13 March 2020

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Dear Kelly,

**Waikato District Council Coastal Hazard Assessment – Response to Peer Review**

Waikato District Council (WDC) engaged Tonkin & Taylor Ltd (T+T) to undertake a review of the Waikato District Coastal Hazard Assessment (the report) prepared by the Focus Resource Management Group. This letter provides an overview of the peer review process and commentary on our response.

The peer review was received in December 2019 and provides a detailed and useful examination of the methods and conclusions of the draft report. In addition to the written peer review, two teleconferences were held between the authors of the report and the peer reviewers to discuss and clarify various matters. The report has been revised to reflect the outcomes of these discussions and the written peer review and has been supplied to WDC as a final version.

There were a number of very useful comments and observations made by T+T throughout the report relating to the Figures, Tables, timeframes and presentation of additional data that we have implemented in full. A number of figures have been revised, additional shoreline change data has been provided and a number of tables have been updated.

Other matters raised by T+T are outlined below and discussed in more detail in the following sections:

- Outline of the basis for the erosion hazard estimates
- The use of terminology: “high risk”, and “zones”
- Wave set-up and wave run-up in inundation calculations
- Determination of stable slope values for cliff shorelines
- Use of “emotive” language and discussion of management options
- Report structure

**Erosion hazard areas**

The peer review notes that the erosion hazard estimate generally appear reasonable but observed that it was not always clear how these erosion hazard estimates had been arrived at. The various data and methods used to assess coastal erosion are outlined in Sections 2 and 4 of the report. The site-specific assessments for each area are discussed in relevant parts of Sections 6 and 7. Some additional detail has been added to the report to provide a clearer explanation to the reader.

The coastline of the Waikato Region is highly varied, and in many areas coastal processes are very complex. In open coast and near entrance areas, shorelines undergo very large fluctuations in position over multi-decadal and even century scale cycles. These processes are not well quantified by the limited short-term data available. The assessment of existing and historic rates of erosion have therefore relied largely on historic data (e.g. mapped shorelines where available, historic aerial and other photos), community information and geomorphic analysis. Assessment of how existing erosion rates might be changed by future projected sea-level rise generally relies on the simple models discussed in Section 4.3.1 and geomorphic considerations.

In our view, there is considerable uncertainty in respect to estimation of future erosion around the coast of the Waikato District and the use of standard deterministic or probabilistic approaches to define erosion hazard areas for the next 100 years is not appropriate in this district. An attempt to transparently quantify all possibilities (e.g. relating to lower, modal and upper level estimates of the various erosion components; different estimates for a range of future sea-level rise scenarios) would create a confusing multitude of different hazard areas, each with their own particular set of assumptions. Less transparent approaches that select a single scenario or propose a given probability would give the appearance of a level of certainty that we believe is simply not real.

In order to identify coastal hazard areas that are appropriate to guide effective coastal management while acknowledging the uncertainties, we have:

- Restricted estimates of “high” future erosion vulnerability and risk to relatively short periods (e.g. 20-30 years) where uncertainties are less. The basis for the assessment of these “high risk” (see discussion of terminology below) areas at each location is outlined in the relevant parts of Sections 6 and 7.
- Identified the wider area of coastline that might potentially 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. These areas are generally conservative and the level of uncertainty is very high. As such we have referred to them as “coastal erosion sensitivity areas” rather than coastal erosion hazard areas.
- Advocated that Council move towards the development of adaptive management strategies for each area of coastline. As outlined in the report, these are strategies developed in partnership with the wider community and relevant stakeholders which define how coastal erosion will be managed for different future erosion scenarios,

including triggers (and sometimes timelines) for moving from one management approach to another where appropriate. The recommendation to adopt this approach is the reason why we have included some site-specific commentary on coastal hazard management (see also further discussion of this aspect below).

**Terminology**

The peer review suggested that the word "zones" is usually associated with planning instruments rather than simply areas vulnerable to coastal hazards. While the term "zones" has commonly been used for areas vulnerable to coastal hazards, we have altered the terminology to "areas" in the final version of the report to avoid any potential confusion.

T+T also note that use of the terminology "high-risk" for the defined high-risk coastal erosion and coastal flooding areas implies that there has been an assessment of consequence as well as hazard; since use of the term "risk" by hazard management professionals typically refers to the combination of both hazard vulnerability and consequence.

We note that this strict interpretation of "risk" assumes that high or low consequence is something that can be objectively assessed by "experts". In our experience this is not the case with coastal hazards. For example, a coastal landowner will sometimes regard any loss of their land as being a matter of high consequence, even if that land is relatively undeveloped (e.g. no dwellings or significant infrastructure within the area vulnerable to hazards). Similarly, any adverse consequences (e.g. environmental effects) of protecting that land are often viewed as being of less consequence. Other stakeholders who value the natural shoreline may view the loss of land as a minor consequence and the loss of the natural shoreline (e.g. beach loss) through protection of the land as being a major consequence. One of the reasons that we advocate the development of adaptive management strategies in partnership with communities and all relevant stakeholders is so that all consequences/risks and the varying weightings of these by different stakeholders can be transparently assessed and negotiated.

