



COASTAL COMMUNITIES AND COASTAL MANAGEMENT



UNSW
SYDNEY

COMMUNITY PERCEPTIONS OF COASTAL HAZARDS

COASTAL EROSION AND INUNDATION

The MyCoast study was conducted in conjunction with:



SURF LIFE SAVING
NEW SOUTH WALES



UNDERSTANDING COASTAL EROSION AND INUNDATION

Australia is an island continent with over 35,000km of coastline. Most Australians live within 50km of the shoreline, and the beach is a special place for many Australians.

Natural forces shape the coastline, causing sediments such as sand, mud, clay and gravel to rotate between land and sea, building beaches up (accretion) and breaking them down (erosion). Over time, these natural processes influence all the different components of the coastline, including beaches, rocky foreshores and cliffs, estuaries and mangrove forests.

Coastal areas are more vulnerable than many other places to natural events like cyclones, storm surges and inundation – and as our climate changes, these events are occurring more often.

NATURAL COASTAL EROSION AND THE ROLE OF BEACHES

Coastal erosion involves moving the shoreline (where land and water meet) further towards land. It also involves a decrease in the size of the beach as sediments are taken away by the sea.

Sediment movement on beaches happens in two main ways. The first is short-term storm erosion followed by recovery. Sand can be removed rapidly by the forces of wind and waves during storms. The sand is then slowly pushed back onto the beach by waves and tides over a period of weeks, months or even years. Eventually the beach returns to its original state.

The second movement is long-term coastal recession or accretion, which can either increase or decrease the beach. Beaches lose

sand when some of the sand removed by storms or waves isn't all replaced by waves or currents. That creates a net loss of sediment from the beach system, called a sediment deficit. The opposite can happen and beaches gain sand when a slow net increase of sediment comes into the system.

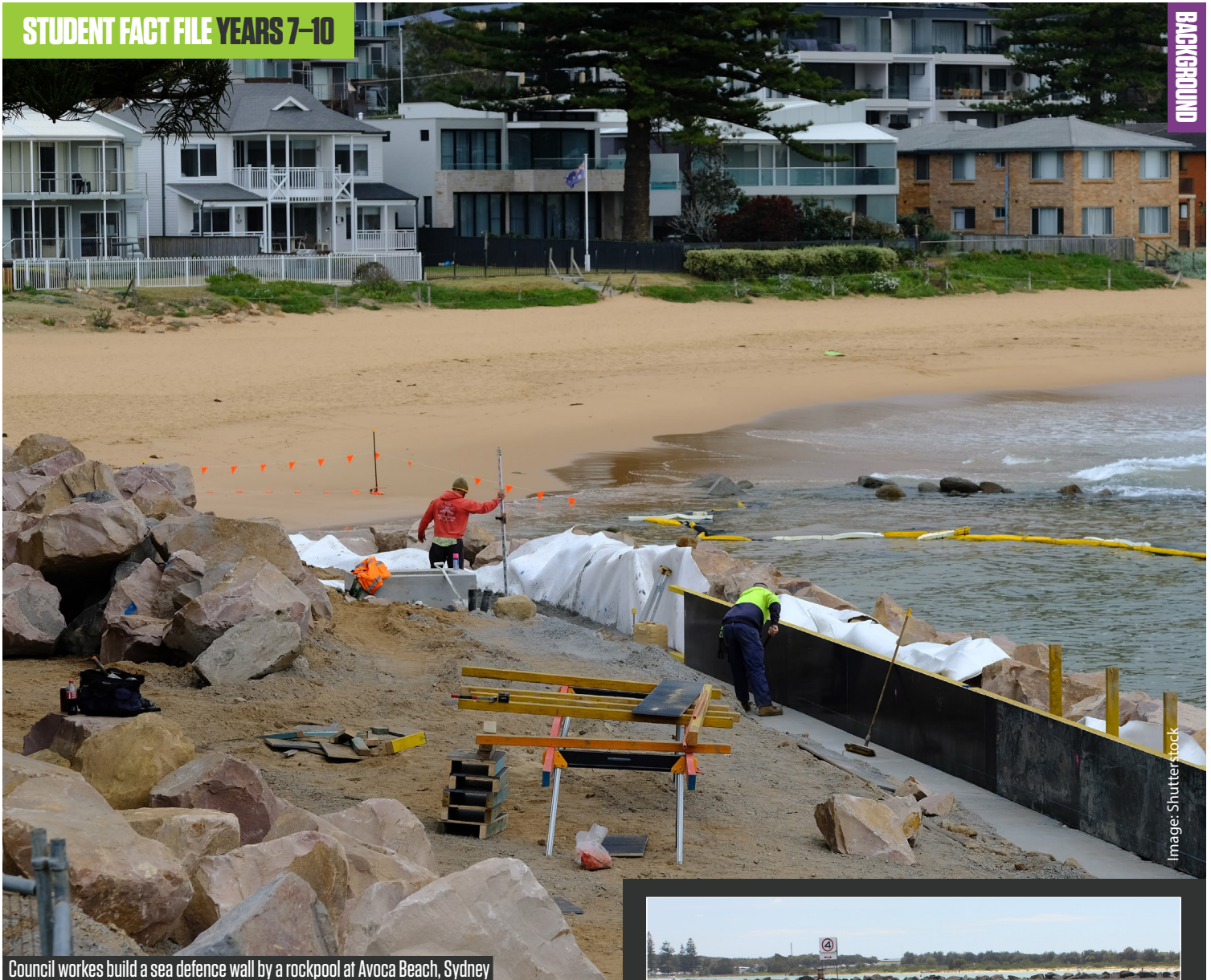
Beaches form a protection against coastal erosion in the way they respond naturally to changing wave and water level conditions. Sand dunes are a strong buffer that use up the wave energy before it reaches the land behind the beach (called the coastal hinterland). Stable dunes that are covered in plants also help stop sand from being blown inland by the wind.

