

# ICA Actions of the Sea – Data and Knowledge Development Project

Cities Power Partnership Presentation

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# Presentation Outline

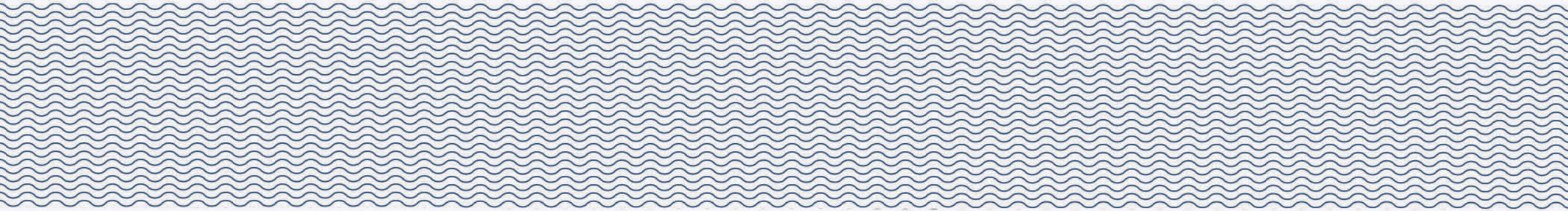
- What are Actions of the Sea?
- Responses and mitigations to Actions of the Sea
- Issues related to Actions of the Sea
- Summary of key Issues and Recommendations



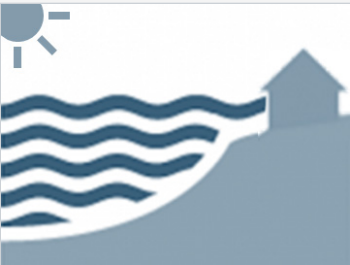


Collaroy-Narrabeen on 7 June 2016. Source: UNSW WRL<sup>1</sup>

<sup>1</sup> <https://newsroom.unsw.edu.au/news/science-tech/danger-extreme-storms-and-high-seas-rise>


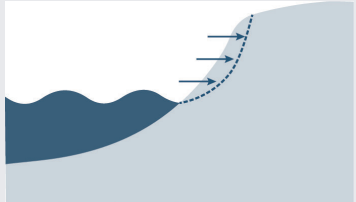

# **Actions of the Sea - Definitions**



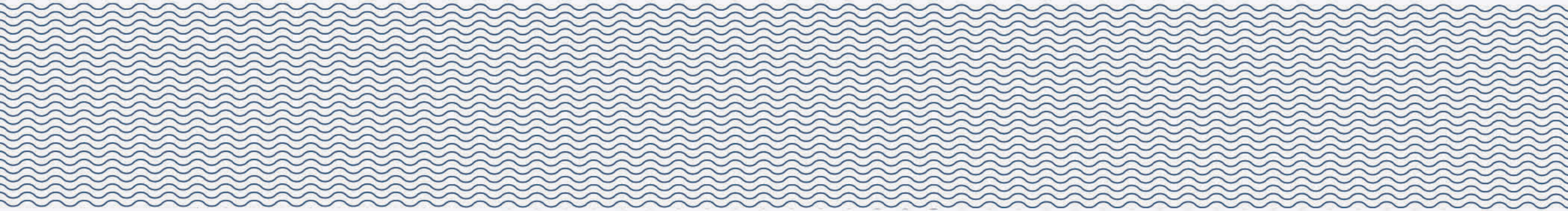
# Actions of the Sea

Action of the Sea	Description of Process
<p><b>Tidal Inundation</b></p> 	<p>Inundation of normally dry land caused by elevated coastal water levels which are above Highest Astronomical Tide (HAT) levels due to variations in coastal water levels that occur outside a severe weather event. Tidal inundation excludes other flooding that is associated with severe weather including rainfall run-off or riverine flooding or ocean storms. Tidal inundation of land that is not currently impacted by seawater, except in severe weather events, will be an increasing risk with future sea level rise.</p>
<p><b>Coastal and Estuarine Inundation</b></p> 	<p>Inundation of normally dry land caused by elevated coastal water levels which are above Highest Astronomical Tide (HAT) levels due to severe weather event processes. Inundation of this type can be a result of any single (one) or combination of the following processes: elevated coastal water levels including storm surge, wave action, rainfall run-off and/or riverine flooding.</p>
<p><b>Sea level rise</b></p> 	<p>Sea level rise is not a distinct process causing impact on its own, but rather increases properties' exposure and impacts from other coastal processes (including tidal inundation, coastal inundation, coastal erosion and shoreline recession).</p>