In our identification of "high-risk" areas, we have focussed on areas zoned for residential/commercial use and the adjacent roads and reserves. The high-risk areas therefore predominantly affect roads and road margins, coastal reserve land and private residential properties. We feel that it is reasonable to expect that these areas are subject to a relatively high level of public or private use and/or considered to be of relatively high "value" either in terms of monetary value to the private owner, or in terms of public use value in the case of coastal reserves and roads. When combined with the short timeframe and relatively high certainty of hazard, we are comfortable that this is a reasonable approach to identifying "high-risk". This matter was also discussed with WDC planners who agreed to retain the existing terminology. However, we emphasize that consequence and risk can only be properly assessed in partnership with stakeholders during the adaptive management process. As such, we note that the definition of "high risk" areas may well change during the development of adaptive management strategies.

**Wave Set-up and Run-up**

T+T comment that the recommendations for coastal inundation levels do not appear to include allowance for wave set-up. As outlined in the report, the extreme sea-level estimate we have used sums the maximum observed tide, maximum observed storm surge and maximum sea-level anomaly as determined by the work of Stephens et al. (2015), based on water level measurements from the tide gauge on Kawhia Wharf. We can confirm that wave set-up is included as this was a component of the maximum storm surge estimated by Stephens et al. (2013). For the reasons outlined in Section 4.2 of the report, we believe the extreme sea-level used to map flooding around the harbours is adequately conservative for the combination of tides and storm surge, including wave set-up.

The inundation levels expressed in the report do not however include any allowance for wave run-up; only the static components of the assessed extreme storm-elevated sea level (i.e. tides, storm surge, sea-level anomaly and future sea-level rise). Wave run-up is very site-specific and varies around the harbours with exposure to wave effects. We have recommended that WDC include a "freeboard" allowance when converting the flooding level into minimum floor levels to allow for wave run-up and other sources of uncertainty. The required freeboard will likely vary with exposure, though a freeboard of 0.5 m is commonly used around estuarine shorelines.

On the open exposed coast, wave run-up and other complex wave effects will likely be very significant but limited to the more seaward areas; with lower-lying areas further inland typically protected by the high dunes common on sandy beaches along this coast. Nonetheless, there are low-lying areas (e.g. upstream of stream/river entrances) which may be subject to significant wave effects. The width of the sensitivity area on the open coast has been set at sufficient width (200 m) to ensure that such areas are identified as requiring a site-specific coastal hazard assessment should future activities requiring resource consent occur in these areas.

**Stable Cliff Slope and Baseline**

T+T note that the application of a 1(V):1.5(H) slope to define some high risk coastal erosion hazard areas in Raglan (e.g. Cox Bay and Greenslade Road) may provide insufficient protection from slope instability given observations of highly varied existing slopes and limited data.

We have reviewed this matter. While most existing stable slopes are steeper than 1(V):1.5(H), there is presently no detailed information on potential slope instability in these areas. Moreover, while existing slopes suggest that failure to a gentler slope might be a relatively low probability event; such failure would be very high consequence (i.e. potential risk to houses and human life), Unlike coastal erosion, these events are not gradual and the use of gradual adaptation landward in response to erosion is therefore not practicable. As such, we concur with T+T and have adopted a more conservative approach (i.e. a slope of 1(V):2(H)) in definition of the high risk coastal erosion risk areas. This increases the width of the high risk area and in some locations (e.g. Cox Bay) it will now be difficult for landowners to avoid the need for a site-specific assessment of slope instability to support consent applications. It may also affect insurance for

these properties. However, given that we were not able to find any detailed investigations of slope instability in this area, a precautionary approach is required.

T+T also suggest that the baseline for the stable angle mapping following 1.0 m of sea level rise should be based on the current toe elevation rather than the RL 3.0 m contour suggested in our assessment. We understand the reasons advanced by T+T but believe that RL 3.0 m is more appropriate – as the toe of the bank will rise with sea level. We also believe that bed levels within the estuaries will generally rise with sea level. To assume that current bed levels are maintained would be to assume that the harbour will become largely subtidal with higher (e.g. 1.0 m) sea-level rise scenarios. Given catchment inputs and the active circulation of marine and catchment sands by tidal and wave processes, we believe that is extremely unlikely.

