Coastal Reserve Management

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Coastal Reserves within the Shire of Denmark

The Shire of Denmark has a coastline covering 84 km.

Coastal reserves within the Shire, comprises cross-tenure management between local government agency the Shire of Denmark, and the state government agency the Department of Biodiversity, Conservation and Attractions (DBCA).

Coastal Reserves within the Shire of Denmark

State government DBCA managed lands such as Nature Reserves and National Parks can have significance at an international, national, regional and local scale and are important for their biodiversity values, heritage value and tourism.

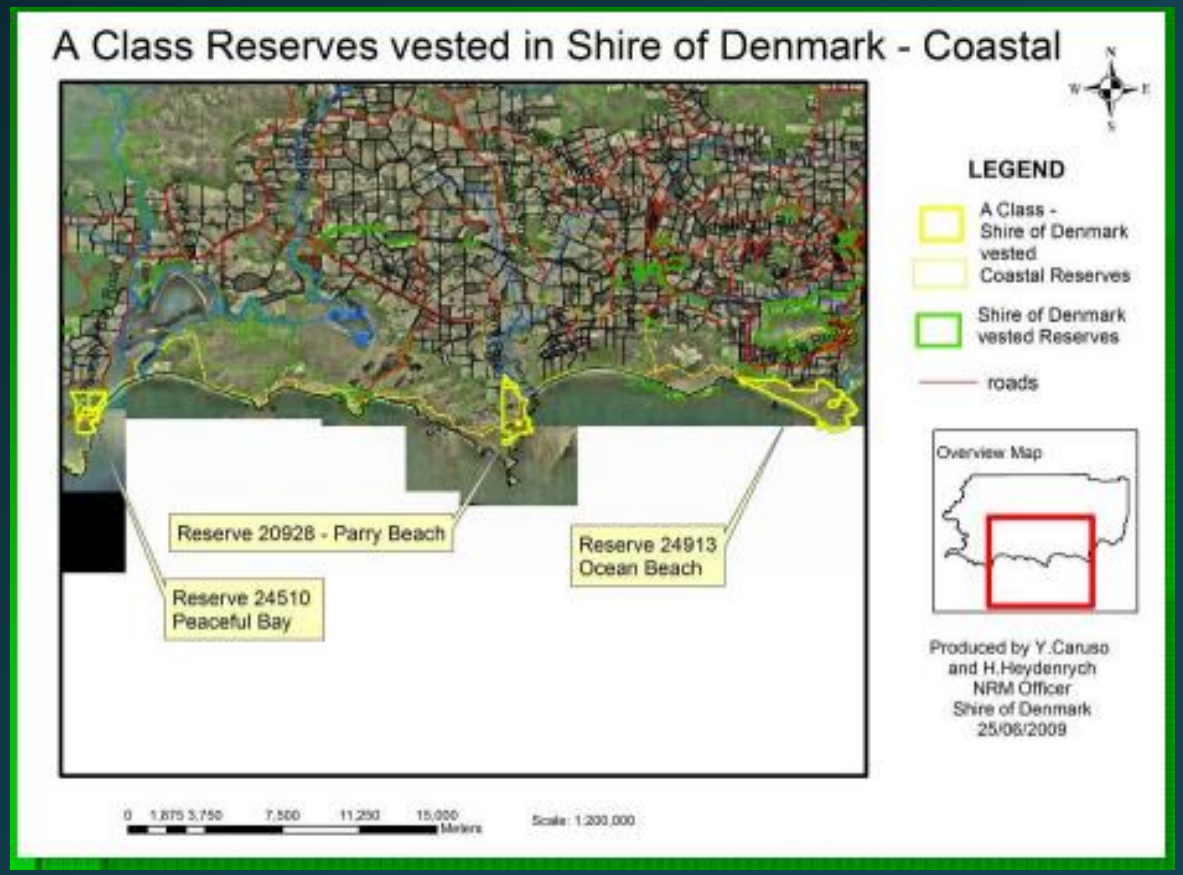
State-managed coastal reserves within the Shire of Denmark includes:

- William Bay National Park
- Quarram Nature Reserve
- Walpole-Nornalup National Park
- Walpole and Nornalup Inlets Marine Park

Shire of Denmark Coastal Reserves

The Shire manages four coastal Reserves located at:

- Ocean Beach (614 ha)
- Parry Beach (223 ha)
- Boat Harbour (59 ha)
- Peaceful Bay (83 ha)



Management of Shire coastal reserves is detailed in the *Coastal Reserves Management Strategy and Action Plan 2010 – 2020*.

The plan prioritises management recommendations for all four Shire coastal reserves for: environmental protection, rehabilitation and future land uses over a ten year period.

Coastal Reserve Management

Natural Resource Management in Reserves

- Maintaining and restoring environmental and biodiversity values
- Maintaining and restoring community recreational and heritage connection values
- Developing management plans
- Managing recreational uses
- Developing facilities and signage
- Monitoring & reporting resource uses