# Actions of the Sea

Action of the Sea	Description of Process
<b>Coastal Erosion</b>	 <p>Scour of material (such as sand) primarily due to wave action resulting from a severe weather event. Erosion can cause damage to structures, including buildings, landscaping and supporting structures. Erosion during severe storms can result in movement of the beach and shoreline, landslide and subsidence.</p>
<b>Shoreline Recession</b>	 <p>The erosion of shorelines from ongoing coastal processes and sea level rise. Shoreline recession can lead to damage to structures, including buildings, landscaping and supporting structures. Recession is inter-related with beach and shoreline erosion, landslide and subsidence.</p>
<b>Tsunami</b>	 <p>A tsunami event that impacts on the Australian coastline, typically from distant sub-sea earthquakes, that may cause inundation, coastal erosion or structural damage.</p>

# Responses to Actions of the Sea



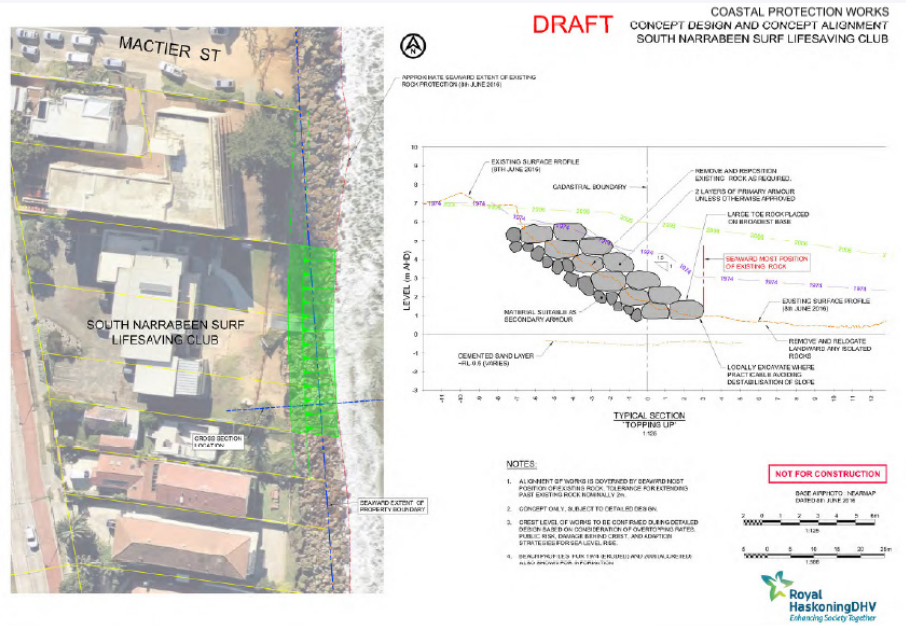
# Land Use Planning

- Governed at the State and Local Government level
- Consistency in general approach:
  - Avoid impacts for new developments over a 100-year planning period
  - Avoid / Accommodate / Protect upgrade or redevelopment over 20 to 50 year period
- Sea level rise will continue into the future beyond 100-year planning horizons



# Engineering

- A range of engineered responses are available to mitigate Actions of the Sea
- Solutions can focus on individual property, local or regional scale