Coastal inundation involves seawater flooding normally dry, low-lying coastal land and entering coastal freshwater lakes, wetlands and estuaries. It is usually caused by a combination of high tides, storm surges and large waves caused by powerful coastal storms.

King tides can also cause inundation, the effects of which are amplified if they coincide with coastal storms. Inundation by king tides also gives us insight into the impacts of future sea level rise.

WATCHING THE COAST

Witness King Tides is a citizen science program that gathers photos of king tides around the coast. You can share your photos and see others of your local area at: www.witnesskingtides.org



Council workers build a sea defence wall by a rockpool at Avoca Beach, Sydney

COASTAL INUNDATION, HUMAN ACTIVITIES AND CLIMATE CHANGE

Many parts of Australia's coastline are no longer in a natural state and coastal erosion has become a big challenge for coastal communities. Beaches and coastlines are very popular places to live and visit, so there are many roads, houses and buildings built close to the shoreline.

Powerful coastal storms with gale force winds, heavy rain leading to flash flooding, rough seas and large coastal swell, all make coastal erosion happen faster. They can also lead to coastal inundation.

While these extreme events occur rarely, mathematical and computer models that shape our understanding of coastal systems show that they are likely to happen more often in the future because of climate change. Models also show that extreme rain events and tropical cyclones will become more intense, and are likely to increase the risk of inundation and erosion in coastal areas.

Warming oceans and melting of polar ice are predicted to cause sea-level rise that will likely lead to the recession of shorelines and the permanent loss of beaches.

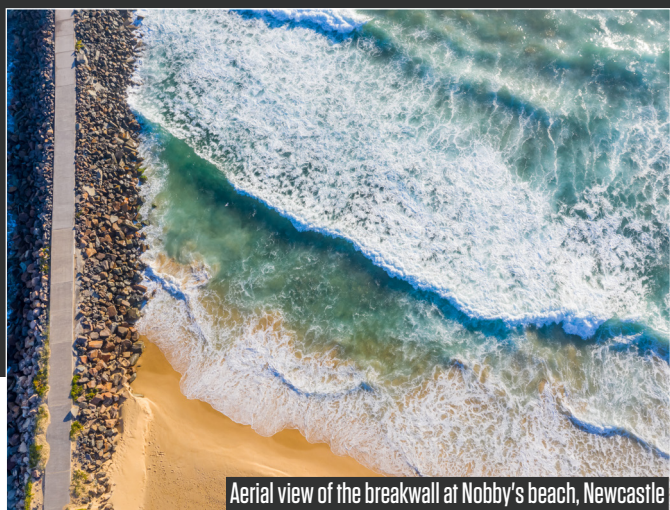


Flooding at Lake Illawarra Foreshore

“Powerful coastal storms with gale force winds, heavy rain leading to flash flooding, rough seas and large coastal swell all make coastal erosion happen faster.”



