Western Cape Government
Environmental Affairs & Development Planning

BETTER TOGETHER.

INFORMING COASTAL EROSION DECISION-MAKING

USER-FRIENDLY GUIDELINE

NOVEMBER 2020

ACKNOWLEDGEMENTS

Document title:
Western Cape: User-Friendly Guidelines Informing Coastal Erosion Decision-making

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Acknowledgements:

The Department would like to acknowledge the following partners for their contributions in developing this informative document:

- City of Cape Town
- West Coast District Municipality
- Overstrand Municipality
- Garden Route District Municipality
- Department of Environment, Forestry and Fisheries
- Department of Public Works and Infrastructure
- CapeNature
- SANParks

Date:
November 2020

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GLOSSARY

For the purpose of this guideline, please note the following definitions are in terms of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008):

- "**adverse effect**" means any actual or potential impact on the environment that impairs, or may impair, the environment or any aspect of it to an extent that is more than trivial or insignificant and, without limiting the term, includes any actual or potential impact on the environment that results in-
- a detrimental effect on the health or well-being of a person;
- an impairment of the ability of any person or community to provide doe their health, safety or social and economic needs; or
- a detrimental effect on the environment due to a significant impact or cumulative effect of that impact taken together with other impacts
- "**authorisation**" means an authorisation under the NEM: ICMA, and includes a coastal waters discharge permit, a general authorisation, a dumping permit, a coastal lease, a coastal concession and any authorisation that is regarded as being an authorisation under this Act, but excludes an environmental authorisation;
- "**coastal access land**" means land designated as coastal access land in terms of section 18(1), read with section 26;
- "**coastal activities**" means coastal activities listed or specified in terms of Chapter 5 of the NEMA which take place in the coastal zone;
- "**coastal environment**" means the environment within the coastal zone;
- "**coastal management**" includes-
- *the regulation, management, protection, conservation and rehabilitation of the coastal environment;*
- *the regulation and management of the use and development of the coastal zone and coastal resources;*
- *monitoring and enforcing compliance with laws and policies that regulate human activities within the coastal zone; and*
- *planning in connection with the activities referred to in (a)(b) and (c);*
- "**coastal management line**" means a line determined by an MEC in accordance with section 25 in order to demarcate an area within which development will be prohibited or controlled in order to achieve the objects of this Act or coastal management objectives;
- "**coastal management objective**" means a clearly defined objective established by a coastal management programme for a specific area within the coastal zone which coastal management must be directed at achieving;
- **"coastal management programme"** means the national or a provincial or municipal coastal management programme established in terms of Chapter 6;
- **"coastal protection zone"** means the coastal protection zone contemplated in section 17;
- **"coastal public property"** means coastal public property referred to in section 7;

- **"coastal zone"** means the area comprising coastal public property, the coastal protection zone, coastal access land and coastal protected areas, the seashore, coastal waters and the exclusive economic zone and includes any aspect of the environment on, in, under and above such area;
- **"competent authority"** means a competent authority identified in terms of section 24C of the National Environmental Management Act;
- **"development"**, in relation to a place, means any process initiated by a person to change the use, physical nature or appearance of that place, and includes—
- *the construction, erection, alteration, demolition or removal of a structure or building;*
- *a process to rezone, subdivide or consolidate land;*
- *changes to the existing or natural topography of the coastal zone; and*
- *the destruction or removal of indigenous or protected vegetation;*
- "**dynamic coastal processes"** means all the natural processes continually reshaping the shoreline and near shore seabed and includes—
- wind action;
- wave action;
- currents;
- tidal action; and
- river flows;
- "**environmental authorisation**" means an authorisation granted in respect of coastal activities by a competent authority in terms of Chapter 5 of the NEMA;
- "**high-water mark**" means the highest line reached by coastal waters, but excluding any line reached as a result of-
- exceptional or abnormal floods or storms that occur no more than once in ten years,
- or an estuary being closed to sea;
- "**littoral active zone**" means any land forming part of, or adjacent to, the seashore that is-
- unstable and dynamic as a result of natural processes; and
- characterised by dunes, beaches, sand bars and other landforms composed of unconsolidated sand, pebbles or other such material which is either unvegetated or only partially vegetated.

INTRODUCTION

In South Africa, the Western Cape coastline is one of the most desired locations for human settlements due to its rich and diverse natural resources, socio-economic benefits, visual appeal and attractiveness for recreational activities. With strong prevailing winds, such as the South Easter in Cape Town, and a growth of urbanisation, especially along the coastline, our sensitive, vulnerable and highly dynamic ecosystems are increasingly being placed under pressure.

