IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Kaipara Ltd for coastal permits to extract sand from the coastal marine area offshore at Pakiri (CST60343373)

STATEMENT OF PROFESSOR MIKE HILTON ON EXPERT CAUCUSING

9 FEBRUARY 2022

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1. INTRODUCTION

1.1 I am an Associate Professor in the School of Geography at the University of Otago where I teach and research coastal geomorphology and environmental management. I have had a professional interest in sand mining at Pakiri-Mangawhai since 1990, when I concluded my doctoral research on the geomorphology of the Pakiri-Mangawhai Sand System, in relation to the impact of coastal sand mining. I subsequently submitted on related consent applications in 1992; contributed data to the Pakiri-Mangawhai Coastal Sand Study (NIWA, 2000); provided expert evidence to the Environment Court in 2005; and published papers on the sand system in 1989, 1994, 1995, 1996 and 2003.

1.2 With respect to the current consent applications the Hearing Panel issued a direction on the 17th August 2021 that I may join the Coastal Processes Expert Caucusing Group (CPECG) to contribute to the design and analysis of a bathymetric survey of the Pakiri-Mangawhai seabed (which was completed in October 2021). A joint witness statement, that I contributed to, was submitted on the 13th December 2021.

2. BACKGROUND

2.1 Previously, coastal experts have (largely) relied on point and transect data to understand processes of sand transport in the Pakiri-Mangawhai embayment. The bathymetric surveys completed by DML Ltd provide the first synoptic (embayment wide), high-resolution, data on the bathymetry and seabed features of the Pakiri-Mangawhai embayment; albeit the data is restricted to a shore-parallel strip of seabed between the 25m and 40m isobaths. This survey yielded a digital surface model that identifies large-scale bedforms and the extent and depth of trenches in the seabed resulting from offshore sand mining, which commenced at Pakiri-Mangawhai in ca. 2003.

2.2 These surveys provide new insights into the nature of the Pakiri-Mangawhai Sand System and the actual and potential impacts of offshore sand mining. Past hearings, since 1992, have struggled to resolve whether the sand system (the dune-beach-nearshore-inner continental shelf sand deposit) is closed to (significant) inputs of sand from the middle continental shelf or from Bream Bay. Consultants for the mining companies have argued it is an open sand system and that it receives substantial quantities of sediment from Bream Bay; the middle continental shelf; or from *in situ* shell production. Others, including myself (see arguments in Hilton & Hesp, 1996), and NIWA

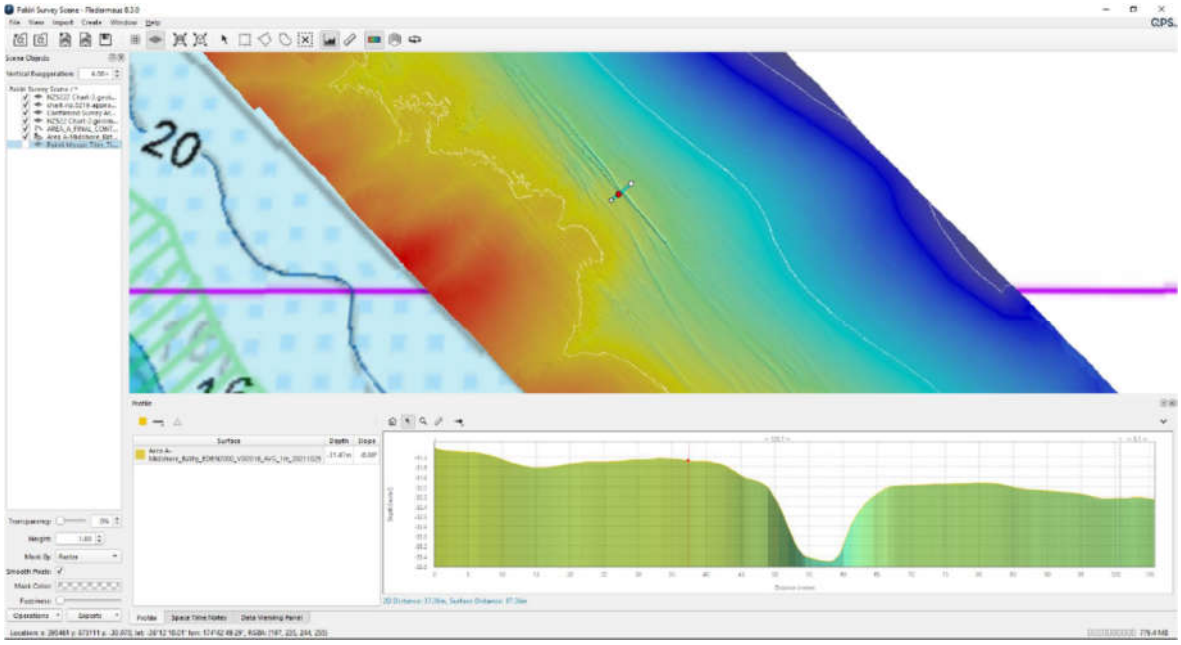
(2000) have presented evidence that the maximum limit of the modern beach system, and hence the nearshore sedimentary environment, approximates the 25 m isobath. That is, sand transport within the System is much more likely to occur close to shore but may extend to water depths of around 25m (the 25m 'isobath') in major storm events. Sediment transport may occur in deeper water, but not in quantities, or at rates, that might replace the persistent mining of sand from the shallow nearshore zone (nearshore consents). Moreover, we know mining of the offshore zone, beyond the 25m isobath, has been focused in a relatively narrow zone parallel to the shoreline but, apart from an areas surveyed by Dr Mead, we have never gained a synoptic view of the extent or intensity of the trenches resulting from these operations.

