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Mandorah Marine Facility – Alternative Design PIANC APAC 2024

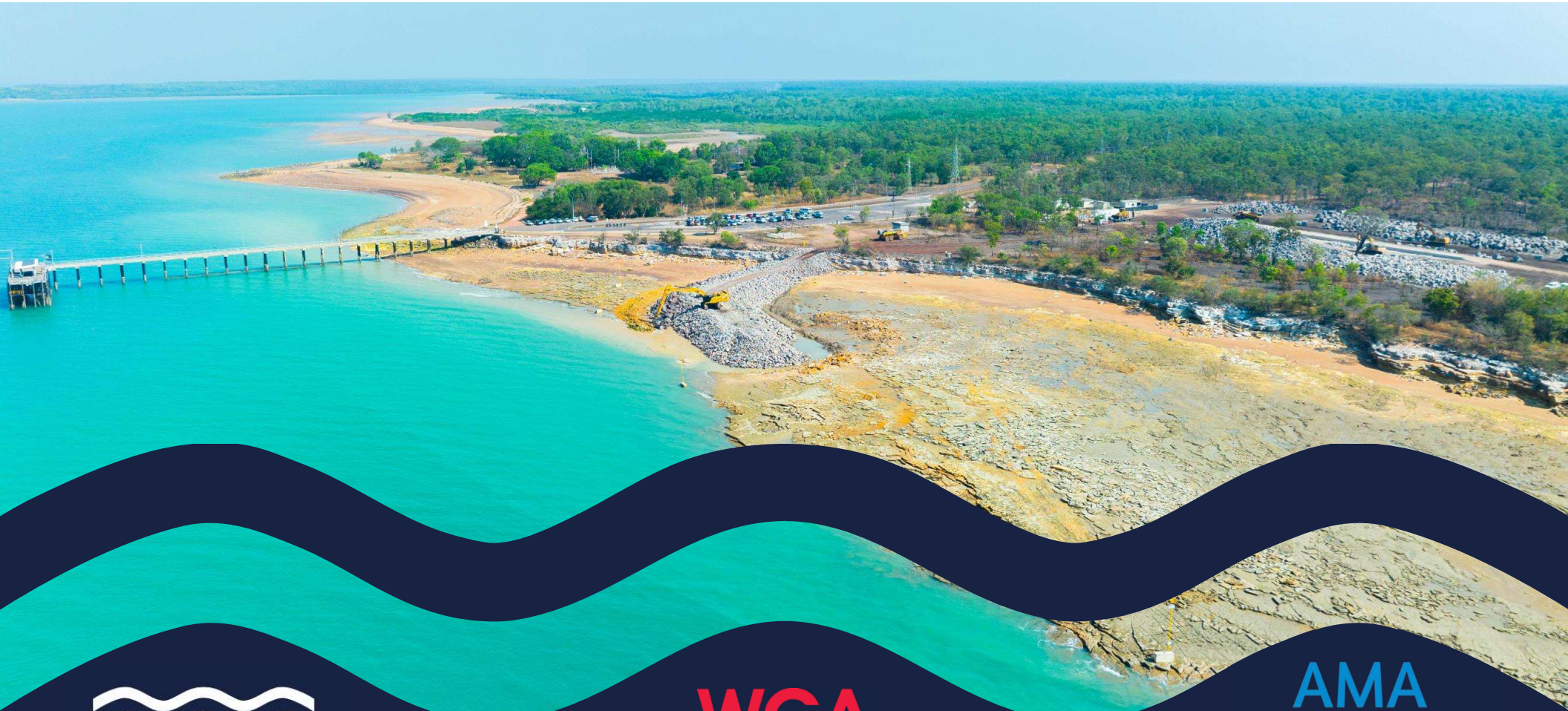
Mandorah Marine Facility – Alternative Design

Agenda

- Project Background
- Original Design and Drivers for the Alternative Design
- The Alternative Design concept design
- Environmental considerations
- Design refinement
- Construction progress

Key Participants and Acknowledgements

- Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) (Project Proponent)
- SMC Marine (SMC) (D&C Lead Contractor)
- Wallbridge Gilbert Aztec (WGA) (Lead Designer)
- AMA Maritime Consulting (AMA-MC) (Environmental Consultant)



