

BEFORE THE FAST-TRACK EXPERT PANEL

IN THE MATTER

An application for approvals under section 42 of
the Fast-track Approvals Act 2024 (“FTAA”)

AND

IN THE MATTER

Te Ākau Bream Bay sand extraction, a project
listed in Schedule 2 to the FTAA

STATEMENT OF EXPERT EVIDENCE OF KARIN BRYAN FOR NGĀTIWAI TRUST BOARD AND TE
PATUHARAKEKE TE IWĪ TRUST BOARD

(COASTAL PROCESSES)

19 MAY 2026

1. INTRODUCTION

- 1.1 My name is Karin Roisin Bryan.
- 1.2 I am a professor at the University of Auckland, cross-appointed between the School of Environment and the Institute of Marine Science. I am a coastal processes expert and Ngā Ahurei a Te Apārangi Fellow of the Royal Society of New Zealand, with 29 years of experience, including publication of 138 international journal articles and 44 technical conference papers. I have a doctorate in Physical Oceanography from the Dalhousie University in Canada, and I am currently appointed 111 international expert for the College of Harbour, Coastal and Offshore Engineering at Hohai University in China. My role is to provide expert opinion on the coastal processes.
- 1.3 I have been asked by Te Patuharakeke Te Iwi Trust Board and Ngātiwai Trust Board to provide expert evidence to inform their comments on the application lodged by McCallum Bros Ltd for approvals for sand mining in Te Ākau Bream Bay.
- 1.4 In this brief of evidence, I am addressing the evidence provided on the coastal processes aspect of the application, including the calculation of depth of transport (“DoT”) and depth of closure (“DoC”), the effect on the physical environment around the extraction site and the beach, and the estimates on size of the Holocene sand resource.
- 1.5 In preparing this brief I have:
 - a. reviewed the Coastal Processes Report, the “Te Ākau Bream Bay Sand Extraction Project - Resource Consent and Wildlife Approval Applications and Assessment of Effects under the Fast-track Approvals Act 2024 (Draft for Consultation)”, The Northland Regional Council paper for the Council workshop (18th March 2026), the Sand Extraction Operation Plan, the Assessment of Surf Break effects, the Bream Bay Geotechnical Report, the “MBL response to Patuharekeke CIA feedback” by R O Boyd, November 17 2025, and the “Joint Statement of Evidence from Richard Reinen-Hamill and Edward Beetham on behalf of McCallum Brothers Limited in Response to Minute 4 Further Information Request”;
 - b. read and complied with the Environment Court’s code of conduct for expert witnesses in Part 9 of the Environment Court Practice Note and agree to abide by that code.

2. EXECUTIVE SUMMARY

- 2.1 The beach is already experiencing a small but consistent erosion, and so is vulnerable to removal of any sand from the active zone of transport (landward of both the inner and outer DoC, such as commonly occurs during times of higher than normal or extreme waves. It is not clear whether the location of the outermost DoC has been correctly identified and a suitable buffer to reflect uncertainty has been correctly applied.
- 2.2 Large sand waves (with heights of up to 3 m) exist in the extraction zone. It is not clear whether these are active or relict, what role they play in characterising the physical

and ecological environmental setting on the shelf, and what effect extraction might have on these features.

- 2.3 It is not clear that the extent of the resource has been correctly mapped, and whether the undulating surface and undulating lower boundary of the resource have been incorporated into the mapping. Given the resource is non-renewable, correct estimates of its extent are essential to understand effects of extraction.

