RC14513 / COASTAL PROTECTION STRUCTURE AND ASSOCIATED ACTIVITIES REPLY STATEMENT OF JONATHAN CLARKE (COASTAL ENGINEERING AND PROCESSES)

I have reviewed the reply statement of Mr Davis, and make the following comments.

Commissioner Query - Difference in Exposure time for 1.5m vs 5m ex boundary

1. Setting the seawall 3.5m further back will result in either a longer time until the wall is exposed, or in the event of a significant event and associated storm cut, exposure of less of the structure.

2. My review produced a number of minor comments on the methodology used by Mr Davis, these included results that produced short-term erosion rates that were marginally larger for lower sea level rise scenarios, and the probabilities and longer-term erosion distances adopted. However, having performed a separate analysis the difference in exposure time was considered comparable to the results presented by Mr Davis.

3. Based on the long-term erosion rates presented in the latest coastal erosion hazard assessment (Tonkin & Taylor 2024), positioning the wall 3.5m further back would result in a theoretical reduction in the time until it was exposed by approximately 10 years, consistent with Mr Davis's analysis. However, this does not consider short-term variations and beach response to storm events.

4. The beach profile at Waihi is subject to natural cycles of storm cut and setback during large events and post storm recovery where the beach builds back up to an equilibrium profile. The potential changes in the position of the beach toe are far and above those calculated for the long-term annual retreat. As a consequence the wall may in either position be exposed during a large storm in any given year, albeit to a lesser extent if the wall is only 1.5m from the boundary.

5. In my view the long-term rate is more reflective of the beach's ability to recover. Although a large storm may expose part of the structure the sediment is still in the local beach system and based on the long-term erosion rate would have the ability to rebuild and cover the wall for several more years (~10 years) if the wall was setback to 1.5m from the boundary.

6. Rates of erosion are also linked to longer term trends including the Southern Oscillation Index ("SOI"). La Nina phases typically result in a more aggressive wave climate and more frequent storms resulting in extended periods of

beach erosion (years), conversely El Nino phases are associated with periods of beach recovery and accretion. The SOI is currently in a neutral phase and it is not possible to predict how this may change in the coming years.

7. In summary, rates of erosion are dependent on a number of factors including storm frequency and magnitude, rates of sea level rise, and longer-term weather patterns such as the SOI. Each of these carries a degree of uncertainty and the proposed wall can be partially exposed in either location following an extreme storm event (which is the intended function of the structure). Based on the long term erosion rate, pushing the wall back to 1.5m from the boundary will result in ~10 years of additional time whereby there is a volume of sediment in the wider beach system that would allow for the structure being fully covered as the beach rebuilds.

Mr Davidson Evidence "structure exposure in 2 years" – Summary Statement (Paragraph 9)

8. Mr Davidson states that *"…unless there is significant natural beach recovery in levels, it will be exposed almost immediately. Based on the graphs submitted using T&T recession rates, exposure (with the structure located 5 metres off the boundary) is predicted within two years…"*.

9. I agree that a storm event could expose the structure within 2 years, however this is the purpose of the structure.

10. The current beach profile is in a very eroded state, and it is likely that the beach will recover towards a more equilibrium profile over the coming months as stated by Mr Davis. Establishment of vegetation following construction will also result in a reduction in potential beach setback during storm events.

11. The time frames on exposure set out in the evidence provided by Mr Davis are consistent with the long-term average erosion rates. There will always be a risk of wall exposure during extreme events, but these would typically be followed by recovery back towards the levels described in his evidence.

Mr Davidson Evidence – The full extent of Type 2 structure is unjustified (Summary Statement Paragraphs 1-4)

12. The length of the Type 2 structure needs to extend far enough that the end of the structure is not exposed and results in end effects that would adversely affect adjacent properties.

13. Based on the Tonkin & Taylor 2024 hazard report, this would necessitate building most of the Type 2 wall section now as it could potentially be at risk in the short term. It is important to note that this report forms part of a regional assessment with values averaged over the length of individual cells. Figure 1.8[1] (Appendix A) demonstrates that the potential setback is larger either side of Three Mile Creek and therefore larger than the average value adopted for the coastal cell.

14. During periods of high flow from Three Mile Creek, as is frequently the case during storm events, the foreshore in the vicinity is typically lower than the adjacent coastline. This allows for larger waves to reach the dune area. This coupled with a potential increase in wave heights as they move against flows from the creek, in addition to turbulence and wave focusing around the groyne, are likely to result in increased storm cut in the area adjacent to Three Mile Creek.

15. I agree that the Groyne structure is primarily responsible for the build up and retention of dune sand south of Three Mile Creek. Should this partially fail or be removed then the coastline position is likely to rapidly erode to historical contours and result in all properties behind the Type 2 wall being at risk.

16. Due to the Type 2 wall being at an angle, to the predominant wave action, then focusing of wave energy is likely to result in a further localized setback, over and above that observed on the open beach, at the point the exposed wall meets the dune face.

17. Based on the above reasoning it is likely that even with the groynes in place most of the Type 2 section would be required now for property numbers 13 and 11, and will be required for number 9 over a longer time period. All of the Type 2 structure would likely be necessary to protect the properties now, should the groyne be removed, shortened or damaged.

Reply to submitters - Locating the Wall on Private Properties

18. I agree with Mr Davis's assessment that given the current assets within the property boundaries, and narrow width of the available construction corridor, that a vertical wall would be the most practical option under this scenario.

[1] Noting that there are two figures labelled 1.8 and it is the second one to which I am referring.

19. Although positioning the wall further landward may result in a longer timeframe until the wall is exposed, once exposed the adverse effects are likely to be greater.

20. Vertical walls cause more wave reflection, are susceptible to greater scour at the structure and inhibit beach recovery to a greater degree than sloping, permeable rock structures.

21. Due to most property boundaries being at an angle to predominant wave action it is also likely that incoming waves will be channelled along the impermeable vertical face once exposed. This is likely to cause a greater erosion setback than would occur with a comparable sloping permeable rock structure.

22. A vertical wall may cause greater impacts on ecological values, amenity and visual effects. This is considered outside the scope of my review and has been covered by other submissions.