Densification of already urbanised areas is almost more of an issue than urbanisation itself. When looking at urbanisation one can still plan appropriately as it is generally a greenfield site, however when looking at densification, footprints are already established by urbanisation and developers are densifying putting more people and structures at risk. Consequently, there is also generally less space to work within, and the option of retreating within these areas is often not possible. The value of the risk to infrastructure also increases with densification. In such areas there is no longer any space to work with natural systems or buffers and alternative approaches are required.

Additionally, there is a great lack in understanding the complexity of coastal processes in the littoral active zone (LAZ); the consequences of poorly planned developments; and ecological carrying capacities. As such, coastal communities are exposed to an ever-increasing level of risk. A big step for government is to address exactly this: improve our engagement with the public to improve their awareness of some of these issues.

This guideline was developed to equip coastal municipalities of the Western Cape, with a reference document on how to respond to erosion and accretion along the coast. It provides key considerations when managing structures in the LAZ as well as provide clarity on applicable legislation as it relates to activities along the Western Cape coastline.

LEGISLATIVE CONTEXT

The National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) ("NEM: ICMA"), aims to facilitate the integrated management of the coastal environment and maintain the natural attributes of coastal landscapes and seascapes, and ensure that development and use of natural resources in the coastal zone is socially and economically justifiable and ecologically sustainable. It also seeks to define the rights and duties of stakeholders in relation to coastal areas and determine roles and responsibilities of organs of state as well as give guidance when it comes to inappropriate development and other adverse effects on the coastal environment.

The NEM: ICMA requires that where environmental authorisation in terms of the Chapter 5 of the National Environmental Management Act ("NEMA") is required for coastal activities (i.e. where an Environmental Impact Assessment ("EIA") listed activity is triggered), and competent authorities need to consider the following:

- Whether coastal public property, coastal access land or the coastal protection zone will be affected by the proposed activity or action;
- Whether the proposed activity is consistent with the purpose or objective(s) of the various zones as prescribed in the NEM: ICMA;
- The likely effect of dynamic coastal processes (such as wave, current and wind action, erosion, accretion, sea-level rise, storm surges and flooding) on the activity;
- The socio-economic impact of that activity or action is authorised or not;
- Coastal Management Programmes, Coastal Management Lines, Estuarine Management Plans and Coastal Management Objectives;
- Whether the development of an activity is likely to cause irreversible or long-lasting adverse effects on the coastal environment that cannot be properly mitigated; will prejudice the achievement of any coastal management objective; or will not be in the interest of the whole community; and
- Whether the proposed activity or development will provide important services to the public and / or whether the very nature of the proposed activity or development requires it to be located within coastal public property, the coastal protection zone or coastal access land.

A big lesson the Western Cape has learned is that, in the past, the spatial extent to which coastal processes can take place, were drastically underestimated. Consequently, there is infrastructure located along the Western Cape coastline that is now exposed to coastal processes which are '*burdens*' to coastal municipalities. It is therefore vital that a conservative stance is taken in the consideration of coastal processes and the extent to which they may occur against appropriate time horizons.

SECTION 15 OF THE NEM: ICMA

Any acts or physical responses to erosion or accretion on coastal public property is prohibited by Section 15 of the NEM: ICMA.