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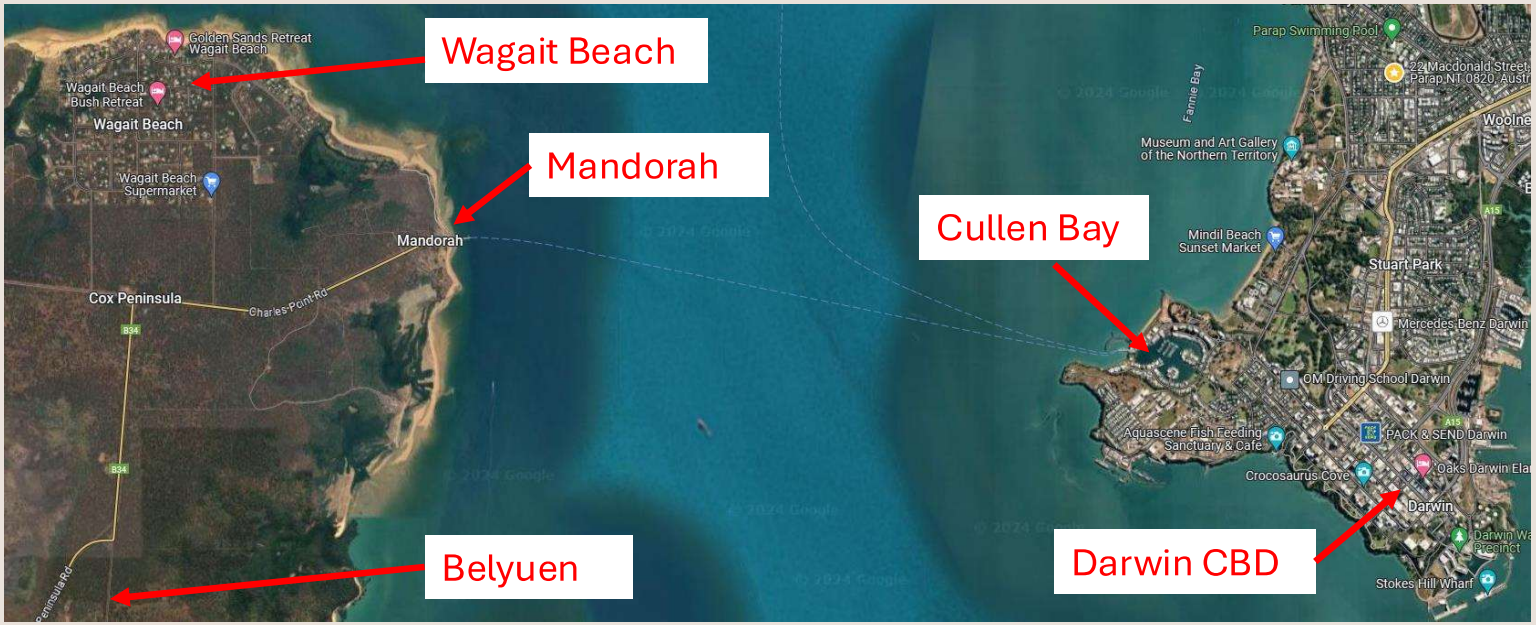
Background, Layout and Environmental – Richard Mocke (AMA)

Project Background

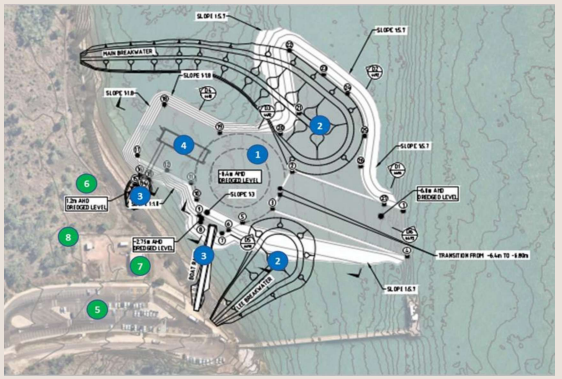
- The Northern Territory Government is delivering new marine facilities to improve and maintain public transport services for residents of and visitors to Cox Peninsula, Wagait Beach and Belyuen.
- A masterplan for a new Marine Facility at Mandorah was released in November 2020 following several years of significant stakeholder and community consultation.
- The new facility aims to deliver a safer, more weather resistant and DDA compliant ferry service between Darwin and Mandorah, as well as provide recreational opportunities to the Cox Peninsula.

