Government of Western Australia

Department of Transport and Major Infrastructure

Department of Planning, Lands and Heritage

WAPC Western Australian Planning Commission

coastwa

Information Sheet

Economic assessment of coastal hazards in Western Australia

June 2025

Coastal Hazards Adaptation – WA's Strategic Approach

In accordance with the *WA Coastal Zone Strategy* and the *State Coastal Planning Policy* (SPP2.6), the Western Australian Government is investing in the coastal planning and management to achieve a sustainable coast. Further, in response to the statewide assessment of coastal erosion hotspots in 2019, the CoastWA investment of $33.5M (over its first 5 years) is facilitating the development and implementation of effective coastal erosion adaptation and has demonstrated positive economic, social and environmental benefits.

Western Australia has more than 20,000 km of coastline with a wide variety of natural systems and is our most contested space. It is dynamic and subject to human, natural and climate pressures which are becoming increasingly hazardous and challenging to manage.

The WA Coastal Zone Strategy sets a vision of "a sustainable coast for the long-term benefit of the community and visitors to the State" The State Coastal Planning Policy complements the Strategy, it guides development and land-use in the coastal zone and requires coastal hazard risk management and adaptation planning for areas at risk. CoastWA is the Western Australian Government's strategic response to the coastal hazards.

CoastWA has significantly lifted Western Australia's capacity to combat increasing erosion and inundation at coastal hazards hotspots. It has changed the momentum of coastal adaptation actions in its first 4 years with 173 grant projects, 36 ground-truthing studies and data collection, increased technical expertise and community engagement and training.

The 2024 review[1] of the implementation of the CoastWA program across the 55 erosion hotspots found that, due to investment in adaptation measures, more than half of these sites may be downgraded in severity or reclassified to watchlist status.

Projects focused on specific adaptations like large-scale sand nourishment and dune rehabilitation at Port Beach, building a rock revetment at South Thompson Bay on Rottnest Island, GSC groyne construction and sand nourishment at Sunset Beach in Geraldton and relocating and safeguarding assets at Ocean Beach in Denmark, have shown clear cost benefits.

Investment in enhancing coastal datasets for Western Australia – including geotechnical investigations, met-ocean data reports, sand and rock supply studies, and drone monitoring – is strengthening the State's ability to effectively respond to and manage increasing coastal hazard risks.

The CoastWA program also offers opportunities for coastal managers to leverage Australian Government funding. Since its inception, the program has facilitated the leveraging of over $26 million for 15 Western Australian coastal projects, with a combined total value exceeding $46 million.

Continued investment in coastal adaptation is essential for Western Australians to remain resilient and maintain their coastal lifestyle.

For further information about coastal planning in WA and the CoastWA program please go to the Department's coastal planning and management page.

[1] WA Coastal Erosion Hotspots - Review of Impacts, Management Actions, and Funding 2018/19 to 2024/25.

Project overview

This information sheet provides an overview of the Economic Assessment of Coastal Hazards project (the project). The project was commissioned by the WA Department of Planning, Lands and Heritage (DPLH) to evaluate the economic case for coastal adaptation. The project identified the overall costs of coastal hazards, and the potential costs and benefits of adaptation measures in Western Australia (WA). The *Economic Assessment of Coastal Hazards* project builds on previous work undertaken by the Commonwealth Government and the WA Government as shown in Figure 1[2].

National Climate Change Risks to Australia's Coast (2009, 2011)

The national analysis identified assets at risk from coastal hazards for the whole of Australia including WA, it included all assets within a certain distance of the coast.

WA Coastal Hazard Risk Management and Adaptation Plans

WA Council-led plans identify coastal hazards and develop proposed adaptation measures and pathways. These plans include some economic analysis of options.

Assessment of Coastal Erosion Hotspots in WA (2019)

The 2019 assessment identified 55 coastal erosion hotspots as priority areas at risk, as well as an additional 31 watch-list locations.

Statewide Coastal Inundation Assessment for WA (2024)

The 2024 assessment identified 23 coastal inundation risk locations with high risk of damage to buildings and assets.

Figure 1: Previous work of relevance for this report

This project used the 55 coastal erosion hotspots and 23 coastal inundation risk areas as the basis for this assessment. These highest risk locations represent only a proportion of the total area at risk from coastal hazards, and only cover ~0.51 per cent of the WA coastline.