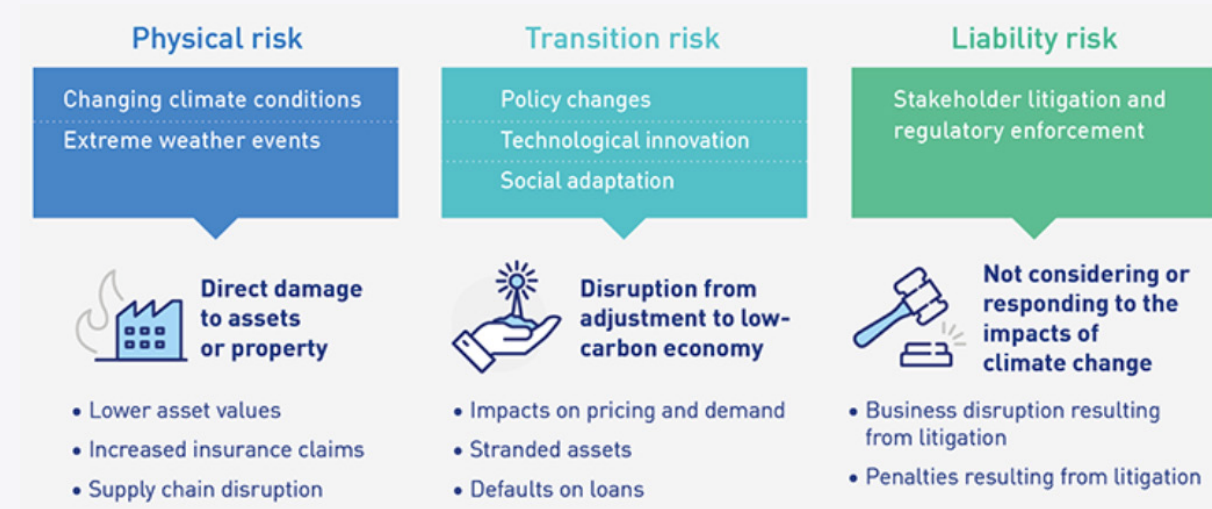


Tweed River and Kirra Beaches: (top) 1974 pre-bypass with major sand accumulation to the south of Tweed River and severe erosion of Kirra beaches; (bottom) 2020 with bypass system that has been operational since 2000.



# Financial

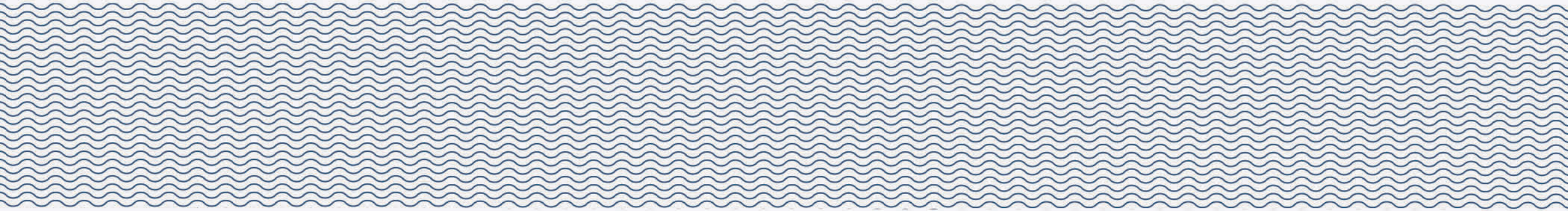
- Financial responses have not been as widely adopted in the past
- Examples include
  - Local government raising special levies to cover coastal management
  - Council's implementing voluntary purchase agreements
  - 80% of the costs for Collaroy-Narrabeen seawall covered by property owners
- Financial services sector is rapidly responding to considering and pricing future risk
  - Prudential Practice Guide on Climate Change Financial Risks (CPG 229)



Prudential Practice Guide on Climate Change Financial Risks (APRA, 2021)<sup>1</sup>.

