

# WA'S FIRST LARGE SCALE BENEFICIAL USE BEACH NOURISHMENT PROJECT: LESSONS LEARNED

Demont Hansen, WA Department of Transport Maritime (DoT), [demont.hansen@transport.wa.gov.au](mailto:demont.hansen@transport.wa.gov.au)  
Jake Costin, M P Rogers & Associates Ltd (MRA), [j.costin@coastsandports.com.au](mailto:j.costin@coastsandports.com.au)

## INTRODUCTION

Port Beach, a popular beach in the metro area of Perth, Western Australia, is the result of 130 years of development of Fremantle Port. During many stages of development, dredged material has been disposed of at Port Beach which has resulted in a source of sand as well as undesirable material on the beach as well and in the nearshore environment.

Erosion of this beach became noticeable in the 1990s and a major storm in 2003 resulted in damage to infrastructure. In 2018 Port Beach was designated the highest erosion risk beach in the Assessment of Coastal Erosion Hotspots in Western Australia by DoT and the Department of Planning, Lands, and Heritage (DPLH).



Figure 1 - Major Erosion at Port Beach in May 2003

In WA, the management of the coastline is generally the responsibility of the respective Local Government (LG) which in this case is the City of Fremantle (CoF). The WA State government assists LGs with coastal management through technical support from DoT Maritime as well as a number of Grant programs including Coastal Adaptation and Protection (CAP), Hotspot Coastal Adaptation and Protection (HCAP), Coastal Management Plan Assistance Program (CMPAP), and Coastwest Grants.

## PROGRESSION TOWARDS COASTAL ADAPTATION

Western Australia's State Government Coastal Planning Policy 2.6 requires a risk management approach and provides the framework for undertaking risk management planning for risks arising from coastal hazards in Western Australia. The tool for implementing this is the Coastal Hazard Risk Management and Adaptation Plan (CHRMAP). More information pertaining to CHRMAP can be found here ([CHRMAP guidelines](#)) however the basic components require establishing the context, risk identification, vulnerability analysis, risk evaluation, risk treatment, and implementation.

In 2017, the City of Fremantle completed a CHRMAP for the Port, Leighton and Mosman Beaches in partnership

with the Town of Mosman Park. Through this process, Port Beach was identified as being at extreme risk from erosion in the short term to 2030, and it was recommended that the City implement either (i) a seawall and nourishment or (ii) dune stabilisation, revegetation, and nourishment. In the longer term to 2050 onward, protection or retreat was recommended.

On the back of their CHRMAP, CoF was awarded a 2018 DoT CAP grant to investigate adaptation options and determine a preferred option for short term protection. The Coastal Engineering Consultant for this work was MRA. The following options were developed in liaison with local stakeholders, and assessed through a Multi Criteria Analysis using technical, social, environmental, and economic criteria:

- Option 1 Retreat and Protect
- Option 2 Protect (current shoreline position)
- Option 3 Headlands and Groynes
- Option 4a Sand Nourishment via terrestrial source
- Option 4b Sand Nourishment via dredge

The options study concluded that sand nourishment via dredge material (4b) sourced from the Fremantle Port Authority's (FPA) Deepwater Channel was the preferred Option.



Figure 2 - Oblique Aerial Image of 2019 shoreline (top) and artistic impression of post-nourishment shoreline (bottom)

In 2019 CoF was awarded another CAP Grant for the detailed design of 150,000m<sup>3</sup> of Beach Nourishment as well as required environmental studies for an impending EPA Referral. This was also completed by Coastal Engineering Consultants MRA.

## STAKEHOLDERS OBJECTIVES

The responsibility for Port Beach is more complex than many beaches. Port Beach Road is a major transport route to and from Fremantle Port, and erosion damage to this road would be unacceptable. It is also acknowledged

that FPA bears responsibility as the Port development has resulted in the current state of Port Beach. Thus, Stakeholders include CoF, FPA, Main Roads Western Australia (MRWA) and DoT who also comprise the primary members of the Project Working Team (PWT).

FPA's objectives are clearly outlined in their "Statement of Corporate Intent" and are primarily focused on port trade, safe and efficient operation, property and security. One objective however is to "Protect the environment of the port and minimise the impact of port operations on that environment."

Port Beach is the result of over 100- years of Fremantle Port development. While it is considered to be Western Australia's #1 erosion hotspot, the shoreline actually sits 100m proud of the natural shoreline in 1901 before port development began. FPA's impact on Port Beach cannot be ignored, therefore FPA has been a contributing member of the PWT since project inception.

