heron | *Ardea goliath* | | 1 | 1 | 1 |
| Intermediate Egret | *Ardea intermedia* | | | | 2 |
| Green-backed Heron | *Butorides striatus* | 1 | | | 1 |
| Hamerkop | *Scopus umbretta* | 1 | 2 | | |
| Hadeda Ibis | *Bostrychia hagedash* | 5 | 19 | 2 | |
| Brown-throated Martin | *Riparia paludicola* | | 15 | | |
| White-throated Swallow | *Hirundo albigularis* | 1 | 13 | | |
| African Pied Wagtail | *Motacilla aguimp* | 2 | | | |
| Cape Wagtail | *Motacilla capensis* | 2 | 1 | | |
| | ***Total number of individuals*** | **69** | **195** | **43** | **64** |
| | ***Total number of species*** | **14** | **23** | **11** | **12** |
| | ***Total number of species*** | **39** | | | |
| **Additional record** | | | | | |
| Lesser Swamp Warbler | *Acrocephalus gracilirostris* | | | | |

# 4. ECOSYSTEM SERVICES

## 4.1 WHAT ARE ECOSYSTEM SERVICES?

The NBA 2018 (van Niekerk *et al.* 2019) describes ecosystem services as "the benefits that people obtain from ecosystems, including provisioning services (such as food and water), regulating services (such as flood control), cultural services (such as recreational benefits), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth." These ecosystem services add value to human society as a result of a healthy stock of ecological infrastructure. Therefore, if this ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish.

Ecosystems can be viewed as natural capital which contributes to economic production. They provide goods, services and attributes, collectively known as ecosystem services, which contribute to human welfare (Barbier 1994):

- Goods are harvested resources, such as fish.
- Services are processes that contribute to economic production or save costs, such as water purification.
- Attributes relate to the structure and organisation of biodiversity, such as beauty, rarity or diversity, and generate less tangible values such as spiritual, educational, cultural and recreational value.

The Millennium Ecosystem Assessment (2003) categorised the services obtained from ecosystems as follows:

- Provisioning services such as food and water,
- Regulating services such as flood and disease control,
- Cultural services such as spiritual, recreational, and cultural benefits, and
- Supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.

The first three align well with the definitions of goods, services and attributes described above, while the fourth underlies these and need only be considered in as much as changes in these affect the values of the first three (Turpie 2007).

## 4.2 GOODS AND SERVICES PROVIDED BY THE ILOVU ESTUARY

The main types of ecosystem services that are associated with subtropical South African estuaries are listed in Table 4.1, based on Dawson *et al.* (2021). Not all of these are provided by the iLovu Estuary as the system is small and has already been subjected to anthropogenic

impacts in the past. The goods and services provided by the iLovu Estuary are discussed in more detail below.

**Table 4.1.** Ecosystem services based on definitions by Costanza *et al.* (1997) that are likely to be provided by a subtropical South African estuary (Turpie 2007).

| Category | Goods and Services | Examples |
|---|---|---|
| Ecological | Biological Control | Maintaining the balance/diversity of plants/animals |
| | Refugia/Migratory Corridors | Fish and crustacean nurseries and roost for migratory birds |
| | Sediment supply | Creation and maintenance of beaches, sand bars and sand banks |
| | Erosion control | Prevention of soil loss by estuary vegetation, and by capturing soil in reed beds and mangroves |
| | Soil formation | Accumulation of sediment and organic material on floodplains and in mangroves |
| | Nutrient supply and cycling | Nutrient supply, nitrogen fixation and nutrient cycling through food chains |
| | Genetic Resources | Genes for mariculture, ornamental species and fibre |
| | Disturbance regulation | Flood control, drought recovery and refuges from natural and human induced catastrophic events (e.g. oil spills) |
| Subsistence | Collection of living resources for food | Line fishing, inter-tidal collecting, beach and seine netting |
| | Raw material for subsistence use (e.g. building material) | Harvesting of craftwork and house-building materials |
| Recreational & Tourism | Scenic Views | Nature appreciation Providing access to estuaries and associated wildlife for viewing and walking. Scenic views Resort, residential houses, housing complexes and offices with scenic views, increasing turnover of properties with a sea view |
| | Culture | Aesthetic, educational, research, spiritual, intrinsic, and scientific values of estuary ecosystems |
| | Sports fishing | Estuary flyfishing, estuary and inshore conventional fishing |
| | Water sports | Swimming, sailing, canoeing, skiing, and kayaking |
| Commercial & Industrial | Waste treatment | Breaking down of waste and detoxifying pollution |
| | Water supply and regulation | Water supply to marine environment and water for mariculture |
| | Mariculture (e.g. oysters, bait, etc.) | Production (natural and cultivated) of fish, crustaceans, and worms |
| | Commercial food production | Fishing |
| | Raw material for commercial use | Diamond and titanium mining |
| | Transport services | Ports, harbours, marinas and ski-boat launching sites |

Forbes and Demetriades (2008) reviewed 16 estuaries along the central KZN coastline, including the iLovu, and noted that these estuaries perform various essential ecosystem services, which benefit humans and the natural environment alike. Degradation of estuarine habitat and estuarine functionality from human activities has been shown worldwide to affect the essential ecosystem services rendered by estuaries. The global decrease in estuarine habitat and quality affects all estuarine ecosystem services, most notably viable fisheries (~33% decline), suitable nursery habitats (~69% decline) and filtering and detoxification services provided by vegetation and associated wetlands (~63% decline). The associated loss of biodiversity and ecosystem functions may have contributed to biological invasions, declining water quality and decreased coastal protection from flooding and storm events (UNEP 2006).

### 4.2.1 Raw materials

Provision of material for natural use and human consumption is a key ecosystem service of an estuary such as the iLovu. Estuaries are some of the most productive aquatic ecosystems and provide habitat and food for large numbers of biota at all taxonomic levels. Nutrients produced in the organic rich estuarine environment support coastal marine ecosystems. Rural communities along the estuarine habitat derive food from the estuary through subsistence fishery. The estuary provides silt and fine sediments to the marine environment and also for human use. Excessive mining of river sand in the iLovu Estuary has however, been shown to be detrimental to ecosystem functioning (Demetriades 2007). Marine prawn and fish species found in the iLovu Estuary, many of which are of commercial importance as food for humans, have an obligate estuarine phase. The provision of suitable physical habitat thus supports many of these commercial fisheries.

Other than direct human consumption, estuaries produce many other useful materials such as vegetation that may be used as fertilizer and grazing for livestock. In the lower portion of the river system, particularly in the area around the town of Tongaat, utilisation of goods and services (fish, wood for fuel, building and handicrafts, medicinal plants, and riparian grazing) is of high importance to a significant proportion of the population. However, there is no recorded use of building materials (e.g. reeds, sand) gathered from the within the estuarine area for subsistence or commercial purposes, the only exception being that sand is mined just upstream of the estuary head. The lack of subsistence use is unsurprising because of the lack of traditional dwellings close to the estuary.

### 4.2.2 Carbon sequestration

Carbon sequestration is a pivotal ecosystem service provided by estuaries, which assists in addressing the important issue of climate change. Estuary sediments have been shown to act as a significant store of carbon and, if undisturbed, they can store carbon for thousands of years.

Carbon transported down the catchment by rivers and tides, or that originates in the estuarine environment, are trapped by estuary plants or degrade into the sediments. An estuary therefore has the potential to store the carbon released by an entire catchment. Coastal habitats that capture and store this “blue carbon” in sediments contribute significantly to reducing the free atmospheric carbon.

### 4.2.3 Waste treatment

Estuarine sediments serve both as reservoirs and as potential sources of contaminants to the water column. Estuaries naturally act as a sink for anthropogenic waste originating in catchments. Pollutants are often introduced into estuarine environments through anthropogenic activities such as farming, waste treatment, industries and human settlements. Waste from anthropogenic inputs increases concentrations of pollutants such as metals, often to concentrations that indicate enrichment over natural background levels. When introduced into the aquatic environment, contaminants eventually accumulate in estuarine sediments where it may remain bound to sediment particles until remobilized. In addition, the estuarine environment also contributes to waste treatment through the breakdown and detoxification of pollutants discharged from land based activities. Wetlands associated with estuarine floodplains also act as filters of organic contaminants and convert the nutrients through anaerobic nitrification into nitrogen, preventing eutrophication and subsequent enrichment of estuarine and coastal waters.

### 4.2.4 Refugia and nursery areas

Large temporarily closed estuaries such as the iLovu serve as very important nursery habitat for a large number of marine, estuarine and freshwater organisms, most notably prawns and fish (Forbes and Forbes 2013, Tweddle *et al.* 2016), as they provide a suitable range of environmental niches and habitats. Many of these organisms have an obligate estuarine phase, during which the post-larvae and juveniles migrate into the nutrient rich, warm and stable estuarine environment, where they stay until reaching the sub-adult stage. Prolonged closure and/or freshening of such systems will affect the nursery functioning and prevent recruitment. In addition, poor water quality and habitat loss will equally result in reduced provision of this important ecosystem service.

The high species count of estuarine dependent prawn and fish species recorded in the iLovu Estuary is clear evidence of the very important ecosystem service the estuary performs in this regard.

### 4.2.5 Export of materials and nutrients

Assimilation and release of materials and nutrients from the estuarine environment into the marine environment represent one of the key ecosystem services of estuaries. Large temporarily closed

estuaries such as the iLovu serve to assimilate nutrients from various catchment sources, which are then released back into the estuary and most importantly, into the coastal marine environment. Nutrients from such estuarine systems contribute significantly to the productivity of the coastal ecosystem. In addition, sediment transport through the estuary provides the much-needed substrate for benthic organisms in the coastal environment and replenishes beaches. Change in mouth dynamics due to reduced runoff from the catchment often leads to extended mouth closure, with nutrient being trapped in the lower estuary. This deprives the coastal marine environment of the nutrients upon which the coastal ecosystem depends.

### 4.2.6 Tourism and recreational value

Historically, people have inhabited coastal areas, particularly along rivers and estuaries and estuarine mouths, largely due to the aesthetic value of these areas. People are attracted by the aesthetic quality of estuaries as they are invaluable open spaces in coastal cities. A local valuation considers estuaries one of the highest value ecosystems within the Durban open space system (Forbes and Demetriades 2008).

Residential development makes up a very small proportion of the land-use of the iLovu estuary. This is mainly due to the fact that the iLovu is a relatively small rural estuary surrounded by farmland. The infrastructure for large scale urban development simply does not exist at present. In additional, the iLovu does not seem to have exceptional tourism value and at least in the near future, will serve a limited commercial tourism function. The iLovu mouth is however a popular beach and recreational fishing spot.

Harrison *et al.* (2000) reviewed the aesthetics of KZN estuaries and rated the iLovu as of intermediate aesthetic value, with poor water quality and habitat disturbance in the system being the primary reason for the relatively low score. The overall socio-cultural scores give to the iLovu Estuary by DWA (2103) as part of their estuarine health index determination of the estuary given in Table 4.2.

**Table 4.2.** Overall Socio-Cultural scores for the iLovu Estuary (DWA 2013).

| Ritual Use (0-5) | Aesthetic (0-5) | Resource Dependence (0-5) | Recreational Use (0-5) | Historical/ Cultural (0-5) | Ecosystem Services Score |
|---|---|---|---|---|---|
| 2 | 4 | 2 | 4 | 2 | **2.49** |

# 5. IMPACTS OR POTENTIAL IMPACTS TO ESTUARY

## 5.1 BRIDGES AND CAUSEWAYS

According to MER (2019a) the system has a long history of human interference and modification. A rail bridge in the approximate position of the present road bridges appears in the 1936 aerial photographs. The present rail bridge at the mouth "built upon an enormous 500 m long causeway across what was formerly wetland and water areas" (Begg 1978) was constructed in 1940. The old national road bridge, now part of the R102, was built in 1984 and the freeway over the period 1979-1981. Begg (1984) emphasised the changes that had occurred as a result of bridge building, sugarcane farming and canalisation and which could be identified from aerial photographs. These and subsequent photographs, including those from 2007, clearly demonstrate the total loss of the flood plain on the northern bank between the railway line (Figure 5.1) and the road bridges (Figures 5.2 & 3.3) and the construction of levees upstream of the road bridges, which have allowed virtually the entire flood plain to be put under sugarcane.

**Figure 5.1.** Railway bridge at the mouth of the iLovu Estuary.

The risks of placing hard structures on flood plains have been graphically illustrated in the case of the iLovu. The road bridge and railway bridge embankment were washed away in 1959. The road bridge collapsed in 1976 and again in 1987. Begg (1978) quoted suggestions that at that time there was a perception that flood events were becoming more frequent because "the system no longer had the capacity to absorb such volumes of water" due to "infilling as a result of high rates of siltation". An assessment of the state of the Physical Habitat of the iLovu Estuary (DWA 2013) (Table 3.8) clearly shows that bridges have had a major impact on the estuary.

**Figure 5.2.** Oblique aerial showing the 500 m long causeway which has effectively removed part of the estuary (from MER 2019a).

**Figure 5.3.** The double Bridge Dual Lane Freeway (N2) crossing the iLovu Estuary, with the old main road (R102) bridge in front of it. Note the remnant pilings of a previous bridge still in position in front of the three bridges.


**Figure 5.4.** Google Earth Image (January 2021) showing the three bridges (Dual N2 & R102) and the railway line crossing the iLovu Estuary.

Another barrier that has been identified is a Rock Causeway which is positioned just East of the 4th road bridge some 4.1 km upstream of the estuary mouth (Figure 5.5). It is currently unknown whether or not this causeway is a barrier to tidal flow in the iLovu Estuary.

**Figure 5.5.** Rock Causeway just east of the 4th road bridge across the iLovu Estuary.

## 5.2 SEDIMENTATION WITHIN THE ESTUARY

As per the findings of a wetland study for Umgeni Water by Gibb (2019a), the iLovu River suffers from a turbidity problem as a result of improper farming practices and overgrazing occurring within the catchment, which has given rise to soil erosion. Additional problems affecting the catchment include; high *E.coli* levels within watercourses due to inadequate infrastructure of the surrounding informal settlements, as well as high phosphate levels which is attributed to over fertilisation of the agricultural lands.

## 5.3 SAND MINING

According to Demetriades (2007), extraction of material within or near a streambed will have a direct impact on the stream's physical habitat characteristics. These characteristics include channel geometry, bed elevation, substrate composition and stability, instream roughness elements (large woody debris, boulders etc,), depth, velocity, turbidity, sediment transport, stream discharge and temperature.

The negative impacts on the biota are caused by three main processes:

- Alteration of the flow patterns resulting from modification of the riverbed,
- An excess of suspended sediment, and
- Damage to the riparian vegetation and instream habitat.

The disturbance activities can also disrupt the ecological continuum in a number of ways. Local channels changes can propagate impacts upstream and downstream and can trigger lateral

changes. Alterations of the riparian zone can result in changes in channel conditions that can impact aquatic ecosystems in a similar way to some in-channel activities. The interconnectedness of channels and riparian systems requires the simultaneous evaluation of potential disruptions of the riparian zone.

Demetriades (2007) noted that the iLovu Estuary is a relatively heavily mined system with seven mining sites being recorded. They noted that in places 3 m high berms had been constructed down the centre of the river channel rendering them extremely vulnerable to erosion (Figures 5.6, 5.7 and 5.8). A record of historical sand mining from 1980 to as recent as 2018 is illustrated in Appendix 4. A proposed 100m buffer from the 20m contour is indicated on the final map.

Although the system was characterized by semi-turbid conditions during his study, McLean (unpublished M.Sc. data, as quoted in MER 2019b) recorded extremely high turbidities reaching a maximum of 883 NTU in the lower reaches during high flows in February 2007. This was considered to be due in part to the activities of the sand mining operations which generated unconsolidated sediments in the river channel and denude the floodplain alluvium of vegetation, exposing it to erosion (MER 2019a).

According to Dawson *et al.* (2021), specifically low-value sand mining has been identified has having impacts on critical estuarine habitats, water flow, the grain size of sediment and depleting sediment reservoirs that are vital to replenish physical habitat after flood events cause scouring. In addition, the frameworks governing small-scale sand mining in South Africa lack the necessary capacity to support better environmental compliance, and the enforcement mechanisms to successfully deter illegal activities are weak (Dawson *et al.* 2021). Based on the available information sand mining is definitely having a major impact on the iLovu Estuary, its structure and ecological functioning.

**Figure 5.6.** Sand Mining in the iLovu Estuary upper reaches (Source: Coast KZN, ORI).

**Figure 5.7.** Sand mining operation on the iLovu Estuary, clearly illustrating infilling, river diversion and destruction of riverine habitat (from MER, 2007).

**Figure 5.8.** Sand mining on the north bank of the iLovu estuary showing the destruction of the floodplain vegetation (from MER 2019a).

CSIR (2008) reviewed the sediment budget of estuaries within the eThekwini Municipality, with the aim to assess the ecological impact of sand mining on estuaries, as well as the long-term sustainability of the sand resource and potential implications for coastal stability. In a number of systems, including the iLovu Estuary, sand mining was found to be detrimental to the ecosystem as the annual mining volume (48 720 $m^{-3}$ pa) far exceeded (by 52%) the mean annual sand yield (23 240 $m^{-3}$ pa) of the catchment, resulting in a substantial sediment deficit. The implication is that sand mining extract much more sand than the catchment would "naturally" have provided to the coast, leading to long term coastal instability and erosion. This is in addition to the direct impact of sand mining on riparian erosion as well as sedimentation and poor water quality in the estuary. **Most importantly, the ecological and socio-economic contribution of sediment from the iLovu Estuary to the "value" of coastal processes (e.g. erosion prevention, recreation, urban development, ecological functioning and coastal conservation), called Opportunity Costs, also far outweigh (R109.6 $m^{-3}$) the direct financial benefit of sand mining (R 30.2 $m^{-3}$).**

## 5.4 MICRO PLASTICS

Naidoo *et al.* (2015) reported microplastic concentrations in five estuaries in the subtropical zone, viz. uMdloti, uMgeni, Durban Bay, iSipingo, iLovu. In the sediment, MP concentrations ranged from 13.7 at iLovu to 159.9 particles/500 ml at Durban Bay; concentrations in the water column ranged from 7.4 at iLovu to 31.07 particles/kL at iSipingo. Microplastic concentrations in the iLovu Estuary were however consistently lower than in estuaries around Durban.

## 5.5 ALTERATIONS TO FLOODPLAIN AND INVASIVE / ALIEN SPECIES

### 5.5.1 Alteration to the Floodplain

According to MER (2019b) the vegetation within the mapped estuary areas has been substantially transformed and no longer corresponds with what naturally occurred. Although some is due to alien plant invasion, this transformation has been greatly spurred by agricultural conversion of land adjacent to and within the EFZ. The floodplain of iLovu has been severely impacted. Bank alteration and encroachment of sugar cane cultivation onto the floodplain is evident in even the earliest available (1937) aerial photographs. A stand of *Hibiscus tiliaceus* occurs along the south bank of the lower estuary but its distribution is limited by the steep rise in terrain on the landward side. Upstream a fringe of riverine vegetation occurs along the banks of the river and the coastal vegetation surrounding this on both the north and south sides are disturbed, and alien infested. Dune thicket occurs along the coast on either side of the estuary. Further upstream the area is characterized by agricultural development. As a result, the species composition of most of the open vegetation bears little resemblance to what should occur under natural conditions, while a large amount of the woody vegetation within the estuary, estimated at more than 50%, comprises alien species.