Coastal communities include many different groups of people that are affected by coastal management decisions



Aerial view of the breakwall at Nobby's beach, Newcastle

There are other human activities that affect coastal erosion. Diverting rivers for irrigation and damming rivers reduces sediment flow into waters near the shore so there is less material for the natural rebuilding of beaches. Removing sand dunes and vegetation and building hard-surface coastal structures like sea walls and breakwaters can reduce the ability of the coastline to adjust naturally.

DEFINING COASTAL COMMUNITIES

Coastal management seeks to balance human and natural activities that affect coastal areas with social, economic, recreational, and ecological factors. Coastal managers must engage with coastal communities – but they face a common challenge: how to define a coastal 'community' to engage with and who can they talk to help them make decisions?

Australians love their beaches and coastlines, so there are many different groups of people who are affected by decisions made about how to manage these areas. Another challenge is knowing the best way to communicate information to these groups effectively.

Like the coastline, these groups are constantly changing. Different groups will use areas at different times, and groups have different parts of the coast that they engage with. These groups have varied relationships with the coast, and the groups often overlap.

'Communities of place' are groups of people linked through a specific place. Examples are coastal tourists, coastal Indigenous communities, frontline coastal erosion residents and members of Surf Life Saving Clubs.

'Communities of interest' are groups of people linked through a common activity or profession. These communities can include teachers, coastal management professionals, business owners and employees and coastal council employees.



Images: Shutterstock

View over Bogggy Creek, Merimbula, NSW

COASTAL MANAGEMENT

Coastal management must deal with a wide range of complex issues. These include social, economic, aesthetic, recreational and ecological factors. Coastal managers try to balance all of these factors to come up with long-term plans that are sustainable for the future, that work with nature and that maintain the coast's natural ability to adapt to change.

IMPACT OF COASTAL HAZARDS

In NSW, there are 15 'erosion hotspots,' all having five or more houses and/or a public road located in a coastal hazard area. These include Collaroy and Narrabeen beach, Woolli Beach, Norah Head and Batemans Bay.

Research on the US east coast found that erosion of coastlines in front of homes reduced the value of the properties, and NSW studies found severe coastal erosion could cost billions of dollars state-wide through damage to infrastructure, recreational facilities and the environment.

The Sydney Beaches Valuation Project showed communities are aware of erosion issues and want action to happen to limit its impacts.

SYDNEY BEACHES VALUATION PROJECT

Evaluating the need for coastal management practises and prioritising these is complex. The Sydney Beaches Valuation Project was conducted as a collaborative project between the Sydney Coastal Councils Group and UNSW Sydney to estimate the economic value of selected beaches in Sydney, Australia.

The project provided information to assist local and State government agencies to identify the most appropriate response to both existing coastal management pressures and to projected climate change impacts. You can find more information here: bit.ly/SBVP_UNSW

THE MYCOAST STUDY

Led by UNSW Sydney, the MyCoast Study took place in 2017–2018 with the aim to provide an evidence-based information platform to assist local governments and coastal management professionals in the future development of suitable and effective educational strategies and programs. The ultimate goal was to help improve the ability of NSW coastal communities to adapt sustainably to the risk of coastal erosion and inundation.

CASE STUDY 1

COASTAL
EROSION AND
MANAGEMENT IN
THE NEWS

Aerial view of Collaroy Pavillion, NSW, during the storm surge event of June 2016

NEWS.COM.AU JUNE 8, 2016

COLLARROY MANSIONS SURVIVE OVERNIGHT KING TIDE BUT CLEAN UP CAUSES CONFLICT

Liz Burke and AAP

A "last chance effort" by an army of volunteers and emergency workers has saved some of Sydney's most exclusive homes from slipping into the sea, for now.

The 10 multi-million-dollar properties remain teetering on the coastline after being smashed by the savage storm.

An estimated hundreds of volunteers and emergency crews worked to create a sandbag wall at Collaroy last night after the coastline was ripped apart by king tides.

The beachfront-turned-clifftop mansions imperilled by the wild weather survived another hammering as the fourth night of king tides battered the northern beaches.

More than 10,000 sandbags holding tonnes of sands were laid against the precariously positioned homes by volunteers who came from all over the city, forming human chains to pass along sandbags in scenes described as "organised chaos".

The king tide hit about 10pm, but the efforts to shore up the vulnerable homes worked — and it looks like it was the last strike as the storm event passes.