**Management Recommendations and Report Structure**

The peer review recommends that *"…the hazard part of the report (assessment of hazard values, extents and what is affected) is separated from the discussion of management options"*. T+T feel that "*this would allow the hazard assessment to be dealt with as a factual report while the management options can be discussed and worked through with stakeholders*." T+T feel this would avoid concerns that options were already pre-determined.

We understand the concerns raised by T+T and have given this matter careful consideration. We have also discussed it with WDC officers and planning advisors.

The site-specific commentary on coastal management that is included in our report in Sections 6 and 7 reflects the approach that we have proposed; i.e. that (over time) Council work with stakeholders to develop site-specific adaptive management strategies for the management of coastal hazards. At many sites in the Waikato District we have been very clear with WDC that successful long term management of coastal hazards cannot be achieved solely through the District Plan, but will require the development of an adaptive management plan, which will reflect the interests of all stakeholders and sustainable long-term environmental management. This process will involve all relevant stakeholders and the outcomes of these strategies cannot be pre-determined.

The site-specific comments are not management recommendations to be implemented by Council; but simply commentary and advice to help inform and facilitate the development of the adaptive management strategies by Council and relevant stakeholders. We have made some adjustments to the text to ensure this is clear. Expert advice of this nature is critical to the adaptive management approach to ensure that stakeholders are well-informed of the pros and cons of different management options. In addition, the management of coastal hazards does not occur in a vacuum; there are national and regional policies that need to be taken into account (e.g. to protect public access, natural character, amenity values). It is important that these various matters are highlighted so they can be incorporated with other site-specific considerations (e.g. property and infrastructure at risk) in the development of adaptive management strategies.

We have however provided general recommendations for Council in respect to management of coastal hazards, as outlined in Section 5; based on national and regional policy and existing best practice. The recommendations will also guide management of development in the identified high-risk and coastal hazard sensitivity areas until site-specific adaptive management strategies are developed and agreed. This is important as Council have significant duties and associated liabilities in respect to the management of hazard risk areas. The lack of coastal hazard setbacks and associated management guidance in past plans has led to the development of some very complex hazard management issues in Raglan and it is important that these issues are not further aggravated over time. The recommendations follow approaches typically adopted on the New Zealand coast. Once site-specific adaptive management strategies are developed and agreed with relevant stakeholders, these will take priority in the management of individual sites.

In regard to management, T+T also question some of the comments we have made in regard to seawalls, suggesting these are subjective or emotive. We firmly disagree with this. There have been extensive scientific investigations looking at the effects of seawalls and we are both familiar with this literature. Collectively, we also have over 50 years' experience working with coastal hazards. The adverse environmental effects of seawalls structures on beaches (to which most of our comments relate) are well-established. In short, seawalls placed on eroding/retreating beaches result in progressive beach loss and narrowing, which in turn impacts on recreational, aesthetic and amenity values of the beaches and public access at high stages of the tide. Additional adverse effects can also arise from seawalls even where beaches are not retreating; particularly where seawalls are placed too far seaward or with sloping structures that encroach seaward over beaches. Seawalls can also have significant adverse effects on natural character and landscape amenity when not sympathetically designed. These various adverse effects are particularly important considerations on high value public beaches in tourist towns like Raglan where the coast plays a significant role in the local economy. The various potential adverse effects of seawalls are a key reason these structures are discouraged by the NZCPS 2010 and, in fact, internationally. We note that there are also places where we have suggested that seawalls might well be a useful component of adaptive management strategies, if appropriately designed and located (e.g. Wallis Street and Lorenzen Bay). We do not believe that the report has any inherent bias against these structures but it is important that the pros and cons of these measures are openly acknowledged. Nonetheless, we acknowledge the peer review and have reviewed our comments on seawalls to ensure they are factual and not subjective.

Overall, we are grateful to T+T for a very useful and helpful peer review.

Yours sincerely

Jim Dahm and Bronwen Gibberd

For the Focus Resource Management Group

# 1 APPENDIX A: SUMMARY OF RECOMMENDED HAZARD AREAS

| Location | Shoreline Type | High Risk Hazard Area | Coastal Sensitivity Area | Notes |
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| **Open West Coast (Rural)**<br><br>**Erosion** | All | n/a | 200 m | Provides for diverse range of coastal hazards on the open west coast, which could be otherwise estimated by:<br>10 m toe erosion + 1:2 slope for tertiary sedimentary rocks<br>75 m of erosion (per 1.0 m of SLR) + 1:2 slope for Pleistocene sands<br>200 m at stream mouths on the open coast<br><br>Also provides for long term potential sensitivity to coastal flooding, including the effects of wave run-up.<br><br>Measured from 2012 shoreline baseline. |
| **Estuary Shorelines (Rural)**<br><br>**Erosion** | All | n/a | 100 m | Flags the area that may be dynamic/erodible for further investigation. Coastal erosion hazard could be estimated by:<br>10 m toe erosion + 1:2 slope.<br><br>Measured from 2012 shoreline. |
| **Estuary Shorelines (Rural) Flooding** | All | n/a | <5.0 m elevation | Provides for long term coastal inundation risk including effects of sea level rise. |