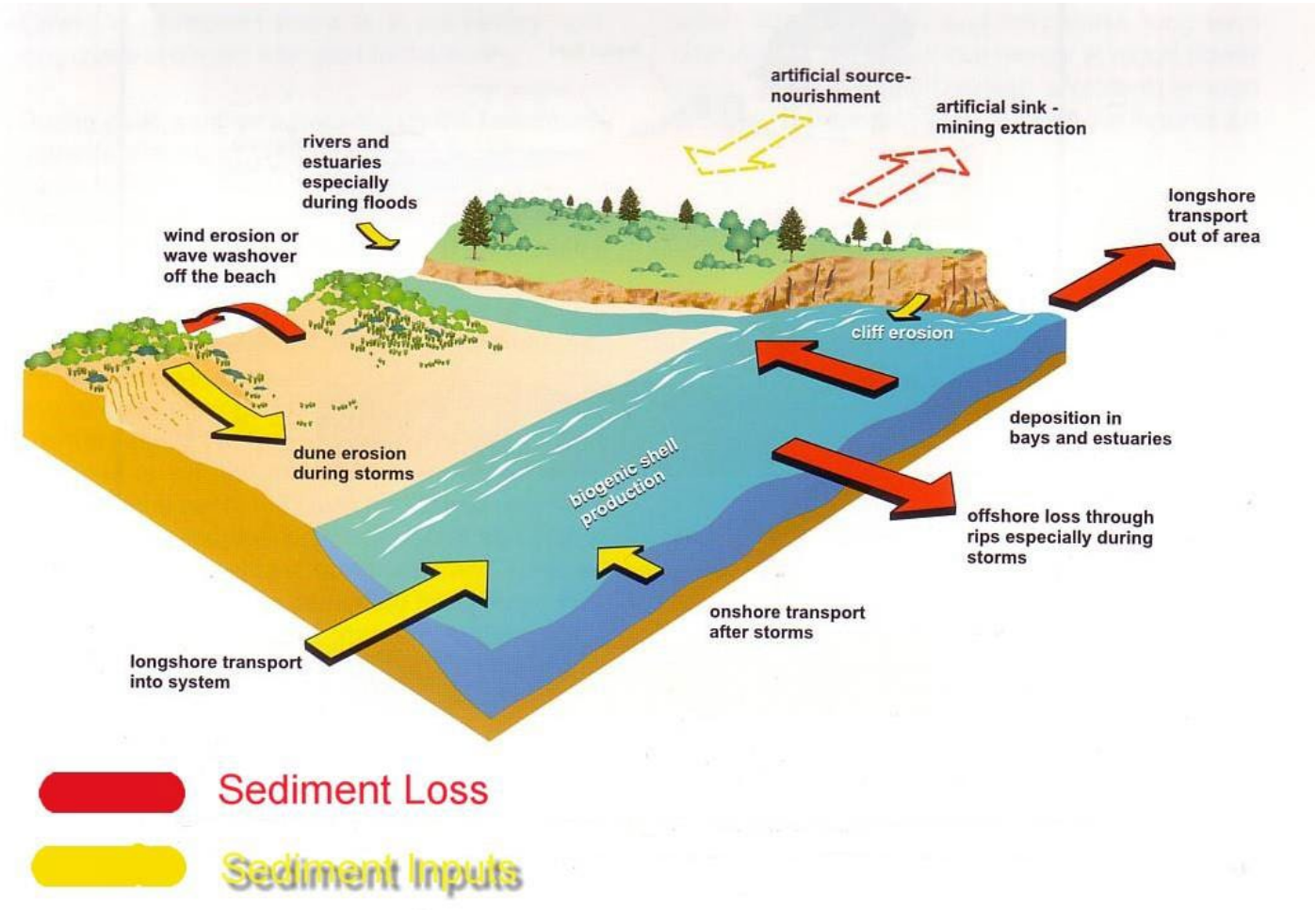
> ***(1) 'No person, owner or occupier of land adjacent to the seashore or other coastal public property capable of erosion or accretion may require any organ of state or any other person to take measures to prevent the erosion or accretion of the seashore or such other coastal public property, or of land adjacent to coastal public property, unless the erosion is caused by an intentional act or omission of that organ of state or other person;***
>
> ***(2) No person may construct, maintain or extend any structure, or take other measures on coastal public property to prevent or promote erosion or accretion of the seashore except as provided for in this Act.'***

It must be noted that any erosion response methods may only occur within the ambit of legislation as the NEM: ICMA specifically prohibits the erection of erosion protections measures within coastal public property. The erection of erosion protection measures may only be considered under certain circumstances. This guideline must be used as a reference or guiding document by authorities, as a last resort option for erosion protection measures within the coastal zone; while taking cognisance of all relevant and applicable legislation.

EROSION AND ACCRETION

Erosion and accretion are natural processes working harmoniously that characterise the natural dynamics of the LAZ, a single sediment system, wherein there is a continuous exchange of sediment between beaches, dunes, river mouths/estuaries and the surf zone sandbars (Figure 1). Coastal **erosion** can be defined as "*the weathering of rocks, removal of beach or dune sediment as a result of wave action, tidal currents or drainage*" (www.coastkzn.co.za). In contrast, **accretion** refers to the accumulation of sediment in water courses and along coastlines deposited through the same natural forces.

Although erosion is a natural process along our coastline, it results in property loss; a reduction in property values; and can further negatively affect coastal communities who rely on tourism to survive. Beaches, wetlands and dunes are also influenced by erosion as well as accretion as depicted in Figure 1.



(Figure 1: Biophysical components of the cycle of erosion and accretion in the coastal zone (WC EMFIS Activity Guidelines, 2019)

FACTORS INFLUENCING EROSION

Biophysically, the coastline of the Western Cape consists of sandy beaches interspersed with occasional rocky outcrops, headlands and wave-cut platforms. Our sandy shores tend to be more susceptible to coastal erosion than rocky shores due to its dynamic nature.

Any structures in the LAZ hinder the natural process of sand exchange which could result in sand inundation problems or erosion. The destruction of foredunes through activities such as mining or coastal development and even unmanaged human impact such as trampling of dunes, removes the reservoir that supplies sand to the beach during erosion events. This also applies to artificial sand stabilisation with vegetation.