Though rough surf conditions will continue, most of the foul weather which has belted the state's coast has moved towards Tasmania.

While the expensive clean up is beginning, authorities are warning people to be vigilant as they return to homes evacuated during the floods. **Read more:** bit.ly/newsCollaroy



Image: UNSW

King tide at Swansea Channel

Image: Nick Cummins/Witness King Tides

NEWCASTLE HERALD JANUARY 2, 2014

KING TIDES CAUSE FLOODING: PICS, VIDEO

Matthew Kelly

Low-lying parts of Newcastle and Lake Macquarie got a taste of predicted sea level rises during Thursday morning's king tides.

Streets around Swansea Channel were inundated as the tide moved in just after 9am.

Several private jetties and breakwalls around the channel also went under.

In Newcastle, the water crept into the gutters around Wickham, Maryville and Carrington.

The 2.08 metre tide was a millimetre lower than the last major king tide to hit the

region in January 2009.

Black Neds Bay resident Ken Hoff said he had seen the water reach higher than this morning's high water mark.

"It's probably about three inches from where it's reached in the past," he said.

Green Cross Australia asked people to post their photos of the king tide on its website: www.witnesskingtides.org

The website is part of a research project to visualise the potential future impacts of sea level rise.

Read more: bit.ly/newsHerald

ABC ONLINE 9 FEB, 2019

CLIMATE CHANGE EATS AWAY AT TORRES STRAIT ISLANDS, PROMPTING CALLS FOR LONG-TERM SOLUTIONS

Anna Hartley

Rising sea levels, coastal erosion, unpredictable winds and destructive king tides are increasing problems in the Torres Strait, with roads, buildings and even cemeteries being washed away in recent years.

A flood prevention method that withstood wild weather this week may be rolled out to other vulnerable Torres Strait communities, including Yam Island where families were left homeless after king tides last year.

Torres Strait Island Regional Council deputy mayor Getano Lui said geotextile sandbags were used for the first time in the Torres Strait this week when abnormally high tides impacted Poruma Island, a cultural hub home to just 200 people.

"It's getting worse every year," he said.

Read more: bit.ly/newsABCNorth



Yam Island residents calling for better flood protection after their homes were inundated

Image: Facebook: TS Connect



Oyster bags installed in Sydney will help to reduce coastal erosion

ABC ONLINE 27 OCT, 2016

OLD OYSTER SHELLS TO BE USED TO REGENERATE SYDNEY HARBOUR MARINE LIFE

Amanda Hoh

The creatures that live in Sydney Harbour are set to have their own "fish hotel" in a trial to regenerate oyster reefs.

By packing old oyster shells into biodegradable coconut fibre bags, OceanWatch Australia, a not-for-profit environmental company, have developed a method to line shorelines using natural materials.

The bags will help reduce erosion and siltation along the shore, while also restoring the shellfish population and providing a new habitat for other marine life.

"Oyster larvae love nothing better than other oysters," Andy Myers, aquaculture program manager, said.

"It's about the high lime content

of oysters shells that make them really attractive to baby oysters.

"When oyster larvae settle on other oysters, when they grow they secrete a natural cement and bind the structures together.

"When the bag breaks down the structural complexity will still be there for a multitude of marine organisms."

Five river sites have been selected for the trial including at Sugarloaf Point in Lane Cove National Park, end of Avro Rd in Chatswood, Mann's Point, Greenwich Point Reserve and Rob Reserve in Castlecrag.

Read more:

bit.ly/ABCNewsOyster



CASE STUDY 2

COMMUNITY PERCEPTIONS OF COASTAL HAZARDS

Seawater covers the infrastructure at Fairlight Pool, Sydney

GETTING COASTAL COMMUNITIES TO ADAPT TO IMPENDING coastal risks has been described as a 'wicked problem.'

Coastal risks are complex. Uncertainty around the impacts that will occur because of sea level rise and increased extreme events combined with a wide array of different perspectives and values from community members, together with an uncertain timeframe, provides a prime example of a wicked problem.

Wicked problems are difficult or impossible problems to solve because the things that contribute to them can be hard to define, incomplete, contradictory and changing. Wicked problems also are complicated further by the way they mix with other problems. That's why the best approach is often to find ways to reduce the effects of wicked problems, and adapt to them, rather than to find a solution.

