

Investigating Management Strategies for addressing challenges caused by Coastal Erosion in the Local Port Beach Region of Western Australia

Aim:

To investigate solutions for the effects of coastal erosion upon the Port Beach region.

Both **long term** and **short term**.

Short Term Hypothesis

That the implementation of soft-engineering techniques such as Beach renourishment and Dune regeneration will ultimately be ineffective.

Long Term Hypothesis

That there exists only two solutions to coastal erosion in the Port Beach area: Hard engineering techniques at the expense of the coastline or Managed Retreat

Data Collection Methodology

1. Web collection of publicly available information
2. Physical observations at Port Beach
3. Collect images in person, and from several news sources.
4. Analyse data and interpret.

Type of Solutions

Soft-Engineering

Description: Does not involve the building of artificial structures. A more sustainable and natural approach to coastal management. Cheaper generally.

Hard-Engineering

Description: The construction and maintenance of artificial structures upon the coastline. Unsustainable and unnatural, considered more expensive.

VS

Sources

- Western Australia. Dept. for Planning and Infrastructure. New Coastal Assets Directorate. (2004). Port Beach coastal erosion study. Fremantle, WA.: Department for Planning and Infrastructure, New Coastal Assets Directorate. <http://www.dpi.wa.gov.au/marine/1139.asp>
- Miller, B. (2019, February 18). 20 Beach Renourishment Pros and Cons. Retrieved July 19, 2020, from <https://greengarageblog.org/20-beach-renourishment-pros-and-cons>
- Community News, J. (2020, June 04). Storm erosion hits old beach fuel depot. Retrieved July 19, 2020, from <https://www.perthnow.com.au/community-news/fremantle-gazette/storm-erosion-hits-old-port-beach-fuel-depot-c-1062712>
- Siegel, E. (2019, January 02). The Simplest Explanation of Global Warming Ever. Retrieved July 19, 2020, from <https://www.forbes.com/sites/startwithabang/2019/01/02/the-simplest-explanation-of-global-warming-ever/>
- USA, N. (2019, November 19). Climate Change: Global Sea Level. NOAA Climate.gov. Retrieved July 19, 2020, from <https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>
- BBC, B. (2020). Hard engineering strategies - advantages and disadvantages - Coastal management - AQA - GCSE Geography Revision - AQA - BBC Bitesize. Retrieved July 19, 2020, from <https://www.bbc.com/bitesize/guides/z2z34j6/revision/1>

Labeled Map(2018), Pre-mass Erosion:



The Challenge:

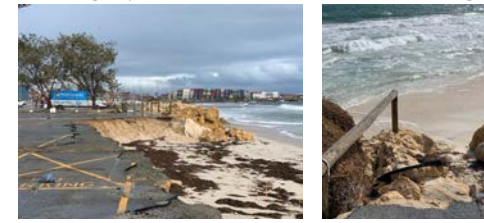
The Fremantle City Council faces the challenge of coastal erosion in the North Fremantle Region, specifically along Port Beach.

This erosion threatens both residential and commercial areas, a rapid process as noted by the mass receding of the coastline seen in the past 10 years.

The Fremantle Council has several options, these options all based upon either hard or soft engineering techniques.

This poster seeks to evaluate options available, providing an answer based upon both time and budget constraints, as well as considering the human factor.

Photographic Evidence of the Challenge



On left: A carpark has collapsed due to its foundations being eroded by the ocean.
On right: A pathway leading to the sea has also been damaged by storm waves.

credit: photos taken on site by Eduardo C.

Location Details:

@googlemaps



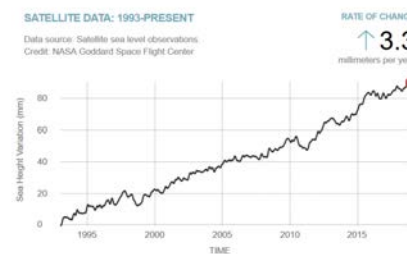
The Eastern Coastline of North Fremantle, situated alongside Port Beach Road is facing the threat of coastal erosion.

North Fremantle is situated upon a peninsula. A peninsula being defined as a section of land almost surrounded or projecting into a body of water. With the Swan River flowing on its east side, whilst on the West; the Indian Ocean.

Coastal Erosion has mostly occurred upon its east, devastatingly impacting Port Beach. The area having an industrial past, coastal erosion has exposed industrial waste (from old fuel depots) and rocks, preventing beachgoers from attending safely.

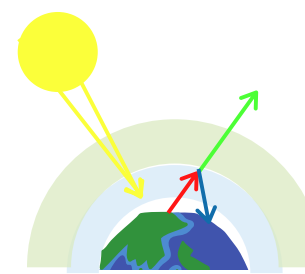
Onsite locations at risk include restaurant COAST, 2 carparks, and the Fremantle Surf Life Saving Club (SLSC) Annexe all at risk of collapsing into the sea.