1. ARPA (2021). PRUDENTIAL PRACTICE GUIDE: Draft CPG 229 Climate Change Financial

# **Issues related to Actions of the Sea**



# Issue 1: Does it make sense to rebuild after a severe event?

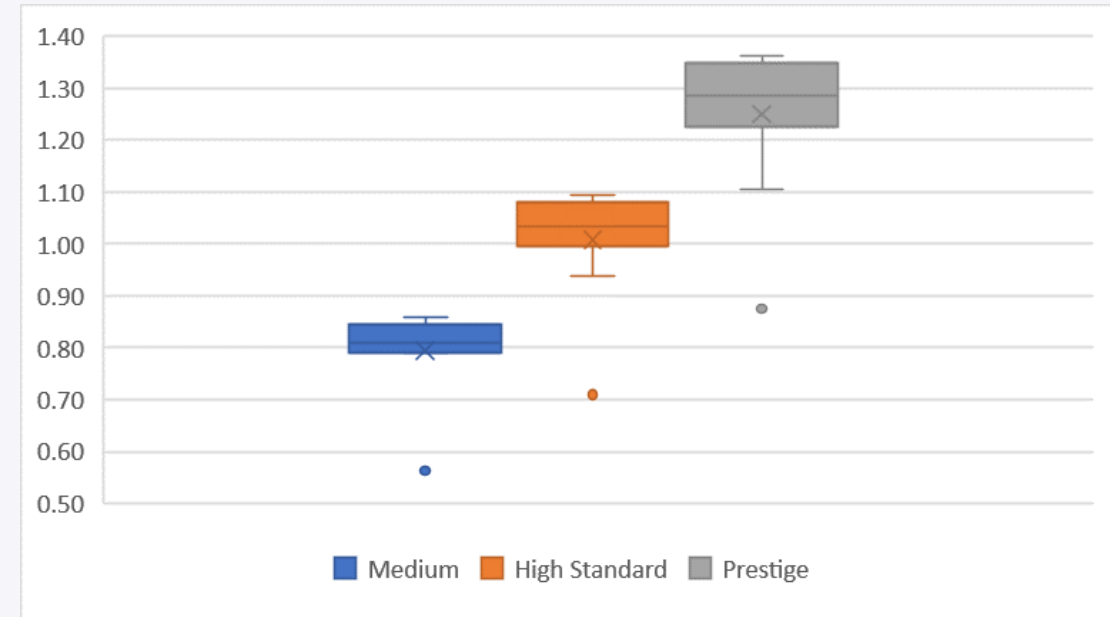
## Insights

- No precise, quantitative trigger to assess the value of rebuilding
- Range of factors need to be considered:
  - *Exposure to current and future actions of the sea*
  - *Property value and local economy*
  - *Community and environmental values*
- Need to *Build Back Better* with solutions that are effective, adaptable and sustainable
- Case study provides insight into what situations the economics stack up to re-build properties
  - *Community and environmental values also need to be considered*



# Case Study Insight: Economic Assessment

- Case study included economic assessment of damage on beachfront property along Collaroy-Narrabeen
- Annual and net present damage costs are relatively high for the June 2016 situation
- The seawall under construction will significantly reduce damage
  - But at a cost of \$230,000 per property (4-5% of property value, May 2021), this investment has net economic benefit only for high-standard or prestige properties



Sea Wall Scenario Benefit-Cost Ratio Results  
(Net present value when > 1)

# Issue 4: What do property owners and the wider community need to know to be assured that coastal mitigations are effective

## Insights

- Overall functional performance of coastal defenses at protecting properties and communities from current and future Actions of the Sea is not consistently addressed in national building codes and standards
- Various state and local governments have implemented effective controls for coastal property development
  - *Queensland RPEQ*
  - *Case study presented how local planning controls can address requirements for coastal properties*