UNSW Sydney worked with the Sydney Coastal Councils Group, Surf Life Saving NSW, the NSW Office of Emergency Management and the NSW Office of Environment and Heritage to assess community expectations and understanding about the hazards of coastal erosion and coastal inundation.

The UNSW Sydney MyCoast Study used surveys to explore perceptions of coastal communities in NSW in regards to how the impacts of coastal storms and sea level rise will affect their use of the coast in the future. This includes how communities see the



The Pasha Bulker aground at Nobby's Beach in Newcastle after a storm in 2007

“Coastal risks are complex, ... and provide a prime example of a wicked problem.”



Image: Alison Smart/Witness King Tides



Image: Shutterstock

King tide at Crookhaven Heads, NSW. Inset: Sandbags protect a local business during flooding

challenges and hazards facing the coast, what they think is the best way to manage impacts of these hazards, and who should pay for damages that occur from these hazards.

The study then showed the difference between community understanding of hazards, and what coastal management professionals and scientists understand the hazards to be.

The MyCoast research showed there was a lack of awareness of threats to coastal areas due to climate change. Fifteen per cent of general coastal users and 25% of coastal accommodation businesses do not think, or are unsure, that sea level rise is occurring.

Only 50% of coastal users and 38% of coastal accommodation businesses think sea level rise will impact them directly, even though around 40% of surveyed coastal accommodation businesses had previously been affected by erosion and/or inundation, with 32% of this group indicating these events occur once a year.

UNSW MYCOAST STUDY

More information including fact sheets and the final report on the UNSW MyCoast Study can be found here: www.bees.unsw.edu.au/nsw-my-coast-study

About 30% of coastal users don't think storm surges affect coastal inundation and 50% don't identify tidal influences (king/spring high tide) as factors. Fifteen per cent of surveyed coastal users had never had any information about coastal erosion and 24% had never had any information about coastal inundation.

The study results will help NSW coastal managers give better information to their communities, to understand and include their community's needs and help prepare adaptation schemes that will make coastal communities more resilient and better prepared.



Image: Shutterstock

TEACHER TOOLKIT

Looking out across the Tweed River, NSW

GENERAL CAPABILITIES

PART 1 Who belongs to the coastal community?

Personal and Social Capability

In this introductory activity, students describe who makes up a 'coastal community' and list examples of specific groups who interact with the coastal environment. Examples include: surfers, Indigenous owners, homeowners, tourists, council workers, event and community organisations (such as Keep Australia Beautiful), and scientists. Students conduct primary research (observations during site visits, prior knowledge) and secondary research (case studies, newspaper articles, books) of each community group listed, and then consider how they themselves might interact with different cultural groups.

Describing coastal 'communities' are important when thinking about who may be affected by different coastal hazards and how. This might include impacts to their property, usage, values or interests.

The NSW Government provides more information, including definitions of coastal zones, here: bit.ly/NSWCoastal.

Students can individually complete sections of Table 1 and then share their findings with the rest of the class.

PART 2 How do different coastal community groups interact with each other?

Intercultural Understanding

Students compare two coastal community groups and the way they interact with each other. They consider the broader benefits and compromises each group would contribute when sharing the use and maintenance of the coastal zone.

PART 3 The science of a coastal community

Literacy, Numeracy and ICT

Collate and present information that describes the basic science of coastal zones and the impact, focus, goals, and communications of at least two of the community groups discussed so far and their impact on the science of the coastal zone.

Critical and Creative Thinking

Students identify and tabulate challenges and threats now and in the future to coastal zones before suggesting possible broad solutions.

Ethical Thinking

Students choose two community groups and write an ethical action plan where the two coastal community groups can support each other to address challenges to coastal zones. If possible students can share and/or implement their action plan with the relevant coastal communities.



STUDENT ACTIVITIES

INTRODUCTORY QUESTIONS

NAME:

1. Write your own description of a 'coastal zone'.

2. Give examples of groups of people that you would include in:

- (a) Communities of place
- (b) Communities of interest

3. What are some of the different ways that people engage with coastal areas?



PART 1 Who belongs to the coastal community?

 **Personal and Social Capability**

(a) In your own words, write down any ideas you have about what a coastal community is:

(b) Use this resource or any other secondary source to define a 'coastal community'.