### 5.5.2 Alien invasive Species

The invasive alien snail *Tarebia granifera* has according to MER (2019b) managed to spread into the iLovu Estuary. They state that the snail has continued to expand in KZN coastal lakes, rivers and estuaries and the iLovu is no exception, although as yet, no data exist to suggest that this has had an effect on the indigenous diversity. *Tarebia* has however been considered as a biological control mechanism against bilharzia vector snails in other parts of the world so there is a presumption that it is able to displace or outcompete other snail species. This has however not yet been conclusively shown to be the case in South Africa (MER 2019b).

## 5.6 WATER QUALITY AND WASTEWATER DISCHARGES

Although Demetriades and Forbes (2008) noted an improvement in water quality in the iLovu Estuary since the 1980s during their 2007/2008 survey, the water quality of the system is still regarded as in an intermediate to poor state. Both the 2011 (van Niekerk and Turpie 2012) and 2018 (van Niekerk *et al.* 2019) NBA reports stated that pollution pressure in the estuary was of medium intensity. This suggested no improvement in pollution pressure from 2011 to 2018. In addition, the 2011 NBA report (van Niekerk and Turpie 2012) rated the health of the estuary in terms of its water quality at level 2 (Fair), on a 4-point scale (1. Poor → 2. Fair → 3. Good → 4. Excellent). This contributed to a Habitat State and Overall Estuarine Health score also at level 2 (Fair), which should be considered low for a relatively un-industrialized, rural, predominantly open

estuary. This confirms poor water quality as an ongoing concern and a source of ecosystem pressure.

Although the iLovu Estuary and lower iLovu River flows through predominantly rural and agricultural areas, with limited industrial development, the extent of wastewater and indirect sewage discharge along the catchment is largely unknown. With a river length of 135km, flowing through large areas of peri-urban settlements, the potential for contamination by wastewater effluent, sewage and small-scale industrial discharge thus remains high. Demetriades and Forbes (2008) did however report that nutrient concentrations recorded during 2007/2008 were comparatively low compared to the other 16 KZN estuaries assessed as part of the 2008 Estuaries of Durban report.

## 5.7 SUMMARY OF IMPACTS AND PROBLEMS

Various aspects and activities threaten or potentially threaten the health of the estuary and will collectively contribute to an array of problems and associated environmental impacts and socio-economic consequences if not managed appropriately. It remains challenging to attribute direct linkages between activities, problems and impacts i.e. several aspects/activities can contribute to one or more problems which, in turn, can contribute to more than one impact, and vice versa. Tables 5.1 and 5.2 provide an overview of categorised linkages and relationships between activities/aspects, potential problems and associated ecological impacts and socio-economic consequences.

## 5.8 RESTORATION MEASURES NEEDED TO IMPROVE ESTUARY CONDITION AND PRODUCTIVITY

The 2018 NBA rates the cumulative pressure level of the iLovu Estuary as high, with the main pressures listed for the estuary including, Flow Modification, Habitat Loss and Fishing Effort (very high), whilst Cumulative Impacts, Pollution and Alien Invasive Plants being of a medium pressure level (van Niekerk *et al.* 2019). Together these allow the identification of a number of management actions for restoration of the estuary and floodplain.

The restoration measures recommended van Niekerk *et al.* (2019) for the improvement of the iLovu Estuary are listed as follows:

- The restoration or protection of freshwater base flows reaching the estuary.
- Manage/reduce stormwater & drainage from flood plain
- Improved management or reduction of stormwater and drainage from flood plain.
- Rehabilitate riparian areas and wetlands
- Remove/reduce fishing pressure/bait collection
- Improved mouth management (prevent unauthorised breaching).

- Remove alien vegetation.

**Table 5.1.** An overview of key activities and linkages to potential environmental problems if not managed appropriately.

| CATEGORY | ACTIVITY / ASPECT | PROBLEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Siltation | Physical habitat alteration/ destruction | Alteration of salinity regime | Eutrophication | Toxic chemical pollution | Microbial contamination | Littering | Suspended solids | Direct alteration of biomass / species |
| Land-use & Infrastructure Development | Alien vegetation infestation in flood plain | x | x | x | | | | | | x |
| | Veld fires | x | x | | | | | | x | x |
| | Road Infrastructure (including roads, crossings, culverts) | x | x | x | | | | | x | |
| | Riparian Infrastructure (including fences, low-lying developments) | x | x | x | | | | | x | |
| | In-stream infrastructure (e.g. jetties, pumphouses) | x | x | | | | | | | |
| | Recreational activities (boating, canoeing, fishing, swimming) | | x | | | | | x | | x |
| | Mining (sand) | x | x | | | x | | | x | |
| | Artificial breaching | | x | | | | | | | x |
| | Agriculture: crop production & livestock in catchment | x | x | | x | x | x | | x | |
| Water Quantity & Quality | Water abstraction (river, groundwater, direct abstraction, sumps) | | x | x | x | | | | | |
| | Alien vegetation infestation in catchment causing flow reduction | | x | x | x | | | | | x |
| | Wastewater disposal (non-reticulated sewage upstream) | | | | x | x | x | | | |
| | Solid waste disposal (building rubble, leachate and litter from municipal landfills | | x | | | | | | | x |
| | Agricultural return flows | | | x | x | x | x | | | x |
| Living Resources | Harvesting and burning of reeds and sedges | | x | | x | | | | x | x |
| | Gill netting of indigenous fish species | | | | | | | x | | x |
| | Introduction of alien fish species | | | | | | | | x | x |
| | Agriculture: Livestock grazing of riparian zone | x | x | | | | | | | x |

**Table 5.2.** Environmental impacts and socio-economic consequences potentially associated with specific problems.

| CATEGORY | IMPACTS / CONSEQUENCES | PROBLEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Siltation | Physical habitat alteration / destruction | Alteration of salinity regime | Eutrophication | Toxic chemical pollution | Microbial contamination | Littering | Suspended solids | Direct Alteration of biomass/species |
| ECOLOGICAL | Modification / loss in species composition | x | x | x | x | x | x | | x | x |
| | Smothering of benthic communities | x | x | | x | | | x | x | |
| | Entanglement of organisms (e.g. birds) | | | | | | | x | | |
| | Chronic effects on biota | | | x | x | x | x | | x | |
| | Mortality (acute effects) on biota | | | x | x | x | x | | x | |
| | Opportunistic / nuisance / harmful algal blooms | | | x | x | | | | | |
| | Anoxic conditions | | x | | x | | | | | |
| | Pathogenic infections in biota | | | | x | x | x | | | |
| PUBLIC HEALTH AND SAFETY | Human health and safety risks through recreational activities | | x | | x | x | x | | | |
| | Human health risk through ingestion of contaminated seafood | | | | x | x | x | | | |
| FOOD SECURITY AND POVERTY | Loss in quality of seafood products | | | | x | x | x | | x | x |
| | Loss of fisheries resources and revenue | | x | x | x | x | x | | x | x |
| OTHER SOCIO-ECONOMIC | Loss of aesthetic value (e.g. for tourism) | x | x | | x | | | x | x | x |
| | Loss of coastal real estate, public facilities and recreational potential | | x | | x | | x | x | x | x |

# 6. OVERVIEW OF SOCIO-ECONOMIC CONTEXT

The information provided in this chapter has primarily been taken from the eThekwini Municipality's most recent Integrated Development Plan (IDP), Spatial Development Framework (SDF), South Spatial Development Plan (SSDP) and the Local Area Plans (LAPs) for the Illovo area i.e., Illovo South and Illovo Bhekulwandle.

## 6.1 DEMOGRAPHIC

### 6.1.1 General Characteristics of the eThekwini Municipality

The eThekwini municipal area (EMA) is largely metropolitan in nature notwithstanding some rural settings and a wide range of formal and informal land uses. The main languages spoken in the EMA are isiZulu and English. Rural areas i.e. traditional structures and communal land with dispersed settlement patterns form the majority (68%) of the municipality with about 10% comprising commercial agriculture and metropolitan open space. There are also a large number of informal settlements distributed throughout the municipality and on the periphery i.e. on steep lands or flood plains which makes them vulnerable and at-risk communities. The remainder of the municipal areas are urban in nature comprising residential, commercial and industrial land uses.

In 2001 the population of eThekwini was 3.09 million (Stats SA, 2003) growing at an average annual percentage of 1.13% per annum reaching 3.44 million according to the 2011 national census (Stats SA, 2012) with the next Census scheduled for 2021 (eThekwini Municipality, 2020). Stats SA use the following demographic assumptions during population censuses: fertility rate, life expectancy, mortality rates, HIV/AIDS and migration patterns. In addition to the short-term demographic forecasts, Stats SA undertook a community survey in 2019 which estimated the 2020 eThekwini population at over 3.94 million (eThekwini Municipality, 2020). The forecast in Table 6.1 below indicates population projections for eThekwini between 2020 and 2024 when the population total is estimated to exceed 4.16 million by 2024.

**Table 6.1.** Population growth projection for eThekwini between 2020 and 2024.

| Year | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Total Population | 3 947 020 | 4 004 603 | 4 059 719 | 4 112 675 | 4 164 503 |

*Source*: eThekwini Municipality, 2020.

In terms of population distribution across the EMA, the greatest concentrations of people occur in the Central and North planning regions. The Outer West region represents the largest extent of the Municipality (approximately 78 438ha) and comprises 11% (approximately 338 000 people) of the total municipal population. The North region represents approximately 26% of the total extent of the municipality with approximately 1.15 million people equating to 33% of the total municipal population. The majority of the population of approximately 1.18 million people (34% of

the total population) is located in the Central region, the second largest in extent in the municipality. The iLovu Estuary is situated within the South planning region where 23% of the total municipal population (760 000 people) resides.

At a more localised level and according to 2013 South Illovo LAP, there were approximately 27 108 people residing in the Illovo area i.e. Illovo South and Illovo North, which equated to 7 101 households with an average household size of 3.9 people per household (Table 6.2). The seaside town of Winkelspruit which falls outside the area of the LAP had an estimated population in 2011 of 1 689 people within 428 households. The iLovu Estuary is situated between North Illovo, South Illovo and Winkelspruit within wards 97, 98 and 109. At the time of compiling this report in 2021 (a decade after the 2011 census), the number of people living in the Illovo area, as illustrated in Table 6.2, is likely to have increased, possibly by as much as 30% if one compares the increase over a 10-year period in terms of the overall national census figures.

**Table 6.2.** 2011 population of Illovo South and Illovo North as recorded in the 2014 Illovo South LAP.

| Area | No. of people | No. of households |
|---|---|---|
| Illovo South | 1 843 | 461 |
| Illovo North | 25 265 | 6 640 |
| Illovo *(Combined Total)* | ***27 108*** | ***7 101*** |

*Source:* eThekwini Municipality, 2014

### 6.1.2 Characteristics of wards in the Illovo area

Recent empirical data at a localised level i.e. for wards 97, 98 and 107 is not readily available beyond the national census carried out in 2011. In addition to whatever information could be obtained from the municipal IDP and LAPs it was queried with the Stats SA Deputy Director-General for economic statistics, Mr. J de Beer, whether more recent data, such as unemployment data, was available at a ward or sub-place level for eThekwini where it was confirmed that only provincial data is updated by Stats SA. Recent household surveys at a ward level is currently not available (J. de Beer pers comm, 12 October 2021).

A recent community survey undertaken by Stats SA in 2016, which provides indicators at national, provincial and municipal levels relating to education, health, sanitation, water supply, housing, transport, etc was also consulted for more recent statistics and demographic information (StatsSA, 2016). Wazimap, a tool derived from the Census Reporter created in the USA as an independent project to make data from the community surveys easier to use, was explored for more specific and recent local data for wards in eThekwini (https://wazimap.co.za). Table 6.3 summarises various statistics for wards 97, 98 and 107 based on the 2011 National Census (Stats SA, 2011). If available, Wazimap includes data from the 2016 Community Survey however more

specific information sought for the wards in question relating to this situation assessment was not included (i.e. not updated) during the 2016 survey.

**Table 6.3.** Summary statistics for wards in the Illovo area.

| Statistic | Ward 97 | Ward 98 | Ward 109 |
|---|---|---|---|
| Size (km²) | 17.8 | 52.9 | 29.9 |
| Population | 25 132 | 33 990 | 41 550 |
| Density (people per km²) | 1 414.3 | 642.3 | 1 391.4 |
| Primary language spoken | English (51%) | IsiZulu (91%) | IsiZulu (90%) |
| Median age | 37 | 23 | 23 |
| Employment rate (%) | 60.7 | 30 | 35.4 |
| Annual household income (R) | 115 100 | 14 600 | 29 400 |
| Access to water (%) | 96.2 | 77.3 | 91.5 |
| Access to sanitation (%) | 97.7 | 36.2% | 77.1 |
| Refuse disposal (%) | 96.2 | 25.1 | 78.8 |
| Education - Grade 9 or higher (%) | 87.9 | 68.2% | 75.7 |
| Education - Matric or higher (%) | 68.7 | 37.2 | 45.9 |

Source: https://wazimap.co.za

## 6.2 ECONOMIC PROFILE

### 6.2.1. General overview

The eThekwini region is the economic powerhouse of KwaZulu-Natal making a significant contribution to the South African economy. It is a vital link between the regional economies of Pietermaritzburg (and onward to Gauteng) and Richards Bay and ranks as the second largest economic center with the second most significant industrial region in South Africa (eThekwini Municipality, 2017b). In terms of the municipality's overall *Economic Development and Job-Creation Strategy 2013-2018*, the main objective was to introduce a suite of fundamentals to drive economic growth over a 20 year period focusing on growth opportunities and capitalising on the role of the Durban Port, the King Shaka International airport and modernising rail, road, infrastructure, information, innovation and communication technologies.

In 2016, the eThekwini economy was predominantly based on tertiary industries including finance (20%), manufacturing (19%), community services (20%), trade (18%), transport (14%) and construction (6%). Gross Domestic Product (GDP) in eThekwini increased by 0.9% in 2016 (R292.1-billion) with positive growth recorded in most sectors. Community services (1.9%), finances (1.7%) and manufacturing (1.2%) were the best-performing sectors. The lowest growth which was in fact negative growth was recorded in the agriculture sector at -7.4%.

### 6.2.2 Local economy

At a more local level, the economy in the Illovo area is currently and was historically driven by the agricultural sector where commercially cultivated sugarcane was the primary land use activity along both the north and south banks of the iLovu River, which includes some sections of

property/land bordering with the estuary. Quantitative economic statistics typically required to develop a more accurate economic profile specifically for the Illovo area are not readily available in the literature (including municipal documentation) and the acquisition and inclusion of specific data would go beyond the scope of this report. Some economic statistics are however available for the eThekwini Southern Planning Region (in which the Illovo area is situated) and have been included in the chapter sub-sections below as a proxy representation of the local Illovo area.

6.2.2.1. Gross Value-Added (GVA) Contribution

GVA is a measurement of Gross Domestic Product (GDP) used for measuring Gross Geographic Product (GGP) and other measures of the output of entities smaller than a whole economy. GVA contribution allows for a more comprehensive understanding of the Municipality's economic climate and economic sectors. From a perspective of the sectoral GVA profile, Table 6.4 illustrates that the South African economy has a service-based, tertiary economic structure, with these sectors contributing a combined 68.6% to the GVA output of the country. A similar contribution is made by this sector in the KZN economy (68.2%). eThekwini's economy is structured slightly differently, with a significantly lower contribution made by primary sector industries (1.3%) and a relatively higher contribution made by secondary sector industries (27.4%) and tertiary industries (71.4%). This is in contrast to the eThekwini South Region where secondary sector industries contribute a relatively larger GVA output (34.2%) (Quantec 2018, Urban-Econ 2018).

**Table 6.4.** Comparative GVA sectoral profile in 2016.

| INDUSTRY | ECONOMY | | | |
|---|---|---|---|---|
| | **South Africa** | **KwaZulu-Natal** | **eThekwini (All)** | **eThekwini South** |
| **Primary** | 10.3% | 5.4% | 1.3% | 1.3% |
| **Secondary** | 21.1% | 26.4% | 27.4% | 34.2% |
| **Tertiary** | 68.6% | 68.2% | 71.4% | 64.5% |

Figure 6.1 provides a comparison of the indication of the year-on-year growth in GGP for South Africa, KwaZulu-Natal, the eThekwini Municipality and the eThekwini Southern Region, which can be measured by GVA at constant 2010 prices for the period 2007 to 2016 (Quantec 2018; Urban-Econ 2018). All four economies witnessed strong year-on-year GVA growth between 2006 and 2007 of between 5.2% and 6.3%. After 2008 the growth trajectory deteriorated significantly in all four economies, with a year-on-year contraction in GVA of between 1% and 1.4% in 2009 at the height of the Global Financial Crisis (GFC). An economic recovery was experienced in all four economies, thereafter, as evidenced by the relatively strong economic growth of between 2.9% and 4.1% in the period 2010 and 2011. Between 2012 and 2016, GVA growth underwent a downward trend falling to a low point of between 0.4% and 1.1%, again the downward trend being similar across all four economies (Figure 6.2).

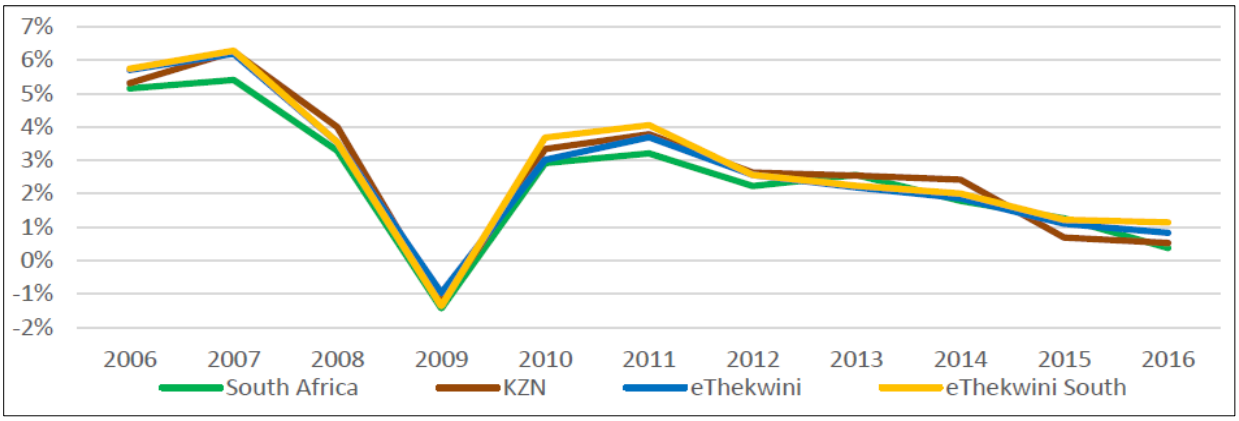


**Figure 6.1.** Year-on-year change in GVA, 2006-2016.

The relative 2016 GVA contributions made by the ten major economic sectors in South Africa, KZN, eThekwini and the eThekwini South Region are illustrated in Figure 6.2b (Quantec 2018, Urban-Econ 2018).