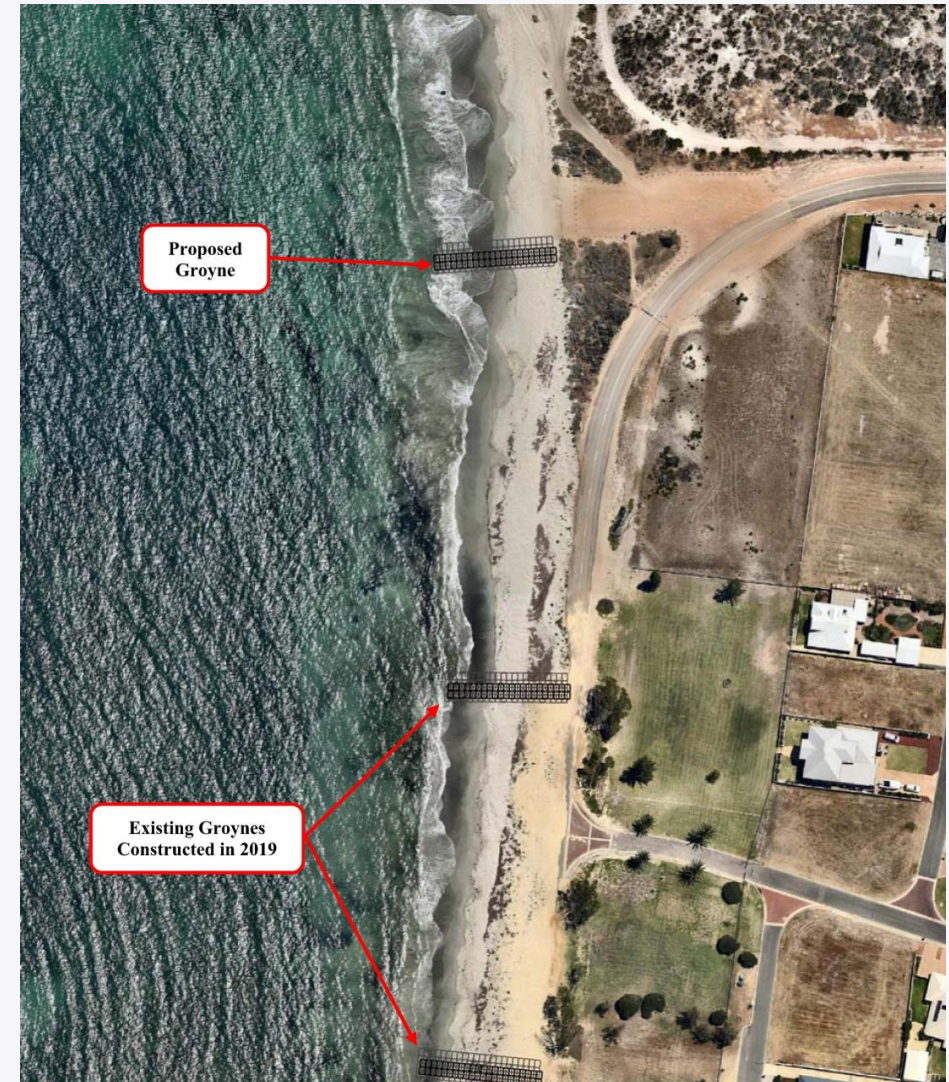
Wollongong Coastal Study – Erosion hazard impact areas: 2010 to 2100 (Cardno, 2011)<sup>1</sup>

1. Available from Wollongong City Council: <https://www.wollongong.nsw.gov.au/about/environment/coast-and-waterways/coastal-zone-management>

