

Waikato District Plan – Stage 2 Coastal Hazards

Coastal Hazard Mapping – Inundation and Erosion

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I am co-author of the District-wide coastal hazard assessment¹ and associated maps. The coastal hazard study commenced in 2017 and included an analysis of the available published and unpublished information, field observations and three rounds of public consultation in Raglan and Port Waikato. The coastal hazard assessment report¹ was peer reviewed by Dr Tom Shand (Tonkin & Taylor)².

Two coastal erosion and two coastal flood areas have been defined and mapped for developed sites in Raglan and Port Waikato:

- **High risk coastal erosion/inundation areas**, identifying the areas where there is significant risk from coastal erosion or inundation with existing sea level and coastal processes in the short term (within the lifespan of the District Plan).
- **Coastal erosion/inundation sensitivity areas**, identifying the additional areas potentially vulnerable to coastal erosion/inundation over the period to 2120, assuming sea level rise of 1.0 m.

Coastal sensitivity areas have been defined for the rural estuarine shoreline of Port Waikato, Raglan Harbour and Aotea Harbour:

- **Coastal sensitivity area (inundation)** – defined as all areas below 5.0 m above MSL to provide for coastal inundation and the potential landward migration of estuarine ecosystems with future sea level rise.
- **Coastal sensitivity area (erosion)** – 100 m from the shoreline.

A single coastal sensitivity area (open coast) (200 m from the shoreline) has been identified on the open coast of the District. This has been refined through broad scale or local scale studies at Port Waikato, Raglan and Aotea Harbour entrances and at Whale Bay/Whaanga Coast. This sensitivity area covers erosion and inundation hazard.

Our coastal hazard assessment outlines criteria that could be used to define and map rural coastal sensitivity areas based on the geology of the shoreline, but detailed implementation of these criteria as local scale mapping was outside the scope of the assessment. The 100 m and 200 m wide generic coastal sensitivity areas were implemented to encompass these areas.

It is important to note that coastal sensitivity areas identify the area of coastline that might be affected over the next 100 years (the minimum planning period Council is required to consider) so that appropriate attention can be given to the management of coastal erosion or inundation when considering future development. These areas are generally precautionary and there is a significant level of uncertainty given the long timeframe and unknowns relating to future climate change and sea level rise. It is for these reasons we have not referred to them coastal “hazard” areas.

¹ FOCUS, 2020: Waikato District Coastal Hazard Assessment. Prepared for Waikato District Council by the Focus Resource Management Group. Focus Report No. 20/130.

² Shand, 2019: Review of Waikato District Coastal Hazard Assessment. Prepared for Waikato District Council by Tonkin & Taylor Ltd. December 2019. Job No. 1012915.6p.

The key aspects of coastal hazard mapping to be addressed at this hearing are summarised below.

Coastal Erosion Hazard: Raglan Township Cliffs

Cliff erosion occurs as slow erosion at the base of the slope, which leads to gradual oversteepening, and subsequent failure of the cliff face. Hazard mapping therefore relies on quantifying toe erosion rates and selection of appropriate stable slopes. Dr Shand's peer review of our coastal hazard assessment was constructive, and resulted in some minor changes to the reporting, and the mapping of coastal hazard and sensitivity areas on cliff shorelines in Raglan³. The most significant change resulting from the peer review was the adjustment of stable slope applied to mapping of High Risk Coastal Hazard Area (Erosion) from 1V:1.5H to 1V:2H to reflect unknowns relating to potential slope failure.

A number of submissions were received challenging this relatively precautionary approach to defining the High Risk Coastal Hazard Area (Erosion). Following site visits, submitter meetings and additional field investigations, we made the decision to return to the 1V:1.5H slope to define the High Risk Coastal Hazard Area (Erosion) as recommended in our initial hazard assessment. This reduced the width of the High Risk Coastal Hazard Area (Erosion) compared with the areas notified. We feel that this slope identifies the areas of most significant hazard, and any remaining hazard that may exist is addressed by the Coastal Sensitivity Area (Erosion). These changes affected the High Risk Coastal Hazard Area (Erosion) along the high cliff shorelines of Raglan Township, including Rangitahi Peninsula.

Further submissions have been received for properties in Cox Bay (Raglan), requesting further refinement or removal of the coastal hazard overlays because of site-specific geotechnical reports or existing engineered works.

Mr Mark Mitchell (providing evidence on behalf of Ruth Walden) also provides comments relating to our broader approach to hazard mapping on the Raglan cliffs, expressing concern that we have applied unnecessarily conservative slope factors, and that our approach has not considered site-specific factors. Mr Mitchell also suggests that we revise the nomenclature of the High Risk Coastal Hazard Area (Erosion) to simply be "Coastal Hazard (Erosion) Area" to reflect the variation in risk and uncertainties associated with our mapping. The use and justification of the term "high risk" is complex and must consider both the scientific perspective and planning objectives. I have discussed this in more detail later in my statement.

