Paihia Waterfront
Summary of Key Findings from Detailed Scheme Layout Report

OVERVIEW

FNHL (Far North Holdings Ltd) are progressing the Paihia Waterfront project, which was granted consent in 2011. It includes offshore breakwaters and abutments/groynes, as well as a renourished beach. FNHL's primary objectives for the project are:

- Improved public beach and promenade amenity;
- Less energetic wave environment along Paihia waterfront to help protect existing coastal assets and the proposed beach and abutments against storm waves.

Numerical wave modelling has recently been undertaken by MetOcean Solutions Ltd, with assessment of the results by Beca Ltd. The modelling results help to confirm the scheme layout and inform the detailed design. This document summarises the key findings from the work and outlines the next steps.

KEY WAVE MODELLING RESULTS

The 2021 numerical wave modelling considered the existing situation at Paihia Waterfront and future layouts including the proposed beach, abutments/groynes and offshore breakwaters. Two wave models were run to examine:

- Wave conditions over 30 years (1990-2019), with this information used to forecast extreme waves for use in detailed design.
- The behaviour of large storm waves approaching the waterfront as they travel from Motumarie Island towards the shoreline, including for shallow water processes such as refraction, diffraction, shoaling and wave breaking.

Key findings from the 2021 wave modelling are as follows:

- The latest modelling gives a 2% AEP[1] significant wave height[2] of 1.8m near Motumaire Island and 0.9m at the Paihia Wharf, for the existing situation. (The 2% AEP significant wave height is a statistical description of a specific wave condition. Larger waves than this will occur, with lower frequencies).
- The modelled significant wave heights are consistent with a study done in 2011 and wave heights estimated by Professor Raudkivi in 2004. The latest wave heights are lower than the results of initial wave modelling carried out in 2004. This is to be expected as the initial modelling was at the concept stage of the project and considered 4 years of wave data; while the 2021 modelling is more detailed and considers 30 years of wave data.
- The modelled wave heights near the shore are 20% to 40% of the wave heights at Motumaire Island, as a result of the combined influence of the offshore islands and reefs together with the proposed offshore breakwaters, abutments and beach. This is consistent with the findings from the previous modelling. The next page shows an example of modelled wave heights for the existing situation, and for layouts with and without offshore breakwaters.
- Comparing the modelling results for the existing situation and future layout, there is a 10-30% reduction in modelled wave height and a 25-55% reduction in wave energy as a result of the breakwaters, abutments and beach, consistent with the 2011 results.

[1] AEP = Annual Exceedance Probability. It is the probability of an event occurring in any year, expressed as a percentage (e.g. 2% = 1 in 50 probability).
[2] Significant wave height is the average wave height of the highest one-third of waves and is used in coastal and ocean engineering to describe wave conditions and for design.

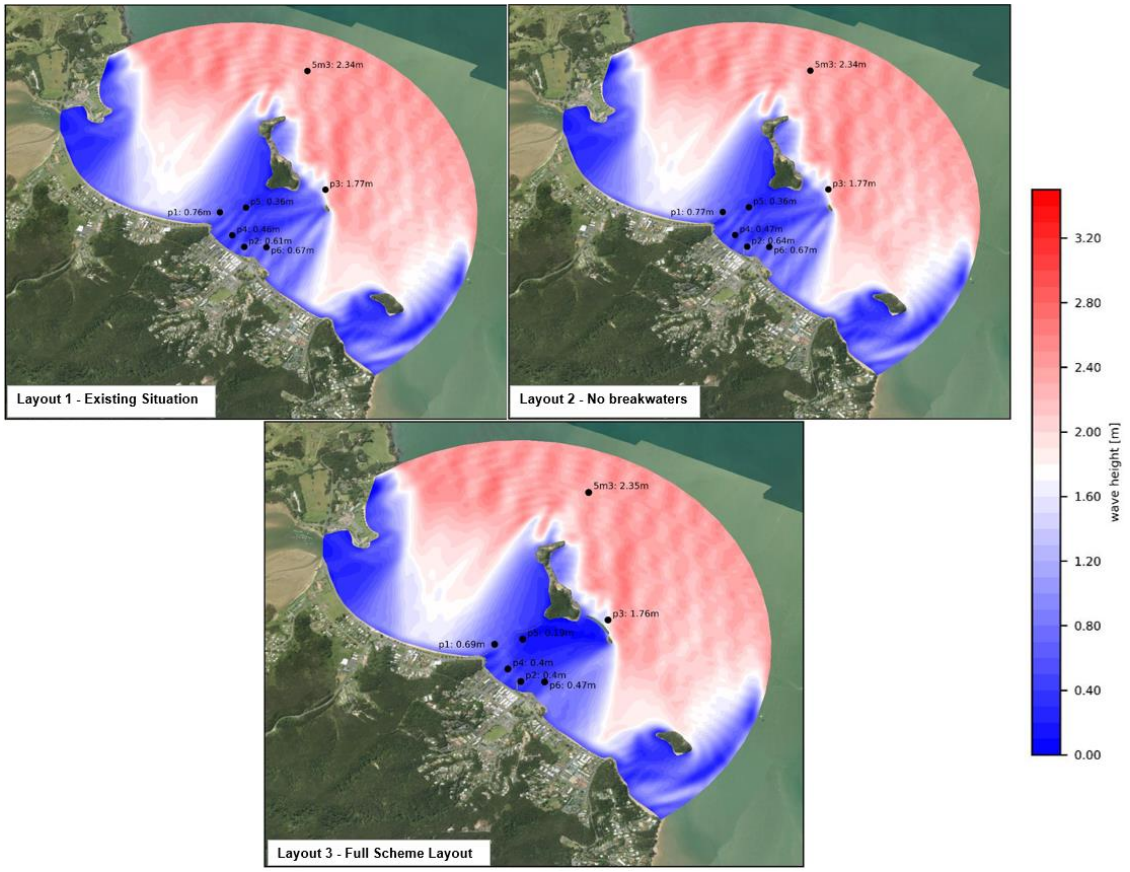

Figure 1: Example of wave modelling results showing wave heights with existing and future layouts (adapted from MetOcean, 2021)

- There is no identifiable potential for effects on Te Ti Beach from the modelling results. There is a small difference in modelled wave patterns at the west end of Paihia Beach, which will be investigated further in the shoreline evolution modelling (refer to Next Steps).
- The modelling included simulations allowing for 0.5m sea level rise. These typically indicated an increase in significant wave height near the shore of up to 0.1m, for a large storm event.

NEXT STEPS- ENGINEERING

Following the numerical wave modelling at Paihia Waterfront, the next steps for the project include:

- Hydrodynamic and shoreline evolution modelling to confirm there are no significant adverse effects on tidal currents and adjacent beaches, and to inform detailed design of the beach.
- Detailed design of the landside area (by Haigh Workman), new access channel (by Shorewise) and marine structures (by Beca), all working together with landscape architect Littoralis. The detailed design will allow for climate change, including sea level rise, taking into account the results of the wave modelling and Ministry for the Environment guidance.
- Production of tender documents, including engineering drawings and technical specifications.