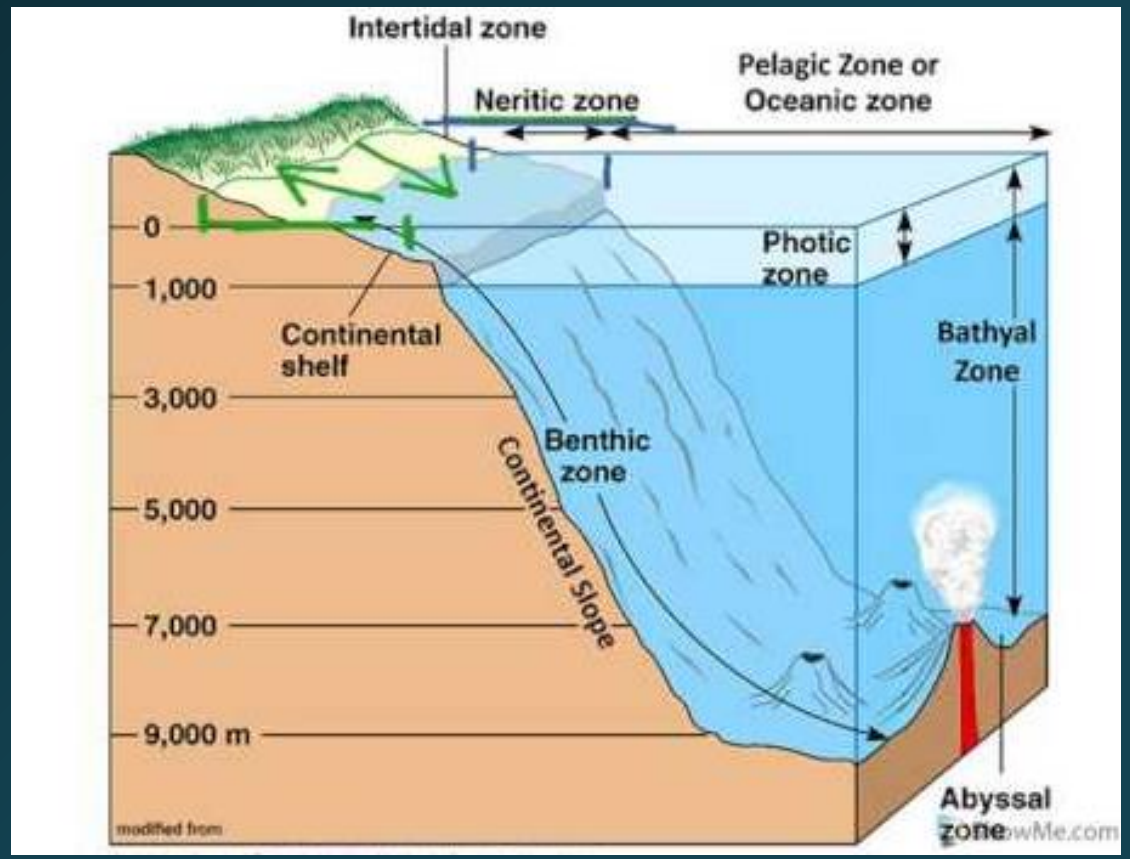
Shire of Denmark Coastal Reserves Management Plan 2010-2020

Coastal and Marine Environments

Marine Environment:

- Aquatic environment with high salt content
- Main zones:
  - Inter-tidal (littoral and sub-littoral)
  - Neritic (lies over the continental shelf)
  - Pelagic (open ocean)
  - Abyssal (deep ocean)
  - Benthic (the sea floor)
- Landforms
- Marine life

Function: regulates climate, prevents erosion, accumulates and distributes solar energy, absorbs CO_2, maintains biological control.



Marine Ecosystem Zones

Coastal and Marine Environments

Coastal Environment:

- Interface between the land and sea
- Beaches, tidal wetlands, estuaries, bays, mangroves, seagrass meadows, saltmarsh
- Landforms: caves, cliffs, sand dunes
- Everything that lives in this environment

Coastal Landforms

Function: highly dynamic critical zones of valuable ecosystems, regulating function vital for nutrient decomposition, practice of agriculture/aquaculture, resource-based industries, desirable location for residential, tourism and recreational uses

Coastal Functions

Conserving Biodiversity in Coastal & Marine Environments

Biodiversity:

- The biological range and variety of different organisms, genes and ecosystems found in a particular area. In order to conserve biodiversity it is important to protect the habitat of the fauna and flora in which the coastal and marine creatures live.

Western blue groper (*Achoerodus gouldii*)
Found down WA west coast and spawn is swept up in Leeuwin Current along WA south coast.
Fun fact: largest carnivorous bony fish reaches up to 1.7m and weighs up to 40kg.

Leafy sea dragon (*Phycodurus eques*)
Found on southern coastline of Australia –
Conservation Status: Near Threatened
Fun Fact: male sea dragon becomes pregnant & gives birth to live young