[2] Also see - Towards a National Collaborative Approach to Managing Coastal Hazards in Australia (2023) - Report of the Intergovernmental Coastal Hazards Working Group.

Key findings

- ✓ The benefits of investing in coastal adaptation are significant
- ✓ Adaptation significantly reduces the costs of inaction
- ✓ Approximately $18 billion in built and natural assets and recreational values are at risk from coastal hazards in high-risk coastal erosion and inundation locations in WA over the next 75 years
- ✓ Damage and disruption to these assets and values alone could cost the community approximately $700 million over the next 75 years or an average annual cost of $44 million per year
- ✓ Estimated adaptation investments of $200 million are required over the next 10 years
- ✓ For every $1 invested in coastal adaptation, the WA community is expected to receive $2.65 in benefits
- ✓ The project demonstrates that there is clear value for the WA community from investing in well-planned, locally informed and strategically timed coastal adaptation measures.

Assessing the costs of coastal hazards to WA

The project included an assessment of the costs of coastal hazards under a base case of no further adaptation action. The assessment was limited to the previously identified 55 erosion hotspots and 23 inundation areas. These areas were used to identify the value of built and natural assets as well as recreational values at risk from erosion and inundation. For erosion this included assets at risk over the next 75 years, for inundation this was limited to 25 years.

The analysis quantified the following costs that the community faces from coastal hazards:

- **Damage and loss of built assets, infrastructure and utilities** including residential and commercial buildings (not including land value), road and rail infrastructure, water, electricity and gas supply
- **Disruption and loss of recreational values** including use of beaches, foreshores and other recreational areas
- **Damage and loss of environmental assets** including dunes and foreshore areas.

Additional costs which could not be quantified but which are expected to be substantial include disruption to business and industry including tourism, disruption and health and wellbeing costs to communities, and the loss of cultural heritage values.

Assessing the benefits of adaptation investment

The *Economic Assessment of Coastal Hazards* project included six cases studies of proposed adaptation measures for coastal hazards (see Figure 2). The case studies provide a representative range of locations, adaptation actions, and values at risk.

The case studies were assessed using information from relevant Coastal Hazard Risk Management and Adaptation Plans (CHRMAPs). The CHRMAPs identify coastal hazards and develop proposed adaptation measures and pathways. Each case study represents a single adaptation pathway focused on action by local government. It should be noted that the pathways included in this assessment are at an early stage and may not be chosen in future as preferred adaptation actions.

The case studies were used to assess community benefits and costs from adaptation measures, such as managed retreat, monitoring and soft/hard protection. The analysis also reviewed identified adaptation measures and costs across all 55 erosion hotspots to understand the scale of funding likely to be required to address coastal hazards in WA.

Figure 2: Six case study locations

Key messages

Coastal areas of Western Australia have significant values at risk from coastal hazards

$13.8 billion worth of built and natural assets as well as recreational values are at risk from coastal erosion over the next 75 years at the 55 highest erosion risk locations in WA. $4.1 billion worth of built assets are at risk from inundation in the next 25 years at the 23 coastal inundation risk areas. The actual costs of damage and disruption to the assets will depend on the timing and severity of coastal hazard events.

Coastal hazards have wide-reaching impacts across natural and built assets, recreational activities, businesses, communities, and cultural heritage

Given the high concentration of homes, businesses, cultural, and social activities in the coastal zone, the increasing risk of coastal erosion and inundation in Western Australia is likely to lead to:

- Damage and destruction of assets and infrastructure
- Loss or disruption of recreational activities
- Loss or damage to environmental values
- Disruption to business and industry including port activities and tourism
- Loss of cultural heritage
- Disruption to communities for example from relocation and loss of social networks.

Coastal hazards are expected to result in significant costs to Western Australia

The actual costs to the WA community from damage and disruption to the $17.9 billion in assets and values in the highest risk locations is expected to be $703 million in present values. This is equivalent to $44 million in average annual cost. This is a conservative estimate, and costs are likely to be well over $1 billion when considering higher risk hazard scenarios, additional at-risk locations and costs which could not be quantified in this assessment.

