



DHI CASE STORY

PROTECTING SINGAPORE'S MANGROVE FORESTS

Using EMMP to determine the impact of construction works

Singapore's Tekong Island has one of the largest mangrove forests in the country. However, coastal erosion on the northeast coast of Tekong has threatened these mangroves. To protect them, Singapore undertook a coastal protection and restoration project. To ensure that the works themselves would not threaten the existing mangroves, the country's National Parks Board (NParks), in conjunction with the Housing and Development Board (HDB) has engaged us to develop and implement an EMMP. In doing so, we helped ensure the long-term sustainability of Tekong's mangrove forests. Furthermore, we contributed to furthering knowledge on how to improve the design of Singapore's coastal protection structures. This will enable the country to better protect its mangroves and marine environment in the future.

MANGROVE FORESTS AT RISK

When modern Singapore was first founded, 13% of the country consisted of mangroves. Important for its biodiversity of plants and animals, mangroves now account for less than 1% of Singapore's land area. Singapore's Tekong Island contains one of the country's largest remaining mangrove forests.



Erosion of the mangrove shoreline at Tekong Island prior to stabilisation of the shoreline on the island

SUMMARY

CLIENT

- National Parks Board of Singapore (NParks)
- Housing and Development Board of Singapore (HDB)

CHALLENGE

- Risk of loss of rare and endangered mangrove trees due to coastal erosion
- Uncertainty about the impact of coastal protection measures on mangroves

SOLUTION

Using an Environmental Monitoring and Management Plan (EMMP) to minimise the impact of coastal protection measures that are put into place to prevent coastal erosion

VALUE

- Increased understanding of the effect of coastal protection work on the environment
- Ensured protection of Singapore's largest remaining mangrove forest area

LOCATION / COUNTRY

Tekong Island, Singapore

The island's northeast coast suffers from coastal erosion, threatening the mangroves there. To address this, Singapore's National Parks Board (NParks) is implementing coastal protection and restoration works in the area. However, the coastal protection measures could themselves have a negative impact on the existing mangroves and the environment. The construction equipment, turbidity and/or vessel wake waves generated by construction vessels along the shoreline during construction could:

- damage mangrove trees on the shoreline
- pollute the natural environment around the island
- cause problems for nearby fish and oyster farms

To protect the environment, Singapore's NParks and Housing Development Board (HDB) asked us to devise and implement an EMMP. Our EMMP ensured that protection measures undertaken on Tekong Island would not negatively impact:

- existing mangrove forests on the island
- surrounding waters
- offshore aquaculture farm users

Before the construction of the coastal protection measures, we developed a pre-project baseline of the environmental conditions. We then used this information during the construction and demobilisation phases of the project to monitor the effect on the environment.



Photo of the shoreline after construction of the shoreline stabilisation measures showing our monitoring team

PROTECTING MARINE ENVIRONMENTS

As part of the EMMP, we modelled the shoreline to make sure that the coastal protection measures did not cause a significant change in currents in the area or increase erosion. In addition, we conducted surveys of the existing mangrove forests twice a year. This confirmed that the works conducted on the shoreline were not negatively affecting the mangroves further inland on the island.

We also monitored the growth and survival of mangrove seedlings planted as part of the coastal protection measures. We conducted 18 monitoring surveys at 20 locations of the newly planted mangrove seedlings in a 12-month period. This helped increase understanding of how well mangrove seedlings tolerate being planted at different degrees of tidal inundation.

Furthermore, we identified a large amount of natural regeneration of mangrove seedlings during our monitoring of newly planted ones. This discovery led to an additional 12 months of surveying on the island to better understand the phenomenon. The results of the study will help improve the design of future coastal protection structures, ensuring that they facilitate natural mangrove colonisation.

Over the course of the project, we also helped the construction contractor understand the need to minimise the impact of their activities on Singapore's waters. We monitored the contractor daily to ensure that they did not:

- damage mangrove trees with their equipment
- pollute the environment (for example, through rubbish or oil from machinery)
- generate large waves with their vessels and disturb neighbouring fish farms or cause shoreline erosion
- disturb nearby fish and oyster farms by travelling too fast or coming too close

To further protect the fish and oyster farms, we also modelled sediment plumes created by construction vessels and took water quality samples offshore to ensure that water quality offshore was not being negatively affected by work at the site. By applying a comprehensive EMMP, we helped ensure that the coastal protection measures were both sustainable and would not negatively impact Tekong Island's marine environment.

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