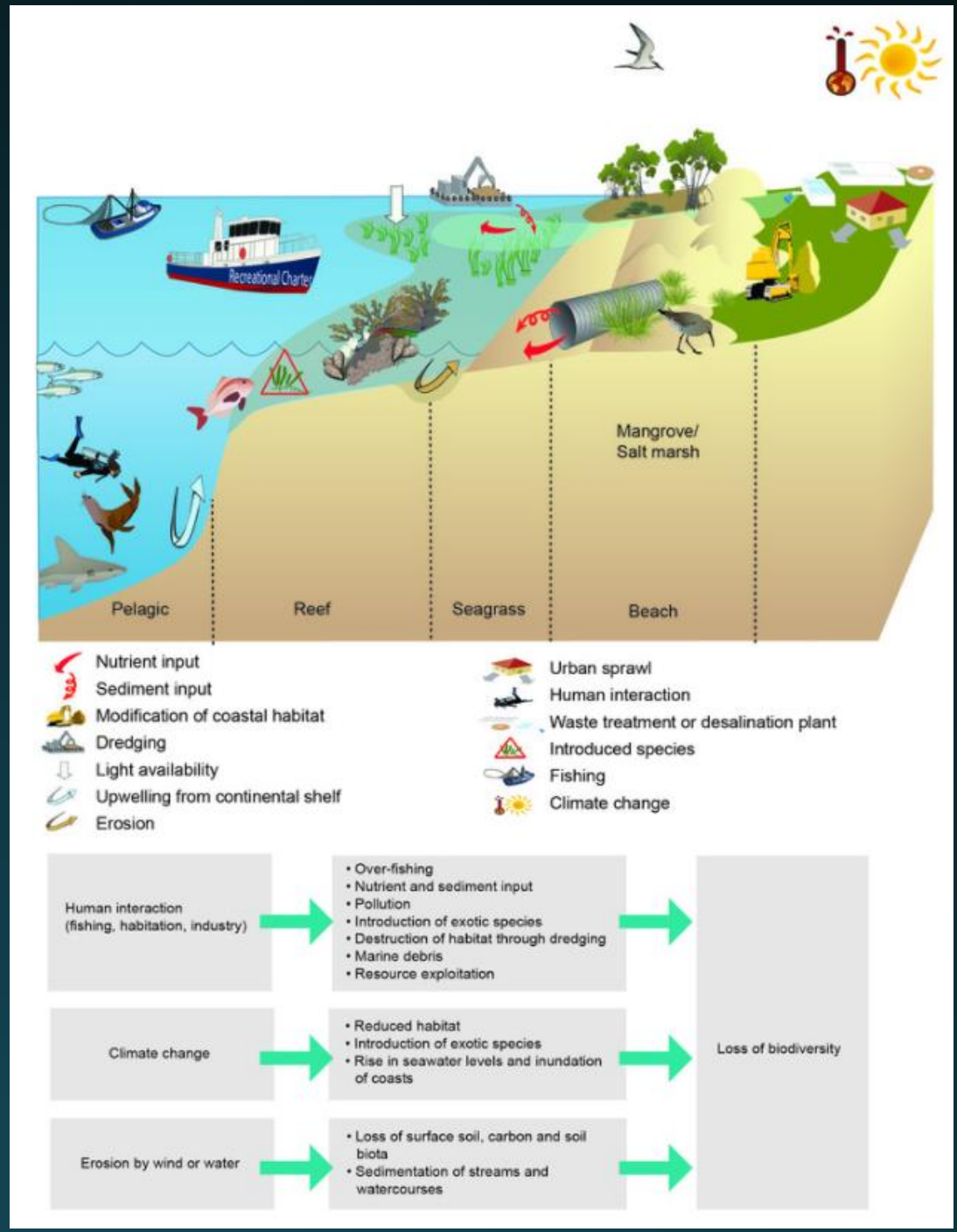
Coastal saltmarsh (Threatened Ecological Community – TEC)
Sarcocornia blackiana
Conservation Status: Vulnerable

Hooded plover (*Thinornis rubricollis*)
Nests are simple scrapes or burrows in the sand with 2-3 eggs incubating for 4 weeks.
Conservation Status: Vulnerable

Threats to Marine & Coastal Environments

Coastal environments are one of the earth's most threatened environments.

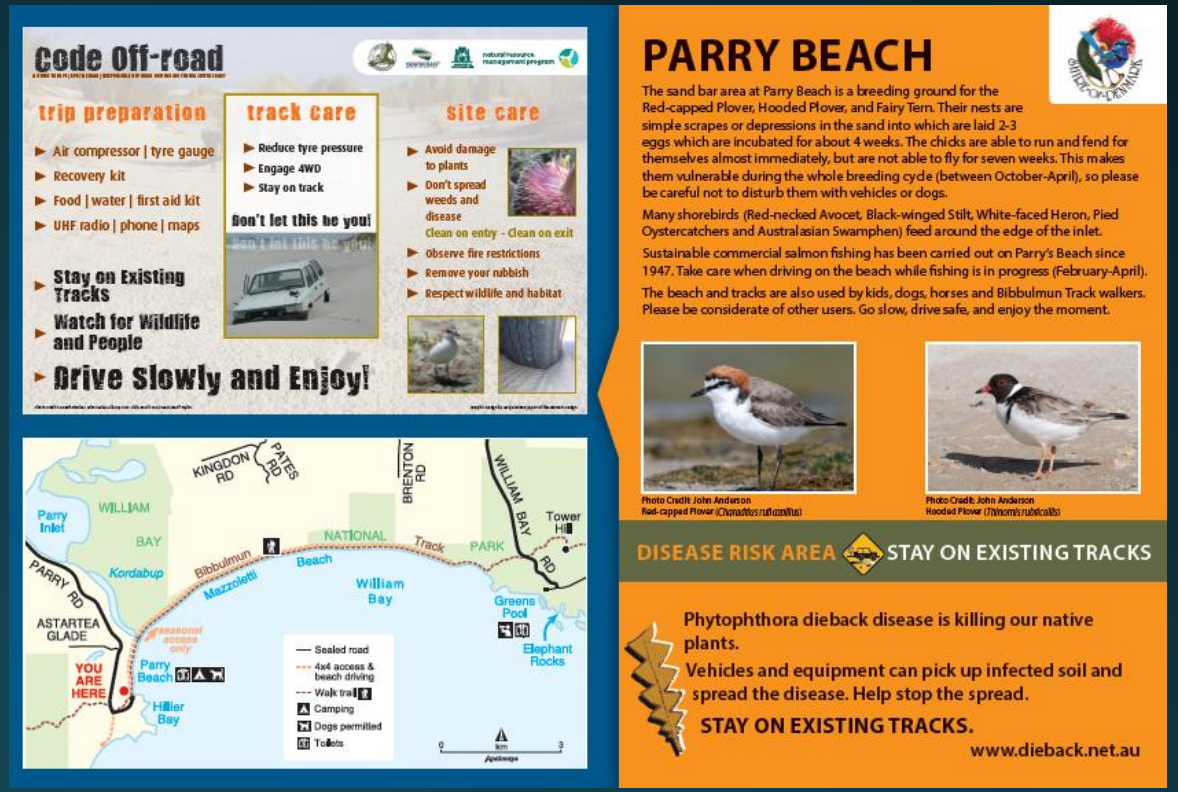
- Increasing population and visitor pressures
- Water pollution - nutrient & sediment input
- Litter – plastic pollution in our oceans
- Dieback
- Over-harvesting & over-exploitation of fish species
- Inappropriate fire regimes and wildfire
- Invasive species
- Habitat destruction and fragmentation
- Natural weather events
- Coastal Erosion Processes
- Climate Change – rising sea levels, extreme weather events