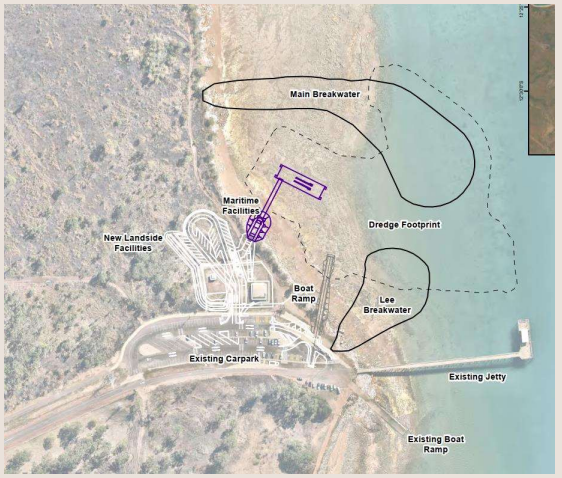


Original Design

RFT Requirements

- Initially issued by DIPL in February 2022 for a part Construct Only and part Design and Construct (D&C) tender;
- Re-Issued to the market in January 2023;
- Construct Only components:
  - Pre-dredging to remove soft marine sediments (with offshore disposal);
  - Construction of a safe harbour formed by rock armoured breakwaters;
  - Capital dredging of access channel, turning basin and berthing areas with landside disposal / material reuse; and
  - Construction of a new single lane boat ramp within the harbour (provisional item).
- Design and Construct components:
  - New floating pontoon, gangway, and rock armoured causeway to meet Disability Discrimination Act (DDA) compliance;
  - Redevelopment of existing car park to accommodate new car and trailer parks for boat ramp facility
  - New carpark and passenger pick-up / drop-off with a short road connecting it to the existing carpark, as well as pedestrian paths and minor onshore amenities; and
  - New passenger terminal (provisional item).

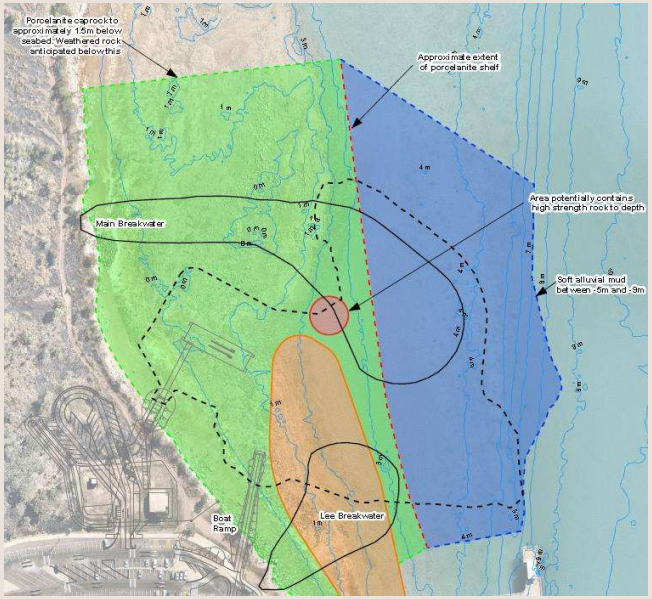


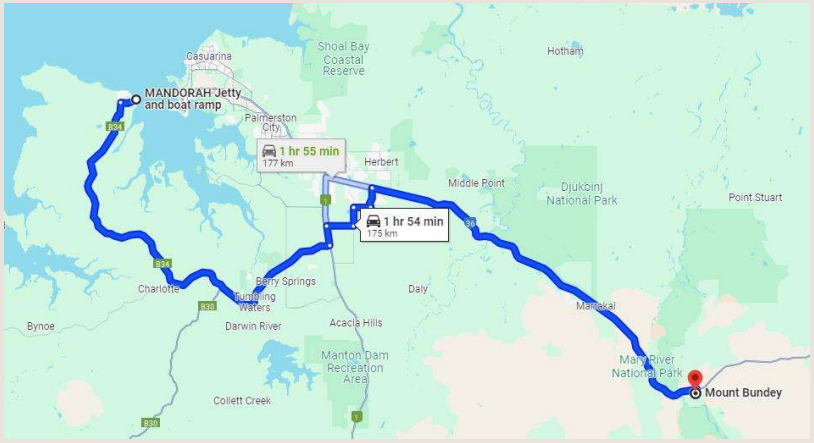


Alternative Design

Drivers for focussing on Construct Only Components

- The breakwaters and dredging works represented a significant component of the cost of the project (~80%) and hence the potential benefits to be gained (circa $30M in cost savings required to meet the clients project budget);
- The need for pre-dredging introduced additional logistical challenges for the project and ability to commence the works in a timely manner (dredge availability);
- Land-based equipment was much more readily available in the Darwin region and, hence a potentially cheaper option as significant excavation of the basin could be undertaken by utilising the tides;
- The closest established rock quarries were ~180km away;
- The need for a safe, all-weather access and safe passenger boarding facilities remained; and
- Minimising any impacts to existing ferry services was also a key requirement of the project.