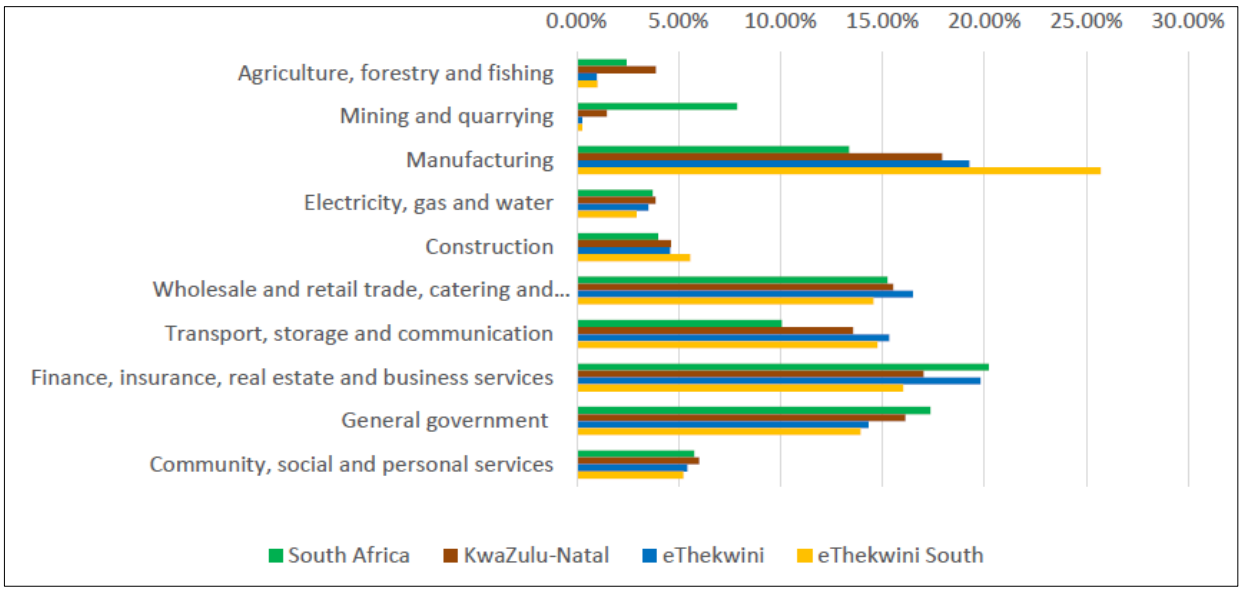


**Figure 6.2.** Sector-based industry GVA contributions across the four economies in 2016.

As shown in Figure 6.2 the manufacturing sector contributes significantly to the economies of KZN (18%), eThekwini (19.3%) and eThekwini South (25.7%). The manufacturing output of the entire eThekwini Municipality accounts for 59.2% of KZN's manufacturing GVA with the eThekwini South Region contributing 9.9% towards the manufacturing GVA of the municipality. The manufacture of transport equipment is therefore a relatively significant industry within the eThekwini South economy contributing approximately R951 million to the municipal economy in 2017 (Quantec 2018, Urban-Econ 2018).

Figure 6.3 shows an overall perspective of the current land types and associated human settlements surrounding the iLovu estuary based non-strategic municipal data (eThekwini GIS).

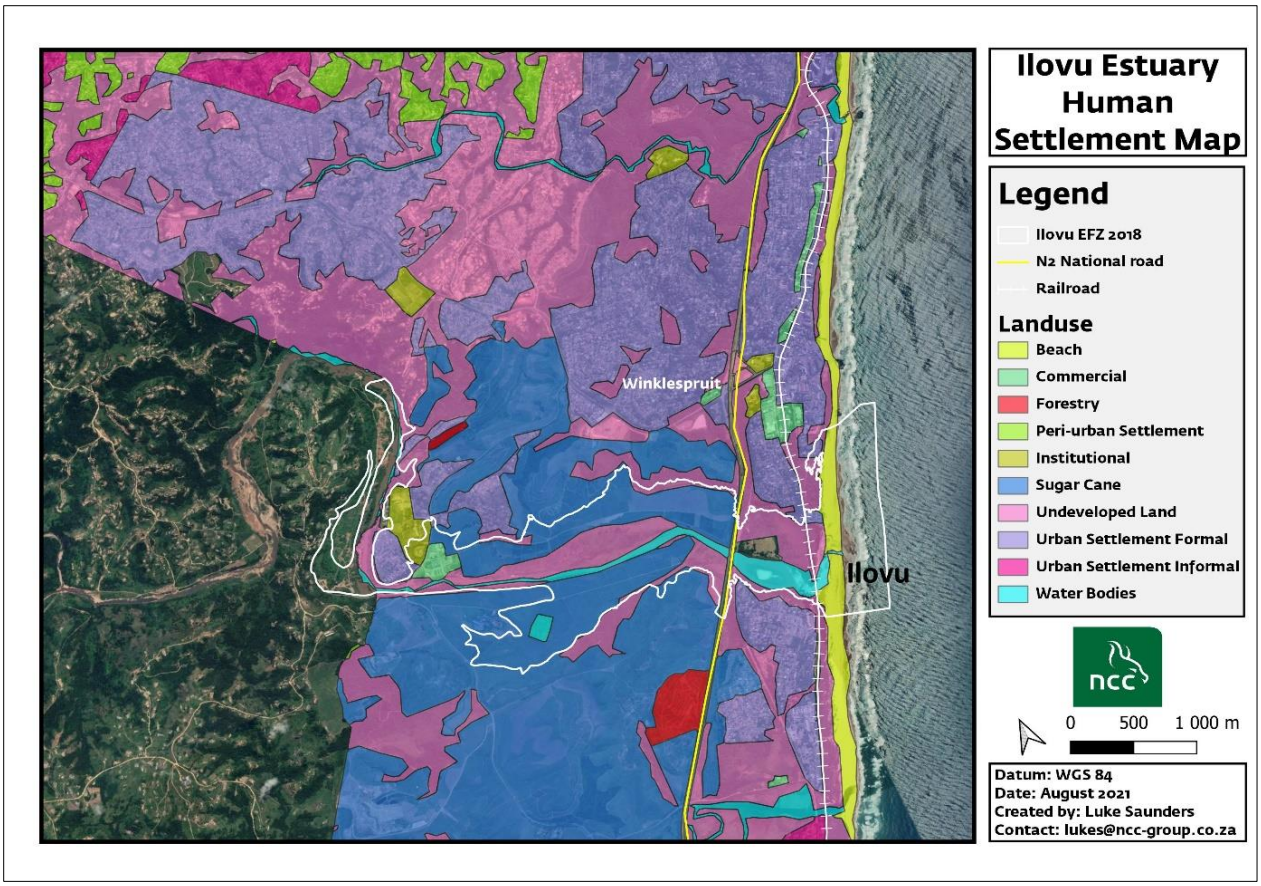


**Figure 6.3.** Land types and human settlements around the iLovu Estuary.

6.2.2.2 Future economic context in relation to the Illovo area

In relation to the eThekwini Spatial Development Framework (SDF), the Illovo area is considered an important urban development node and corridor (eThekwini Municipality, 2017a). The Illovo South Boundary is within close proximity to the South end of Durban Port and forms part of the Strategic Investment Project (SIP 2) corridor from the South of Durban inclusive of the Port to Gauteng. The Port expansion plans, the Back of Port Plan, the Dedicated Freight Route and the Automotive Supply Park (ASP) are all integral elements of SIP 2 and are considered crucial to the economy of eThekwini and KZN (eThekwini Municipality, 2021a). Figure 6.4 shows the existing and proposed land uses surrounding the estuary based on spatial data obtained from the eThekwini GIS portal.

In terms of the main economic drivers in the context of recent proposed plans for growing the local economy, there are future development plans within the Illovo area in terms of a collective proposal to shift largely from agricultural land use towards other sectors of development which will ultimately form part of a collective Special Economic Zone (SEZ). The original landowner, Illovo Sugar (Pty) Ltd has recently sold much of the land to Dube Trade Port Corporation (DTPC) who have been requested by the KZN MEC for Economic Development, Tourism and Environmental Affairs (EDTEA) to investigate the feasibility of developing a large-scale industrial

park where various land uses such as general industry, industrial, business and municipal infrastructure (water reservoir and electrical substation) are proposed. This proposal is in alignment with the municipality's approval of the South Illovo LAP which includes the development of 3 792 residential homes, 1 316 207m$^2$ of industrial space and 51 810m$^2$ of commercial space catering predominantly for the planned development of an Automotive Supplier Park (ASP).

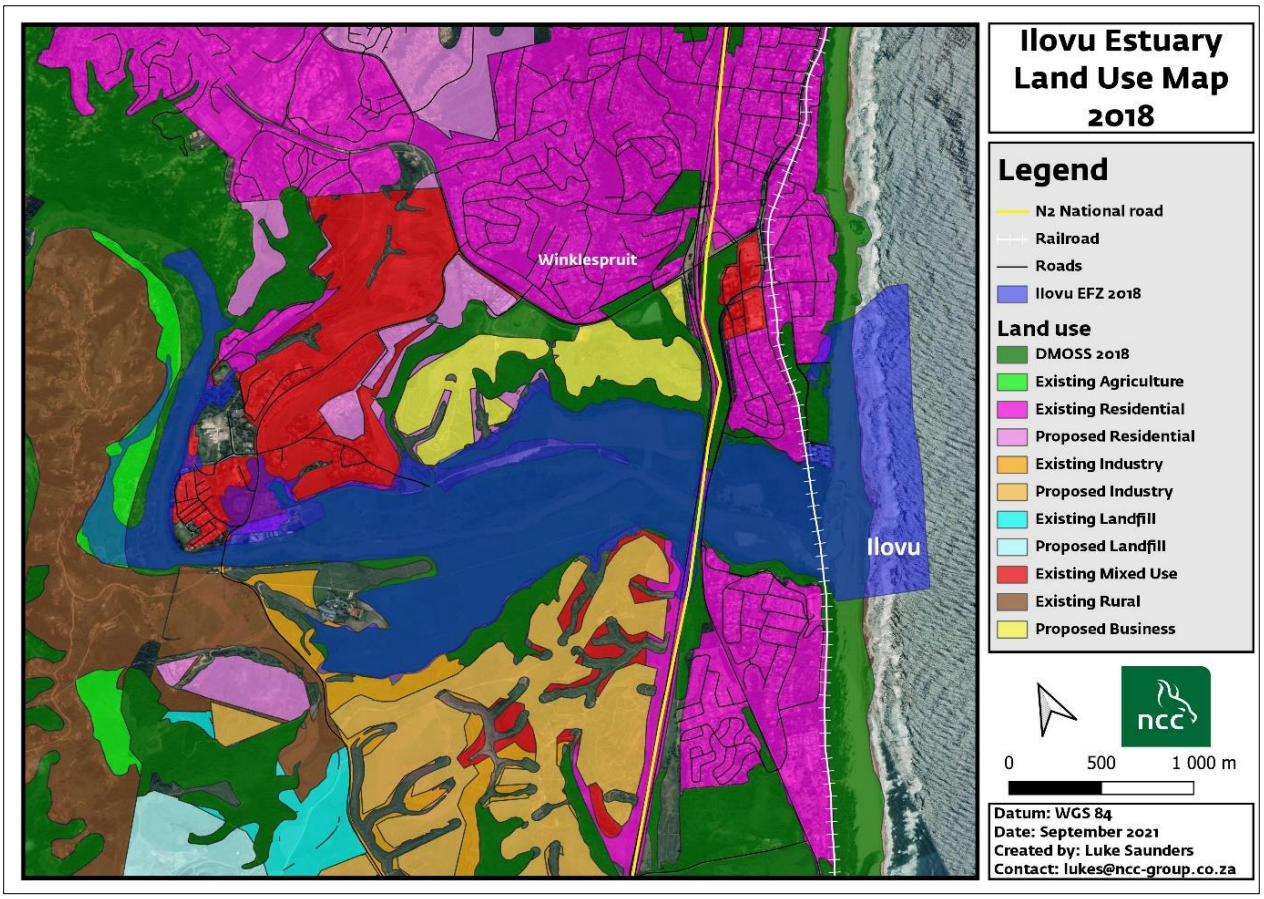


**Figure 6.4.** Existing and proposed land uses surrounding the iLovu Estuary.

It is expected that the ASP will accommodate at least 100 hectares of 'developable' industrial land. In addition, the establishment and operation of a seawater reverse osmosis (desalination) plant by Umgeni Water SOC, the largest supplier of bulk potable water in KwaZulu-Natal, was authorised by the relevant national government authority in 2017. The sites for both proposed developments fall within the Illovo area on the southern side of the ILovu River and Estuary. From a biodiversity and conservation perspective, ecologically important and sensitive wetland and estuarine areas will be offset and/or set aside for open space/conservation use to maintain ecological connectivity between the terrestrial and aquatic (riverine, estuarine and marine) components via a system of ecological corridors and/or buffers.

## 6.3 SOCIAL CONSIDERATIONS

### 6.3.1 Education and schooling

In terms of education, illiteracy levels have decreased in the EMA between 2003 and 2015 however illiteracy is still highest compared to that of other metropolitan municipalities i.e. Johannesburg and Cape Town (eThekwini Municipality, 2017b). 26% of the population in the EMA have some secondary education (Grade 12/Standard 10), 25% have some primary education and 7% have no schooling. Only 5% of the population in eThekwini have tertiary level education which is lower than the City of Cape Town and Johannesburg metros (eThekwini Municipality, 2020). Recent studies have shown at a more local level, which includes the EMA sub-places of Illovo North and South (with a combined area of 21.36km$^2$) that there has been a steady decline in the proportion of the population over 20 years of age with no formal schooling with an average annual decline of 4.3%, however the compound annual growth rate (CAGR) in these two areas in comparison to the broader EMA and KZN in general, is higher (Urban-Econ 2019). Although somewhat speculative, this shift in the educational profile gives an indication that there is a generally improving skills base in the labour force in Illovo North and Illovo South (Urban-Econ 2019).

### 6.3.2 Employment and income

Employment levels are an important indicator of socio-economic wellbeing as they provide insight into the proportion of the population with access to income and the ability to provide for basic needs, such as food and shelter, among others. With a steadily growing population the majority of people in the EMA are under the age of 35 years (57%) where unemployment rates are relatively high (eThekwini Municipality, 2020). The EMA has uneven distribution of economic opportunities with most employment and consumption opportunities concentrated in the central core areas i.e. Durban City Centre, Durban South Basin, the Port of Durban and the Pinetown and New Germany areas (eThekwini Municipality, 2017a).

In terms of a recent study where extrapolations based on historical trends were carried out, it was indicated that a relatively high proportion of the population in Illovo North and Illovo South are likely in formal employment (89.4%) with a relatively low correspondingly unemployment rate (10.6%) (Urban-Econ 2019). This extrapolated figure is considerably lower than the national unemployment rate of ~27.2% (eThekwini Municipality, 2017b). As highlighted in the 2020 IDP, unemployment rates in KZN (33.4%) and eThekwini (27.7%) were comparatively higher compared to Illovo North and South (eThekwini Municipality, 2020). The employment figures shown in Table 6.3 do not correspond closely with the findings of the 2019 study and this may be attributable to various factors such as differences in the methods used, the areas sampled, the sample sizes, etc. The current economic situation exacerbated by the Covid-19 pandemic has

negatively affected employment and it is predicted that the potential unemployment rate across eThekwini has reached ~42.4% (eThekwini Municipality, 2021b) including the Illovo area. Recent figures released by Stats SA showed slight improvement in the jobless rate in eThekwini which increased by 1.8 percentage points to 34.4% in the second quarter of 2021 as compared with 32.6% in the previous quarter (IOL, 2021). Table 6.5 shows the comparative unemployment rates based on the second quarter labour force survey conducted in August 2021 (Stats SA, 2021).

**Table 6.5.** Comparative unemployment rates (%) for the last five quarters of 2020-2021.

| Quarter | Region | | |
|---|---|---|---|
| | South Africa | KwaZulu-Natal | eThekwini |
| Apr-Jun 2020 | 42.0 | 46.2 | 37.8 |
| Jul-Sep 2020 | 43.1 | 47.5 | 37.1 |
| Oct-Dec 2020 | 42.6 | 46.0 | 33.7 |
| Jan-Mar 2021 | 43.2 | 46.4 | 34.9 |
| Apr-Jun 2021 | 44.4 | 47.1 | 36.9 |

Stats SA (2021).

In terms of household income in the Illovo area, research conducted and data derived from random household surveys are summarised in the 2010 Illovo LAP. In 2010 the household income profile showed a combination of low and high income levels as follows:

- 31.3% earning between R6 401 and R12 800 per month,
- 18.8% earning between R3 201 and R6 400 per month,
- 16.7% earning between R25 601 and R5 120 per month, and
- 12.5% earned no monthly income.

More recent data was obtained during the 2011 National Census with a breakdown of the annual average household income for wards 97, 98 and 109 illustrated in Figure 6.5. It is evident that wards 98 and 109 are more rural in nature with less employment opportunities, higher unemployment rates and significantly lower income rates compared with ward 97 which is essentially the jurisdiction of the coastal town of Winkelspruit.

### 6.3.3 Covid-19

The negative impacts of the current Covid-19 pandemic are extensive worldwide. Importantly in the context of this situation assessment, the pressure on the iLovu Estuary in terms of the over utilisation of resources and more specifically illegal fishing through gill-netting due to high rates of unemployment and an ever-increasing number of people needing access to food has increased significantly with a concomitant loss of ecological functioning and a potential threat of the estuary becoming a collapsed (CO) ecosystem in the future.


**Figure 6.5.** Annual household income for wards surrounding the iLovu EFZ. (Source: https://wazimap.co.za).

### 6.3.4 Social Amenities

In terms of road infrastructure, access is generally good via the N2, R102 and MR197 in a north southerly direction and the R603 and MR242 in a east-westerly direction. Although formal development in the Illovo area started in the 1990s, there are limited signs of a maturing urban area. Social facilities are limited and most residents depend on higher functional areas such as Isipingo to purchase basic household goods and luxuries (eThekwini Municipality, 2010). The 2010 Illovo LAP acknowledges that socio-economic conditions in the area are similar in nature to most urban and peri-urban areas in KZN which are characterised with limited household level production, high levels of unemployment, low household income levels and limited access to social facilities.

In terms of access to water in the Illovo area according to 2001 data and modelled data for 2011, a large segment of households had access to piped water inside the dwelling (48.7%) with the next biggest segment having water access in the yard (23.1%). Provision of piped water from community stands accounted for 23.37% whilst just under 5% obtain water from either boreholes, rain-water tanks, wells, dams or rivers (Illovo LAP, 2010). In terms of access to sanitation in 2011, 68.84% of households had flush or chemical toilets, 17.98% had pit latrines, 1.34% had bucket latrines and 12% either unspecified or having no sanitation (eThekwini Municipality, 2010).