3. ANALYSIS

3.1 The depth of closure and depth of transport assessments.

- 3.1.1 Beaches are composed of volumes of sand, the extent of which varies substantially with time and space, depending on temporal and spatial changes to waves and wave-driven currents (e.g. rip currents), sand supply and water level.
- 3.1.2 The energy within waves is largest at the surface of the ocean, but decreases toward the seabed, and the rate of decrease depends on the wave period. Longer period waves are more likely to reach the seabed. Outside the zone of breaking waves, the waves cause a gentle movement of the sand toward the shore; conversely, inside the zone of breaking waves, strong currents transport larger amounts of sand seaward. If the water depth is deep, only long period waves can move sand shoreward at the seabed. If the water depth is very deep, only extremely long period waves can move the sand shoreward at the seabed.
- 3.1.3 During storm conditions, strong currents inside the breaking zone move large amounts of sand seaward; the more extreme the storm, the more the sand, and the further out that sand is deposited. During calmer times, when the zone of breaking waves is close to the shore, the sand slowly moves back on shore. This zone of constant shoreward and seaward transport is referred to as the "active zone".
- 3.1.4 Calculations of DoC and DoT are done in order to determine the seaward extent of the active zone: how far offshore the sand that is eroded during storms and extreme events might end up, because this sand needs to be retained to replenish the beach during fair weather conditions. Because the DoC and DoT represents a delicate balance between storm and fair weather conditions, accurate assessments depend on accurate understanding of the observed temporal and spatial variability of wave conditions. Wave conditions can change substantially between years with climatic conditions (e.g. El Niño-La Niña conditions) and the occurrence of extreme events (e.g. cyclones), effects which are not easy to accurately replicate with wave models.
- 3.1.5 The NZ Coastal Change database shows that the beach at Te Ākau Bream Bay is eroding in many locations, with rates on the order -0.02 m/yr, but in some case up to more than -0.3 m/yr. Although this is a small amount, it does show clear evidence that the beach face sand resource is not being replenished and could

be at risk over the 35 year time frame. In such a case, the beach will lose sand to the point where the dunes systems will be eroded.

- 3.1.6 Erosion of the dunes will compromise the coastal hazard zone (the dune edge is usually the seaward edge of the coastal hazard zone). The coastal hazard zone is the buffer zone that protects amenities, infrastructure and property from the sea. It is designed so that it can withstand some erosion during storm events, as long as it can recover effectively between successive events. The dunes also provide other ecosystem and cultural services.
- 3.1.7 Given that the beach is already in a state of deficit, it means that already there is not enough sand available to replenish the beach between storms. It is already likely that the waves will start eroding into the coastal hazard zone within the next 35 years. With this in mind, it is important to add an extra layer of precaution in interpreting the uncertainty in the DoC and DoT methodology. Correctly locating the boundary of the outer zone (zones 3 and 4 in the Coastal Processes report) is critical to the ongoing stability of the beach.
- 3.1.8 The calculation of outer DoC and DoT in the Coastal Processes Report follow standard and accepted methodology. The DoC methodology is more universally-accepted whereas the DoT is relatively new and thus not tested to the same extent, and so a greater emphasis should be put on the limits defined by the DoC.
- 3.1.9 The proposed Te Ākau Bream Bay sand extraction zone is set to be deeper than the depth reached by the annual mean of the DoT. However, in some years the proposed extraction zone is shoreward of annual outer DoC values. Noting that the beach is generally in a long-term sediment deficit and so is vulnerable to any loss of sand within the active zone, the evidence provided (Figure 4-2 in the Coastal Processes Report) shows that during some years, the beach will be reliant on the contribution of sediment from the proposed extraction zone in order to recover. If the sediment is not there because it has been extracted, that will adversely impact post-storm beach recovery. A buffer zone has been set, but the buffer zone is based on the average not the range of the outer DoC. The buffer zone should incorporate a range so that it can ensure there is sufficient sand for the beach to recover between events during years when the wave climate is more energetic.
- 3.1.10 The empirical formulae used in assessing the DoC and DoT are not deterministic hard rules (see 3.1.4), they are best estimates based on patchy and locally-varying evidence (e.g. wave observations, bed sediment texture). The wave climate and sand texture observations collected at Te Ākau Bream Bay are also patchy and locally-varying, and so there is uncertainty associated with the outer DoC. Therefore, it is important that the buffer zone accommodates the range in DoC between years.
- 3.1.11 Further evidence supporting the spatial extent of the zones of exchange shown in the Coastal Processes Report can be found in the geomorphic signatures (the

shape of the seabed). The Inner DoC is associated with a slope break, which is shown in Figure 4-2. Seaward of this is generally an exponential (concave) profile, which may have a superimposed convex area that reflects the storage of sediments moved offshore during winter storms (as noted in the Coastal Processes report). This outer zone is essential to the recovery of the beach after such events, and the outer DoC is meant to protect this zone. Figure 4-2 shows that the profiles have the convex curvature extending well into the proposed extraction area, which may indicate that this is the storage zone of active beach face sediment that has been moved offshore during extreme events, or during years with higher annual wave energy. This means that the beach relies on the sand within the extraction area to recover between extreme events or years with higher wave energy.