Ways in which human activities have intensified the challenge



1. Rising Sea Levels:
A rise in sea levels is caused by thermal expansion of the ocean (due to global warming) as well as the melting of the Polar Ice Caps. [ON LEFT]

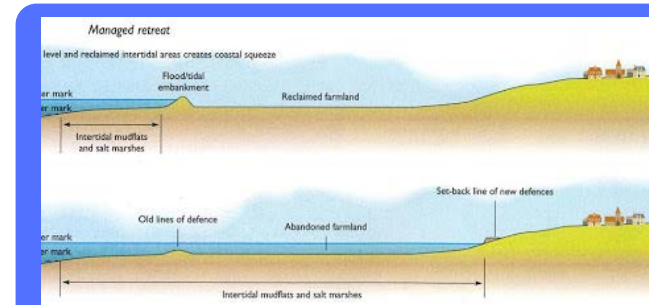
Rising sea levels lead to increased severity of wet weather extreme events. This in turn leads to further coastal erosion. NASA Satellite predictions describe an average 3.3mm increase in sea levels.



2. Global Warming
Sun Rays enter Earth atmosphere as light and heat energy (YELLOW). Some of the heat is reflected from the Earth (GREEN), but some of it is absorbed by greenhouse gases (DARK BLUE)

Due to industrialisation, more greenhouse gases exist. Thus increased global warming. This leads to more extreme weather events + higher sea levels.

Additional Potential Solutions for Port Beach



Managed Retreat
(Non-Implemented)

On Left, a diagram of Managed Retreat.

Type: Soft-Engineering.

Description: A Pyrrhic victory of a solution, Managed retreat concedes land to coastal erosion, retreating the line of defence further inland. It is the controlled flooding of low-lying coastal lands. Whilst simultaneously evacuating any individuals in the area to higher ground.

Pros: A generally cheaper solution compared to other hard engineering techniques. Does not require constant maintenance like beach renourishment or dune regeneration. Creates a salt marsh ecosystem; a natural defence against erosion and flooding.

Cons: Land is completely lost. Owners must be compensated.

Rapid, effective short term.

Total Land Loss Comp. Expensive

Effective Long Term



Sea Walls
(Implemented in other locations)

Type: Hard-engineering

Description: Made of concrete, these walls are placed at the foot of cliffs/hills as to prevent undercutting from erosion. Reflects energy back into the sea.

Pros: Best used for protecting the base of cliffs. Can be walked along.

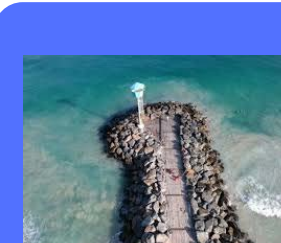
Cons: Very expensive: For example, Kingscliff Sea Wall in Kingshire, North South Wales. The Seawall being 300m shall cost between 3-5million dollars. Sea Walls also require constant maintenance.

MAJOR CON: Beach is completely lost. This just protects property without having to evacuate.

Effective once built, before not so much.

Expensive Base Cost

Effective Long Term



Groyne
(Implemented in other locations)

Type: Hard-engineering

Description: Low lying wooden walls shield by rocks at right angles to the beach. Captures sand from longshore drift, builds up a larger beach in front of it.

Pros: Rebuilds beach in front of it. Prevents movement of material. An attraction for tourists. Effective.

Cons: Seen as unattractive, expensive to build and maintain. Sections of coast further exposed to erosion down drift of the groyne.

Takes time to build..

Expensive Base Cost

Causes additional problems.

City of Fremantle Solutions currently applied:



Beach Renourishment (Implemented)

Type: Soft-Engineering

Description: A project which replaces sand lost to erosion by other compatible sources.

Pros: Protects structures behind the beach, Widens the beach (more usage).

Cons: No public access during renourishment process, does not solve the base problem, a temporary fix.

EFFECTIVE SHORT TERM

INEFFECTIVE LONG TERM



Dune Regeneration (Implemented)

Type: Soft-Engineering

Description: Project in which dunes are built up + increased vegetation

Pros: Keeps a natural coastline, provides barrier between land and sea.

Cons: Requires careful management (expensive), easily damaged by storm waves, takes time for vegetation growth.

Semi-effective in the short term.

Effective, but at risk to rising sea levels

Conclusion

To conclude, as Sea levels continue to rise (by more than 3.3mm per annum) due to global warming (in turn caused by increased greenhouse gases from industrialisation and population growth). It can be expected that Port Beach and other locations will suffer major coastal erosion problems now and into the future.

Considering costs, time constraints as well as analysis of previously attempted solutions. It can be declared that in the long term only managed retreat can be effective. This is due to the fact hard-engineering strategies require constant maintenance and upgrades. Whilst managed retreat does not.