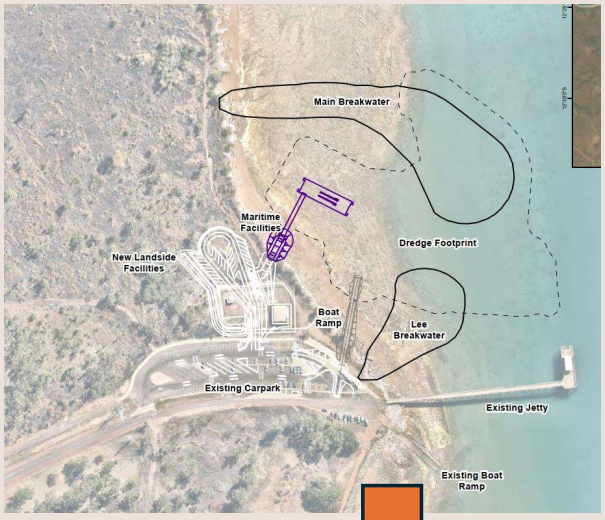




Alternative Design

Concept Design

- WGA designers worked closely with SMC Marine to develop an “Alternative Design” in response to the RFT
- The primary features of the Alternative Design:
  - Construction of the breakwaters entirely on Porcelanite shelf;
  - Ferry pontoon now protected behind the southern breakwater;
  - Separate boat ramp and trailer parking area to north of site; and
  - Existing ferry drop off/pick up and parking area remains unchanged.
- Many of the original design features retained (to maximise the value of work previously undertaken):
  - Access channel and vessel turning areas;
  - Breakwater design cross sections;
  - Pontoon and DDA compliant gangway (although single ferry berthing only); and
  - Boat ramp, car and trailer parking requirements as previous.



Original Design

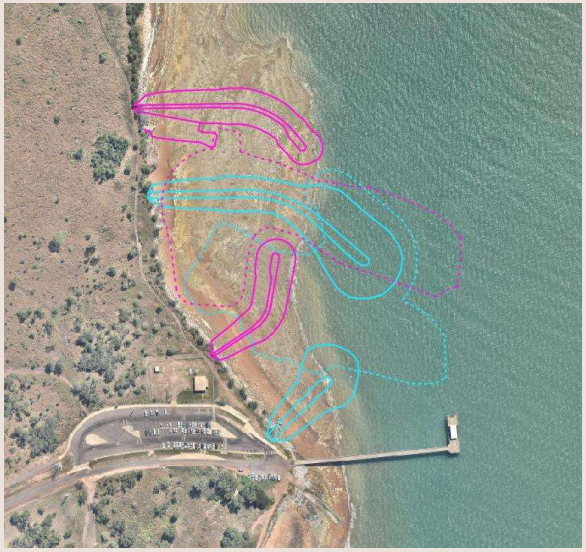
Layout of Alternative Design as tendered

Alternative Design

Concept Design

Key Benefits of the Alternative Design:

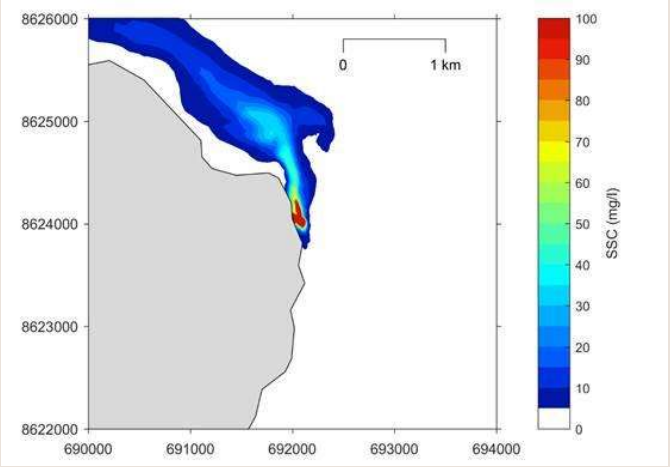
- Reduced volume of imported quarry rock materials (~ 50%)
  - Closest quarry ~180km away, hence halved the impact on at the quarry, physical impact to existing roads and carbon footprints.
- More predictable and shorter construction programme
  - ✓ Breakwater construction largely independent of dredging activities;
  - ✓ A more flexible dredging approach which allows for a combination of land-based excavations and marine dredging.
- Better separation of boat ramp and ferry functions (particularly in terms of traffic and carparking)
- Improved operability for ferry and safer boarding operations;
- Reduced environmental impacts during dredging;
- Reduced impacts to existing carpark during construction (developed offline); and
- Considerable savings in capital costs to help meet client's project budgets.