(c) Complete the table below by:

- i. Listing as many different coastal community groups that you can think of in the left-hand column;
- ii. Describing how each of these groups uses the coastal area in the middle column;
- iii. Outlining how you might interact with each of these community groups when using the coastal area. If you think you belong to this coastal community, include this information here also.

TABLE 1 – WHO BELONGS TO A COASTAL COMMUNITY?

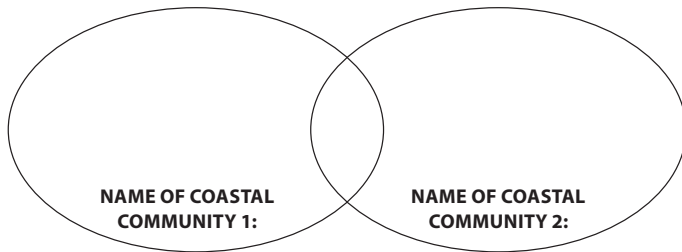
Which groups use the coastal area?	How do they use the coastal area?	How might you interact with them when you use the area?



PART 2 How do different coastal community groups interact with each other?

 **Intercultural Understanding**

(a) Choose two coastal community groups from Table 1 and compare the similarities and differences of their use of the coastal area in a Venn diagram:



(b) What benefits does each group bring to the coastal community when they use it on a daily or weekly basis?

(c) What benefits does each group actively bring to the maintenance of the coastal zone?

(d) What negative effects might each group have on the maintenance of the coastal zone?

(e) How might one group support another in maintaining the coastal zone?

(f) How might one group have to compromise how they use the coast in relation to the other group?

PART 3 The science of a coastal community

 **Literacy, Numeracy and ICT**

1. What questions do you have about coastal communities? Design a few questions which can provide you with more information about coastal zones.

Choose one of these questions to research by conducting one of the following:

- (a) Create a data table to collect and present primary quantitative or qualitative data from a coastal zone of interest. You can either visit the site of interest and record a range of measurements, or conduct a survey of the opinions and ideas of various individuals or groups.
- (b) Collect and present secondary quantitative or qualitative data related to the changes taking place at coastal zones. Use information in this resource, relevant websites or the UNSW MyCoast study factsheets: www.bees.unsw.edu.au/nsw-my-coast-study

2. Identify a community group that collects data on the coastal zone. Access some of that data and present it back to your peers using software of your choice, such as an excel spreadsheet, a webpage, a short animation or a podcast.

3. Create voiceover text for the Collaroy video (See news article p6 or this website: bit.ly/newsCollaroy). Include information on:

- (a) The cause of the damage
- (b) What is being done to protect the area from further damage
- (c) The community groups affected
- (d) The community groups taking action



 **Critical and Creative Thinking**

Complete the following table to list the challenges faced by coastal zones both now and in the future. For each challenge, log your ideas about possible solutions.

CHALLENGES NOW	POSSIBLE SOLUTIONS	CHALLENGES IN THE FUTURE	POSSIBLE SOLUTIONS

 **Ethical Thinking**

1. Choose one coastal community group and research the following questions in relation to coastal erosion and inundation:

(a) What is the community's understanding of the challenges now and in the future?

(b) How prepared are they for what is to come?

(c) What resilience to the challenges do they have?

(d) How will their use of the coastal zone change in the future?

(e) How can they help improve the coastal zone? What are their strengths as a group?

(f) Which other coastal community group could this group best support, in order to act on the challenges to the coastal zone? Justify your response.

(g) Which coastal community group could best support your chosen group, in order to act on the challenges to the coastal zone? Justify your response.

2. Once you have researched your chosen community group, collaborate with one other classroom group who researched a different coastal community and come up with an action plan where both coastal community groups could support each other to address one of the challenges to the coastal zone.

3. Design and describe an action plan that includes an outline of what the solution would look like including; a timeline, equipment, cost, specific jobs, possible challenges and how to overcome them.



EVALUATION OF LEARNING

1. What did you most enjoy learning about coastal zones and the communities that use them?

2. How did your awareness and attitude to the challenges facing coastal zones and communities change while undertaking these activities?

3. What do you think are the current priorities when managing coastal zones?

4. What further questions do you have about the future of coastal zones?

CURRICULUM LINKS

SCIENCE UNDERSTANDING

YEAR 9

Biological Science

Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176).

Physical Sciences

Energy transfer through different mediums can be explained using wave and particle models (ACSSU182).

YEAR 10

Earth and Space

Global systems, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189).

Physical Science

Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190).