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| **Port Waikato Northern Coast** | Major River Entrance | n/a | 1,500 m | Reflects very large historic changes in entrance location.<br><br>Provides for large dynamic fluctuations and future sea level rise. Reflects uncertainty.<br><br>Measured from 2012 shoreline (ocean shoreline alignment) |
| **Raglan Harbour Entrance Northern coast** | Major Estuary Entrance | n/a | 400 m | Provides for dynamic shoreline fluctuations and future sea level rise.<br><br>Measured from 2012 shoreline |
| **Aotea Harbour Northern Coast** | Major Estuary Entrance | n/a | 400 m | Provides for dynamic shoreline fluctuations and future sea level rise.<br><br>Given low probability of future development could be mapped as rural open coast (200 m) translating to rural estuary hazard area (100 m).<br><br>Measured from 2012 shoreline |
| **Estuary Shorelines (Developed)** | Banks/Cliffs | 1:2 slope | 5 m toe erosion<br><br>+ 1:2 slope | Includes Nihinihi, Cox, Greenslade. Also extend to cover the shoreline fronting Marine Parade (south of the Te Kopua Bridge), Oputuru Road, Goodare Road, Smith Street, Karioi Crescent and Wainui Road from the one lane bridge to Raglan Town Centre.<br><br>High risk measured from 2.0 m RL contour (MVD '53)<br><br>Sensitivity measured from 3.0 m contour (MVD '53). |
| **Estuary Shorelines (Developed)** | Beaches | 10 m | 25 m | Applies to Lorenzen Bay. Uses site specific baseline.<br><br>Limited to landward by 5.0 m contour at Lorenzen. |

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| **Port Waikato**<br><br>**Sunset Beach** | Beach | 60 m | | Provides for 10 years of erosion + stable dune slope.<br><br>Measured from 2019 shoreline |
| **Port Waikato Spit** | Wider spit | n/a | Entire spit. | Flagging entire spit as sensitivity area due to extreme uncertainty and long-term potential for spit breach. |
| **Port Waikato Upstream** | Putataka Headland | 2 m + 1:1.5 slope | 5 m<br><br>+ 1:2 slope | Consistent with developed estuary sensitivity area with small allowance for seawall effects.<br><br>Measured from 2017 shoreline |
| **Whale Bay** | Bank/cliff | 7 m | 30 m | Allowance for 2 m toe erosion and stable slope.<br><br>Sensitivity: toe erosion increased based on SLR effects – 10 m + 1:2 slope.<br><br>High risk measured from 2.0 m RL contour (MVD '53)<br><br>Sensitivity measured from 3.0 m contour (MVD '53). |
| **Raglan Entrance Area** | Beach | 24 m on open coast, reducing to 16 m at toilet block continuing at 16 m around to Te Kopua | All areas on sand (approximated by 10 m contour in absence of detailed data) | Allowance for 15 m dune fluctuations in short term on open coast, 10 m at toilet block, plus stable dune slope.<br><br>Sensitivity area reflects harbour entrance setting and lack of knowledge about subsurface geology.<br><br>Measured from 2017 shoreline. |

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| **Te Kopua** | Estuarine beach/entrance | Northern shore: 12 m,<br><br>Southern shore:<br><br>7 m | All areas on sand<br><br>(approximated by 10 m contour in absence of detailed data) | Provides for 10 m short term fluctuations plus stable dune slope. 5 m plus stable slope on southern Te Kopua shoreline.<br><br>Measured from 2012 shoreline baseline |
| **Upstream Te Kopua** | | | 15 m | Measured from 2012 shoreline baseline |
| **Cliff Street** | Low Estuary Bank | 5.5-8.0 m<br><br>(varies with elevation) | 14.5 m | 2 m toe erosion + stable slope (1V:1.5H).<br><br>Sensitivity 10 m toe erosion + stable slope (1V:1.5H).<br><br>High risk measured from 2.0 m RL baseline (MVD '53)<br><br>Sensitivity measured from 3.0 m contour (MVD '53). |
| **Wallis Street** | Low Estuary Bank | 7.0 m | 11.5 m | High risk provides for seawall effect and minor erosion + stable slope (1V:1.5H)<br><br>Sensitivity: 10 m toe erosion + stable slope (1V:1.5H).<br><br>High risk measured from 2.0 m RL contour (MVD '53)<br><br>Sensitivity measured from 3.0 m contour (MVD '53). |
| **Estuary Coastal Flooding (developed)** | All | 3.1 m RL (MVD) | 4.1 m (MVD) | These include no allowance for wave effects or freeboard. |