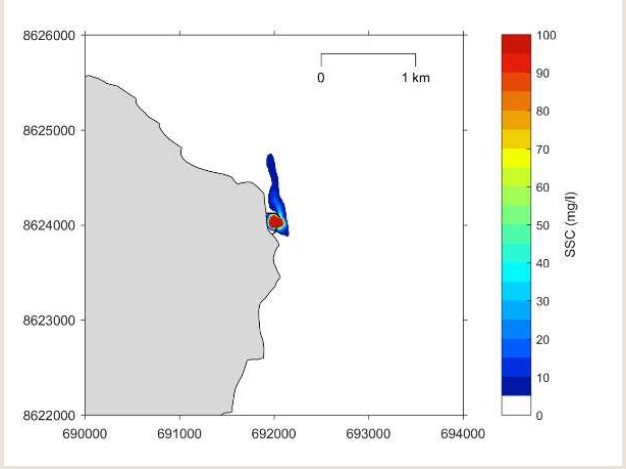
Environmental Considerations

Dredge Plume Modelling

- Dredge plume modelling undertaken to assess the effect of changes in design for revised compliance monitoring and to optimise the proposed dredging works
- Re-sequencing of works activities associated with the Alternative Design (completion of breakwaters first) was found to provide significant benefits in terms of dredge plume effects (reduced plume generation and sedimentation)
- As a result, a much more flexible working arrangement (daylight only vs 24hr working), type of dredge equipment (BHD vs CSD) and disposal method (surface vs bottom discharge) was able to be implemented (lower cost and better environmental outcomes)

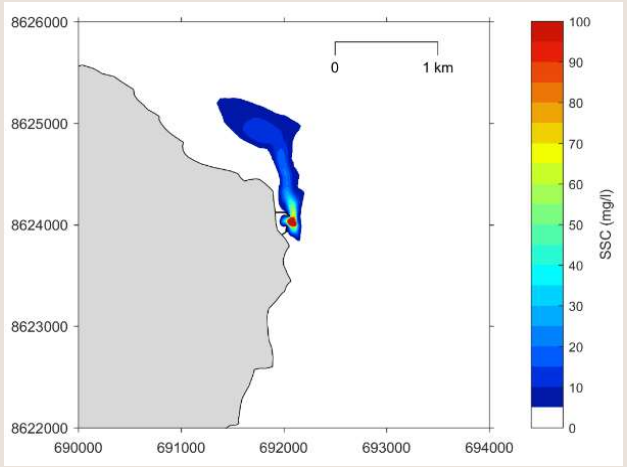


Original Design – Simultaneous Dredging and Breakwater Construction Works



Alternative Design – Breakwater Construction followed by Excavation/Dredging Works

(Stage 1: Basin Excavation / dredging within Breakwaters)



(Stage 2: Channel Dredging outside Breakwaters)

Environmental Considerations

Comparison of Predicted Coastal Impacts

Hydrodynamics:

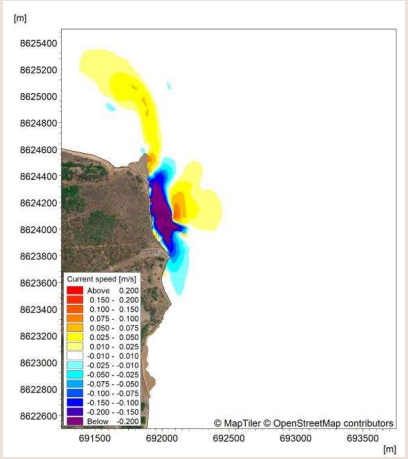
- Reduced impacts on tidal currents due to smaller offshore projection of breakwater structures

Shoreline response:

- Similar shoreline evolution impacts
  - Comparable accretion rate of ~2,000 m^3 per year on northern side of the northern breakwater
  - Comparable erosion rate along the shoreline sections to the immediate south (<1,000 m^3 per year)

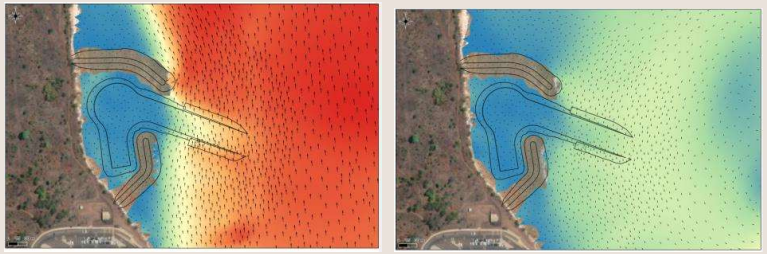
Channel sedimentation:

- Similar sedimentation rate in the channel
- Sediment trap incorporated at entrance to manage channel sedimentation



Flow current impacts - peak of ebbing tide

Comparison of modelled shoreline impacts after 10 years



Flow current speed at peak of ebbing tide (left) and flooding tide (right)