In the face of a changing global climate and the presence of naturally dynamic coastal processes, the long-term sustainability of built coastal areas in hazardous coastal areas in the Western Cape is increasingly compromised by marine storm surges, terrestrial flooding, shifting dunes and coastal erosion events. This is further evident by the increasing response by government and coastal stakeholders, and the development and implementation of management tools, such as Coastal Management Programmes; Coastal Management Lines; Estuary Management Plans and the continued involvement and function of various coastal governance forums in the Western Cape.

(Figure 2: Example of structures vulnerable to erosion due to its position in the LAZ at Paradise Beach)

HUMAN FACTORS INFLUENCING EROSION AND ACCRETION

Erosion and accretion are always active processes in the LAZ. However, dominant driving forces determine the balance between these processes at a certain point in time, which can either be natural forces or as a result of human activities and interactions. It is therefore necessary to understand how human activities influence erosion and accretion which can contribute towards the proper management of the root causes of imbalance in our ecosystems.

The following are the most common human-induced activities which contributes to erosion and accretion along the coast and should be addressed before erosion and accretions becomes hazardous or problematic, as stated in the *Western Cape EMFIS Activity Guidelines, 2019*:

- Poorly designed and poorly sited developments;
- Inappropriate coastal defence structures;
- Erosion protection/ bank stabilisation;
- Deforestation and other land clearing activities;
- Inappropriate and / or unmanaged pedestrian access;
- Vehicles on beaches;
- Coastal mining as well as mining in estuaries;
- Construction of dams and loss of sediment to system;
- Poorly managed stormwater runoff;
- Livestock grazing;
- Artificial breaching of estuary mouths;
- Inappropriate control of Invasive Alien Plants;
- Poor agricultural practices;
- Boat wake and dam releases (in estuaries); etc.

(Figure 3: Example of Human factors influencing erosion/accretion (poorly designed and sited developments) during a storm event in the City of Cape Town)

PRINCIPLES FOR DEVELOPMENT IN LAZ

The following general principles should be used as decision making informants for developments within the LAZ, to reduce uncertainty and unanticipated consequences thereof:

- If at all possible, development within the LAZ or any are subject to dynamic coastal process must be avoided;
- The shoreline is a dynamic system and should be treated as such and allow for the free movement of sand without any interferences;
- The coastal management line and its informants of the given coast must be implemented and considered;
- The functioning of each beach, dune and estuarine system must be determined before making new development or management proposals – this should include a historical analysis of the spatial extent to which coastal processes occurred, as well as conservative estimates of future predictions of these coastal processes;
- Where permissible, hidden structures or soft techniques such as sand nourishment should be used rather than obvious hard techniques to solve beach erosion problems;
- If a storm has drastically altered a beach, it is best to wait for the natural sediment cycle to run its course, as sand will likely be returned to the beach;
- The best expertise available and relevant to the project should be used e.g. coastal engineer, dune rehabilitation specialists, anecdotal knowledge of local residents, etc.

ACTIVE INTERVENTION MEASURES

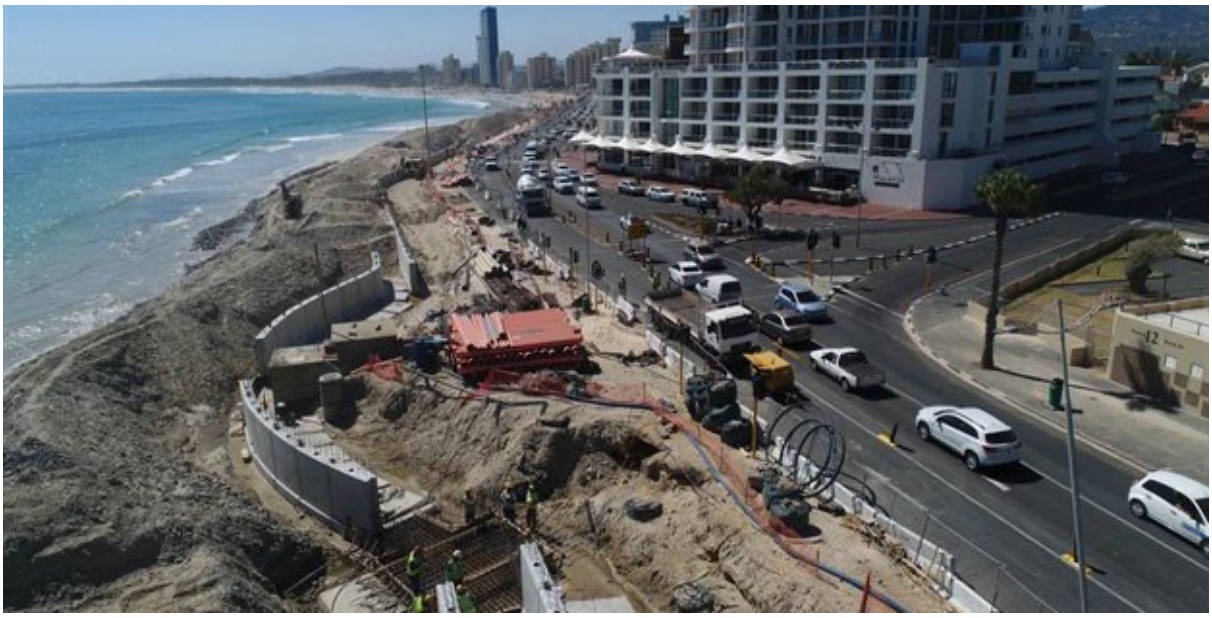
When intervention and erosion protection measures become necessary, the competent authority(ies) need to consider the following in a given scenario:

- The physical character of the site;
- Cause of coastal erosion;
- The severity of the erosive forces;
- Frequency of events;
- Potential recurring nature of the erosive forces;
- Potential and nature of extreme events;
- Future climatic conditions and weather patterns;
- Nature of present or future human activities in the sea;
- The degree of maintenance that is practical for a particular method;
- Direct and indirect impacts of proposed intervention on coastal processes and adjacent coastline
- Whether the provisions of NEM: ICMA provides for development within such zone, e.g. coastal public property.

The idea is to work with nature instead of against it by placing emphasis on introducing artificial elements to natural processes.

Erosion protection measures and bank stabilisation can include hard techniques, soft techniques or a combination of both.

- **Hard Techniques:** *typical engineering solutions used for structures such as revetments (sloped) and retaining walls (vertical) as seen in Figure 2.*
- **Soft Techniques:** *more holistic approach through the incorporation of natural environmental materials / elements (artificial buffer) and considerations, yet the same engineering principles as 'hard techniques.*
- **Managed Retreat:** *removal and relocation of houses and other infrastructure away from erosion prone areas – this could be applicable to properties that are already in the active erosion zone*



(Figure 4 – An example 'Hard techniques' used for the Strand Beach Seawall)

Soft and hard techniques can also be combined, to provide the same protection as 'hard techniques' and offer the following benefits:

- Structures that are hidden and therefore aesthetically acceptable;
- Structures that are shaped for better 'fit' within the surrounding environment;
- Structures made from material that have a more natural appearance;
- The use of natural forces and energy, such as dune rehabilitation techniques used to overcome the effects of windblown sand;
- Opportunities for designing structures benefiting both humans and nature.
- Soft structures enable option retention unlike hard structures which lock you into a certain scenario.

LESSONS LEARNED FROM TECHNIQUES

International case studies have provided a range of experiences in relation to cost benefit and environmental sensitivity in terms of responding to coastal erosion. These include the following (Breetzke *et al*., 2008 & City of Cape Town, 2020):

1. 'Soft Techniques'

- Soft coasts (e.g. defined by sandy beaches and dunes) require soft solutions;
- Cost effective relative to hard protection measures;
- Growing popularity with proven effectiveness;
- Protection of infrastructure in the short term;
- Reduce deflection of energy into neighbouring properties;
- Increasing exposure to coastal processes into the future and associated rising maintenance costs;
- Requires continuous maintenance;
- Reduced safety hazard;
- Coastal dune rehabilitation improves slope stability, consolidates each sediment and reduces wave energy;
- Aesthetically more pleasing than 'holding the line' through hard engineering defence options;
- Provides a greater opportunity for the continuation of natural coastal processes.

2. 'Hard Techniques'

- Positive effect restricted to the intended site
- Expensive to construct with a continued maintenance burden;
- Aesthetically offensive;
- Protection of infrastructure in the current location in the short term;
- Deflection of wave energy to neighbouring properties and the exacerbation of erosion for these properties;
- Unintended negative impacts on neighbouring / adjacent sites
- Requires expansion to adjacent areas as their impacts extend beyond the affected area;
- Increases turbulence and sediment scouring;
- Likely to result in the loss of beach adjacent to such structure, especially in the long term;
- Disrupts longshore sediment transport;
- Impeded access to and along coastal public property as a consequence of such interventions;
- Loss of coastal public property adjacent to the hard engineering defence interventions;
- Loss of beach amenity;
- Impacts likely to remain in place at multi-generational scale;
- "Locking in" of undesirable scenarios as determined by above impacts.