Increasing Population & Visitor Pressures on Coastal Environments

- **Increasing population pressures** on coastal environments – including population migration/relocation to coastal areas (in part due to Covid-19 social impacts, globalisation, and technological advances (eg. Zoom) enabling people to work remotely) – increases demands for coastal services and infrastructure

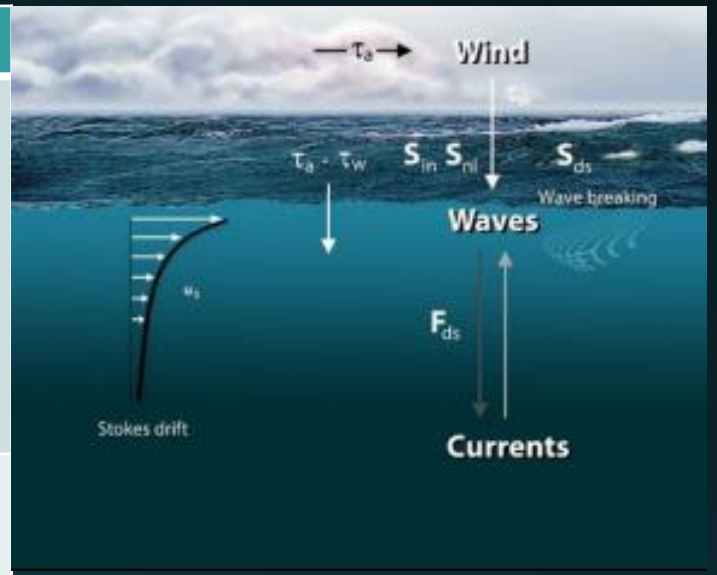
- **Conflicting visitor uses** – four wheel driving along the beach can substantially modify the habitat of intertidal fauna; nesting bird habitats
- **Management Plans**
- **Community education**:
  - Vehicle accessible and non-accessible beach areas
  - CODE OFF ROAD signage and brochure – a guide to safe environmentally responsible coastal 4WD use