3.1.12 It should be noted that many studies globally have attempted to verify the formulae used to assess the inner and outer DoC (the “Hallermeier limits”) and have not achieved unanimous agreement. Now they are considered to be adequate for early assessment in early design phases but should be verified locally, see review in Siemens, T., & Bastola, S. (2024). “Depth of closure, a review of empirical formulae and assessment of climate change along the coast of Louisiana”. *Journal of Coastal Conservation*, 28(5), 71.

3.1.13 The DoC and DoT calculations in the Coastal Processes report rely on modelled wave measurements that underpredict the observed wave conditions (Figure 3-18). Therefore, calculation of the DoC and DoT in the Coastal Processes Report includes a bias correction. Knowing that the outer DoC and the DoT are sensitive to biases in wave modelling, especially at the extremes, means further exploration should be done on bias corrections (for example, the bias correction could include uncertainty, and its effect on the outer DoC and DoT). In addition, it is not clear from the Coastal Processes Report how the bias correction undertaken influences the size of extreme events in Section 3.83, which does not include a bias correction? It is also unclear whether the bias correction was included in the calculation of DoT, and if not why not?

3.1.14 In determining the effect of wind-driven currents during extreme events, it is important to note that wind driven currents are quite different in embayed systems compared to more open coast sites. Currents can speed up substantially around headlands and between islands and the shoreline. Currents can be strongly three-dimensional, as mass and momentum continuity mean that strong surface currents are balanced by opposing bottom currents. It would be very difficult to estimate the effect of currents without running a validated three dimensional numerical model.

3.1.15 The Coastal Processes Report shows that the proposed extraction area features large sand waves of heights up to 3m (Figure 3-6). Such sand waves can be evidence of active movement, especially during extreme storm events where sediment can be mobile even in depths > 25m. These sand waves are very common in the extraction region as shown in the recently published New

Zealand Coastal LiDAR maps (available on the Land Information New Zealand data portal).

3.1.16 It is not clear how the buffer zone in the Coastal Processes Report is calculated, interpolated and applied (Figure E1-1).

3.1.17 There is an inconsistency of approach in the Coastal Processes Report in that the DoT and outer DoC are used as an argument that the proposed extraction zone is not in an active wave zone, yet the active waves are the main mechanism for ensuring that the signature left by each extraction event (see proposed management plan) is temporary.

3.2 The effect on the physical environment of the extraction zone.

3.2.1 The physical environment of the proposed extraction zone is heterogeneous, with changes in grain size, and layers of different sediment texture (shown in the cores provided in the Geotechnical evidence provided with the application). Other evidence of this are the sandwave features (Figure 3-6 in the Coastal Processes Report) which are also shown to be a common feature on the recently published New Zealand Coastal LiDAR dataset.

3.2.2 This heterogeneity is common in shelf environments (including in New Zealand). In overseas studies, where repeat surveys are available, they have been shown to be mobile and changing during storms. We do not know much about the mobility of these environments in New Zealand. We also do not know much about the extent to which they form a critical element of ecological habitats. Permanently lowering the bed level by 0.55 m, while homogenising the surface that is normally characterised by potentially-mobile large sand waves will cause permanent structural changes to the character of the shelf environment. Therefore, in my view, the effects of extraction on these features or on any ecological dependencies has not been adequately addressed. In the absence of established data to rely on, the applicant should have undertaken a site-specific assessment to understand these matters.