3. 'Managed Retreat'

- Expensive or can be cost effective;
- Often not an option in highly transformed urban environments;
- Retain the beach as an important recreational and amenity public space;
- Managed retreat is likely to be less expensive than the cost of construction and ongoing maintenance of sea defence (but context specific) if considered against a long-term time horizon;
- Beneficial to the local economy;
- Planned retreat and establishment of a vegetated dune cordon as a 'soft engineering' response enables options retention into the future;
- Aesthetically pleasing;
- Retention of current facilities;
- Will require significant planning and substantial construction works;
- Established dune cordon will require ongoing maintenance to ensure its functionality; and
- Sound and most environmentally sustainable solution.

(Figure 5: Sand bags used as a coastal protection measure against storm surges in Milnerton, Cape Town)

SHORT TERM BEST PRACTICE PRINCIPLES

With the coastline being a very dynamic space, which can potentially be dangerous to those residing along the coast, coastal communities need to accept and adapt to the natural variations of this environment. The following can be considered as best practice guidelines to manage human responses to coastal erosion (*coastkzn.co.za*):

1. **Accept and Live with Erosion**
   - Plan any coastal construction so that it is a safe distance (buffer) away from the high-water mark and reinstate natural defence mechanisms with the necessary environmental authorisations.
   - Buffers must be informed by coastal processes that occur along that stretch of coastline.
   - Where construction along the coast is necessary, such structures must be designed in such a way to withstand / mitigate impacts of coastal processes. This is mostly applicable to necessary infrastructure along the coast.

2. **A Collective Response is required at appropriate scales**
   - Holistic planning and implementation by municipalities in response to coastal erosion is critical. A Municipal Coastal Management Programme, incorporating Shoreline Management Plans, is required to reduce the direct and associated effects of erosion.
   - Neighbours (local authorities) need to institute similar mitigation measures. This collaboration will increase defence effectiveness and reduce costs.
   - It must be noted that any erosion response methods may only occur within the ambit of legislation. The NEM: ICMA specifically prohibits the erection of erosion response in certain instances.

3. **Establish a Coastal Management Line**
   - A coastal management line provides for the protection of the natural coastal environment and use and value thereof from encroachment from development as well as protecting the beachfront developments from the effects of storms and accelerated coastal erosion.
   - A CML also provides for the management of development seaward or partially seaward of the CML including the prohibition or restriction of certain activities.
   - Any development seaward of this line is considered to be at high risk to coastal erosion and any other coastal process which may result in loss of recreation and amenity value of the coast.
   - In the Western Cape the delineation of the CML is informed by the modelling of coastal processes as well as other environmental sensitivities including vegetation. Landowners or developers of property along the coast must take cognisance of this information which must be considered as part of the EIA process where applicable.
   - The CML as well as the information that informs the delineation of the CML must be considered when designing and siting any structures or infrastructure along the coast.
   - Although the CML is primarily intended to manage future development the informants of the CML must be used to inform future management strategies in response to erosion such as retreat or infrastructure redesign.

4. Work with Natural Processes in Responding to Erosion

- Soft coasts require soft solutions.
- The preferred protection measures should make use of soft engineering solutions.
- The design of any erosion protection measures proposed must be considerate of the natural processes.
- Municipalities are not responsible for providing or maintaining sea defence systems for private property owners.
- Any measures proposed must be located within the cadastral boundary of private property and landward of the HWM where the HWM has moved inland of a property boundary.
- As far as possible any erosion protection measures erected landward of the seaward property boundary must still as far as possible mimic natural ecological infrastructure.
- It is important to note that measures such as active dune management requires continuous management.

5. Replace Lost Sand with Sand (where feasible)

- Sand used for protection measures must be sourced from the beach directly in front of the affected property. This should only be done of sufficient sand is available and is not an option in sand-poor areas.
- Sand may not be sourced from any dunes (vegetated or not), nor from any other relatively undisturbed area.
- It is important that the sand used must be of a similar nature (of marine origin, colour and grade) to that found on the beach.
- Acquiring beach sand from other sources should only be considered following input from the appropriate specialists.

6. Consider Hard Engineering Solutions in Exceptional Cases Only

- Resort to hard engineering solutions only in exceptional cases and only after detailed environmental assessment and authorisation is obtained.
- Private property owners and municipalities should remain obliged to maintain any defence system they establish and should be held liable for any failure, or where such failure affects other property owners or requires that the natural environment be rehabilitated.
- Structures to protect private property must be built in the private property and not encroach onto Coastal Public Property.

7. Be Prepared, Monitor and React

- Coastal property owners should prepare for erosion events by purchasing and storing appropriate sand bags. that are environmentally friendly as well as meet durable and sustainable standards.
    - → In the context of flooding in estuaries, sandbags could be placed (temporarily) around e.g. doorways of houses, in an emergency situation, in an attempt to prevent floodwater from entering houses – this would have limited success and highly dependent on the scale of flooding.
    - → It should be noted that unless these bags are large enough, they will just be washed around in a storm event and litter the coastline post such an event. Also, the packing of bags in an inappropriate location can result in exacerbating erosion on coastline if they deflect wave energy that would normally be absorbed by coastline/beach or sand dune etc.