The motion of objects can be described and predicted using the laws of physics (ACSSU229).

SCIENCE AS A HUMAN ENDEAVOUR

Most SHE outcomes for Years 7–10.

SCIENCE SKILLS

All outcomes

GEOGRAPHY

Human-nature relationships

YEAR 7

The economic, cultural, spiritual and aesthetic value of water for people, including Aboriginal and Torres Strait Islander Peoples and peoples of the Asia region (ACHGK041).

The influence of environmental quality on the liveability of places (ACHGK045).

The strategies to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047).

YEAR 8

The aesthetic, cultural and spiritual value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples (ACHGK049).

YEAR 9

The effects of people's travel, recreational, cultural or leisure choices on places, and the implications for the future of these places (ACHGK069).

YEAR 10

The human induced environmental changes that challenge sustainability (ACHGK070).

The environmental world views of people and their implications for environmental management (ACHGK071).

Skills and Knowledge

YEAR 7/8

Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (Year 7 – ACHGS054, Year 8 – ACHGS062).

YEAR 9–10

Reflect on and evaluate findings of an inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic, political and social considerations; and explain the predicted outcomes and consequences of their proposal (Year 9 – ACHGS071, Year 10 – ACHGS08).

Conservation and sustainability

YEAR 7

The ways that flows of water connect places as it moves through the environment and the ways that it affects places (ACHGK038).

The economic, cultural, spiritual and aesthetic value of water for people, including Aboriginal and Torres Strait Islander Peoples and peoples of the Asia region (ACHGK041).

Factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043).

The influence of environmental quality on the liveability of places (ACHGK045).

YEAR 8

The different types of landscapes and their distinctive landform features (ACHGK048).

The geomorphic processes that produce landforms, including a case study of at least one landform (ACHGK050).

The ways of protecting significant landscapes (ACHGK052).

The management and planning of Australia's urban future (ACHGK059).

YEAR 9

The distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (ACHGK060).

The effects of people's travel, recreational, cultural or leisure choices on places, and the implications for the future of these places (ACHGK069).

YEAR 10

The human induced environmental changes that challenge sustainability (ACHGK070).

The environmental world-views of people and their implications for environmental management (ACHGK071).

The application of human-environment systems thinking to understanding the causes and likely consequences of the environmental change being investigated (ACHGK073).

The application of geographical concepts and methods to the management of the environmental change being investigated (ACHGK074).

The application of environmental, economic and social criteria in evaluating management responses to the change (ACHGK075).

Health and wellbeing

YEAR 9

The perceptions people have of place, and how this influences their connections to different places (ACHGK065).

YEAR 10

The different ways of measuring and mapping human wellbeing and development, and how these can

be applied to measure differences between places (ACHGK076).

GEOGRAPHICAL INQUIRY AND SKILLS

YEAR 7–10: ALL SKILLS

HASS

YEAR 7

Skills and Knowledge

Collaborate to generate alternatives in response to an issue or challenge, and compare the potential costs and benefits of each (ACHASSI160).

Reflect on learning to propose personal and/or collective action in response to an issue or challenge, taking into account different perspectives, and describe the expected effects (ACHASSI162).

Conservation and sustainability

Collaborate to generate alternatives in response to an issue or challenge, and compare the potential costs and benefits of each (ACHASSI160).

Develop and use criteria to make informed decisions and judgements (ACHASSI161).

Geography Substrand

Economic, cultural, spiritual and aesthetic value of water for people, including Aboriginal and Torres Strait Islander Peoples and peoples of the Asia region (ACHASSK186).

Factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHASSK188).

The influence of accessibility to services and facilities on the liveability of places (ACHASSK189).

The influence of environmental quality on the liveability of places (ACHASSK190).

The influence of social connectedness and community identity on the liveability of places (ACHASSK191).

Strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHASSK192).



Published by [Refraction Media](#)

Publisher: Karen Taylor.

Head of Content: Heather Catchpole.

Written by Sally Parker, Brendan Fitzpatrick, Fran Molloy.

Designed by Jon Wolfgang Miller.

Produced on behalf of the School of Biological, Earth and Environmental Sciences, UNSW Sydney.

The full My Coast Report can be found at www.bees.unsw.edu.au/nsw-my-coast-study

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Funded under the joint State and Commonwealth Natural Disaster Resilience Program. The views expressed herein do not necessarily reflect the views of the New South Wales Government.