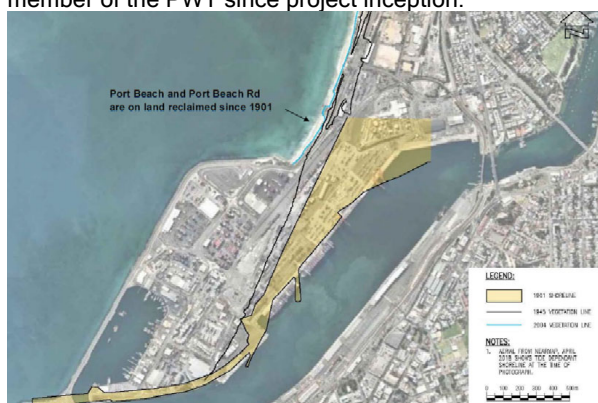


Figure 3 - 1901 Shoreline (yellow shaded) overlaid on 2018 Aerial Imagery.

As previously stated, Port Beach lies within the boundaries of the CoF and therefore they are the local coastal manager of Port Beach. Additionally, their CHRMAP identifies managed retreat as an acceptable adaptation option. While they recognise the social value of Port Beach, CoF has indicated that managed retreat is their preferred adaptation path in the long term to limit ongoing and future expenditure required to maintain the beach amenity.

MRWA is responsible for Western Australia's road network which includes Port Beach Road. While portions of the road are protected by a revetment and artificial headland, there are two unprotected areas that are threatened by the ongoing erosion. For this reason, MRWA is a key stakeholder, however their inclination is to defer action and associated capital expenditure until the threat is more imminent and therefore have been a relatively inactive member of the PWT.

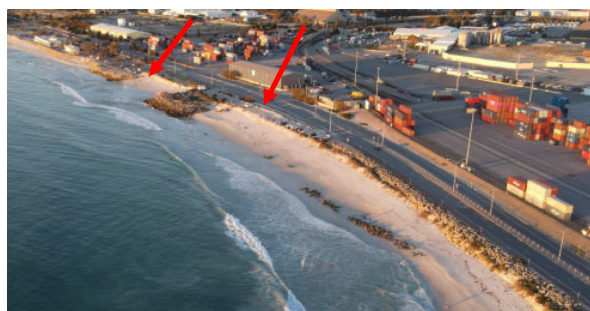


Figure 4 - Red arrows indicate unprotected sections of Port Beach Road threatened by erosion.

DoT Maritime's role pertaining to coastal erosion in Western Australia is to administer the CAP and HCAP programs. It also delivers erosion and inundation hotspot assessments and coastal data collection under the CoastWA 5-year work program, in partnership with DPLH, with provision of ongoing coastal engineering advice to coastal land managers. For this reason, implementation of coastal adaptation such as Port Beach falls within the goals and objectives of DoT Maritime.

It should be noted that DoT, MRWA, and Fremantle Ports all fall within the Western Australia "Transport Portfolio". Therefore, to some extent, available funding for these agencies draws from the same budget.

#### PROJECT FUNDING AND BUDGET

The \$5.8 billion WA Recovery Plan was launched in July 2020 as an important step in WA's COVID-19 journey to help drive economic and social recovery across the State. It's goal is to create jobs, training opportunities and investment and incentives, while helping restore business and consumer confidence, and rebuilding the economy.

Due to the advanced progress of the project as well as it's ranking in terms of WA coastal erosion hotspots, in August 2020 the City of Fremantle was awarded a \$3.25M WA COVID Recovery Plan grant to implement sand nourishment via dredge. The funding was applicable to the 2020/2021 and 2021/2022 financial years. The PWT recognised immediately that prudently spending this funding within the allotted years was going to be a challenge.

The budget is as follows, noting that the first values are original budget and values in parenthesis represent estimates to complete the project.

- Project Management and design - \$155K (230K)
- Environmental Consultancy - \$290K (310K)
- Stakeholder Engagement Consultancy - \$35K (35K)
- Coastal Monitoring Consultancy - \$20K (25K)
- Legal Costs - \$0K (\$120K)
- Construction Costs - \$2.5M (3.1M)
- Contingency - \$250K
- Total - \$3.25M (3.85M)

It can be seen that in order to complete the project there is an anticipated budget shortfall of at least \$600k. For this reason, the City of Fremantle applied for a 2022/2023

HCAP grant to complete the dune restoration component of the project.