- → The packing of bags in an appropriate location can result in exacerbating erosion on the coastline if they deflect wave energy that would normally be absorbed by coastline/beach or sand dune etc.
- → Authorities are required to provide input on applications that involve sand bags, etc.

- Coastal property owners should monitor coastal change in order to allow for adequate time to develop an appropriate response measure/ strategy/ mechanism.
- In order to regard any event to be an emergency event it must be determined as such by the relevant competent authority in accordance with relevant legislation.
- In case of an emergency as per regulations, driving on the beach is a permissible use. Any remediation or rehabilitation necessitating beach driving that does not constitute an emergency requires prior authorisation from the National Department of Environment, Forestry and Fisheries (DEFF).
- Any emergency response is regarded to be a short-term solution and may result in exacerbating erosion if the correct measure is not implemented. As such, a precautionary approach is advised.

8. Appropriately Reconstruct Coastal Infrastructure and Amenities

- Coastal property owners, in collaboration with affected municipalities, remain responsible for the removal of rubble as a result of coastal erosion.
- Infrastructure that is damaged as a result of coastal erosion should not just be replaced. The appropriateness of the infrastructure itself and its placement should be assessed, and necessary improvements made, and in the medium- to long-term plans could be prepared and implemented for a managed retreat of such infrastructure. In certain instances, new authorisations may be required.
- Coastal amenities such as concrete lifesaving facilities that have been damaged should be replaced with more appropriate 'softer' solutions, e.g. temporary wooden lifesaving towers – softer structures make it easy for the recovery process and would have less impact on coastal systems.

9. Avoid and Reduce Risk

- Coastal property owners are responsible for the maintenance of stormwater discharge and are liable for any erosion or negative impact such discharge may have on the frontal dune or beach – where possible, direct discharge on to the beach should be avoided and sustainable urban drainage systems are encouraged.
- Where stormwater must be discharge onto a dune, such discharge should be taken away from the dune face and toe. The discharge should preferably be onto a hardened area such as a rocky headland.
- Integration of stormwater systems between neighbours should be encouraged.
- If storm water is discharged into the sea, the pollution loads of the stormwater should be monitored as the pollution in the stormwater has a negative impact on the receiving environment. Stormwater should ideally be treated via sustainable urban drainage methods or other appropriate treatment before being discharged.

ENVIRONMENTAL AUTHORISATION

PLEASE NOTE:

An Environmental Authorisation may be required for any such activity and the relevant authority(ies) must always be consulted for clarity and verification of applicability and interpretation of EIA listed activities. It should also be noted it is important that changes in the coastal environment must be considered in order to correctly determine the applicability of activities.

LEGISLATION, POLICIES AND PROGRAMMES TO CONSIDER

The following legislation, policy documents and programmes must be adhered to and considered when a state of organ intends to act against erosion or accretion in the Western Cape:

- Bill of Rights in Environmental Management Act
- Coastal Waters Discharge Permit Regulations
- Control of Use of Vehicles in Coastal Areas Regulations
- Dumping at Sea Regulations
- Environmental Conservation Act
- Environmental Impact Assessment Regulations
- Local Government: Municipal Systems Act
- Local Government: Municipal Structures Act
- Management of Public Launch Sites in the Coastal Zone Regulations
- Marine Living Resources Act
- Municipal Bylaws
- Municipal Integrated Development Programmes
- Municipal Spatial Development Frameworks
- National Coastal Management Programme
- National Estuarine Management Protocol
- Spatial Planning and Land Use Management Act
- The National Environmental Management Act
- The NEM: Biodiversity Act
- The NEM: Integrated Coastal Management Act
- The NEM: Protected Areas Act
- The NEM: Waste Management Act
- The National Water Act (Estuaries)
- The South African Constitution
- Western Cape Provincial Coastal Management Programme
- Western Cape Land Use Planning Act
- Western Cape Provincial Spatial Development Framework

The relevant Estuary Management Plans as well as Municipal Coastal Management Programmes should also be considered.