Investments in adaptation measures provide net public benefits and need to be made now to avoid higher future costs

Current proposed adaptation measures for the 55 coastal erosion hotspots are expected to cost approximately $200 million over the next 10 years. Estimated damages due to coastal erosion and inundation at the same locations are $44 million in average annual cost, or $440 million over 10 years. Therefore the net benefits of investment in these adaptation measures are estimated to be $240 million. This is aligned with the assessment of six diverse case studies encompassing a range of coastal adaptation actions from across WA which found that, for every $1 invested in adaptation, WA receives $2.65 in benefits.

The benefits of investing in coastal adaptation are significant and the analysis demonstrates that there is clear value for the WA community from investing in well-planned, locally informed and strategically timed coastal adaptation measures.

The costs of coastal hazards in WA

Coastal hazards affect natural and built assets, recreational activities, businesses, communities, and cultural heritage

The economic, environmental and social costs of coastal hazards in Western Australia are substantial and increasing due to climate change. The Economic Assessment of Coastal Hazards project found that within the 55 coastal erosion hotspots, which account for less than one per cent of WA's coastline, there are:

- **$2.3 billion** in existing built and natural assets at risk from erosion within the next 75 years
- **$11.5 billion** in recreational values at risk over the next 75 years.

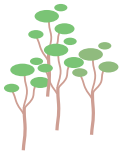
Over the next 25 years in the 23 coastal inundation risk areas there are:

- **$4.1 billion** in built assets at risk including residential, commercial and industrial buildings and transport infrastructure.

This is only a small representation of the total assets and values at risk within these areas as it does not include land values, future developments, cultural heritage values, and economic activities. Given the high concentration of homes, businesses, cultural, and social activities in the coastal zone, the increasing risk of coastal erosion and inundation in Western Australia will lead to:

Damage and destruction of assets and infrastructure: Coastal erosion can lead to the collapse of buildings, roads, and bridges. For example, beachfront properties and coastal highways may be severely damaged or destroyed.

Loss or disruption of recreational activities: Beaches and coastal parks may erode, reducing the space available for activities like swimming, sunbathing, and picnicking. This will also affect local businesses that rely on tourism.



Loss or damage to environmental values: Coastal habitats such as dunes, wetlands, and mangroves can be eroded or inundated, leading to the loss of biodiversity and disruption of ecosystems.

Disruption to business and industry including tourism: Coastal businesses, especially those in the tourism sector, may suffer from reduced visitor numbers due to damaged beaches and infrastructure. This can lead to economic losses and reductions in employment.

Disruption to communities: Coastal erosion and inundation can force communities to relocate, disrupt daily life, and create social and economic challenges for affected residents.

Loss of cultural heritage: Historic sites and culturally significant areas along the coast may be eroded or submerged, leading to the loss of irreplaceable heritage and identity for local communities.

When erosion and inundation events occur, they generate significant costs for government, businesses and communities

The total expected loss of value to the WA community depends on the actual occurrence and timing of erosion and inundation events. As shown in Figure 3, the total area and value at risk is different from the actual loss that occurs during specific future erosion events. The occurrence and timing of erosion events is inherently uncertain, particularly over long time periods. The analysis therefore used hundreds of simulations of possible future coastal erosion and inundation events to model the likely impacts of coastal hazards to 2100.