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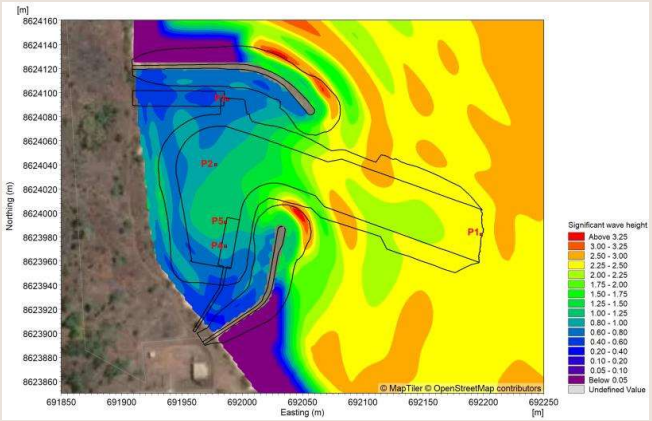
Design Refinement and Construction Progress – Joris Jorissen (WGA)

Harbour Layout Refinement

Coastal Modelling Studies

- Metocean studies and investigations undertaken by Port and Coastal Solutions (PCS)
- Included hydrodynamic and wave modelling, wave penetration studies and sediment transport investigations (incl dredge plume modelling)
- Studies used to refine facility layout, assess metocean design conditions and assess environmental impacts

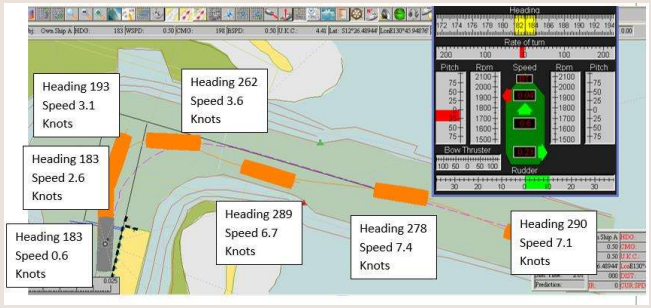


Under Keel Clearance (UKC) Study

- UKC design studies undertaken by OMC International (OMC)
- Minimum dredge depth determined for a range of channel accessibilities / ferry service interruptions
    - 99.85% for design vessel accessibility (up to 4 interruptions per year) was selected

Vessel Simulation Modelling

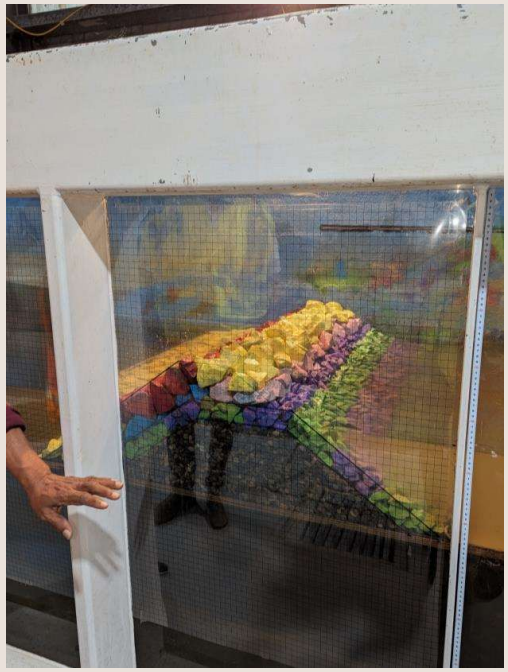
- Vessel simulations undertaken by Northport Simulation Centre (NSC)
- Study conducted in 2D to provide confidence in design outcomes and ability to run a considerable number of simulations
- Comparable ship models to cover a wider range of ship types (recreational and commercial vessels), including proposed ferry vessels