3.3 The depth of the resource.

3.3.1 As recognised by the applicant, this is a non-replenishing relic source which was deposited during the Holocene. As such, there is no possibility of remediation should the effects be more than or something other than anticipated. Similarly, it is not possible to confirm that the resource the applicant intends to take is present.

3.3.2 The applicant asserts that the 35 year extraction amounts to no more than 6.8% of the total resource (8,450,000 m³ (down to -0.55m), of a total estimated resource of 124,110,000 m³). The applicant notes that the sand resource is 'vast'. The evidence for the size of the resource to support this assertion is presented in Section 5.3 of the Coastal Processes Report, and is entirely based on the geotechnical cores, and the assumption is that they adequately represent the region.

- 3.3.3 There are also other factors relevant to estimating the size of the resource that do not appear to have been considered.
- 3.3.4 The surface sand wave features are of up to 3m in height. It is not clear whether these have been taken into account when calculating the upper bound of the resource.
- 3.3.5 The geotechnical report lodged with the application clearly shows the existence of a layer of silt/sandy silt at the seaward end of transect 2. The spatial resolution of the coring does not provide any information of spatial extent of this layer, and whether it represents the lower limit of the resource.
- 3.3.6 The Coastal Processes Report indicated that no interface was seen in any of the cores (Section 5.3). However, the silt/sandy-silt is evidence of an interface with earlier Pleistocene deposits. On P10 of the Geotechnical report

“Vibracore VB 20.01 encountered a distinct change of sand facies at 1.35 m depth below the seafloor which presented as a change in colour from grey to orange brown and a slight increase in density. We interpret that the core recovered from 1.35 to 2 m in Vibracore VB 20.01 is part of the Awhitu group and therefore, not part of the Holocene aged Karioitahi Group. There is a vibracore some 70 m adjacent to this location (VB 20) which extends to 2.2 m and there is no change in colour identifiable. This suggests the Awhitu group seabed level is undulating, possibly part of an irregular dune system, and VB 20.01 might have intersected with the top of one of those features”

- 3.3.7 With the upper boundary of the resource undulating with sand-wave features, and the lower boundary possibly part of an irregular undulating dune system, it is not clear that the resource has been mapped to the extent it could be described as “vast”. It is not clear that the proposed extracted volume represents a small fraction of the available resource.
- 3.3.8 Given the unknown horizontal positioning accuracy of the ship, and the potential for potentially-mobile sand wave features and undulating bottom boundaries to cause the areas of thinning resource, the level of accuracy of multibeam survey (~0.15m), it is possible that the lower base of the resource could be disturbed, mobilising the silt/sandy silt layers.
- 3.3.9 The lower limit of the coring was often only just below the depth of proposed extraction, varying substantially in space. It was not clear how the extrapolations needed to map the whole resource were done, and whether the method adequately and cautiously addressed spatial uncertainty.
- 3.3.10 There is a recently approved consent for capital dredging to Northport. The effects of the approved dredging and disposal on the proposed extraction are not addressed. Aspects that are not certain are: whether the dredging will change the pathways of sand transport around the entrance; the degree to which those sand transport pathways are connected with the active beach and shore face zone; and, whether sand removed by dredging will be permanently

removed from the active beach system, and thus constitute a further restriction on the ability of the beach to recover from erosion occurring during extreme events or years with higher than normal wave conditions.

4 CONDITIONS

- 4.1 Given the many uncertainties presented in Section 3, in particular the ability of the beach to recover between extreme events and/or years of higher wave activity when it already is showing evidence of a sand deficit and the uncertainty on the size of the non-renewable resource, it is difficult to comment on the conditions. There is not enough information to determine the limits needed to set appropriate conditions to protect against lasting negative effects.

5 CONCLUSION

- 5.1 The beach and the continental shelf are essential elements of the natural character attributes of Te Ākau Bream Bay. With the information provided, there is a risk of significant adverse effects occurring, which have the potential to compromise the coastal hazard zone along the beach, and permanently change the character of the beach and continental shelf. The physical character of the coastal environment is fundamental to supporting a wide range of ecosystems and ecosystem services, social and cultural values, infrastructure, property and amenities.

Karin R. Bryan