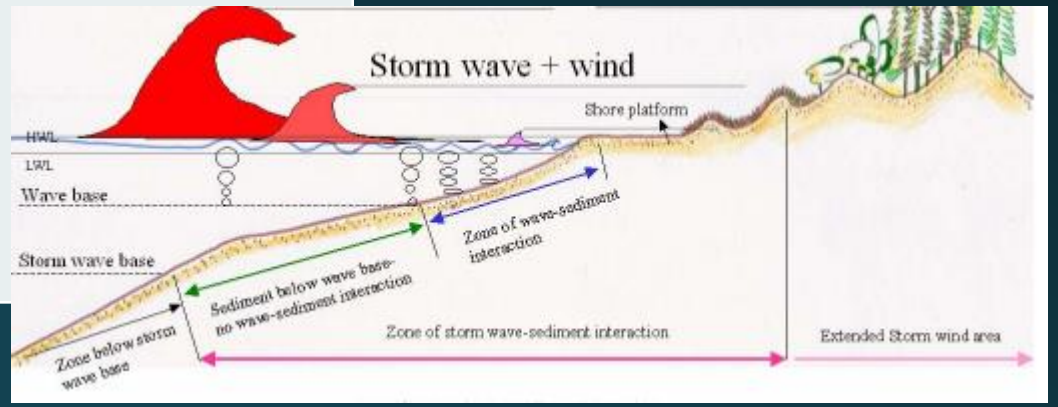


Coastal Erosion Processes

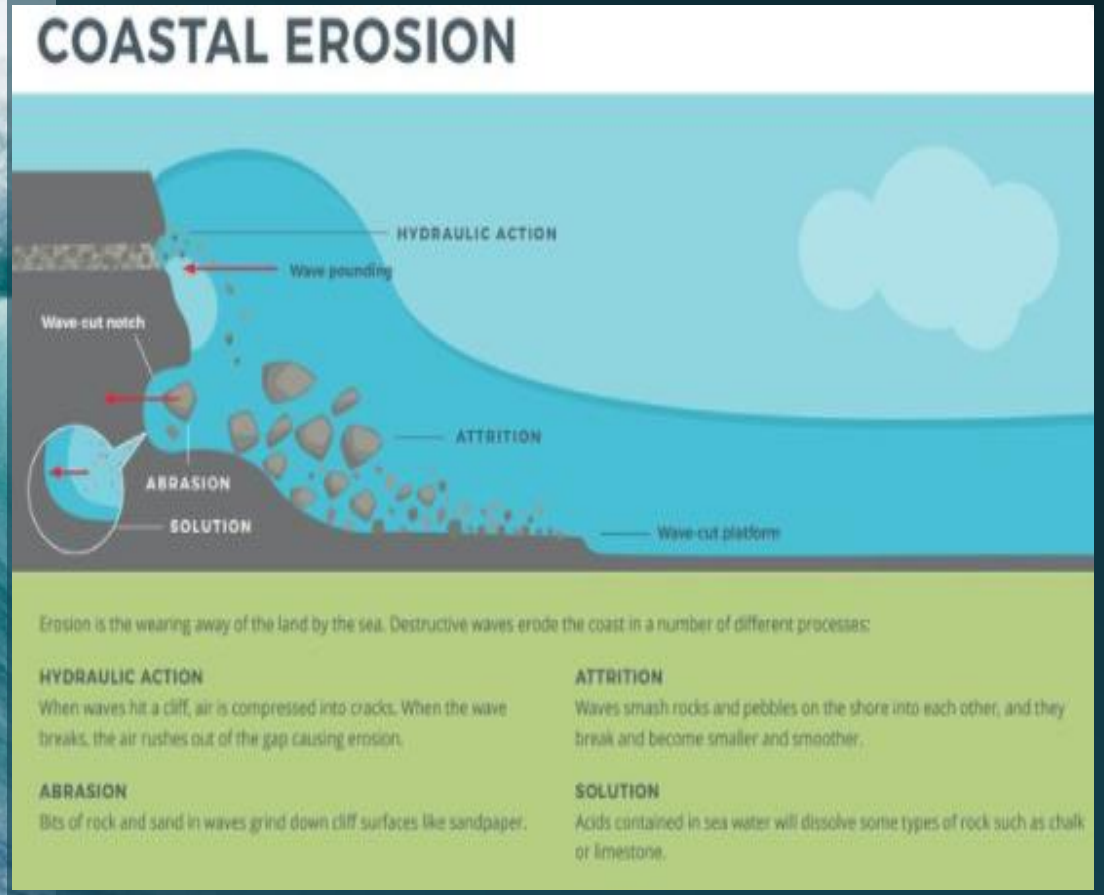
The coast is a dynamic natural environment with ongoing interaction between wind, water and land which produces different landforms and coastal types.

Action	Description
Interaction of wind and sea	The Shire's coast faces south and fronts the Southern Ocean where the major weather patterns include westerly winds in the Roaring Forties and south-east Tradewinds. Cyclones and northwest gales may disrupt the prevailing system and local breezes prevail at other times. Wind blowing over water generates waves and swells that impact on the coast.
Interaction of wind and land	When the wind blows onshore it moves beach sand, from the water's edge, inland. This moving sand may be trapped by vegetation and as the vegetation grows, dunes of sand build. The dunes, being reservoirs of sand, may be attacked by storm waves and the sand moved into a sand bar to be later reworked and returned to the shore and the dune. If there is no vegetation sand may be blown inland to form sand sheets or blowouts. Loss of sand from the beach inland leads to recession of the coast.





Coastal Erosion Processes



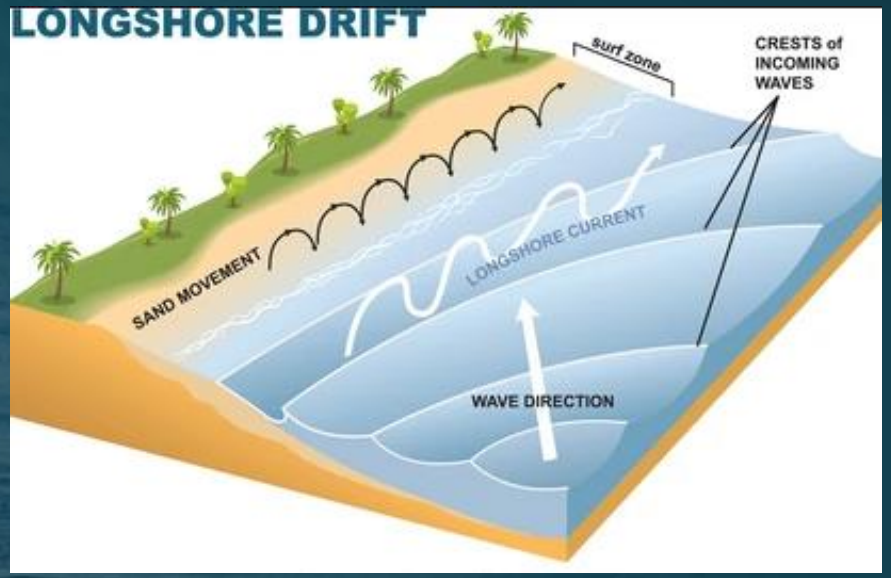
Coastal Erosion Processes:

- Hydraulic action
- Abrasion/Corrosion
- Attrition
- Solution

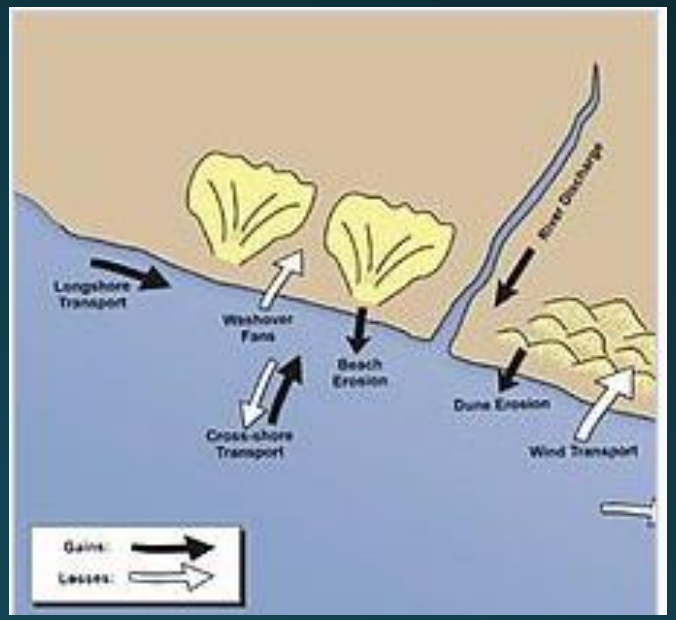
Action	Description
Interaction of sea and land	The type of landform and geology and the action of the swells and currents largely determines the shape of the coast. Under the influence of the sea, the seabed is swept continually, and sediments are deposited onto the shore. Storm waves remove sediment from the beach and swell returns the material to shore. If the eroding and building forces are in balance the shore is stable. Alternatively, if building forces are stronger than the eroding forces, the shore will accrete and if the reverse should occur the shore will recede.
Interaction of sea, wind and land	Over a few decades, if the sea, wind and land are in balance, equilibrium will be achieved and the coast remains unchanged. This balance, however, can be upset by climatic changes, extraordinary weather events, rapid physical changes or interference from human beings. Other forces at work include the interaction of the moon and earth (tides), seasonal changes in wind patterns (winter gales/summer breezes) and greenhouse gas affected climatic change

Coastal Erosion Processes

Action	Description
Littoral drift	Wind on water creates swell, waves and currents that move sand laterally along beaches and shores. Littoral drift may move sand in one direction for certain months of the year and then this may reverse with changing seasonal weather conditions and move back again.
Sand budgeting	The concept of sand budgeting is understanding what sand is entering and what sand is being lost from the beach system. If sand is being lost from the beach then roads, parking areas and buildings will be damaged or lost. Or, if the beach is accreting (gaining sand) the roads, car parks and buildings become further from the beach and need to be replaced and reconstructed.



Littoral (longshore) drift



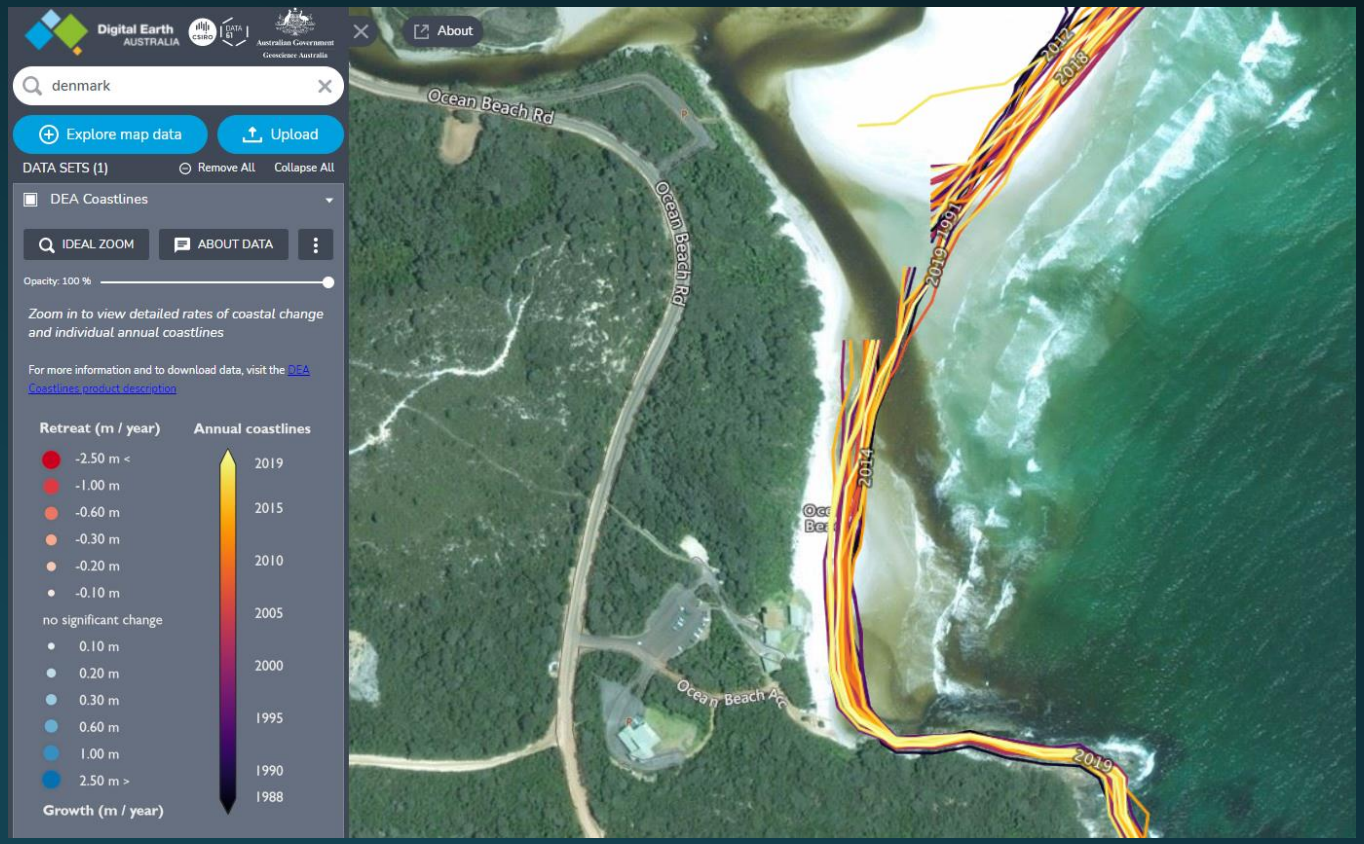
Sand budgeting

Climate Change Impacts – Rising Sea Levels

Rising sea levels – increasing global temperatures will lead to global mean sea level rise as warming oceans expand, and land-based ice melts into the oceans - causing coastal flooding and erosion, significant shore line inundation, dissolution of barrier islands, loss of intertidal wetlands, increased salinisation of coastal embayments.