# 7. LEGISLATIVE INSTRUMENTS AND RELATED STRATEGIES/PROGRAMMES

## 7.1 LEGAL FRAMEWORK APPLICABLE TO ESTUARINE MANAGEMENT

This chapter provides an overview of legislation and policy applicable to the management of estuaries in South Africa and how it has relevance and relates to the iLovu Estuary. South Africa has an extensive legal framework for governing the protection and sustainable use of the coastal marine environment including at least 19 international obligations and agreements to which the country is signatory and approximately 46 national acts (Taljaard 2011, DEA 2014 and Taljaard *et al*. 2019). A comprehensive account of the legislative framework for estuary management including international and regional treaties and obligations, national policies and laws, provincial and local policies and legislation is also provided in Taljaard (2007) and Taljaard *et al* (2019).

### 7.1.1 Legislation and Policy

Policy and legislation which affects estuaries directly can be roughly divided into that affecting estuarine resources planning and protection, that which enables integration for estuarine management and that which governs the management of activities or uses in and around the estuaries (Table 7). The latter can be further divided into (i) water quality and quantity, (ii) land-use and infrastructure, and (iii) exploitation of living resources (van Niekerk & Taljaard 2002, Taljaard 2007). A summary of legislation, regulations, by-laws, policies and plans which govern land use, development and resource use in the estuarine environment and which either specifically or generally relate to water quality and quantity in estuaries is provided in Appendix 1. In addition, a number of integrated coastal management zones and their relevance to the proposed iLovu EMP, as contemplated in terms of the ICM Act, are outlined in Appendix 2.

South Africa's legal framework has a hierarchical structure with the Constitution (No. 108 of 1996) being the supreme law of the Republic which provides the legal framework for legislation regulating environmental management in general. Section 24 of the Constitution states that:
"*Everyone has the right:*

- *to an environment that is not harmful to their health or well-being; and*
- *to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that :*
    - *prevent pollution and ecological degradation,*
    - *promote conservation, and*
    - *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*".

**Table 7.** Primary South Africa legislation governing estuaries (van Niekerk *et al*. 2019).

| KEY PRESSURE CATEGORY | ACT | KEY FOCUS RELEVANT TO ESTUARIES | LEAD AGENT |
|---|---|---|---|
| WATER RESOURCE DEVELOPMENT | NWA | Ensures protection of aquatic ecosystems of South Africa's water resources, including estuaries, through classification of resources and establishment of RQOs. | DWS |
| | | Classifies certain land use (e.g. activities resulting in stream-flow reduction (e.g. afforestation and crop cultivation of crops). | |
| POLLUTION (INCLUDING PLASTICS) | NEMA | Some waste disposal activities (e.g. effluent discharges) are specified as listed activities. | DFFE |
| | ICM Act | Prohibits incineration at sea, and controls dumping at sea, land-based pollution in the coastal, inappropriate development in coastal environment and other adverse effects on the coastal environment. | DFFE |
| | NWA | The Act (section 21) identifies waste disposal (from land-based activities) as 'water uses' that require authorisation. | DWS |
| | NEMWA | Regulates (solid) waste management to protect health and environment by providing reasonable measures for prevention of pollution and ecological degradation. | DFFE |
| | Marine Pollution (Control and Civil Liability) Act | Provides for prevention and combating pollution in marine environment from oil and other harmful substances. | Dept. of Transport (prevention) DFFE (combating) |
| | National Health Act | Delegates responsibility for environmental health (e.g. water quality for recreation) to metropolitan and district municipalities. | Dept. of Health, eThekwini |
| EXPLOITATION OF LIVING RESOURCES | MLRA | Governs utilisation, conservation and management of marine living resources. | DFFE |
| | NEMBA | Regulates control and management of alien invasive species. Controls harvest, use, trade of selected species e.g. seahorses & pipefish (TOPS regulations under NEMBA). | DFFE |
| | CARA | Provides for conservation of natural agricultural resources and protection of vegetation. | DALRRD |
| LAND-USE & URBAN DEVELOPMENT | Disaster Management Act | Provides for integrated and coordinated disaster management policy (including disaster management related to climate change). Also Governs artificial breaching of estuary mouths in urban settings (once approval has been granted under NEMA). | EDTEA / eThekwini |
| | Local Government: MSA | Provides for integrated development planning intended to encompass and harmonise planning over various sectors. | Dept. of Provincial & Local Government & Municipality |
| | SPLUMA | Provides for a framework to govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses. | DRDLR / EDTEA/ eThekwini |
| | NEMA | Specifies listed activities in sensitive areas (including EFZs) that require environmental authorisation before they may proceed. Some waste disposal activities and infrastructural developments (e.g. altering watercourse) are classified as 'water use' that require authorisation. | DFFE / EDTEA/ eThekwini |
| | ICM Act | Ensures that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable. | DFFE |
| | NWA | Classifies certain infrastructural developments (e.g. altering watercourse) as 'water use' that require authorisation. | DWS |
| | Sea-shore Act | Regulating, operating and legalisation process of jetties, slipways and other structures along the seashore, including estuaries. | EDTEA |
| | Municipal Bylaws | Urban drainage (stormwater management) is the responsibility of municipalities for which bylaws need to be promulgated | eThekwini |
| MINING | MPRDA | Regulates mining including management of mining impacts on the environment. | DMRE |
| ALIEN INVASIVE SPECIES | NEMBA | Regulates control and management of alien invasive species, including estuarine environments. | DFFE |
| | CARA | Provides for conservation of natural agricultural resources and protection of vegetation. | DALRRD |
| | Agricultural Pests Act | Provides for measures to combat agricultural pests and prevent their introduction. | DALRRD |

The Constitution lays the basis for environmental law in South Africa (Breen and McKenzie, 2001) and provides important justification for the wise use of estuarine biodiversity. There are three levels of legislation which have been established in South Africa:

- **National** - which includes Acts and national policy,
- **Provincial** - which included Acts such as Land-use planning and conservation, and
- **Local** - which consists of municipal by-laws such as land-use planning and coastal development.

In instances where provincial or local legislation are in conflict with national legislation, national legislation prevails. At a local (municipal) level, municipal councils pass municipal by-laws, which in turn, should not conflict with provincial and national laws (Breen and McKenzie, 2001). Since estuaries do not fall within the broader categories of freshwater, terrestrial or marine environments, they have tended to be neglected in past legislation. However, the fact that estuaries contain freshwater, terrestrial and marine components, and are heavily influenced by activities in a much broader catchment and adjacent marine area, means that they are affected by a large number of policies and laws. The situation has improved with newer policies and legislation, however, despite the significant increase in number and size of South Africa's Marine Protected Areas (MPAs) in 2019, there is still no specific provision for Estuarine Protected Areas. Government's response in mitigating deterioration of South African estuaries is manifested in two pieces of key legislation, namely the National Water Act (Act 36 of 1998) and the National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) (ICM Act), amongst others.

The ICM Act sets out specific requirements for the development of a National Estuarine Management Protocol (Government Gazette 36432. No 533 of 18 June 2021). Specifically, the purpose of the Protocol is to:

- Determine a strategic vision and objectives for achieving effective integrated management of estuaries,
- Set standards for management of estuaries,
- Establish procedures or provide guidance regarding how estuaries must be managed and how the management responsibilities are to be exercised by different organs of state and other parties,
- Establish minimum requirements for estuarine management plans (EMPs),
- Identify who must prepare EMPs and the process to be followed in doing so, and
- Specify the process for reviewing EMPs to ensure that they comply with the requirements of the ICM Act.

The ICM Act requires the establishment of coastal committees which facilitated the establishment of the National Coastal Committee known as “Working group 8” under which Provincial Coastal Committees (PCCs) have been established. A number of Municipal Coastal Committees (MCCs) have also been established at a more local level. There has been an MCC in operation in eThekwini since the early 2000s which was formalised after promulgation of the ICM Act in 2009. There is also scope for private membership with the MCC for a fixed-term where on expiry of such a term, a re-application process for membership can be followed.

Prior to the amended Protocol, gazetted in June 2021, and in a number of existing EMPs for other estuaries along the South African coastline, it was envisaged that a specific estuary sub-committee at each level should be established where the ultimate goal was for each individual estuary to have its own local advisory body e.g. via an estuary forum. However, in terms of estuarine management in the province of KZN under the revised and current Protocol dated 18 June 2021, the PCC and MCC shall serve as the forums for the monitoring the implementation of EMPs which includes the reporting of progress and achievements related to estuarine management. Any existing and/or planned individual estuary forums can be regarded as informal additional advisory bodies for facilitating the implementation of the project plans identified in the EMPs and to foster continuous stakeholder engagement

Estuary management falls primarily under two national government departments; the Department of Water and Sanitation (DWS) which is responsible for water resources, and the Department of Forestry, Fisheries and the Environment (DFFE) which is responsible for all other environmental matters e.g. land use and living resources. Management and conservation of marine living resources is retained as a national competency where responsibility resides with the Department of Fisheries which is housed within the DFFE. Environmental management in most instances is devolved to a provincial level through whichever provincial department is responsible for environmental matters, which in this case is the KwaZulu Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA).

### 7.1.2. Coastal Management Programmes (CMPs)

#### 7.1.2.1 Context of CMPs

The development of CMPs and institutions for cooperative coastal governance is mandated in terms of the ICM Act. Prior to the promulgation of the ICM Act, South Africa had several statutes governing various aspects of coastal management including at least 19 international obligations and agreements, 11 national policies (other White Papers) and approximately 46 national acts (Taljaard, 2011). The most recent overview on international and national legislation pertaining to South Africa’s coastal and marine environment is provided by Taljaard *et al.* (2019). Preceding

literature which also provides contextual background can be found in Glavovic and Cullinan (2009), McLean and Glazewski (2009) and Taljaard (2007).

#### 7.1.2.2 Description of a CMP

A CMP is a policy directive for the management of the coastal zone, inclusive of strategies and plans for the effective implementation of the ICM Act that will enable organs of state to plan accordingly, to set a course for the environmental future of a nation by addressing the resolution of current management problems and user-conflicts (due to the wide variety of activities and uses of the coast), as well as the long-term development and management of the coastline. CMPs also play the vital role of bringing together the various spheres and sectors of government, private sector activities and community activities on the coast for the effective implementation of ICM over a projected period of time. This is achieved by ensuring that the development and use of natural resources in the coastal zone is done with the best interests of the public and economy, while being ecologically sustainable (DEA, 2014).

#### 7.1.2.3 Implementation of CMPs

All spheres of government - national, provincial and municipal - must establish and implement CMPs. Provincial CMPs must be consistent with both the National CMP and the Protocol. Municipal CMPs, applying to a particular coastal municipality, must be consistent with the National CMP and that of the province in which they are located. Therefore, the various provincial CMPs are nested within the National CMP whist the various municipal CMPs (developed at the district and/or municipal level) are nested within the Provincial CMP.

#### 7.1.2.4 The National CMP (NCMP)

The 2015 to 2019 NCMP is the policy directive for coastal management in South Africa and is a tool used by government to manage, maintain and conserve coastal resources. The framework for coastal management identified key components of an integrated CMP presenting the structure – the integrated, coordinated and uniform approach to coastal management. The NCMP is inclusive of strategies and plans for the effective implementation of the ICM Act that will enable organs of state to plan accordingly, to set a course for the environmental future of a nation by addressing the resolution of current management problems and user-conflicts (due to the wide variety of activities and uses of the coast), as well as the long-term development and management of the coastline. CMPs play a vital role of bringing together the various spheres and sectors of government, private sector activities and community activities on the coast for the effective implementation of ICM Act over a projected period of time. This is achieved by ensuring that the development and use of natural resources in the coastal zone is done with the best interests of the public and economy, while being ecologically sustainable. The iLovu EMP will need to be

aligned within the overall framework of the NCMP, particularly Priority 3 which focuses on estuaries. Management objectives set in the iLovu EMP will need to align with the management objectives in the NCMP.

#### 7.1.2.5 KZN CMP

The provincial CMP (EDTEA, 2019a) provides direction for coastal management in KZN over a five-year period and must, in terms of Section 47 of the ICM Act, provide a provincial policy directive for the management of the coast through an integrated, coordinated, uniform approach. The ICM Act requires that a provincial CMP includes a vision for the management of the coastal zone in the province, including the sustainable use of coastal resources. The KZN CMP must also ensure alignment with the NCMP and the NEMP (Protocol). The CMP has various coastal management objectives under various themes, and various priorities and strategies to meet these objectives. One of the objectives is to develop estuarine management plans for estuaries in the province, in this case, an EMP for the Ilovu Estuary.

#### 7.1.2.6 UMGABABA CMP (2009)

This CMP does make mention of monitoring the health of the Ilovu Estuary as part of operational management within the Umgababa Precinct, by the relevant authorities.

#### 7.1.2.7 MUNICIPAL CMP

A Municipal CMP (MCMP) is a legal requirement in terms of the ICM Act where coastal municipalities must prepare and adopt an MCMP for managing the coastal zone or specific parts of the coastal zone of the Municipality. At the time of this SA, an official MCMP for eThekwini has not yet been adopted; this is partly due to the delayed publications of the National and Provincial CMPs.

## 7.2 MANAGEMENT STRATEGIES/PLANS RELEVANT TO THE ESTUARY

### 7.2.1 National Estuary Biodiversity Plan for South Africa

As part of the 2011 NBA, one of the objectives was to develop a biodiversity plan for estuaries by prioritising estuaries and establishing which should be assigned Estuarine Protected Area (EPA) status. This was the first biodiversity plan to include all the estuaries of South Africa providing the first national set of priority estuaries (Turpie *et al*. 2012). In terms of the Ilovu Estuary, the recommended extent of undeveloped margin is partial protection to the extent of 50%.

### 7.2.2 KZN Estuarine Protected Area Expansion Plan 2012 - 2013

Based on the findings of the 2011 NBA and the need for proper protection mechanisms for CR, EN and VU estuaries, the National DEA assigned to the provincial conservation authority,

EKZNW, the task of drafting a list of the priority 20% of each of the KZN estuary types for consideration for proclamation by 2014. The aim of this proclamation was to protect estuaries of high biodiversity importance within KZN. The recommended extent of protection for the Ilovu Estuary is '*partial protection*.'

### 7.2.3 The eThekwini Municipality Integrated Development Plan (IDP)

The IDP focuses on future development within the municipality with a main focus on prioritisation planning, management and monitoring within given timeframes and budgets thereby creating an actionable plan. It identifies and recognises that estuaries are important and require effective management and the hence the need for a management plan.

### 7.2.4 DTPC Automotive Supplier Park Wetland Offset Plan

This conceptual plan, developed by Macfarlane and Teixeira-Leite (2019), was initially required to meet the submission requirements for the EIA and WULA for the proposed KZN ASP development and in its design, is to be implemented to guide the rehabilitation and management of the proposed wetland offset sites, some of which are situated within the iLovu EFZ. Detailed rehabilitation plans have not yet been developed for selected offset sites and more detailed planning and comprehensive assessments are recommended after which a programme can be developed allowing for offsets to be implemented as a phased approach.

### 7.2.5 DTPC Automotive Supplier Park Wetland & Riparian Zone Rehabilitation Plan

This conceptual plan, developed by Eco-Pulse and GroundTruth (2019), intends to provide sufficiently detailed rehabilitation measures that the civil engineers and contractors appointed to undertake the rehabilitation measures can effectively implement during and after construction of the ASP.

### 7.2.6 EMPr for the proposed KZN ASP Incorporating Industrial Development on the Remainder of the Farm Nogi No. 17469 and associated sewer line, at Illovo, KZN.

This plan, developed by Gibb (2019b), provides mitigation and management measures for all phases of the proposed development (Planning, Pre-Construction, Construction and Operations). The objectives of the EMPr are to outline functions and responsibilities, provide standards and guidelines to be followed in terms of environmental legislation, manage environmental impacts and outline mitigation measures and environmental specifications required to be implemented for all phases in order to minimise the extent of negative environmental impacts to prevent long-term or permanent environmental degradation. Mitigation measures in this EMPr have relevance to the Ilovu EMP given that the proposed development poses significant risks to the estuary and will

have detrimental impacts on estuarine health if impact mitigation is not effectively implemented (MER, 2019b). MER have undertaken further work on this project and prepared a report in 2020 "which took the 2019 reports much further and with more details on fatal flaws and offsets". Due to some dispute over payment, we have not had access to this document and as such this means that some of the recommendations of their estuarine ecologists might not match what we believe are best to protect and maintain the estuarine ecosystem and will be taken up in the EMP.

#### 7.2.7 EMPr for the Construction, operation and decommissioning of a 150ML/day Sea Water Reverse Osmosis Plant and Associated Infrastructure in iLovu on the KwaZulu-Natal South Coast, within the eThekwini Metropolitan Municipality, Kwazulu-Natal Province

This draft EMPr (CSIR, 2016b) takes the planning, design, construction, operational and decommissioning phases into account with the function of providing an overall environmental management framework for managing impacts of the development by delegating responsibilities to relevant role players in terms of specified objectives, targets, monitoring requirements and mitigation measures to implement.

#### 7.2.8 The eThekwini Municipality Biodiversity Report 2007

This report includes visions and goals for biodiversity as well as actions to implement this. It details current status of estuaries and other biodiversity areas within the municipality with a list of current threats that include pollution. The relevant recommendations of this report should be included, where applicable, in the iLovu EMP.

### 7.3 EXISTING BY-LAWS

#### 7.3.1 eThekwini Metropolitan Municipality Nuisance and Behaviour in Public Places By-law (2015)

To provide for measures preventing, minimising or managing public nuisances; to prohibit certain activities or conduct in public places; to provide for the repeal of laws and savings; and to provide for matters incidental thereto.

#### 7.3.2 eThekwini Metropolitan Municipality Beaches By-law (2015)

To provide for measures to manage, control and regulate public access and behaviour at beaches and beach areas; to provide for the real of laws and savings; and to provide for matters incidental thereto.

### 7.3.3 eThekwini Metropolitan Municipality Coastal Management By-law (2018)

To provide for measures for managing and protecting the coastal zone; to provide for measures for aligning development within the coastal zone with the objects of the National Environmental Management: Integrated Coastal Management Act; to provide for measures for protecting the natural environment of the coastal zone; to provide for measures for managing public access to the coastal zone; to establish the Municipal Coastal Committee; to give effect to the Municipal Coastal Management Programme; and to provide for matters connected therewith.

## 7.4 EXISTING MONITORING PROGRAMMES

The National Estuarine Monitoring Programme (NEsMP) is undertaken by the National Department of Water and Sanitation for the protection of water resources especially those in estuarine environments. This programme has three tiers (Figure 7) that focus on the collection of basic data, determination of the inflow requirements of estuaries and seeks to resolve key issues related to each estuary such as fish kills and sewerage inflow. Initiated in 2012, the programme continues annually, as long as funding is successful, in collaboration with relevant role players (Cilliers and Adams, 2016). As far as is currently known monitoring that is being undertaken is essentially that of Tier 1 components (Figure 7). As far as has been established it appears that no monitoring of smaller estuaries on the KZN south coast is actually part of the current provincial coastal programme and municipal coastal strategy.