STUDIES AND SPECIALISTS INPUT TO CONSIDER

Organs of state need to request the following studies based on the type of erosion intervention, in order to make better decisions during the EIA process:

- Existing topographic features of the project site and surrounding environment;
- The types, depth, slope, locations of the soils;
- The characteristics of the earth disturbance activity including the past, present and proposed alterations to the project site;
- Wave Modelling;
- Oceanography;
- Wind Circles
- Geotechnical information;
- Hydrodynamic wave modelling – including but not limited to determining significant wave height, wave period, wave frequency, tidal effects, etc. including climate change factors such as sea level rise, increase in storminess, changing factors like changes in wave climate, erosive forces, vegetation changes, etc.
- Updated bathymetry to determine wave propagation in estuaries and in shallow bays, floodlines etc.
- Local climate description and expected changes due to climate change. The information required for climate change will have to be clearly defined during the study;
- Geological survey to determine any unique features of the receiving environment;
- Marine, coastal and estuarine ecosystem study, highlighting present condition and possible impacts of proposed intervention on the ecosystem;
- Engineering study to determine appropriate design of structures which are responsive to the dynamic forces at play
- Anecdotal knowledge
- Technical Reports for CML projects in the Western Cape (Overberg; West Coast and Garden Route).

ROLES AND RESPONSIBILITIES OF KEY AGENCIES

AGENCY	BEFORE SIGNIFICANT EVENT	DURING SIGNIFICANT EVENT	AFTER SIGNIFICANT EVENT
Municipal Disaster Management Centres ("MDMCs")	1. Prepare and maintain the Local Disaster Management Plan 2. Consult with Municipalities, Coastal Management Committees, the DEA&DP and other relevant agencies. 3. Prepare, coordinate and deliver community awareness programmes and educational material with the assistance of the local municipalities to ensure that people in locations potentially threatened by coastal erosion understand the threat and its management.	1. Activate the Local Disaster Management Plan if necessary. 2. Advise the public, local municipality and other emergency management agencies of coastal storms that are likely to affect the municipal area. 3. Conduct regular reconnaissance at locations identified as being susceptible to coastal erosion. 4. Coordinate the provision of advice to the community at risk regarding the likely problem and actions they should take. 5. Coordinate the evacuation of people at risk. 6. Coordinate the transport of removable household possessions and stock, records and equipment from business premises. 7. Provide a 'phone-in' service for the local community to take requests for assistance and advice where necessary.	1. Assign personnel to gather intelligence in areas susceptible to coastal erosion/inundation 2. Review and update the arrangements for managing coastal erosion/inundation in Disaster Management Plans following coastal erosion events. 3. Liaise with DEA&DP to confirm information on the impact of storm events on coastal properties once the storm has abated.
Local Municipalities	1. Carry out the ecologically sustainable planning and management of the coastal zone. 2. Prepare Coastal Management Plans ("CMP"), including arrangements for the emergency management of coastal erosion. 3. Establish and maintain Coastal Management Committees to facilitate the development CMPs and ensure that key agencies are represented on such committees. 4. Participate in education campaigns and assist the MDMC and/or DEA&DP in the development and delivery of educational material to ensure that people in areas potentially threatened by coastal erosion understand the threat and its management.	1. Conduct reconnaissance at coastal erosion trouble spots in consultation with MDMC. 2. Liaise with the MDMC Controller to determine the need for any response actions by the MDMC such as evacuation of residents at risk and any support that may be required to carry out these measures as detailed in the Disaster Management Plan. 3. Liaise with the Engineering Services Coordinator and/or the DEA&DP before constructing or allowing the construction of any unapproved temporary mitigation works to protect coastal property or other structures.	1. Remove and/or mitigate the impact of any temporary physical protective measures from the beach. 2. Liaise with the DEA&DP to determine any changes to the coastal zone and any news areas at risk following storms at sea. 3. Maintain and review municipal Coastal Management Plans in consultation with stakeholders.
Provincial Department of Environmental Affairs and Development Planning ("DEA&DP")	1. Develop and advise on province wide coastal policy, planning and management, 2. Provide ongoing advice to local municipalities and Coastal Management Committees on coastal and estuarine management including procedures for addressing coastal hazards, coastal processes and risks, and management options. 3. Provide MDMC and municipalities with advice on likely erosion 'hotspots' along the coastline.	1. Provide advice to municipalities regarding the most appropriate methods of dealing with coastal erosion and the placement of temporary mitigation measures during storm events.	1. Liaise with municipal staff to ensure appropriate remediation of beaches and dunes following storm events. 2. Provide the MDMC and municipalities with updates on the current state of the coastal zone and any new areas at risk following a storm event. 3. Evaluate and authroise repairs, rehabilitation and reconstruction.
South African Weather Service	1. Formulate and issue official forecasts and Severe Weather Warnings and provide them to the MDMC, radio stations and other organisations prior to and during coastal erosion events.	1. Formulate and issue official forecasts and Severe Weather Warnings and provide them to the MDMC, radio stations and other organisations prior to and during coastal erosion events.	

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- Western Cape Estuarine Management Framework and Implementation Strategy: Best Practice Activity Guidelines v.1 (October 2019)

LIST OF FIGURES

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