Latest IPCC Report states that global sea levels have risen on average around 20cm between 1901 and 2018.

Annual and seasonal sea level coastline trends for Denmark Ocean Beach precinct – data indicates strong variability and fluctuations over time making coastal management decision-making difficult.



Climate Change Impacts – Extreme Sea Level Events

- Extreme sea level events - coastal areas will be exposed to more frequent and more severe extreme sea level (ESL's) events. (Usually 1 in 100 years, now predicted at once a year even at 1.5degC warming.)
- ESL's are triggered by combination of storm surges, tides and waves and constitute severe hazards and extensive damage to human settlements and coastal ecosystems when natural and engineered defences are breached.
- Fastest rise in ESL's in Australia expected to be on eastern, southern coastlines and on the SW coastline of WA.

Coastal Erosion from ESL event and storm surge - August 2021

Coastal Hazard Risk Management & Adaptation Planning (CHRMAP)

Impacts from climate change, coastal erosion, rising sea levels and extreme sea level events coupled with increasing population demands and environmental pressures on coastal environments prompts the need for development and implementation of a **climate resilience strategy** that links adaptation and mitigation.

Coastal hazard risk management and adaptation planning is an integral part of decision-making for sustainable development and land use in the coastal zone.

Focus is on coastal areas with current erosion trend, narrow foreshore reserves, low relief, inadequate coastal protection works – to assess distance required for buildings & structure placement to absorb erosion from ESL's, erosion and accretion.

The *State Coastal Planning Policy 2.6: State Coastal Planning Policy*, supports a risk-management approach and provides a framework for undertaking coastal hazard risk management and adaptation planning for coastal hazards in Western Australia.

Shire of Denmark CHRMAP

Ocean Beach and Peaceful Bay Coastal Hazard Risk Management and Adaptation Plan (2018)

- Identification & assessment of **coastal hazards**
- Establishing the context of **coastal asset values** and community expectations
- **Risk assessment** of the potential impact of coastal hazards upon coastal assets
- **Adaptation planning** for both short term (ten year) and long term (100 year) planning horizons

Table 6.1 Ocean Beach Longer Term Coastal Adaptation

	Planning Horizon (years)										
Coastal Asset	5	10	20	30	40	50	60	70	80	90	100
Prawn Rock Channel: Ocean Beach Road and footpath along channel, including wooden bridge	Accommodate*					Protect					
Ocean Beach: Carpark and Lookout	Monitor		Managed Retreat								
Ocean Beach: SLSC and Sea Rescue Buildings (incl. toilets, change rooms etc.)	Monitor / Protect		Managed Retreat / Protect								
Ocean Beach: Coastal stairs and platforms	Accommodate				Managed Retreat						

10 Year Adaptation Planning

- Beach monitoring – baseline beach & cliff surveys/photos annual and 5-yearly
- Inspections – annual engineering inspections of coastal assets (buildings, stairs, retaining walls, jetties)
- Installation of tide board to monitor inundation over road at PRC
- Geotechnical inspections of limestone cliff stability at OB lookout, with planning & construction of new access stairs.

100 Year Adaptation Planning

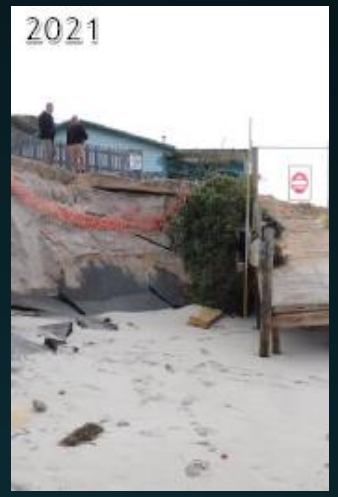
- Options range from:
  - Avoid new development in potentially effected areas
  - Managed Retreat (eg. relocate assets - buildings, stairs - back from shoreline)
  - Accommodation(eg. redesign structures)
  - Protection (eg. retaining sea wall)

Coastal Adaptation Hierarchy

Coastal Erosion impacts at Ocean Beach

Extensive damage caused to coastal infrastructure at Ocean Beach from severe erosion in winter 2021 due to:

- Early southern opening of Wilson Inlet with elevated inlet water level creating a deep channel in front of SLSC allowing greater exposure to wave energy
- Persistent high swells during July 2021
- High tides and associated storm surge, causing waves to erode the foredunes



Extent of damage caused by coastal erosion considered as severe as any site inspected in past 20 years.

