

Climate-proofing Singapore's coastlines

To address rising sea levels, national water agency PUB and the National University of Singapore (NUS) have opened a Coastal Protection and Flood Resilience Institute (CFI Singapore) to develop innovative, multi-functional coastal protection and flood management solutions for Singapore's coastlines, and build up expertise on the matter. **Cheryl Tan** and **Lim Yong** look at some projects that the institute will embark on.

CFI SINGAPORE'S GOALS



Conduct coastal science research

To study the impact of climate change on coastal processes (such as wind, waves, storm surge levels and astronomical tides) and coastal protection structures.



Integrate nature-based solutions

Include mangroves, seagrasses and corals with various man-made structures to shore up coastal protection.



Monitor and predict the coastal environment

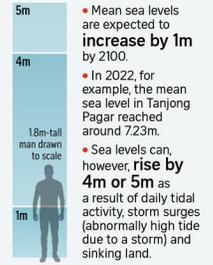
Enhance prediction systems for coastal processes, rainfall and water run-off.



Develop innovative engineering solutions

Create multi-functional solutions for Singapore's coastal environment. For example, the Marina Barrage not only serves as a dam for flood control but is also a source of fresh water and a recreational space.

Impending threat



SOME OF THE PROJECTS

Retrofit existing coastal protection structures

- Modular, watertight units can also be added on top of existing protection structures, such as seawalls, to better protect against sea level rise.
- PUB is working with Delta Marine Consultants to explore the use of modular blocks known as XbloPlus along Singapore's coastlines.



Testing existing hybrid protection solutions

► Mangroves and rock revetments

- Natural ecosystems like mangroves can be harnessed to keep pace with rising sea levels as their tangled roots can trap sediments brought in by the tides.
- They can supplement man-made structures like rock revetments to prevent coastal erosion and reduce the force of waves.
- If found to be effective, these hybrid solutions can reduce the extent of infrastructure needed.



Mangrove saplings sprout from cracks in a rock revetment wall at the Kranji Coastal Nature Park.

► Perched beach

- A submerged breakwater, comprising rock bunds and sand, is constructed to create a beach.
- The underwater structure can reduce wave energy on the beach, while seagrass habitats can help to trap sediment on the seafloor, thus preventing coastal erosion.
- The perched beach also helps to disperse water and control erosion.

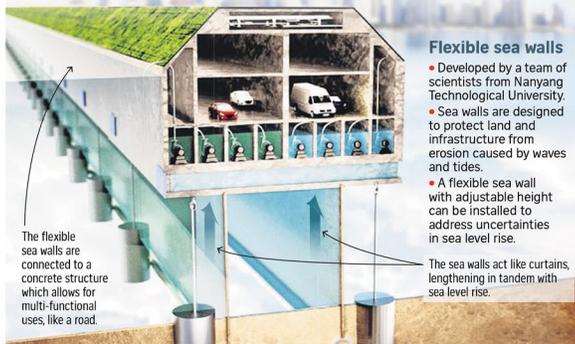


Perched beach on Lazarus Island, which has seagrass habitats and rock bunds.

► Mangrove planters

A joint study by researchers at the University of Melbourne and NUS found that planting pods placed at the Chek Jawa Wetlands on Pulau Ubin (right) were able to increase the survival rates of mangrove seedlings.

- These planters can protect mangrove seedlings from strong currents.
- The planters can be reused once the mangroves have established a strong root system.



Flexible sea walls

- Developed by a team of scientists from Nanyang Technological University.
- Sea walls are designed to protect land and infrastructure from erosion caused by waves and tides.
- A flexible sea wall with adjustable height can be installed to address uncertainties in sea level rise.

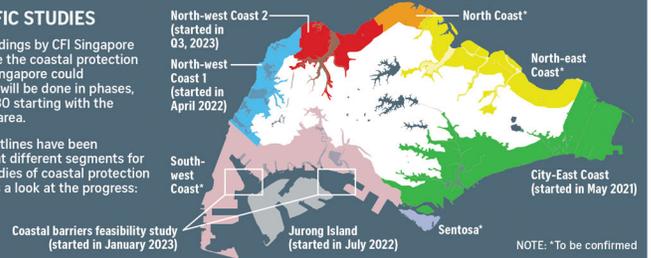
The sea walls act like curtains, lengthening in tandem with sea level rise.

The flexible sea walls are connected to a concrete structure which allows for multi-functional uses, like a road.

SITE-SPECIFIC STUDIES

The research findings by CFI Singapore will help to guide the coastal protection solutions that Singapore could implement. This will be done in phases, from around 2030 starting with the City-East Coast area.

Singapore's coastlines have been divided into eight different segments for site-specific studies of coastal protection measures. Here's a look at the progress:



Source: PUB PHOTOS: ST FILE, AMANDA HSUJUNG, PUB, NTU