#### PROCUREMENT AND TECHNICAL CHALLENGES

Dredging and nourishment tenders for this project were called on 1 March 2022 pending EPA approval. On 28 March, the project gained EPA approval with a decision of “not assessed”.

Only one conforming tender was received from Rohde Nielsen (RN), which exceeded the available construction budget by over 3.5 times. The primary reason for the increased cost was due to the proposed methodology but was also due in part to cost increases resulting from COVID and fuel costs.

The nourishment design required that the nourishment sand was placed on the beach and then a natural beach profile would be created using earthmoving equipment. Bases on early consultation with contractors, it was assumed that the sand could be “rainbowed” onto the beach however RN was not confident at the time that the adjacent water depth was sufficient to allow the trailer suction hopper dredge “Modi R” to place the material close enough to the beach to be available to land-based equipment. For this reason, RN proposed a pipeline along the adjacent breakwater and included a civil subcontractor in the proposal, both of which resulted in costs that were unachievable with the available budget.

During Contract negotiations, the PWT requested that RN propose a “rainbowing” methodology rather than a pipeline. RN provided their estimate of the placement area they believed they could achieve, considering the laden draft and existing bathymetry, shown in cyan in the figure below. As seen in this figure, there was almost no overlap between this area and the design nourishment design areas (A, B, C, D, E).

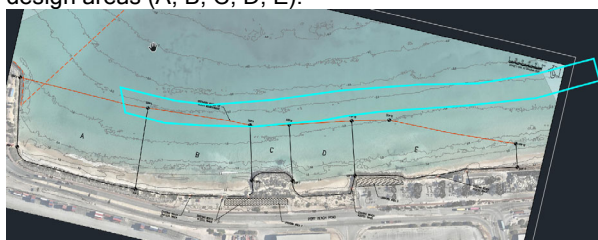


Figure 5 - Design nourishment and RN proposed nourishment areas

After expeditious negotiations, the PWT and RN arrived at an agreed methodology where the sand would be rainbowed as close to shore as possible. The Modi R would approach the project area until draft-limited and then begin rainbowing. As the hopper empties, the draft is reduced which allows the vessel to come closer to the shore. It was not anticipated that the sand could be placed directly onshore and therefore the success would rely upon shoreward progression of the sand during ambient conditions.

#### CURRENT PROJECT STATUS

Phase 1 of the works was completed in December 2021

and included:

- Screening of 29,050m<sup>3</sup> beach sand and removal 503T of small rocks and debris.
- Recovery of 900T of granite armour from a failed revetment. The was then re-used as additional interim protection in front of an immediately vulnerable section of carpark.

Phase 2 of the project includes 150,000m<sup>3</sup> of sand nourishment using dredged sand from Fremantle Ports Deepwater Channel. The nourishment began in July 2022. Thus far, two 1-week campaigns have occurred which have delivered 47,000 m<sup>3</sup> of high-quality sand, nearly 1/3 of the required total. Each load consists of approximately 1000m<sup>3</sup> of sand which is equivalent to 100 truck loads. To date, the equivalent of 4700 truck loads of sand have been placed. Please see our [rainbowing video](#).

The Modi R has been substantially more successful at placing the sand in the nearshore than RN expected. At the end of the unloading process the sand can be placed directly on the beach as seen below.



Figure 6 - Modi R rainbowing onto the beach

#### ACKNOWLEDGEMENTS

The Department of Transport acknowledges the Whadjuk people as the traditional owners of the greater Walyalup area and that their cultural and heritage beliefs are still important to the living Whadjuk people today. We respect the Whadjuk people's spiritual relationship with their country and pay our respect to Elders past, present and future.

This project would not have been possible without the hard work, persistence, collaboration, resilience, and resourcefulness of the PWT. There are too many people to name all of them individually. It would however be remiss to not acknowledge the following people:

- City of Fremantle: Ryan Abbot, Katrina Sachse, Gabriela Eiris
- Fremantle Ports: Joel Bonsel, Dain Osborne
- MP Rogers: Jake Costin, Clinton Doak
- DoT: Fangjun Li, Corey Verwey, Ellena Bromwell,

It should be noted that this extended abstract reflects the author's experience on the Port Beach Project and his knowledge of involved stakeholders. It does not necessarily reflect the views of the stakeholders themselves.

#### REFERENCES

DoT/DPLH (2018): Seashore Engineering, Assessment of Coastal Erosion Hotspots in Western Australia.