# Issue 5: The suitability of different types of coastal defenses at mitigating Actions of the Sea

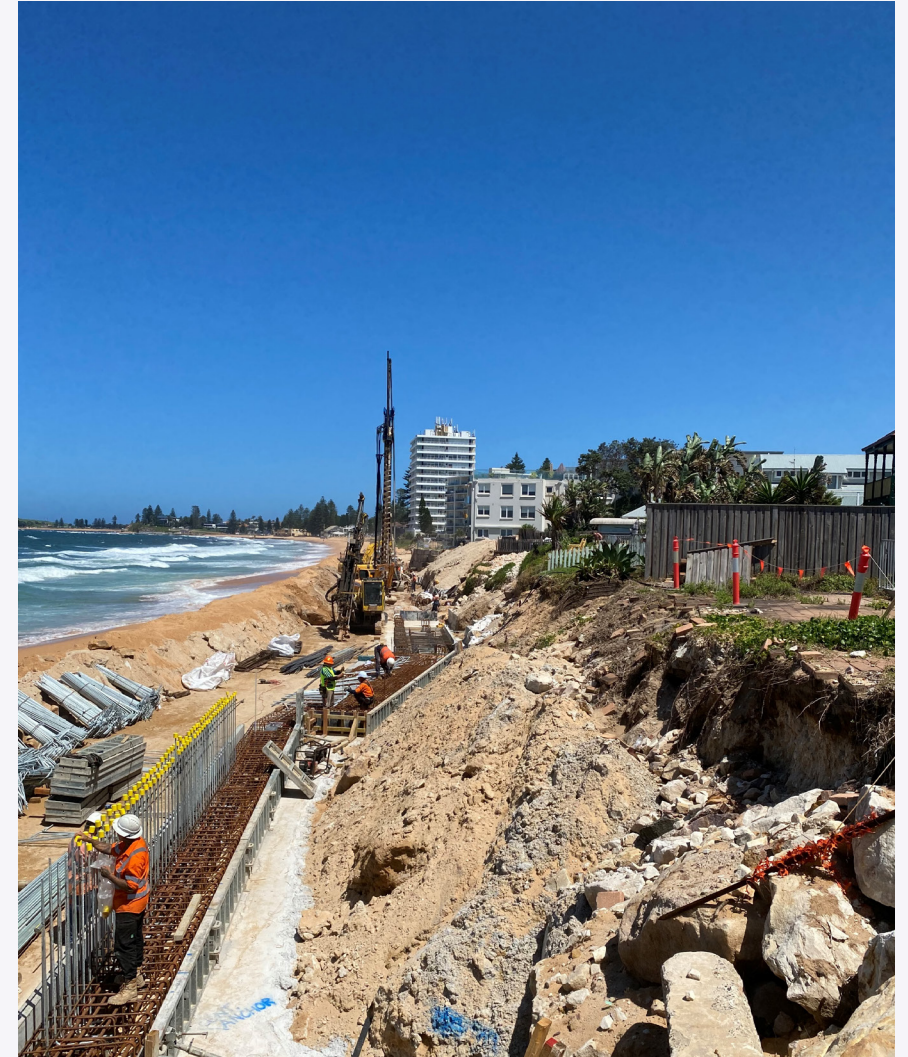
## Insights

- Coastal protection structures that are appropriately designed can be very effective in protecting property
- There are examples of structures that are intended to *reduce impacts on property* as compared to structures that *protect property in design events*
- All coastal defenses have practical limits with respect to the level of sea level rise that can be accommodated before they are ineffective or unsustainable based on environmental, community and cost factors



# Case Study Insights: Engineering Response

- Key response to June 2016 storm as recommended in the CZMP was an integrated seawall along 1.3 km of shoreline
- Design details
  - Seawall alignment within existing property boundaries
  - Designed to protect from erosion and inundation from the 100-year ARI design storm
  - Sea level rise over next 60-years accommodated
  - Time-limited development consent of 60-years
- 80% funded by property owners
- Average cost of \$230,000 per property<sup>1</sup>



Construction of new seawall along Collaroy-Narrabeen (February, 2021)

1. May 2021, average over 1.3 km of shoreline.

# Issue 6: The scale of coastal mitigations and defenses required in Australia to address current and future risks from Actions of the Sea, including sea level rise.

## Insights

- Australia has very high vulnerability to current and future risks from Actions of the Sea
- *Government and communities generally do not understand the scale of investment in mitigations and responses to sea level rise that will be required*