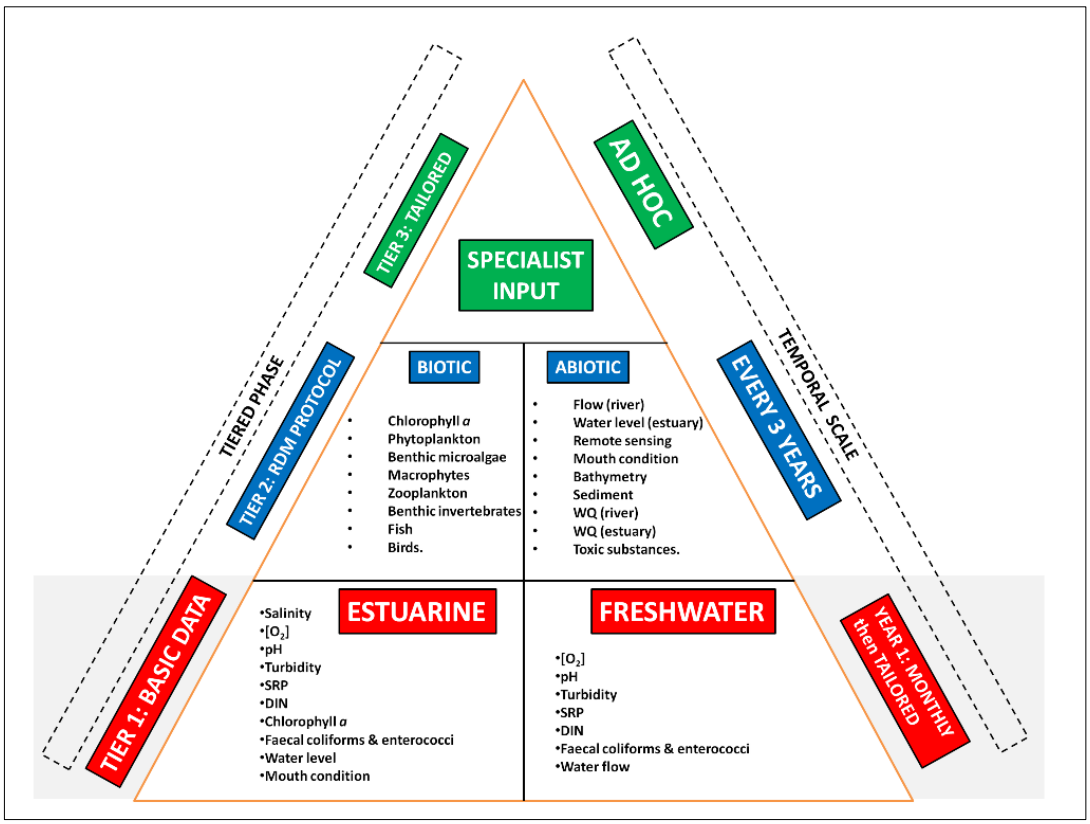


**Figure 7.** The National Estuarine Monitoring Programme for South Africa (Cilliers and Adams, 2016).

## 7.5 INTERNATIONAL POLICY

International policies which South Africa has co-adopted as a signatory member and which have a degree of relevance to the biodiversity, habitats, ecosystem and heritage aspects and attributes associated with the iLovu Estuary are mentioned below:

### 7.5.1 The UN Convention on Biological Diversity (CBD) (1992)

The three main goals of the CBD is the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.

### 7.5.2 The Bonn Convention (1983)

Also known as the Conservation of Migratory Species of Wild Animals, this is an international agreement that aims to conserve migratory species throughout their ranges.

### 7.5.3 The UNESCO World Heritage Convention (1972)

The primary mission of this convention is to identify and protect the world's natural and cultural heritage considered to be of outstanding universal value.

# 8. OPPORTUNITIES AND CONSTRAINTS FOR CONSIDERATION IN THE ESTUARINE MANAGEMENT PLAN

SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is a useful technique for understanding the strengths and weaknesses and for identifying both the opportunities and the threats (or constraints) as part of a planning process, in this case the development of the iLovu EMP. It provides for a structured manner to distinguish between the internal and external factors of influence, as well as assessing the positive and negative factors to be considered. Positive factors are grouped together as 'strengths' (usually internal elements) and 'opportunities' (external elements). Negative factors are grouped as 'threats' (external elements) and 'weaknesses' (generally internal elements that cannot be modified in the short-term).

## 8.1 CONSTRAINTS (THREATS)

- Lack of a field based Estuarine Health Index determination,
- Unregulated and/or excessive sand mining,
- Over- and unlicensed abstraction of water upstream (flow modification),
- Pollution (diffuse and point source from the upstream catchment and municipal landfills),
- Flood risk and loss of property and life for any further or proposed developments in the EFZ (Figures 8.1 and 8.2),
- High and intensifying fishing efforts,
- Unregulated gill netting / poaching,
- Habitat / biodiversity loss and a low level of formal protection (Figures 8.3 and 8.4),
- Alien vegetation encroachment,
- Delays in decentralised water resource management i.e. the CMA is not fully established or functional (Munnik 2020),
- Capacity constraints within the provincial conservation authority with inadequate support and lack of enforcement,
- Communication gaps between management authorities and other users of the estuary,
- Safety and access control to the estuary. Access recommendations as provided in EDTEA (2019b) to be considered for the EMP,
- Scientific data collection and availability is limited / lacking i.e. constrained capacity of the NEsMP,
- Multiple authorities control various legal aspects of the estuary which remains a challenge,
- Accessibility on the south side of the estuary mouth is via several pedestrian bridges over the railway which adjoin with footpaths through the dune vegetation onto the beach. Public parking space at the beach in Lower Illovo south of the estuary mouth is limited to non-existent. Private ownership inhibits public access directly to and around this part of the estuary, and

- The existing railway line and bridge are an obstruction, which cuts across the sensitive dune cordon and the mouth of the estuary <60m from the beach sandbar.

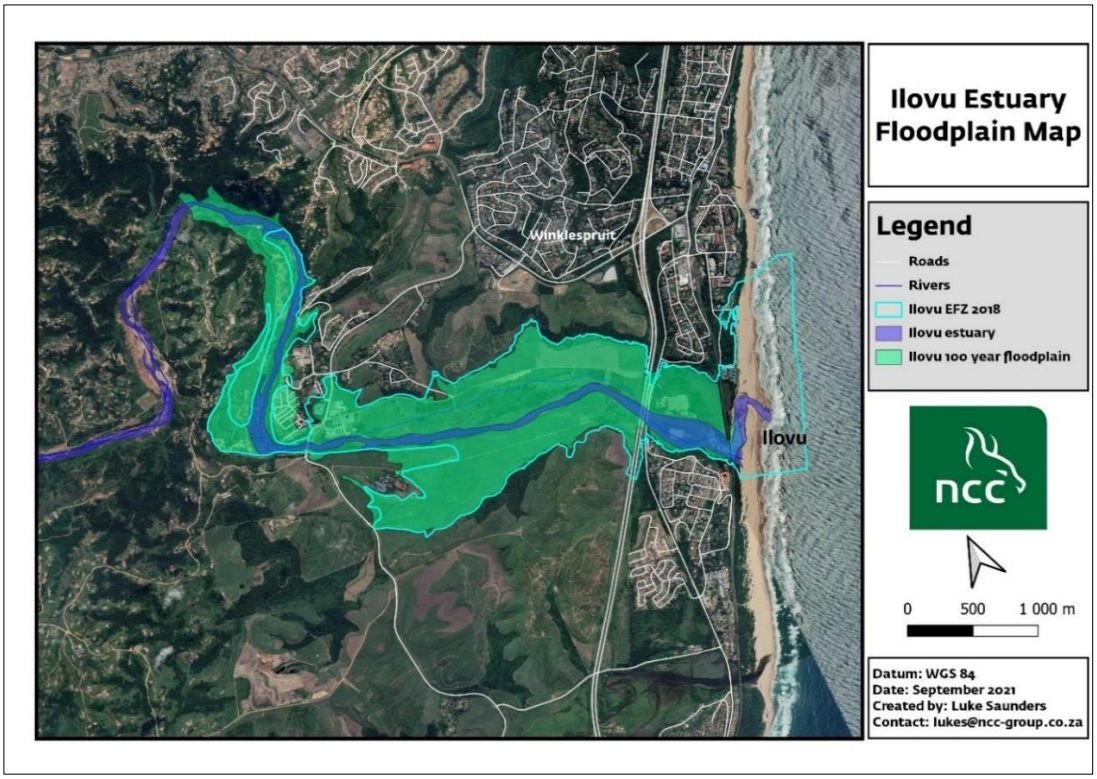


**Figure 8.1.** 1:100 year *flood-line of the iLovu River and Estuary (Data source: eThekwini GIS).

*Mapped in 2006 by Ninham Shand.


**Figure 8.2.** 1987 photograph (date inset) of the iLovu River in flood with the N2 bridge in view taken by E. Beesley of SAPPI-SAICCOR (Data source: CSIR, 1989).

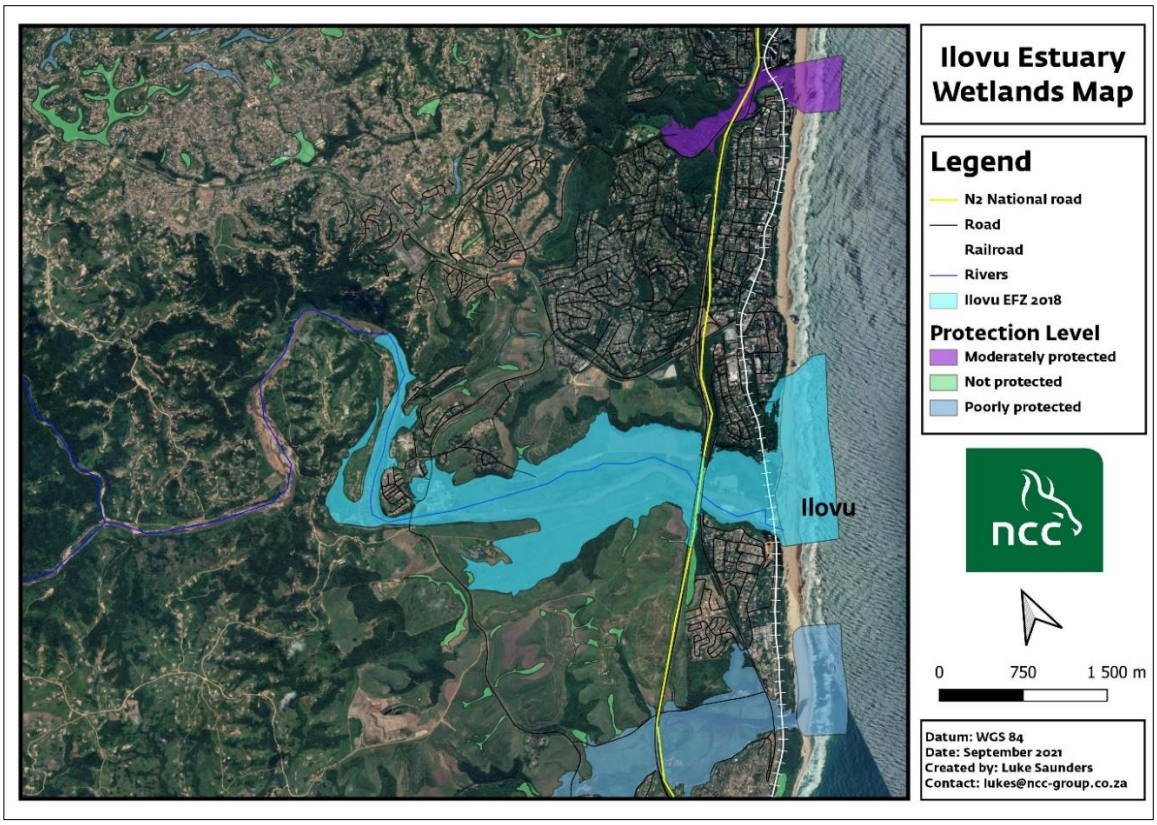


**Figure 8.3.** Ecosystem Protection Level (EPL) for wetland ecosystems in and around the estuary are either *poorly* or not *protected* (Data source: van Niekerk *et al*. 2019).

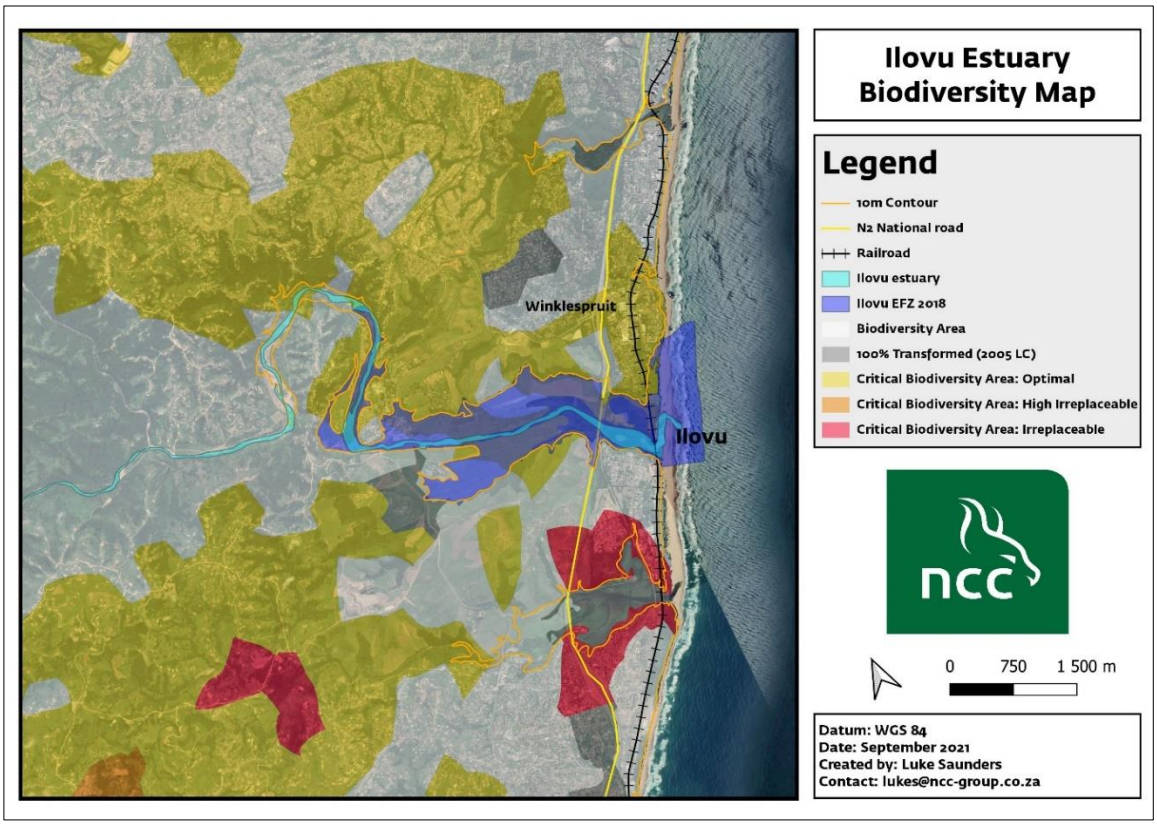


**Figure 8.4.** Critical Biodiversity Areas (CBAs) adjacent to the estuary in the terrestrial realm (Data source: EKZWN, 2016).

## 8.2 OPPORTUNITIES (STRENGTHS)

- There is currently a lack of high-density infrastructure along the estuary/within the EFZ,
- There is commitment in terms of the eThekwini IDP and SDF that estuaries are assets that need to be conserved and managed sustainably in accordance with the D'MOSS development control plan,
- An opportunity exists for improved levels of cooperative governance,
- There is scope to rehabilitate wetlands and improve the EHI (and PES) of the estuary,
- In terms of accessibility, an untarred public access route leads off from the R102 (seaside of and parallel to the N2 bridge) leading to the northern bank of the estuary. There is an open space area where cars are able to park. Pedestrian access to the estuary along the beach from Winkelspruit is an option,
- The recently extended Aliwal Shoal MPA is a nearby eco-tourism attraction (Figure 8.5),
- Opportunity to attract various classes of visitors e.g. canoeists, recreational boating, recreational fishing, birders along the Burchell's Coucal Eco-trail i.e. eco-tourism with an emphasis on sustainable resource use,
- Local residents and homeowners are committed to biodiversity conservation,
- Potential to establish a forum of honorary conservation officers and citizen scientists to assist with management and law enforcement, and
- Research opportunities regarding the values offered by the estuary serving as a good educational setting for schools and tertiary students.

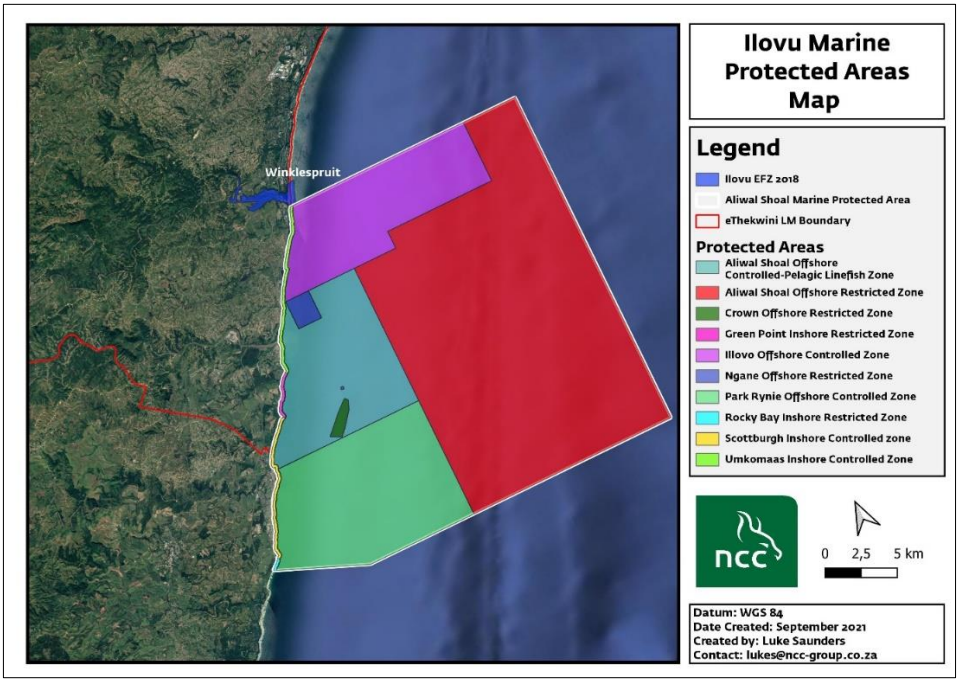


**Figure 8.5.** Aliwal Shoal Marine Protected Area (MPA) adjacent to and offshore from the estuary mouth in the marine realm. Dataset last updated 31 March 2021 (Data source: DFFE, 2021).

# 9. RECOMMENDATIONS TO ADDRESS MAJOR INFORMATION GAPS

As can be seen from Sections 3.2 and 3.3 there has been very little research or data collection conducted in the system over the last 10 years. Spatial and temporal replication of information is valuable for enabling researchers to map the changes that occur within a system over time and how the system is responding to human activities.