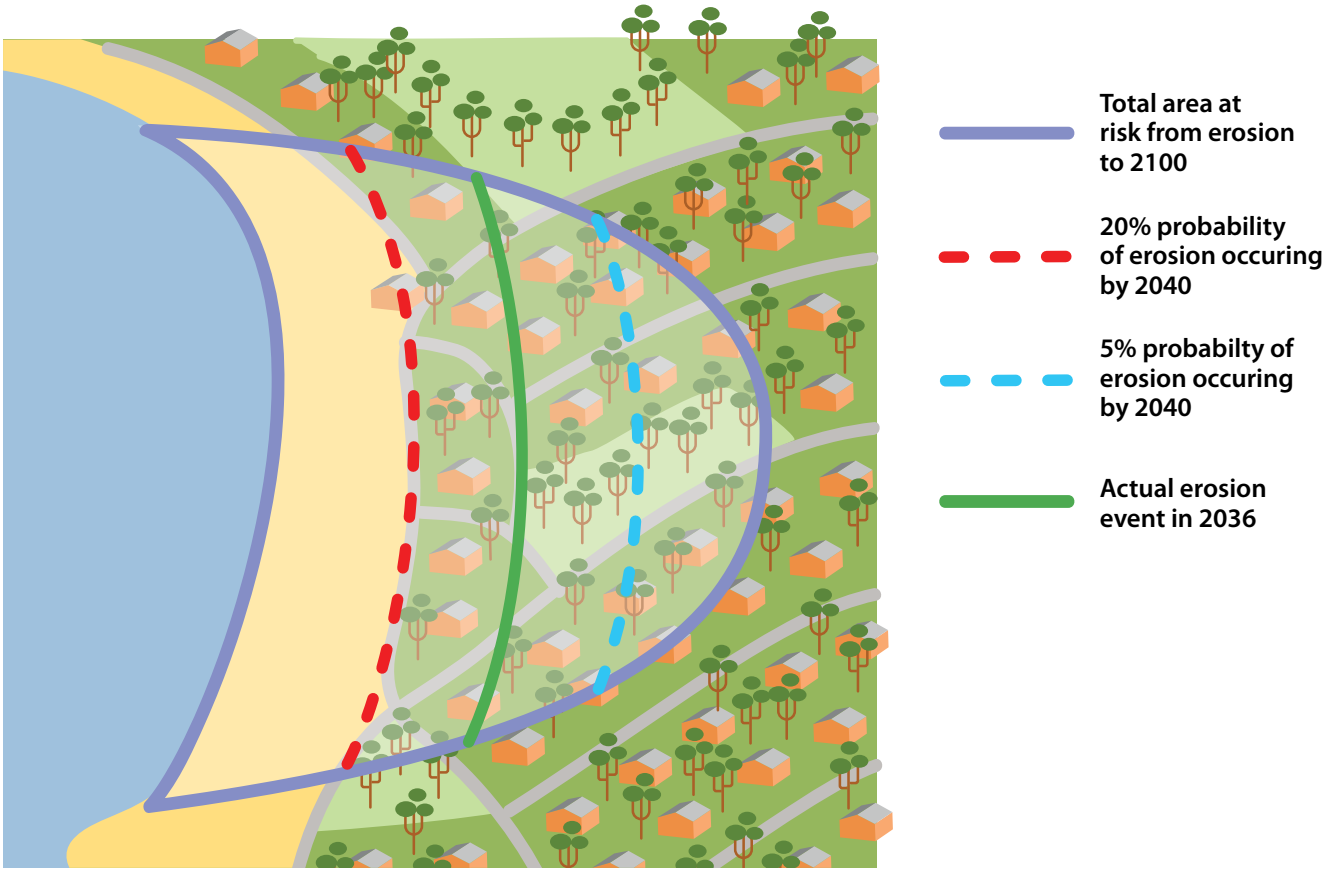


Figure 3: Illustrative example of total area at risk compared to outcomes of actual erosion events

On average across the 55 coastal erosion hotspots and 23 coastal inundation risk areas, discounted losses were estimated at **$703 million** in costs to buildings, recreation, infrastructure, utilities and environment values from coastal hazards. This is a conservative estimate, and costs are likely to be well over $1 billion when considering higher risk hazard scenarios, additional at-risk locations and additional costs which could not be quantified in this assessment.

These costs are equivalent to **$44 million** per year in average annual costs in the short term (0-10 years) of which **$29.5 million** per year is attributed to the costs of erosion and **$14 million** per year is attributed to the costs of inundation.

A breakdown of the losses by different categories is shown in Figure 4.