Wonnerup floodgates – Vasse River, WA

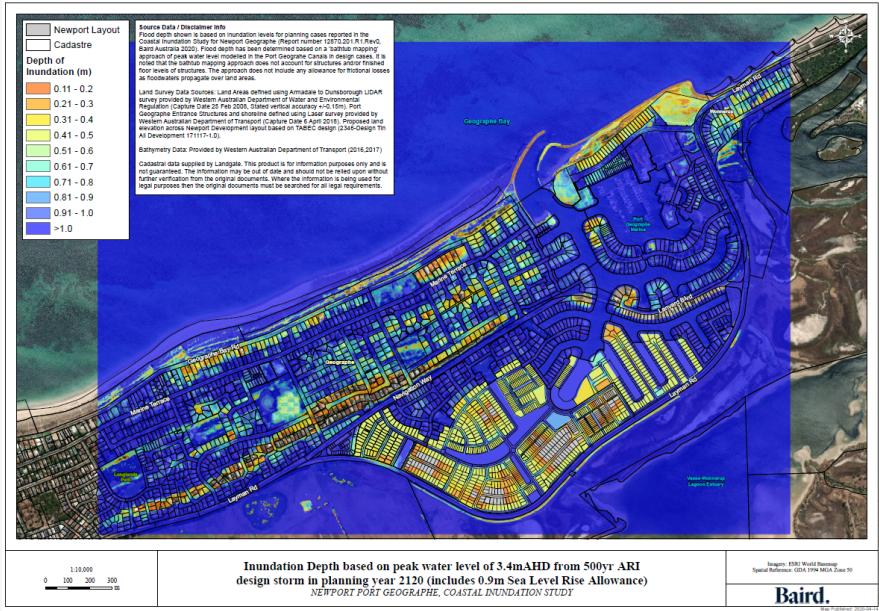


Maeslant barrier, Rotterdam, The Netherlands

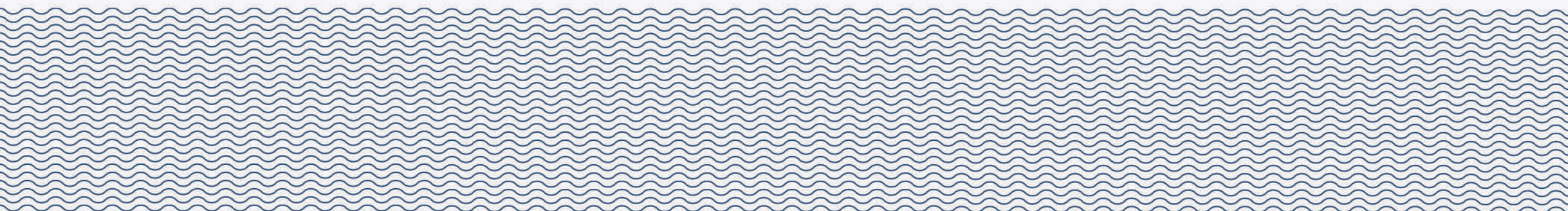


# Study Insights: Regional Scale Response to Sea Level Rise

- Busselton in southwest Western Australia has very high exposure to coastal inundation from future sea level rise
- Key regional community and example of region with extreme vulnerability to sea level rise
  - Population 39,600
  - GRP = \$2.1 billion p.a.
- Draft CHRMAP Options (City of Busselton, 2021):
  - \$8.2 billion for managed retreat
  - \$1.6 billion for tailored adaptation and protect option
    - Over next 100-years: \$800 p.a. per rateable property



# **Summary of Key Issues and Recommendations**



# Actions of the Sea is an increasing problem with climate change

## Key Points

- Many sites around Australia already have significant exposure to Actions of the Sea
- Climate change and sea level rise will increase the exposure significantly into the future
- Increasing number of locations and properties will be uninhabitable
- IPCC (2021): Sea levels will continue to rise for next 2,000 years irrespective of emissions scenarios
  - Planning and development approvals for new development are normally provided without time limits on tenure (granted in perpetuity)

## Recommendations

- Highlight that the cost of mitigation and re-building has negative or marginal economic investment metrics for individual properties except for high-value coastal property
- Advocate that economic impacts from Actions of the Sea need to be considered on a regional basis, with regional responses funded by federal, state and local government
- Establishment of new national standards to cover coastal protection and climate change mitigation works over the long-term

# Scale of investment to respond to Actions of the Sea is significant

## Key Points

- Australia will require at least \$30 billion (net present cost) of investment in large scale coastal protection and adaptation projects over the next 50-years and increasing in the future
- *This level of public investment can be accommodated but requires focused actions and programs across all levels of government*

## Recommendations

- Collate and integrate asset and hazard data sets
- Register of coastal defenses and adaptation measures

# Need for high-quality, high-resolution data on a national scale

## Key Points

- Need to build a national picture of coastal hazard risk
- Integrate local hazard and risk mitigation studies into regional, state and national assessment of mitigation options
- Government, researchers and industry need high quality data sets of major impact events

## Recommendations

- Develop databases of current, planned and considered coastal protection and adaption measures to address Actions of the Sea.
- Implement data standards across government and industry

# Questions and Discussion