The following is a list of information identified as being needed to improve on future EWR studies for the iLovu Estuary (DWS 2015a). This information will also help provide information as to which aspects of the estuary need more management;

- An improved understanding of the catchment water quality, i.e. sources of contamination, concentrations, seasonal fluctuations, potential for remedial actions to improve water quality,
- Better quantification of inflows to the estuary (river and WWTW) that drive the mouth condition including the mode of delivery. Ideally, river inflow to these small systems needs to be resolved at daily or hourly time scales. It is not sufficient to evaluate these on monthly time steps as required by EWR process,
- Continuous mouth state data are lacking and need to be acquired (i.e. water level recorder near the mouth),
- Information on the bioaccumulation of toxic substances (e.g. metal, herbicides and pesticides), and the current impact associated with such accumulation needs investigation, especially in systems in urban area or those receiving extensive runoff from agricultural areas,
- Improved understanding on the responses of microalgae and macrophytes to various nutrient loading and assimilative capacities is required, as well as the effect on dissolved oxygen processes, and
- Long-term data on the composition of biotic communities and the link with ecosystem functioning re also lacking and need to be improved.

This needs to be added the vital issue of obtaining current data on legal and illegal sand mining operations in the system as well as determining if such operations are currently resulting in a sediment deficit in the estuary as well as a negative delivery of sediment to the coastal zone.

# 10. WHAT'S NEXT

This Situation Assessment (as determined during a desktop study) provides the background to the current state and condition of the iLovu Estuary and its biota, as well as highlighting the deficiencies and necessities in terms of management that must be addressed, in order to maintain a functional estuarine system. Next, the local authorities and the general public from the surrounding communities will be consulted to gain their input and perspective on the potential issues, threats and information gaps associated with the iLovu Estuary. The revised situation assessment will then serve as the basis and platform for the development of the Estuary Management Plan.

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# 12. APPENDICES

## 12.1 APPENDIX 1: SUMMARY OF LEGISLATION, REGULATIONS, BY-LAWS, POLICIES AND PLANS.

| NAME | SHORT DESCRIPTION | RELEVANCE | KEY AGENT(S) |
|---|---|---|---|
| **LEGISLATION** | | | |
| The Common Law | The underlying common law principle applicable to the coastal zone is that the owner of the land is also the owner of the space above and below the surface of the land. | Municipalities are governed by the common law in the absence of applicable relevant legislation. In the event that statute law is silent on a particular [1]coastal zone issue the common law will prevail and has particular bearing in terms of use of property rules of nuisance and the control and management of things generally.<br>[1]includes estuaries | |
| The Constitution of the Republic of South Africa (Section 24) | Section 24 of the Constitution's Bill of Rights provides all citizens the right to an environment that is not harmful to their health or well-being as well as to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: prevent pollution and ecological degradation; promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Bill of Rights therefore imposes a duty on the State to promulgate legislation and take other steps that ensure that the right is upheld and that, among other things, that ecological degradation and pollution are prevented. | The environmental right enshrined within the Constitution is of relevance as it highlights the need to prevent pollution incidents, and to develop methods to reverse the current ecological degradation of estuaries, and improve past management trends. NEMA was enacted as a reasonable legislative measure to give effect to this constitutional environmental right. Any proposed developments should comply with the requirements of the NEMA, hence ensuring the protection of this right. With reference to the iLovu Estuary, the EMP under development and its effective implementation is envisaged to function as a tool/mechanism to facilitate this environmental right being achieved. | |
| National Environmental Management Act (No. 107 of 1998), as amended | NEMA is key environmental management legislation stating in section 2(4)(k) that "the environment is held in public trust for the people, the beneficial use of resources must serve the public interest and the environment must be protected as the people's common heritage". Section 28 of NEMA ensures that environmental screening is incorporated into each activity, although it is not formally termed as such. Section 28 (1) imposes a duty which requires that: "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and | In developing the EMP for the iLovu Estuary, the principles of NEMA need to be adhered to. Principles include the Duty of Care, The Polluter Pays and the Precautionary Principle. The estuary is an attractive destination to both local people and tourists and its utilisation to the general public renders the estuary susceptible to increased, harmful and/or negligent anthropogenic activities. | DFFE |

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| | rectify such pollution or degradation of the environment". NEMA provides for co-operative environmental governance through the establishment of national environmental management principles, and procedures for their incorporation into decisions affecting the environment. In particular, the Act provides that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as estuaries require specific attention in management and planning procedures, especially where subjected to significant human resource usage and development. | | |
| National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008), as amended | The ICM Act provides for the holistic management of the coast and estuarine areas as an integrated system, through participation by all stakeholders (public, NGOs, Local, Provincial and National government) to ensure the protection of the environment and it's natural ecosystem functioning, while promoting sustainable development in the use of coastal resources. The purpose of the ICM Act is to determine the coastal zone of the Republic; to provide, within the framework of NEMA, for the coordinated and integrated management of the coastal zone by all spheres of government in accordance with the principles of co-operative governance; to preserve, protect, extend and enhance the status of coastal public property as being held in trust by the State on behalf of all South Africans, including future generations; to secure equitable access to the opportunities and benefits of coastal public property; to provide for the establishment, use and management of the coastal protection zone; and to give effect to the Republic's obligations in terms of international law regarding coastal management and the marine environment. | Planning processes in the coastal area within the boundary of the iLovu EFZ, such as designation/delineation of coastal management lines, coastal planning schemes and coastal planning schemes are governed by the ICM Act. The Act requires the designation of a Coastal Protection Zone (CPZ) extending 100m from the high tide mark (including in estuaries) in areas zoned for residential, industrial or commercial land use, and a much larger protection zone of 1000m for public land and land zoned for agricultural use. | DFFE/ EDTEA / EM |
| National Estuarine Management Protocol (NEMP) GN533 dated 18 June 2021 | Section 33(2) of the ICM Act empowers the Minister responsible for Environmental Affairs with the concurrence of the Minister responsible for Water Affairs to publish a Protocol (the NEMP) that will provide guidance for the management of estuaries through the development and implementation of estuarine management plans (EMPs). | In terms of the NEMP (Protocol), estuaries within the Republic must be managed in a coordinated and efficient manner. The purpose of the NEMP is to determine a strategic vision and objectives for achieving effective integrated management of estuaries; set standards for the management of estuaries; establish procedures or provide guidance regarding how estuaries must be managed and how the management responsibilities are to be exercised by different organs of state and other parties; establish minimum requirements for EMPs; identify who must prepare EMPs and the process to be followed in doing so; and specify the process for reviewing estuarine management plans to ensure that they comply with | EDTEA |

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| | | the requirements of the ICM Act. EMPs should seek to achieve greater harmony between ecological processes and human activities while accommodating orderly and balanced estuarine resource utilisation. | |
| Marine Living Resources Act (No. 18 of 1998), as amended | The objectives and principles of this Act are based on the utilisation, conservation and management of marine living resources and the need to protect whole ecosystems preserve marine biodiversity and minimise marine pollution. The Act aims to ensure the conservation of marine living resources, marine biodiversity and reduction of marine pollution. The Act provides for the declaration of marine protected areas (MPAs) to facilitate fisheries management areas, encourages precautionary measures to be taken in the management and development of marine resources and promotes the sustainable use of these resources to achieve economic growth. | Fishing effort in the estuary is 'Very High' (NBA, 2018). Over exploitation of estuarine and marine resources is a threat within the estuary including along the beaches (at Winkelspruit and Illovo) as these areas area relatively popular for recreational fishing mainly due to fairly easy access to the estuary and coastal area. To ensure the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation, conservation and protection of certain marine living resources, the Act's intention is to regulate these activities via licenses. The Department of Environment, Forestry and Fisheries has been delegated this responsibility within KZN by the National Department. In terms of *DAFF Important Fish Nurseries* assessed during the 2018 NBA, the estuary was assigned to have 'low importance' as a fish nursery. | DFFE |
| National Water Act (No. 36 of 1998) | The purpose of this Act is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled to meet the basic human needs of present and future generations. It ensures equitable access to water while protecting aquatic and associated ecosystems and their biological diversity. | Estuaries are aquatic ecosystems which are classified as water resources and as such, this Act provides guidance with respect to water quality, water use and waste disposal within estuaries through the development of policies to provide guidance in developing resource quality objectives (RQOs) as well as the regulation of water use as well as waste disposal. The Ecological Reserve for the estuary is gazetted under the framework of this Act. Furthermore, any intended water uses as defined in section 21 of the Act will need to follow the legislative process governed by the Act with the Department of Water and Sanitation (DWS) as the regulatory authority. Authorisation of such water use(s) may be via a Water Use License (WUL) or General Authorisation (GA). | DWS |
| National Environmental Management: Biodiversity Act (No. 10 of 2004) | The purpose of this Act is to provide for the management and conservation of South Africa's biodiversity within the framework of NEMA; to protect species and ecosystems that warrant national protection; promote the sustainable use of indigenous biological resources; provides for the management and conservation of South Africa's biodiversity, promote the fair and equitable sharing of | The iLovu Estuary is recognised to have an overall biodiversity status of 'Low to Average Importance' (NBA, 2018). Whilst South Africa's estuaries are important for resident and migratory waterbirds, there are no IBAs associated with or in close proximity to the iLovu estuary. | DFFE |

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| | benefits arising from bioprospecting involving indigenous biological resources; ensure the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith. The Act enforces ratified international agreements relating to biodiversity which are binding on South Africa and mandates SANBI to assist in achieving the objectives of the Act. | | |
| National Environmental Management: Protected Areas Act (No. 57 of 2003) | The Act provides a framework for the declaration, cooperative governance and management of South African protected areas on state, private and communal land. This forms part of a strategy to manage and conserve biodiversity while preserving the ecological character of these areas. The Act promotes the sustainable utilisation of protected areas for the benefit of people and supports participation of local communities in the management of protected areas. | To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. These include marine protected areas (MPAs), whereby the Aliwal Shoal is a declared MPA offshore from the mouth of the iLovu Estuary. The estuary is not a protected area in terms of this Act. | DFFE |
| Mineral and Petroleum Resources Development Act (No. 28 of 2002) | This Act makes provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. | Any proposed mining and exploration concessions which may include sand mining, oil and gas exploration within the iLovu EFZ are governed by this Act and will require authorisation from the CA. | DMRE |
| Disaster Management Act (No. 57 of 2002) | The Act provides an integrated, co-ordinated approach to disaster management aimed at preventing or reducing risk of disasters in the country; mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery; the establishment of national, provincial and municipal disaster management centres; disaster management volunteers; and matters incidental thereto. | Coastal areas are high risk areas making this Act relevant and important to disaster management, particularly floods, around the iLovu Estuary. | Province (EDTEA) & Municipality (eThekwini) |
| National Forest Act (No. 84 of 1998) | This Act promotes the sustainable management and development of forests; provides for special measures for the protection of certain forests and trees (including mangroves), and promote the sustainable use of forests. Natural forests and woodlands form an important part of that environment and need to be conserved and developed according to the principles of sustainable management; plantation forests play an important role in the economy; plantation forests have an impact on the environment and need to be managed appropriately. | Natural forests and woodlands, which may include any riparian trees such as mangroves growing within and along the banks of the iLovu Estuary, form an important part of that environment and need to be conserved and developed according to the principles of sustainable management. Any matters relating to natural forests or demarcated state forests within the iLovu EFZ fall under the jurisdiction of the Department of Forestry. | DFFE |

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| Conservation of Agricultural Resources Act (No. 43 of 1983) | The Act provides the framework for control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation/protection of the soil, the water sources and the vegetation and the combating of weeds and invader plants. | Harvesting of land-based coastal resources are governed by CARA, including any declared invader plants and weeds needing to be managed according to the Act, including where such invasive plants may encroach into the iLovu EFZ. | DALRRD (Agriculture) |
| Agricultural Pests Act (No. 36 of 1983) | Provides for measures to combat agricultural pests and prevent their introduction. | Has relevance to alien invasive species (AIS) which could potentially invade into the iLovu EFZ. | DALRRD (Agriculture) |
| National Heritage Resources Act (No. 25 of 1999) | The Act provides an integrated and interactive framework for the management of national heritage resources which includes landscapes and natural features of cultural significance. | Any sites identified within the estuary and its functional zone that are of national heritage significance must be flagged for preservation, management and protection. | SAHRA |
| Spatial Planning and Land Use Management Act (No. 16 of 2013) | The Act applies to spatial planning and land use management (LUM) in South Africa specifying the relationship between spatial planning and land use management systems as well as other forms of planning. The Act provides a framework to govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses. The aim is to address past spatial and regulatory imbalances and promote greater consistency and uniformity in application procedures and decision making. | This Act has relevant to spatial planning and land use management in and around the iLovu Estuary. The relevant planning office of the municipality is required by the Act to identify how sensitive environments i.e. the iLovu Estuary and associated EFZ need to be incorporated into spatial planning. | Municipality (eThekwini) |
| Local Government: Municipal Systems Act (No. 32 of 2000, as amended by Act 44 of 2003)<br><br>Local Government Transition Second Amendment Act (No. 97 of 1996) | This Act enforces the constitutional provision that municipalities must give priority to the basic needs of the local community and promote the development thereof. Chapter 5 provides specifically for integrated development planning and requires municipalities to prepare and adopt a single inclusive plan for the development of the 'Municipal Area' called an Integrated Development Plan (IDP) which is intended to encompass and harmonise planning over a range of sectors such as water, transport, land use and environmental management. IDPs are intended to link, integrate and coordinate plans and take into account proposals for the development of the municipality; align resources and capacity of the municipality with the implementation of the plan; form the policy framework and general basis on which annual budgets must be based; and be compatible with national and provincial development plans and planning requirements that are binding on the municipality in terms of legislation. | Spatial planning in and around the localised areas of Illovo South, Illovo North and Winkelspruit in terms of this legislation will need to take into consideration all opportunities and constraints in relation to the delineated boundary of the iLovu EFZ. | COGTA, Dept. of Provincial and Local Government & eThekwini Municipality |
| Traditional Leadership and Governance Framework Act (No. 41 of 2003) | This Act provides for the recognition of traditional communities, the establishment and recognition of traditional councils the functions and roles of traditional leaders | In the context of the iLovu EMP where any land portions fall within traditional land (e.g. the Ingonyama Trust), the RMA (EDETA) and the eThekwini Municipality is required to take cognizance of the provisions of this Act in terms of consultation and decision making processes. | |

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| KwaZulu Ingonyama Trust Act (Act 3KZ of 1994) | To provide for the establishment of the Ingonyama Trust and for certain land to be held in trust; and to provide for matters incidental thereto. | Any portions of land which are delineated to fall within the iLovu EFZ and which form part of traditional land held in trust by the Ingonyama Trust Board will require consultation in terms of the iLovu EMP process. The relevant Amakhosi should be consulted during this process if any properties adjoining the iLovu Estuary are registered in the name of the Ingonyama Trust Board. | DALRRD (Minister for Agriculture and Land Affairs) and traditional leaders |
| Water Services Act (No. 108 of 1997) | This Act provides for the national management of water services via management of 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; regulation of industrial use of water, both in terms of use and disposal of effluent; and preparation and adoption of Water Services Development Plans by water services authorities that typically form part of IDPs. | Utilisation of water resources in the upstream catchment and estuary are relevant in the context of this Act where poor or inadequate management will negatively impact on estuarine water resources. Hence, current practices and future utilisation plans must be consistent with the requirements of this Act. These practices relate to water supply, sanitation, agriculture as well as industrial effluent and runoff. | Water Services Authority<br><br>Department of Health, eThekwini Water and Sanitation |
| National Health Act (No. 61 of 2004) | To provide a framework for a structured uniform health system within the Republic, taking into account the obligations imposed by the Constitution and other laws on the national, provincial and local governments with regard to health services. The responsibility to render environmental health services in terms of this Act was delegated to the eThekwini Municipality on 1 July 2004 who must ensure that appropriate municipal health services are effectively and equitably provided in their respective area of jurisdiction. | Future planning and management considerations should, therefore, take into consideration the human health aspects to ensure that the natural functioning of the ecosystem is not polluted or degraded to a level which is harmful to human health and well-being. Such services, insofar as it may influence human health within the estuary, may include implementing water quality monitoring; waste management measures and environmental pollution control. | Department of Health |
| National Environmental Management: Waste Management Act (No. 59 of 2009) | This Act regulates waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures and the licensing and control of waste management activities; to provide for the remediation of contaminated land and for matters connected therewith. | Where any listed waste management activities are to be undertaken in relation to the estuary, authorisation will be required from the CA where mitigation measures detailed in official waste licenses should aim to ensure that potential impacts of waste generation in all its forms are reduced. In order to prevent degradation and pollution into the future it is important to ensure that wastes are managed appropriately (via effective waste mitigation and control measures including in the catchment upstream) to avoid degradation and a decline in estuarine health. | DFFE |

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| Subdivision of Agricultural Land Act (No. 70 of 1970) | To control the subdivision of agricultural land. | Any portions of agricultural land which are delineated to fall within the iLovu EFZ and any proposed development applications within this area, including the iLovu EMP process, requires comment, input and authorisation from the authority. | DALRRD (Agriculture) |
| KwaZulu-Natal Nature Conservation Management Act (No. 9 of 1997) | This Act provides institutional structures for nature conservation in KwaZulu-Natal; to establish control and monitoring bodies and mechanisms and to provide for matters incidental thereto. | Any nature conservation matters relating to the iLovu EFZ are governed by this Act. Nature conservation means conserving naturally occurring ecological systems, sustainable use of indigenous plants and animals therein and the promotion and maintenance of biodiversity. There are currently no formal nature reserves situated within the iLovu EFZ and the wider estuarine ecosystem. | EDTEA, EKZNW |
| KwaZulu-Natal Environmental, Biodiversity and Protected Areas Management Bill, 2014 (Gen N4, PG1314, 25 February 2015) | To provide for the establishment, functions and powers of Ezemvelo KZN Wildlife; the protection and management of the environment and biodiversity; the protection and conservation of indigenous species, ecological communities, habitats and ecosystems; the management of the impact of certain activities on the environment; the sustainable use of indigenous biological resources and the declaration and management of protected areas. | The iLovu Estuary and it's functional zone do not currently form part of any formally proclaimed nature reserves or protected areas. | EKZNW |
| EA issued to Umgeni Water (SOC) dated 11 August 2017.<br><br>DEA ref: 14/12/16/3/3/2/636<br><br>NEAS ref: DEA/EIA/0002273/2014 | EA was granted for the '*Construction, operation and decommissioning of a 150ML/day Sea Water Reverse Osmosis Plant and Associated Infrastructure in Lovu on the KwaZulu-Natal South Coast, within the eThekwini Metropolitan Municipality, Kwazulu-Natal Province'.*<br><br>The holder of the EA, Umgeni Water, is authorised to develop the reverse osmosis desalination plant in wards 97 and 98, as per the geographic coordinates in the EA.<br><br>This includes carrying out the authorised listed activities as specified in the EA. | In terms of the ongoing and long-term health of the iLovu Estuary, the holder of the EA is legally obligated to comply with the conditions of the EA. The EMPr submitted as part of the EA application, which was not approved at the time the EA was granted, must be amended and re-submitted to the Department for approval prior to commencing with the activity. The EMPr must be amended to include all recommendations and mitigation measures in the final EIAr and specialist reports, as included in the final amended EIAr dated March 2017 and a final development layout plan with micro-siting of the desalination plant infrastructure as informed by the detailed engineering design, and all mitigation measures as dictated by the final development layout plan. | DFFE |
| GNR. 1097 dated 12 October 2018 GG41970 in terms of section 16(1)&(2) of the NWA. | '*Reserve determination of water resources for the Mvoti to Umzimkulu Catchments'*.<br>The main objective of the Chief Directorate: Resource Directed Measures (RDM) within the DWS is to ensure protection of water resources as described in Chapter 3 of the NWA where their role is | The iLovu Estuary is situated in catchment U70D where EWR and ecological categories using PES, REC and TEC ratings have been gazetted for a number of other IUAs (integrated units of analysis) in the sub-catchments.<br>There is still a requirement for the EWR to be determined and gazetted for the iLovu Estuary. | National DWS, Pongola-uMzimkulu Proto-CMA |