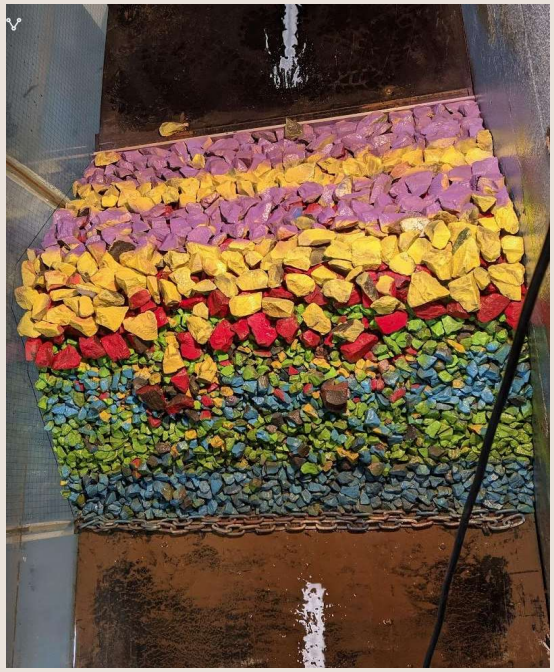


Breakwater Design

Physical modelling study

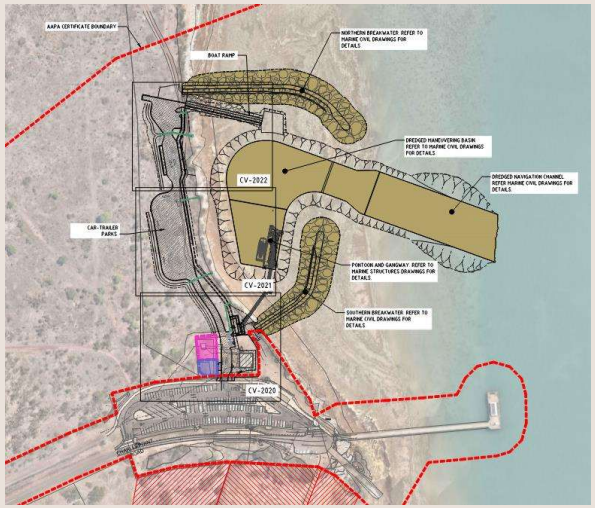
- Physical modelling study undertaken at MHL (Manly, NSW)
- Two stages:
  - 2D wave flume experiment
  - 3D wave basin experiment
- Breakwater design refinements :
  - Primary armour rock size of some trunk sections reduced
    - e.g. outer northern breakwater section reduced from nominal 8T to 5T
  - Crest elevations reduced by 0.5-0.7m
  - Roundhead design confirmed





Updated Layout Design

- Onshore area refinements:
  - Access road and parking areas amended in consideration of heritage, environmental and property boundary restrictions and analysis of traffic flows
- Breakwater layout refinements:
  - Outer breakwater orientations adjusted to suit incident wave directions and local bed conditions
- Channel and basin design refinements:
  - Outer channel was widened (from 35m to 42m) to account for the “crabbing” of the vessels due to the strong ebb and flood currents along the entrance approach
  - The more protected inner channel (past entrance) was able to be narrowed from 35m to 30m
  - The turning area was modified to eliminate any redundant areas
  - The berthing area adjacent to the pontoon was widened to facilitate berthing operations
  - A sediment trap was incorporated in the entrance channel



Establishing an Achievable Delivery Programme

- Recognise that Design / Approvals / Construction must all be working in parallel

- Secure long lead time items early:
  - Armour rock
  - Dredge contractor
  - Water quality baseline monitoring
  - Pontoon / Gangway

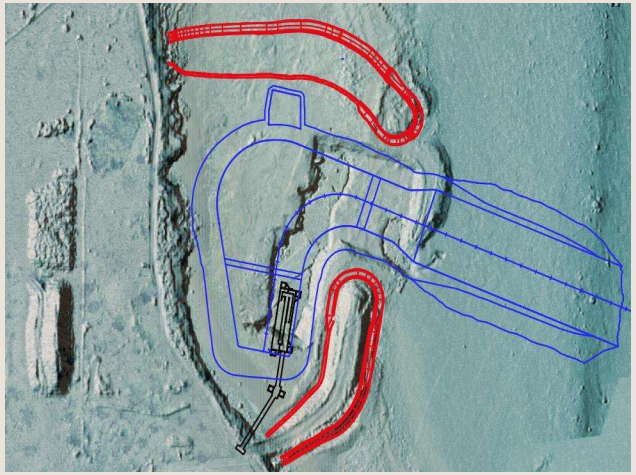
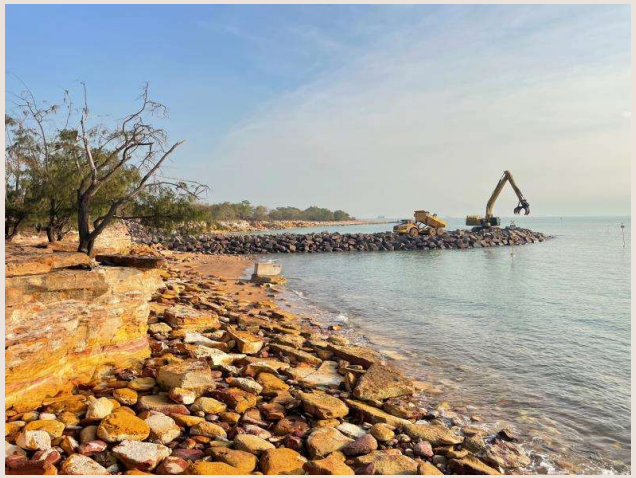
- Plan to avoid the weather:
  - Avoid the wet season [as much as practicable] for large-scale earthworks and haulage operations
  - Avoid the cyclone season for almost all marine work