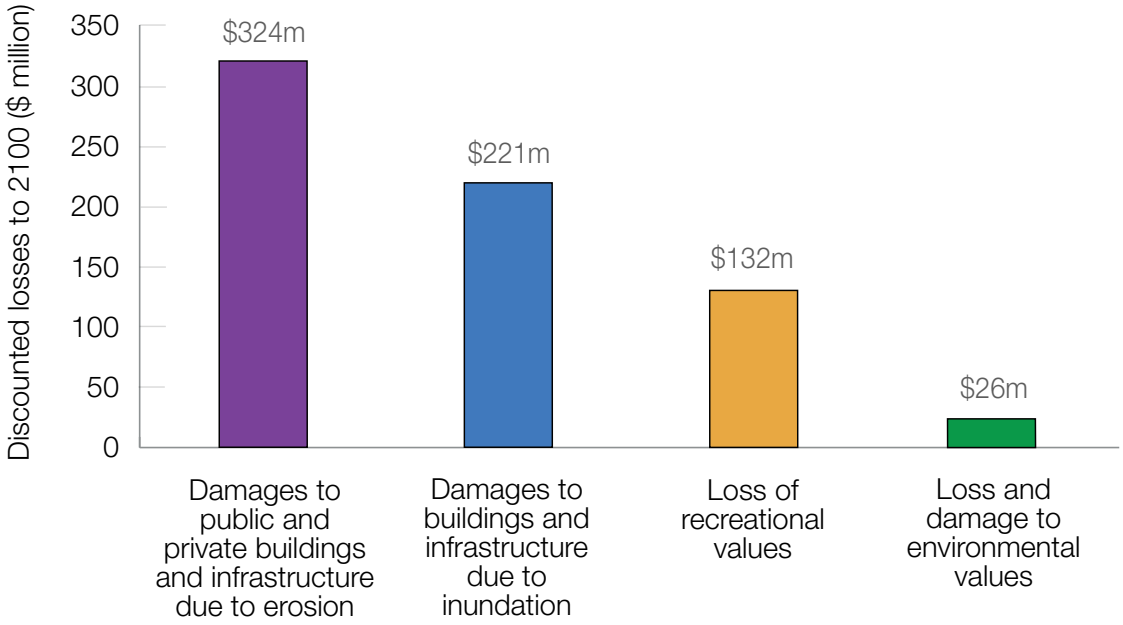


Figure 4: Damages quantified under the base case assessment

Beyond the costs quantified in this project, coastal hazards disrupt lives and livelihoods. Businesses, particularly in the tourism and service sectors, face revenue loss and operational challenges. Communities experience service interruptions, physical and mental health impacts, and in some cases, displacement. Cultural heritage is also under threat, with at least 18 registered Aboriginal sites identified at immediate risk of erosion, and many others unregistered or unmapped. There is a clear case for investing in adaptation to prevent these future losses to the WA community.

The benefits of coastal adaptation

Investments in adaptation measures at high-risk hotspots provide net public benefits

The case for investing in coastal adaptation is both compelling and urgent. This assessment demonstrates that adaptation can generate strong returns for the WA community, significantly reducing the costs of inaction. Across six case studies (see Table 1), adaptation investments on average generate a positive net present value (i.e. benefits are greater than costs). A positive net present value (NPV) suggests that there is greater value in investing in adaptation instead of a business-as-usual approach. An adaptation option will usually have a positive NPV if a major erosion event occurs in the short-term or medium-term.

The case studies found that, **on average, every $1 invested in adaptation WA delivers $2.65 in benefits**. These case studies reflect the diversity of WA's coastal settings, ranging from densely populated urban areas to remote communities and environmentally sensitive zones. In addition to quantified benefits, adaptation actions deliver co-benefits such as safeguarding recreational spaces, supporting local economies, and preserving natural landscapes and cultural heritage.

The short-term costs of investing in adaptation at high-risk locations are less than the costs incurred from erosion

Analysis of adaptation measures at the 55 erosion hotspots found that an average investment of $200 million may be required in the short term (0-10 years) to deliver identified adaptation measures. The average costs associated with coastal erosion over the next 10 years is estimated to be $440 million. This suggests a potential net benefit from adaptation of $240 million. The overall value of coastal adaptation could therefore be significant. Accounting for the significant additional costs associated with coastal erosion which could not be quantified would further increase the net benefits of adaptation.