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| | to provide a framework to ensure sustainable utilisation of water resources to meet ecological, social and economic objectives. | | |
| GNR. 1386 dated 8 December 2017 GG41306 in terms of section 13(1)(a)&(b) of the NWA. | '*Classes of water resources and resource quality objectives for the catchments of the Mvoti to Umzimkulu*'.<br>Classes and RQOs have been gazetted for all significant water resources (catchments, drainage areas and rivers) in terms of IUAs which are classified in terms of extent of permissible utilisation and protection as either **Class I** (high environmental protection and minimal utilisation; **Class II** (moderate protection and moderate utilisation; and **Class III** (sustainable minimal protection and high utilisation). | The TEC for the Lovu River (EWR1 and U70D-04800) is a **B/C** and for the iLovu Estuary also a **B/C**. Whilst no numerical RQO has been gazetted for the Lovu River, the narrative RQO is '*Acceptable*' i.e. a moderate change from present with temporary high sediment loads and turbidity during runoff events (aquatic ecosystems: driver).<br>The iLovu Estuary has not been gazetted as a '*High Priority Estuary*'. | National DWS, Pongola-uMzimkulu Proto-CMA |
| Provincial GN42 dated 13 May 2021 GG2285 in terms of section 83(1)(d),(i) & (o) of the ICM Act | *'Listing of KZN public launch sites and the identified management bodies for each launch site'.*<br><br>KZN has a large boat-based marine recreational and commercial industry that includes line-fishing, scuba diving and other activities. Many of the vessels used in this industry are relatively small craft (less than 10m in length) and are capable of being launched directly through the surf from specially demarcated beach launch sites. | Twenty-five (25) boat launch sites were gazetted by EDTEA on 13th May 2021. There are currently no public launch sites currently listed in/on the iLovu Estuary. Any relevant management body wishing to apply for a public launch site in the estuary would need to complete the application process in terms of the Management of Public Launch Sites in the Coastal Zone Regulations (GN497 dated 27 June 2014). | EDTEA |
| **REGULATIONS** | | | |
| NEMA EIA Regulations (as amended in 2017) GNR 326 in GG 40772 dated 7 April 2017 | The purpose of the Environmental Impact Assessment (EIA) Regulations, promulgated under NEMA, is to regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment and to optimise positive environmental impacts. The Regulations describe the assessment process (BA or EIA) to be followed including the public participation process and the listed activities that may have a harmful impact on the environment, including in the coastal zone. | Listed activities in respect of NEMA must acquire EA prior to undertaking these activities, where applicable, in relation to estuaries. Gazetted Listing Notices provide the criteria for which assessment procedure and which authority (national or provincial) the application for an EA should be lodged, after which the relevant authority will make a decision on whether an EA should be granted for a specified development activity or activities. These Regulations apply to any listed activities relating to the coastal zone which includes the iLovu EFZ. As defined in these regulations an EFZ is '*the area in and around an estuary which includes the open water area, estuarine habitat (such as sand and mudflats, rock and plant communities) and the surrounding floodplain area, as defined by the area below the 5m topographical contour (referenced from the indicative mean sea level*)". | DFFE / EDTEA / EM |

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| NEMA EIA Listing Notice 1: GNR 327 dated 7 April 2017 | The purpose of this Notice is to identify activities that would require EA prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. | Any listed activities proposed within the iLovu EFZ will need to follow the Scoping & EIA regulatory process when applying for EA. | DFFE/ EDTEA / EM |
| NEMA EIA Listing Notice 2: GNR325 dated 7 April 2017 | The purpose of this Notice is to identify activities that would require an EA prior to the commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. | Any listed activities proposed within the iLovu EFZ will need to follow the regulatory Basic Assessment (BA) process when applying for EA. | DFFE/ EDTEA / EM |
| NEMA EIA Listing Notice 3: GNR 324 dated 7 April 2017 | The purpose of this Notice is to list activities and identify competent authorities under sections 24(2), 24(5) and 24D of NEMA, where EA is required prior to commencement of that activity in specific identified geographical areas only. | Any listed activities proposed within the iLovu EFZ which is located in KZN (i.e. a specific identified geographical area) will need to follow either the regulatory Scoping & EIA process or a BA process when applying for EA. | DFFE/ EDTEA / EM |
| GNR. 496 dated 27 June 2014 GG37761 in terms of section 83(1)(g),(n), (p)&(r) of the ICM Act | '*Control of use of vehicles in the Coastal Are*a'.<br><br>Notwithstanding any general prohibitions and permissible uses, any vehicle use in the [1]coastal area needs to comply with these regulations.<br><br>*[1]coastal public property, littoral active zone and/or any area between the high-water mark and up to 500 meters landwards of the high-water mark where dunes, wetlands, mangroves, lagoons, salt marshes, salt pans, mud flats occur, but not exceeding the boundary of the coastal zone as determined in the ICM Act.* | The 'coastal area' applies to the area within the boundary of the iLovu Estuary and the associated functional zone. | EDTEA |
| Control of Vehicles in the Coastal Zone GG 22960, dated 21 December 2001 | Regulations published in terms of NEMA to provide for a general prohibition on the recreational use of vehicles in the coastal zone, to provide procedures for approving the use of vehicles in the coastal zone under specific circumstances, to provide measures for the enforcement of these regulations and to prescribe penalties in respect of contraventions.<br>These Regs have since been amended by GNR. 496 dated 27 June 2014. | Although people are guaranteed reasonable access to the coastal zone, vehicles have caused damage, degradation of the dunes and vegetation and overall habitat destruction. These regulations prohibit the recreational use of vehicles in the coastal zone, which may include the iLovu EFZ. The Off Road Vehicle (ORV) Regs do however provide procedures for the approval of restricted use of vehicles under specific circumstances and measures for the enforcement of these regulations. | EDTEA |
| Coastal Waters Discharge Permit Regulations (Draft) GNR. 214 dated 10 March 2017 GG40674 | Based on Section 69 of the ICM Act, this regulation aims to provide a guideline on managing and controlling the discharge of effluent from land-based sources into the coastal environment. | The Regulations provide procedures to be undertaken by the different competent authorities for pollution at sea which may be derived from land-based sources and which may enter into and pollute the iLovu Estuary. | DFFE / DWS / EDTEA / eThekwini Municipality |

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| GNR. 496 dated 27 June 2014 GG37761 in terms of section 83(1)(g) and 7A & 7B of the ICM Act | *'Reclamation of Land from Coastal Waters'.*<br>**'Coastal waters**' means (a) the internal waters, territorial waters, exclusive economic zone and continental shelf of the Republic referred to in sections 3, 4, 7 and 8 of the Maritime Zones Act (No.15 of 1994) and (b) an estuary, as defined in the ICM Act (No. 36 of 2014).<br>'***Reclamation***' means the process of artificially creating new land within coastal waters, creation of an island or peninsula, but excludes beach replenishment by sand pumping for maintenance purposes. | Any reclamation of land from coastal waters falling within the boundary of the iLovu EFZ will need to follow these regulations in terms of applying for permission / authorisation / approval. | DFFE / EDTEA/ eThekwini Municipality |
| GNR. 497 dated 27 June 2014 GG37761 in terms of section 83(1)(d)(i)&(o) of the ICM Act | *'Management of Public Launch Sites in the Coastal Zone*.' | No public launch sites currently exist within the iLovu Estuary. Any relevant management body wishing to apply for a public launch site in the estuary would need to complete the process of applying in terms of these regulations. | EDTEA |
| **POLICIES** | | | |
| Coastal Policy Green Paper (September 1998) | This policy set out an approach to coastal management aiming to realise coastal benefits, sustain coastal benefits and promote proactive and co-operative governance in recognition of the importance of the coast as a rich national heritage providing enormous benefits to the people of South Africa. | These initial coastal policies set the foundation for developing appropriate legislation and mechanisms for governance and management in the years after the policies were first established. Estuaries, like the iLovu, are coastal ecosystems. | DFFE |
| National White Paper for Sustainable Coastal Development in South Africa (April 2000) | This policy sets out a vision for the coast, and principles, goals and objectives for coastal management in South Africa together with a Plan of Action for implementation. | | DFFE |
| Coastal Policy for KZN (2004) | This policy aided in setting the vision for the KZN coast based of the White Paper and was instrumental in the formulation of the provincial CMP which was established in 2019. | | EDTEA |
| White Paper on National Environmental Management of the Ocean GN426 dated 29 May 2014 | This policy for is informed by the Constitution, international law, domestic legislation including NEMA and associated supporting legislation where eight principles are envisaged to inform the sustainable use and management of ocean resources and ecosystem services. | In terms of priority statement 3.3.2 the Government is committed to develop cross-sectoral spatial ecosystem and biodiversity management plans across bioregions which will facilitate the identification of existing, potential or new economic opportunities while offering maximum protection to threatened species and ecosystems, such as unique benthic fauna and flora and threatened coastal, estuarine and marine ecosystems. | DFFE |

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| **PROGRAMMES** | | | |
| The National Coastal Management Programme (NCMP) 2015 to 2019 | The National CMP is the policy directive for coastal management in South Africa and is a tool used by government to manage, maintain and conserve coastal resources. The framework for coastal management identified key components of an integrated CMP presenting the structure – the integrated, coordinated and uniform approach to coastal management. The NCMP is inclusive of strategies and plans for the effective implementation of the ICM Act that will enable organs of state to plan accordingly, to set a course for the environmental future of a nation by addressing the resolution of current management problems and user-conflicts (due to the wide variety of activities and uses of the coast), as well as the long-term development and management of the coastline. CMPs play a vital role of bringing together the various spheres and sectors of government, private sector activities and community activities on the coast for the effective implementation of ICM Act over a projected period of time. This is achieved by ensuring that the development and use of natural resources in the coastal zone is done with the best interests of the public and economy, while being ecologically sustainable. | The iLovu EMP will need to be aligned within the overall framework of the NCMP, particularly Priority 3 which focuses on estuaries. Management objectives set in the iLovu EMP will need to align with the management objectives in the NCMP. | DFFE |
| KwaZulu-Natal CMP, 2019 | The KZN CMP provides direction for coastal management in KZN over a five-year period and must, in terms of Section 47 of the ICM Act, provide a provincial policy directive for the management of the coast through an integrated, coordinated, uniform approach. The ICM Act requires that a provincial CMP includes a vision for the management of the coastal zone in the province, including the sustainable use of coastal resources. The KZN CMP must also ensure alignment with the NCMP and the NEMP (Protocol). | The KZN CMP has various coastal management objectives under various themes, and various priorities and strategies to meet these objectives. One of the objectives is to develop estuarine management plans for estuaries in the province, in this case, an EMP for the iLovu Estuary. | EDTEA |
| **STRATEGIES** | | | |
| Municipal Coastal Strategy, 2013 | As a precursor to an MCMP, a Municipal Coastal Strategy (dated 20 May 2013) was developed by the Municipality as strategy document to set the scene in which the role of the Municipality is defined and coastal management objectives for the coastline are discussed and defined. The purpose of this strategy document was to provide strategy direction for the development of a detailed MCMP. | At this point in time, an MCMP has not been developed and adopted based off or guided by the strategy. | eThekwini Municipality |

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| **BY-LAWS** | | | |
| Nuisance and Behaviour in Public Places By-law, 2015 | To provide for measures preventing, minimising or managing public nuisances; to prohibit certain activities or conduct in public places; to provide for the repeal of laws and savings; and to provide for matters incidental thereto. Adopted by the Council of the eThekwini Municipality on 24th June 2015. | Relevant in terms of human activities such as recreational use in and around the estuary which includes the mouth and beach area. | eThekwini Municipality |
| Beaches By-law, 2015 | To provide for measures to manage, control and regulate public access and behaviour at beaches and beach areas; to provide for the real of laws and savings; and to provide for matters incidental thereto. Adopted by the Council of the eThekwini Municipality on 24th June 2015. | Relevant in terms of human activities such as recreational use in and around the estuary which includes the mouth and beach area. | eThekwini Municipality |
| Coastal Management By-law (2018) | To provide for measures for managing and protecting the coastal zone; to provide for measures for aligning development within the coastal zone with the objects of the ICM Act; to provide for measures for protecting the natural environment of the coastal zone; to provide for measures for managing public access to the coastal zone; to establish the MCC; to give effect to the Municipal CMP; and to provide for matters connected therewith. | Relevant in terms of development activities and human activities in and around the estuary and the associated EFZ. | eThekwini Municipality |
| **FRAMEWORK** | | | |
| eThekwini Municipal Spatial Development Framework (SDF) 2017/2018 to 2021/2022 | The SDF is an integral component of the Municipal IDP and a key spatial transformation tool which guides how the implementation of the IDP should occur in space. The SDF, therefore, guides the desirable spatial distribution of land uses within the eThekwini Municipality in order to give effect not only to the spatial vision, goals and objectives of the Municipality but by directing where the City should intervene in space to achieve its transformational objective. This is achieved through the identification of metro-wide spatial priorities and spatially targeting interventions in these key areas. The SDF is also aligned with provincial and municipal sector plans and strategies as a way of ensuring that the desired spatial form and outcomes of the Municipality are achieved both horizontally and vertically. In terms of the SDF, the City has a number of priorities that it will pursue, most of which align with national government's focus on infrastructure development and job creation. The SDF identifies Strategic Investment Areas to help prioritise and guide development initiatives to be located in areas where the greatest impact and positive spin-offs from a citywide scale can be achieved. | Spatial planning in this local area will need to take into consideration the opportunities and constraints in relation to the iLovu EFZ. | eThekwini Municipality |

| PLANS | | | |
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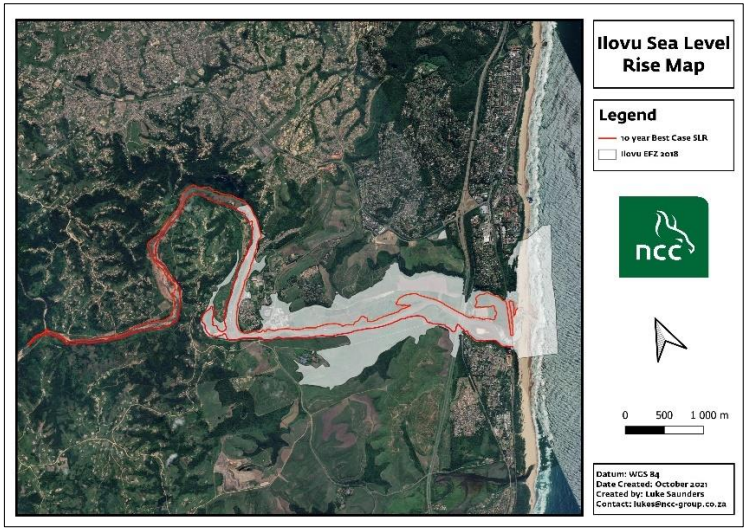
| eThekwini Integrated Development Plan (IDP) 2017/18 to 2021/22 | The Municipal Systems Act (No. 32 of 2000) (MSA) requires that local municipalities prepare Integrated IDPs. The IDP aims to spell out the Municipality's strategic plan of action for the next 5 years serving as a tool for transforming local governments towards facilitation and management of development within their areas of jurisdiction. The MSA identifies the IDP a key component in entrenching developmental local government principles. The focus of current IDP is on building a more inclusive developmental local government that would translate the Municipality's vision into action. | Strategic and integrated planning in the local areas, as contemplated in further detail in the Illovo Bhekulwandle LAP and Illovo South LAP, will need to take into consideration the opportunities and constraints in relation to the iLovu EFZ. | eThekwini Municipality |
| South Spatial Development Plan (SSDP): Review 2013/2014 | The purpose of the SSDP is to determine the economic role of the Southern Municipal Planning Region (MPR) within the context of the existing and envisaged economic activity of the Ethekwini Municipality. Plan was first approved and adopted by Council in November 2009. Further detailed planning in terms of the Illovo LAP was undertaken and adopted in 2010. | Development planning around and adjoining the boundary of the iLovu Estuary and associated functional zone falls within the scope of this plan. | eThekwini Municipality |
| Illovo Local Area Plan (LAP), 2010 | Informed by the IDP and SSDP, the purpose of the Illovo LAP was to plan for developments in greater detail relating to the Illovo Township, Illovo Village and Bhekulwandle area. | Development planning around and adjoining the boundary of the iLovu Estuary and associated functional zone falls within the scope of this plan. | eThekwini Municipality |
| Illovo South LAP, 2014 | This LAP was developed to provide a strategic framework and clear phasing and implementation plan to manage development and develop a land use scheme in a manner that maximises land value and promotes integration and sustainability. The LAP identifies the area to be an important catalytic area with the potential to contribute towards industrial/ manufacturing and retail opportunities combined with higher density housing. | The iLovu Estuary falls within the area covered by this LAP. A 'township establishment area' (TEA) is referred to as District 4 in the LAP and is earmarked as an industrial/manufacturing zone. There is mention in the plan of an Automotive Supply Park (ASP) and supporting service industries which are proposed for District 5. The development and land use proposals for District 4 are based on the requirements of the development of the ASP. There are significant environmental constraints limiting the availability of land for development in both of these Districts (4 & 5) with less than half the land in both districts considered suitable for development. Spatial planning in this local area will need to take into consideration the opportunities and constraints in relation to the iLovu EFZ. | eThekwini Municipality |
| Illovo Bhekulwandle LAP (2015). *Forming part of SDF version dated May 20-21 | This is a spatial representation of the Bhekulwandle sub-place (north of the iLovu River and inland from the N2 road) showing nodal and zonal elements. | Development planning around and adjoining the boundary of the iLovu Estuary and associated functional zone falls within the scope of this plan. | eThekwini Municipality |