Ocean Beach Adaptation Planning

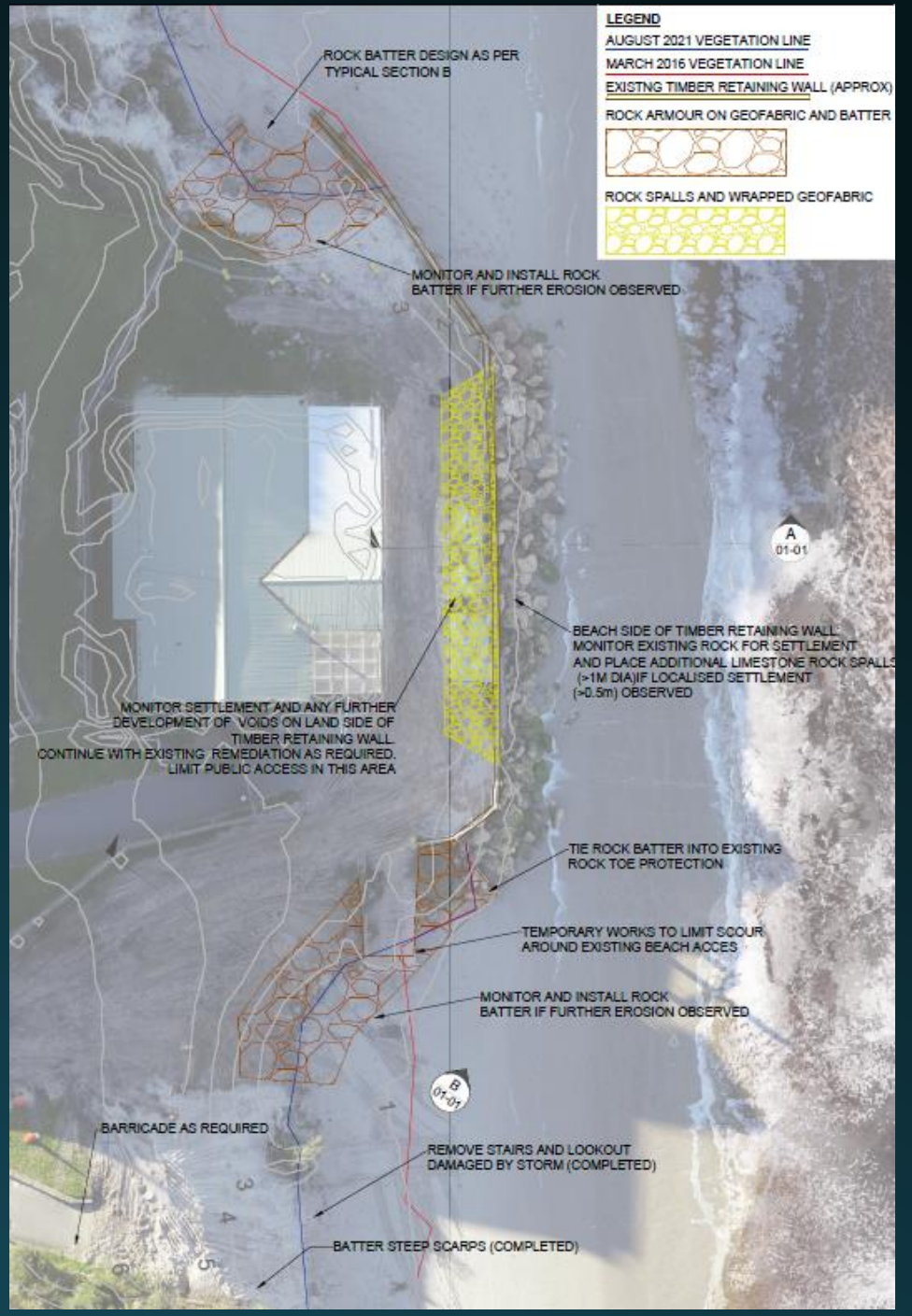
Short Term Response: Restrict access to public, remove stairs, reinforce retaining wall, establish rock batters

Medium Term Response: Refurbish retaining wall, relocate and reinstate stairs/ramps, relocate sand from adjacent beaches to reinstate foredunes

Long Term Response: Review OB concept MasterPlan to ensure DSLSC and structures in context of Coastal Adaptation Hierarchy.

Review influence of bar opening regime on coastal erosion.

Timber retaining wall, and rock scour protection



Community Consultation with Stakeholders

- Government organisations (eg. DBCA, DWER, Dept of Transport, Dept of Fisheries)
- Clubs and organisations (eg. Denmark SLSC; Denmark Boating and Angling Club; Peaceful Bay Progress Association; Peaceful Bay Sea Rescue Group)
- Volunteer groups (eg. Parry Beach Voluntary Management Group
- Not for Profit NGO's (eg. Denmark Environment Centre, Green Skills)
- Community bushcare action groups (eg. South Coast Bush Care Services)
- Friends of Reserve groups (eg. William Bay National Parks Associations

Government of Western Australia
Department of Water and Environmental Regulation

PARKS AND WILDLIFE SERVICE

South Coast Bushcare Services Inc

Denmark Boating & Angling Club Inc W.A.

Denmark Environment Centre Inc

Green Skills Inc

Peaceful Bay Progress Association Inc WESTERN AUSTRALIA

What You Can Do:

- Enter the water at an accessible formalised location to avoid damage to coastal foredunes
- Be aware when coming ashore so as not to damage seagrasses and other habitats.
- Snorkel With Care Take - care not to damage or remove anything. Stand away from coral, seagrass and seaweed.
- Take all rubbish home with you.
- Fish Responsibly - obtain copies of recreational fishing guides and rulers to ensure you stick to the limits.
- Boaties Beware - careful where you anchor your boat, sandy areas are best.
- Stick To The Tracks! When four wheel driving or walking, stick to maintained tracks to reduce erosion in coastal areas.
- When driving on beaches stick close to the water line. Hooded plovers lay their eggs higher on the beach. Watch where you step!
- Become a Citizen Scientist – get involved in local science monitoring and survey projects.

References

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