- Incorporate flexibility in construction methodology/sequence
  - Separation of dredging and breakwater construction activities
  - Enable mix of marine and land-based dredging operations

- Continually track progress & respond
  - Designer and Contractor work together to resolve issues as they arise

Construction in progress



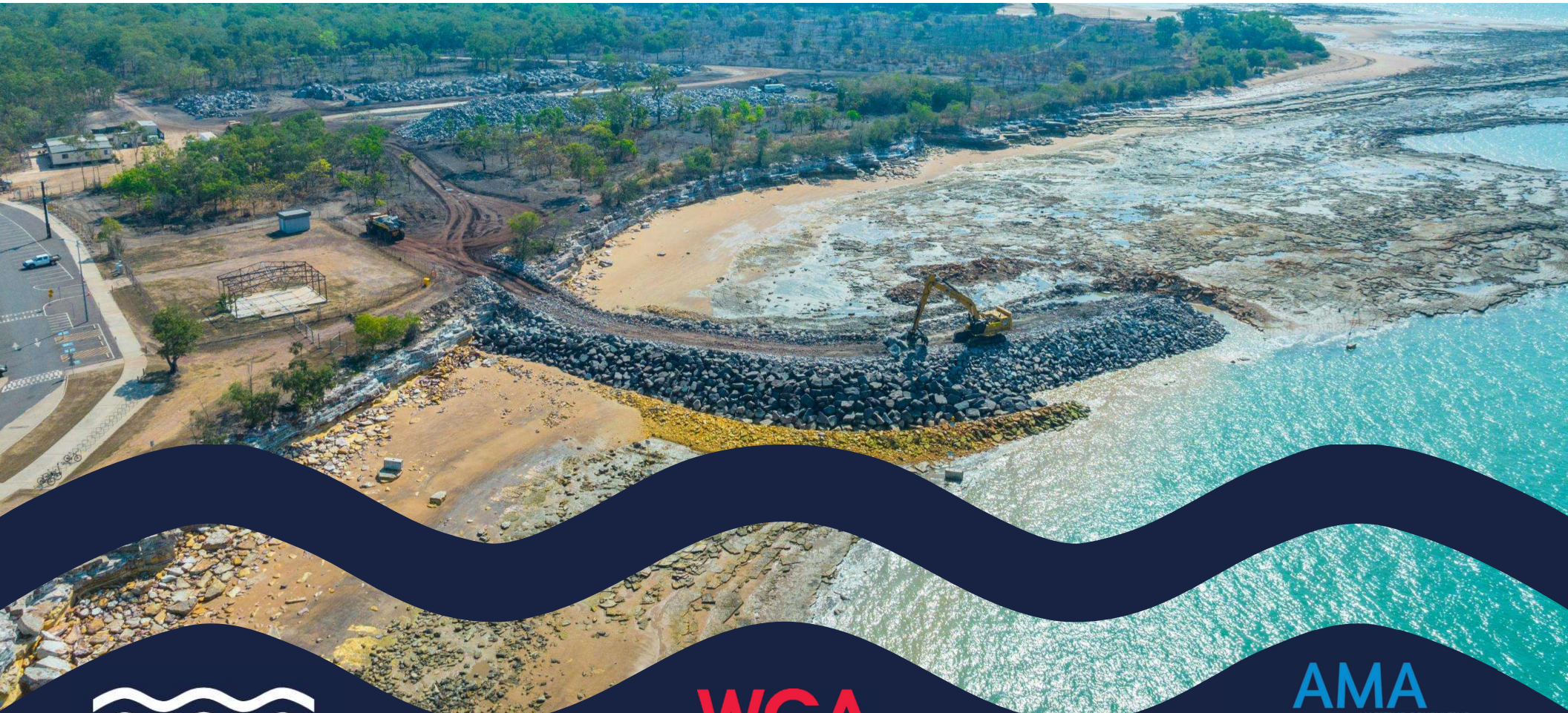
Summary and Conclusions

- Mandorah Marine Facility is being developed to provide a safer, more weather resistant and DDA compliant public transport link between Darwin and Mandorah

- In response to a RFT for a part Construct Only and part Design and Construct (D&C), SMC Marine submitted a tender to deliver the “Alternative Design”, developed by WGA, and was award the contract.

- The “Alternative Design” has several key benefits, compared to the Original Design, including:
  - A more flexible and shorter construction programme
  - Better separation of boat ramp and ferry functions
  - Improved operability for ferry and safer boarding operations
  - Considerable reduction in capital costs

- Designer (WGA) and Contractor (SMC Marine) are working closely together to deliver the project in line with NTG’s project requirements.



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End of Presentation……Any Questions?