Coastal Erosion Hazard: Te Akau South – Horongarara Peninsula

Following notification of the proposed Plan and associated submissions, we completed an additional local scale assessment of coastal hazards for the residential area at Te Akau South. This report was included as Appendix 2 of our response to submissions³. This additional study replaced the generic 100 m wide rural coastal sensitivity area with slope-based high risk and coastal sensitivity areas equivalent to those applied on other cliff coastlines in Raglan Harbour. This assessment reduced the width of the Coastal Sensitivity Area (Erosion) but resulted in some residential properties being affected by the High Risk Coastal Hazard Area (Erosion).

³ Focus, 2021: Waikato District Coastal Hazards – Response to Submissions on Waikato District Plan Stage 2: Coastal Hazard Area Maps. Prepared by Bronwen Gibberd and Jim Dahm for Waikato District Council. March 2021. 98p.

The hazard assessment has highlighted the limited available information and the potential for site-specific field measurements to refine the hazard areas further. The Horongarara Community Group and several individual property owners have provided evidence within which they requests time for a more detailed geotechnical investigation to be completed (at their cost) to further refine this area and reduce the impact on the properties where possible. Further field investigations at a property scale could prove useful and may support a reduction in the width of the coastal hazard overlays.

The Te Akau coastal hazard assessment has recently also been peer reviewed by Dr Shand⁴, and the preliminary comments from this review are discussed in my evidence. Dr Shand has provided a constructive peer review and noted that we have made a “robust local scale assessment”, based on general good practice for this type of shoreline.

Dr Shand has suggested a potential adjustment to our methodology for parts of the eastern facing shore adjacent to 2E and 10D Ryan Road. This approach may refine the High Risk Coastal Hazard Area (Erosion), though preliminary analysis suggests the changes may be very small. This is an area where hazard mapping has been challenging and hazard and sensitivity areas are particularly wide due to the steep, elevated topography. I have discussed this possible change with Dr Shand and my co-author Jim Dahm, and we agree that the proposed approach may be a valid way to define the hazard areas. However, further field investigations would be necessary to apply this approach with confidence, so I am unable to present the results of this change in methodology as a desktop exercise.

Coastal Inundation

The elevations used to define the High Risk Coastal Hazard Area (Inundation) and Coastal Sensitivity Area (Inundation) are based on work completed by NIWA (Stephens et al. 2015) for the Waikato Regional Council, and supported by field measurements and observations, and historical data from local land owners and residents.

The High Risk Coastal Hazard Area (Inundation) has been defined as land with elevation below 3.0 m MVD-53. This is higher than the 1% AEP level calculated by Stephens et al. (2015) using joint probability analysis. The relatively short data record means we have limited confidence in the statistically calculated storm tide levels. We are also aware of potential error in the elevation dataset used for mapping, and the presence of infragravity wave effects on coastal inundation in Raglan Harbour in particular. The 3.0 m MVD-53 is lower than the extreme storm tide level based on measured data (Stephens et al. 2015), so does not represent a “worst case” event.

Dr Brett Beamsley has challenged our decision in this regard and has argued that we should directly apply the statistically calculated 1% AEP level based on analysis of Kawhia and Raglan tide data. Dr Beamsley feels that we have been over-conservative, and that the 3.0 m MVD level is a “worst-case” event. Dr Beamsley does not believe we have fairly defined the “high risk” area.

I feel that we have adopted an appropriate level to map areas of land that may be vulnerable to coastal inundation with current sea level. I believe that the available data record is not sufficient to confidently define a 1:100-year event (1% AEP). As discussed further below, the level of risk within the High Risk Coastal Hazard Area (Inundation) varies depending on land elevation and physical setting. However, all areas will become increasingly vulnerable over time with even small amounts of sea level rise.

⁴ Shand, 2021: Review of Coastal Hazards and Coastal Sensitivity Area at Te Akau South. Prepared by Tonkin & Taylor for Waikato District Council. Job No. 1012915.001.

High Risk Coastal Hazard Areas

The terminology “high risk” has been raised in both the initial peer review by Dr Shand, and in several submissions relating to the coastal hazard report and mapping.

Council is tasked with identifying and managing areas at risk from coastal hazards, with priority given to areas of high risk. Risk represents a combination of the likelihood and consequences of a hazard. The exact level of risk at any given location or property therefore varies depending on distance from the shore, elevation, physical setting and the nature of development. In the future, risk will increase as projected sea level rise influences erosion rates and increases the frequency, extent, and depth of inundation. Risk can be managed in many cases through minimum floor levels, engineering works and/or resilient design. These complexities make it difficult to quantify coastal hazard risk accurately and objectively at the scale of a District or even local assessment. Site-specific investigations can be applied to better refine the level of risk, and/or measures to mitigate future risk at a property scale.

We have only applied High Risk Coastal Hazard Areas within townships and settlements, and to hazards associated with current sea level. These are not “worst case” hazard areas, and remaining hazard outside of the high-risk zones is managed as coastal sensitivity areas. In some physical environments it is possible to identify high risk areas with some certainty, while the nature of the hazard in other settings makes it much more difficult. In my opinion, there may be merit in applying alternative nomenclature in some of the high risk coastal hazard areas, but this change would need to carefully consider not only the underlying science, but also the planning implications.