Table 1: Summary of findings from six case studies

Case study	Location description	Adaptation methods	Outcome (NPV range[a])	Key findings and insights
Abbey and Locke Estate, Busselton	Densely populated recreational and commercial hub, significant residential / tourist infrastructure	Hard protection measures to prevent erosion and inundation	Positive net benefits under all hazard scenarios and cost ranges ($4.6m to $254m)	Densely populated areas with a variety of assets and values at risk receive significant benefits of coastal adaptation even when measures are costly.
Cervantes, Dandaragan	Small coastal community with low population density and high dependence on beach tourism	Protection measures in the short term, managed retreat over long term	Only positive under scenarios with major erosion events occurring in the short term, otherwise costs outweigh benefits (-$4.2m to $15.8m)	Smaller coastal communities see high costs when erosion events occur, monitoring and reporting and adaptive pathways help reduce risks of overspend on adaptation measures.
Chinatown, Broome	Commercial and cultural centre with tourist visitation and historic values	Ongoing monitoring with new protection measures to be implemented once the existing seawall fails	Positive net benefits under nearly all hazard scenarios and cost estimates ($-0.2m to $34m)	Current protection measures are providing significant value, developing an effective adaptation pathway that is timed to when existing measures are no longer effective delivers significant benefits.
Emu Point, Albany	Mixed-use site with recreational and environmental assets in an area with both local residents and tourist visitation	Soft protection measures such as beach nourishment as well as some groynes	Only positive under scenarios with major erosion events occurring in a short time and low-cost options implemented (-$2.1m to $4.7m)	Where recreational values are high and built asset values are low soft protection measures can be valuable, but investments need to be prioritised, to ensure positive returns for the community.
Point Moore, Geraldton	Small residential area (leasehold from Crown Estate) with key infrastructure connections to nearby port	Managed retreat to avoid risks to residential buildings	No scenarios with net benefits identified as the benefits of managed retreat could not be quantified (-$1.3m to -$0.4m)	Assessing the benefits of managed retreat is challenging - key benefits of avoided health impacts and legal liabilities cannot be fully quantified. Other qualitative factors should be considered.
Rockingham to Kwinana	Multi-use coastal zone encompassing industrial, residential, and recreational areas	Hard protection measures such as seawalls and groynes	Net benefits under high-risk low-cost scenarios, costs outweigh benefits when adaptation costs are high or erosion occurs later (-$6.7m to $50m)	More expensive protection measures provide benefits when higher risk erosion events occur, adaptive pathways that respond to actual erosion can help minimise costs and maximise benefits.

[a] There is an 80 per cent chance that NPV falls within this range based on the probabilities associated with hazard lines developed in the CHRMAPs.

Implications for delivering greater benefits from coastal adaptation investments in future

To fully realise the benefits of coastal adaptation in WA investment must be targeted, timed appropriately, and locally informed. Monitoring coastal change, refining adaptation pathways, and ensuring equitable funding across local governments are essential. The case study assessments found that:

- ✓ The timing of adaptation measures is important and adaptive pathways that respond to actual events are valuable
- ✓ Managing the costs of adaptation measures is important. Costs for protection can be high and can sometimes outweigh even significant public benefits
- ✓ Local knowledge and understanding is crucial to effectively target and tailor adaptation measures in the right locations
- ✓ There is significant value in monitoring and other activities which help to delay the need for investment in hard protection measures
- ✓ Benefits may occur across local government boundaries and may not be captured in decision-making relating to investment by a single local government.

This project highlights that adaptation is not just a protective measure - it's an opportunity to invest in the long-term resilience, liveability and prosperity of coastal Western Australia.

Definitions

Coastal Hazards

The consequence of coastal processes that affect the environment and safety of people. Potential coastal hazards include erosion, accretion and inundation.

Risk

The potential for adverse outcomes resulting from the interaction of climate-related hazards with vulnerable conditions. Risk is often expressed as a function of hazard, exposure, and vulnerability (Risk = Hazard × Exposure × Vulnerability).

Net Present Value (NPV)

The current value of a stream of future costs or benefits, discounted to reflect the time value of money. Present value allows decision-makers to compare costs and benefits that occur at different points in time on a consistent basis.

Discounting

The process of converting future costs or benefits into present value using a discount rate. Discounting reflects the principle that people generally prefer to receive benefits sooner rather than later and to defer costs where possible.

Avoided Costs

The estimated costs that would have occurred in the absence of an intervention, project, or policy, but are prevented due to that action. In adaptation planning, avoided costs often refer to damages, losses, or disruptions that are reduced or eliminated by proactive investments.

Adaptation pathways

Sequences of possible actions or decisions that help achieve long-term adaptation goals over time. They map out multiple options and decision points, allowing for flexible, staged responses as conditions change or as new information becomes available. The approach supports making low-regret decisions now while preserving the ability to adjust future actions as needed.

Monitoring for coastal hazards

Refers to the systematic collection, analysis, and interpretation of data related to physical, environmental, and socio-economic conditions along coastlines to detect, track, and assess risks from hazards such as erosion, inundation, storm surge, sea level rise, and extreme weather events.