## **12.2 APPENDIX 2:** SUMMARY OF COASTAL MANAGEMENT ZONES RELEVANT TO THE ILOVU ESTUARY IN TERMS OF THE ICM ACT.

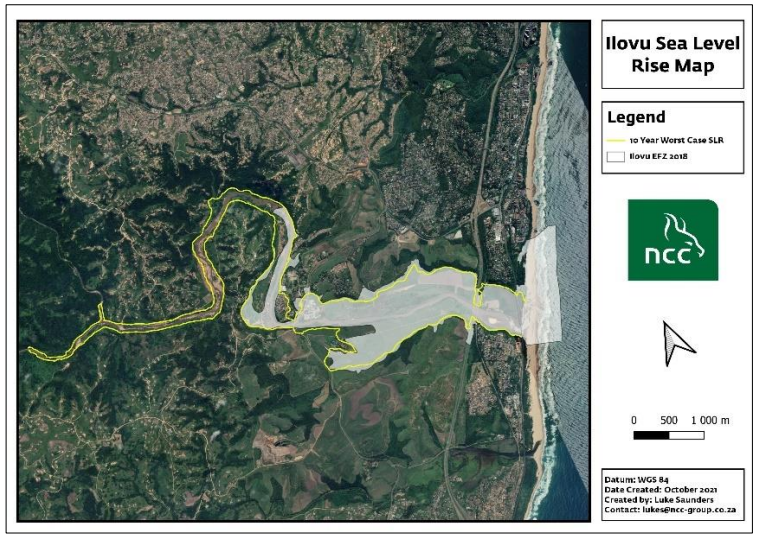
| Zone / Area | Definition | Relevance |
|---|---|---|
| Coastal zone | The building, erection, alteration or extension of structures that are wholly or partially seaward of that coastal set-back line must be prohibited or restricted (ICM Act, Section 25). | The EFZ falls within the boundary of the delineated coastal zone. |
| Coastal access servitudes | The intention of coastal access land, according to the ICM Act, is to provide and facilitate public access to coastal public property via public access servitudes. It is the responsibility of the RMA to declare coastal access servitudes and in doing so, three important actions with regards to the provision of coastal access land: (1) coastal access land must be established using by-laws; (2) coastal access servitudes must be declared within four years of the establishment of the ICM Act and reporting to the MEC on progress towards declaring coastal access land within two years of the ICM Act coming into effect (Celliers *et al*., 2009). | In terms of the Protocol, the RMA (EDTEA) has the responsibility of designating access to coastal public property by identifying and declaring access servitudes in accordance with the ICM Act.<br>Prior to the amended Protocol, local municipalities had this responsibility (Celliers *et al*., 2009). |
| Coastal Protection Zone (CPZ) | This zone is a continuous strip of land that starts from the high-water mark (HWM) and includes the area entirely or partly 100m inland in developed urban areas categorised as commercial, residential, or public open space. Other areas include those that are entirely or partly 1000m inland within areas that remain undeveloped or that are commonly referred to as rural areas. According to the ICM Act, the coastal protection zone manages, regulates and restricts the use of land that plays a significant role in the coastal ecosystem, such as the land adjacent to coastal public property (Celliers *et al*., 2009). | As a consequence of climate change, the spatial extent of flood prone areas has been increased to include rivers as the CPZ forms part of a buffer to the EFZ. The CPZ is informed by a coastal risk zone approximated by the 10m above mean sea-level (amsl) contour or 1:100 year floodline around an estuary, whichever is wider. Therefore all land, including the iLovu Estuary, which falls within this zone needs to be managed (DEA & Royal Haskoning DHV, 2017). |
| Coastal Public Property | These are large areas of the coastal zone, which accord free access to the country's populace. The trustee of coastal public property is the State; hence, coastal public property cannot be transferred or acquired by any means. This prevents the exclusive use of the coast by facilitating access to, and sustainable use of the productive coastal resources for the benefit of all South Africans. The coastal public property includes various components such as the actual water along the coast, the land below that water, islands, the seashore, other state lands such as Admiralty Reserve and is inclusive of natural resources found within these areas (Celliers *et al*., 2009). | The State, and therefore the RMA as trustee of the ICM Act must ensure that coastal public property is used, managed, protected, conserved and enhanced in the interests of the whole community, as opposed to only a few individuals or groups and take reasonable legal or establish other necessary strategies to conserve and protect coastal public property sustainably. |
| Estuarine Functional Zone (EFZ) | The EFZ is defined as a 'space' within which estuaries function over extended time scales ensuring their present and future health (Van Niekerk *et al*., 2012). In South Africa, it is defined as an area comprising of estuarine supporting physical processes, biological processes and habitats necessary for estuarine health and functionality as well as encapsulates the estuary waterbody itself (Van Niekerk *et al*., 2019). | The EFZ is spatially delineated by the 5m topographical contour and is considered a sensitive environment. In terms of the EIA Regulations, an EA is required before development within this zone may proceed. In the absence of detailed flood level data, such as the position of the 1:100 year flood line, the 5m contour, ergo the EFZ, is the default high water mark (HWM) within estuaries (Van Niekerk and Turpie, 2012). In this assessment the EFZ was based off the 2018 NBA. |
| Coastal Management Lines (CMLs) | CMLs are planning tools to inform coastal managers and decision-makers where their purpose is to avoid or minimise negative impacts that emanate from natural processes that may have detrimental effects on people and property, while also serving to protect the coast | With respect to estuaries the CML is delineated by the 5m amsl contour or 1:100 year floodline, whichever is wider, to differentiate a zone where formal development should be |

| | | |
|---|---|---|
| | from human-induced threats to biodiversity and physical features and in so doing, preserve the coastal space. The coastal set-back line intends to protect and preserve coastal public property such as beach amenities and other infrastructure such as parking; coastal private property such as private residences and business properties; public safety in the face of extreme climate and other natural events (DEA & Royal Haskoning DHV, 2017). | discouraged (DEA & Royal Haskoning DHV, 2017). Once adopted these linear limitations propose to prohibit or restrict the construction, extension or repair of structures that are either wholly or partly seaward of the line. EDTEA is currently in the process of developing CMLs for the KZN coastline. |

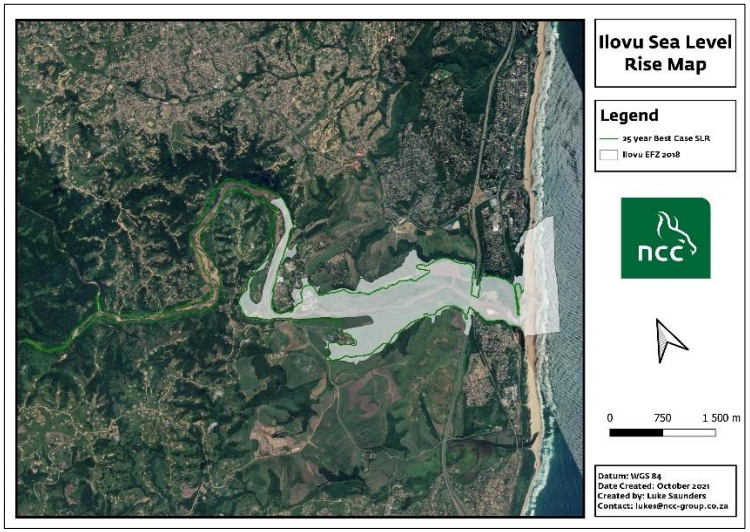
## **12.3 APPENDIX 3:** SEA LEVEL RISE SCENARIOS FOR THE ILOVU ESTUARY USED TO INFORM THE COASTAL MANAGEMENT LINES.



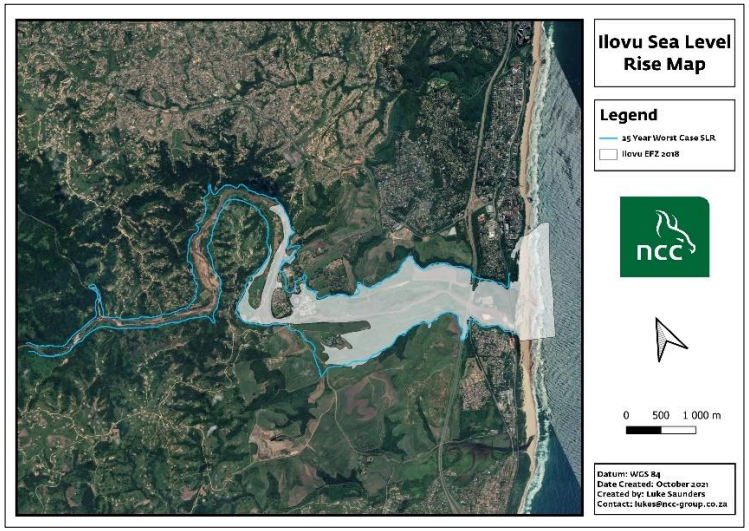

10 year SLR best case scenario 0.



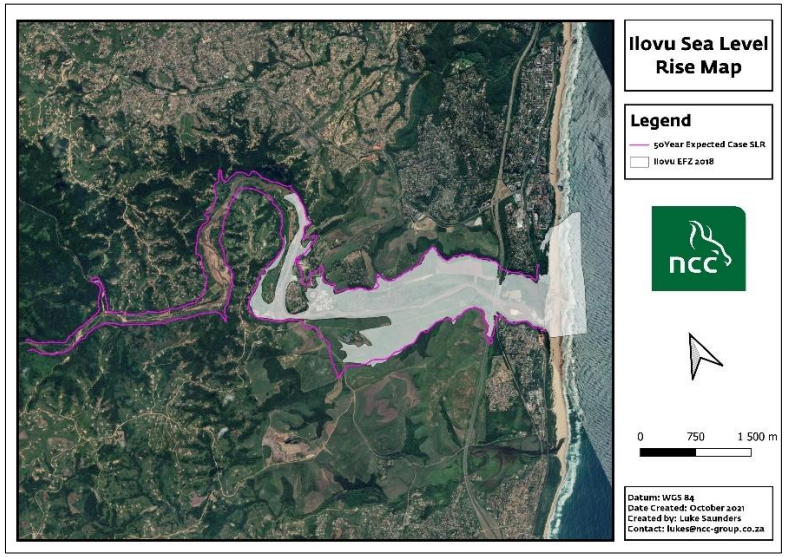

10 year SLR worst case scenario 3a.



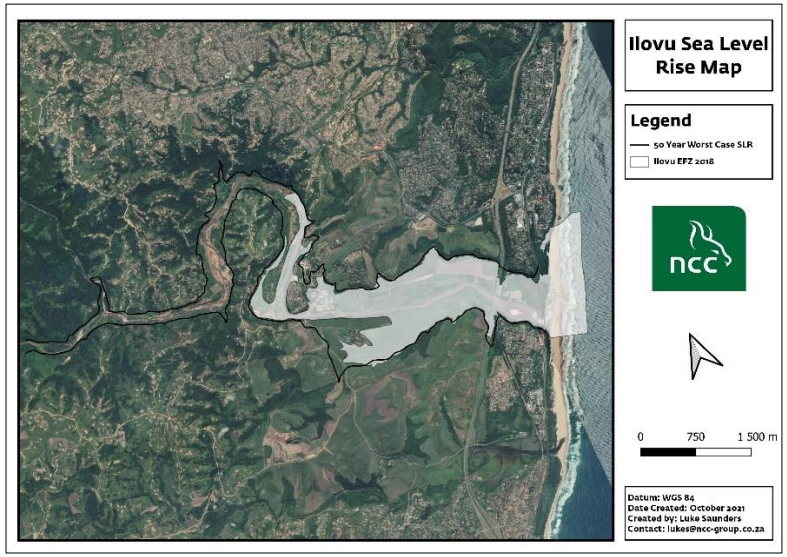

25 year SLR best case scenario 1.



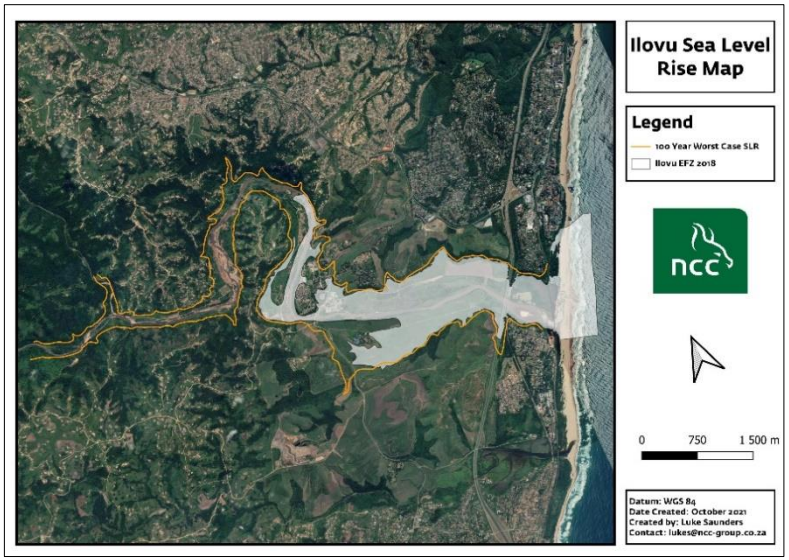

25 year SLR worst case scenario 2.



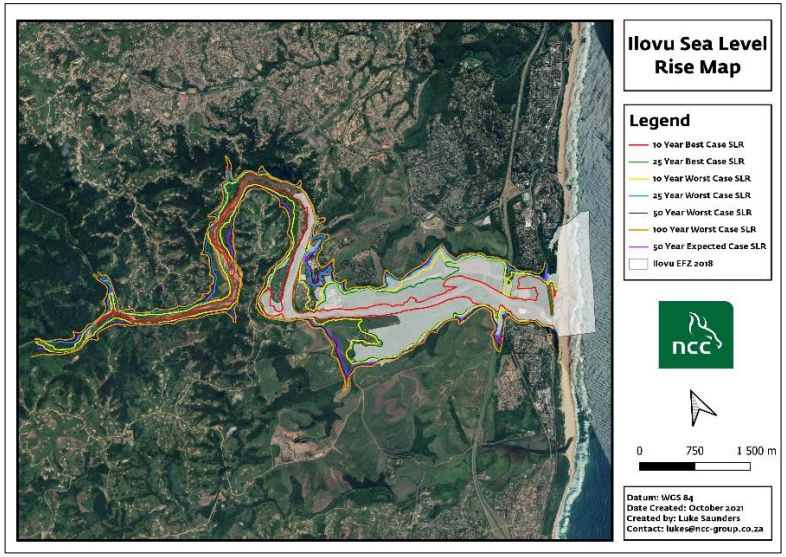

50 Year SLR expected case scenario 3b.




50 Year SLR worst case scenario 3c.

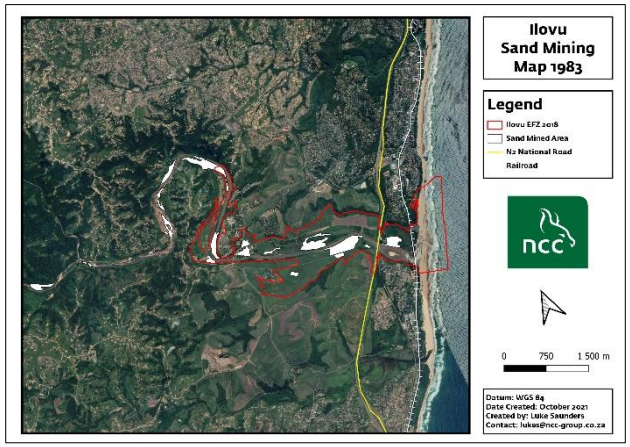



SLR 100 year SLR worst case scenario 3d.

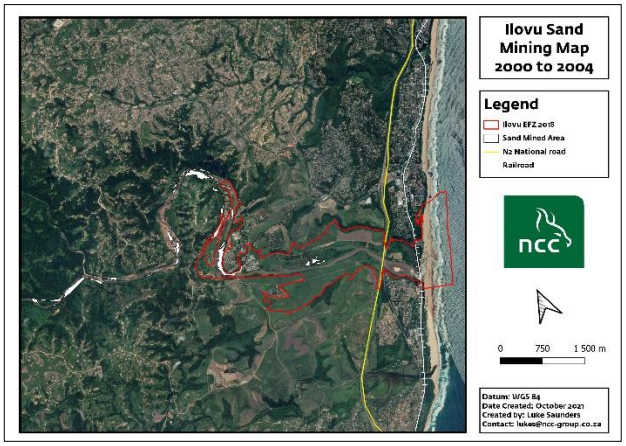



SLR All scenarios.

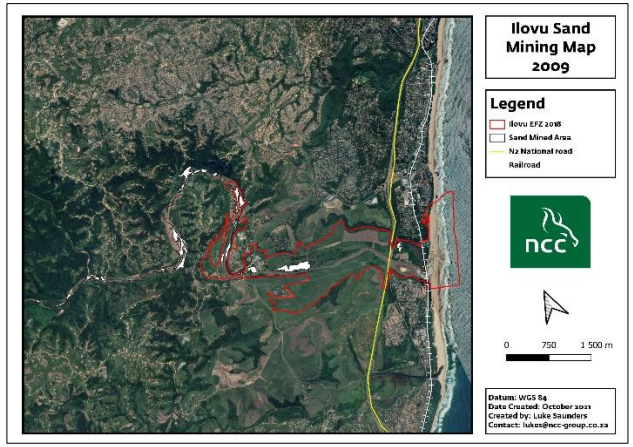
## **12.4 APPENDIX 4:** RECORD OF SAND MINING IN THE ILOVU ESTUARY WITH PROPOSED BUFFER.



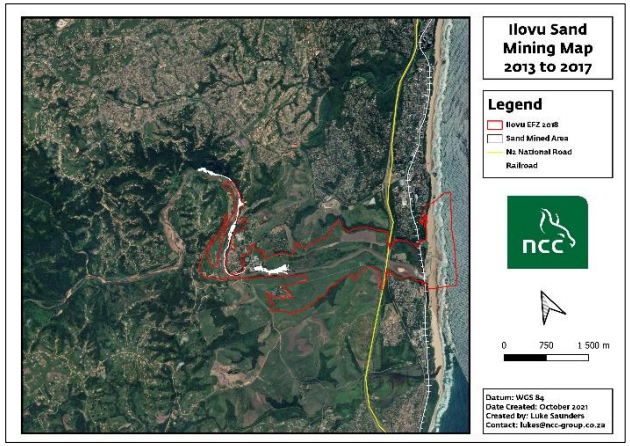

Sand mined areas 1983.



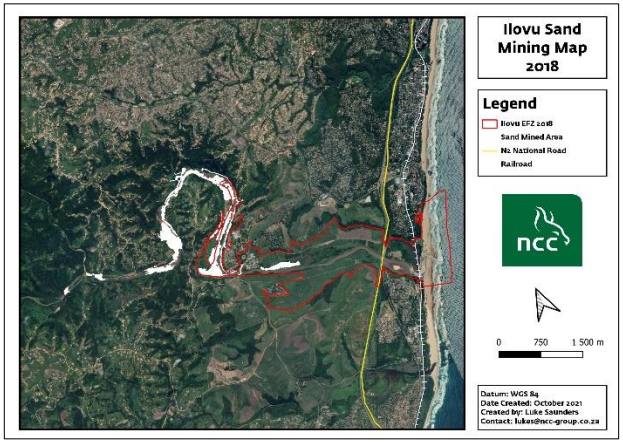

Sand mined areas 2000 to 2004.



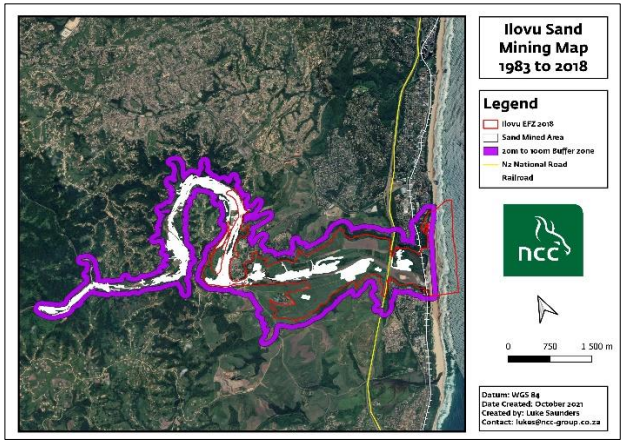

Sand mined areas 2009.




Sand mined areas 2013 to 2017.




Sand mined areas 2018.




Sand mined areas 1983 to 2018 with buffer.