3. INTERPRETATION OF MARCH 2021 AND OCTOBER 2021 BATHYMETRIC DATA

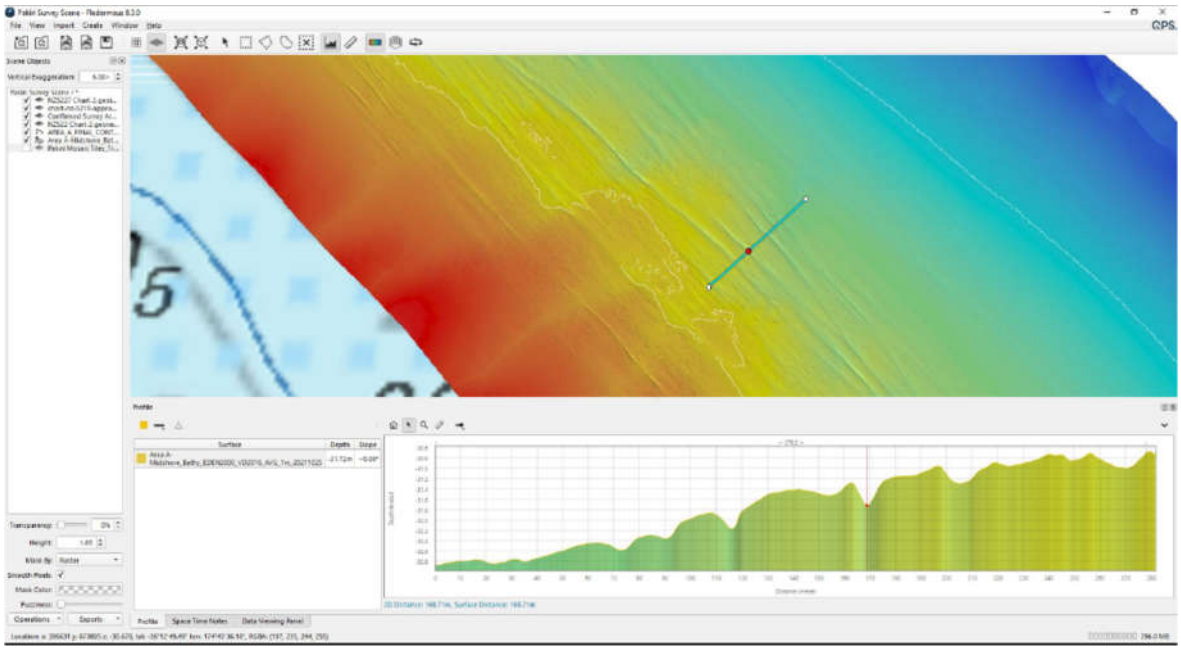
3.1 The joint witness statement of the Coastal Processes Expert Caucusing Group (CPECG) (13 December 2021) summarises the members initial interpretation of the bathymetric data provided by DML Ltd. The presence of distinct mining trenches was agreed; distinct bedforms within the survey area were noted; and some attempt was made to determine whether the trenches had 'infilled' between the above survey dates.

3.2 The digital surface model of the seabed, derived from the October 2021 survey, provides a clear representation of the extent and intensity of mining activity; manifest as shore-parallel trenches. Multiple, mostly shore-parallel, trenches have been excavated in the seabed since the offshore consents were granted in 2003. The largest trenches, 15m across and 1.5m deep, in water depths in excess of 32m, must result from multiple, probably targeted, extractions. Perhaps the mining companies 'harvests' the sand that collects in these trenches over time? Such trenches extend alongshore for hundreds of metres. In other areas there are multiple, more closely spaced (30-50m apart), but shallower (0.2 – 0.5m depth), trenches (including the trenches created as the mining vessel turns); which are doubtless the result of individual extraction 'events'. Images of the seabed that contain these trench configurations, provided by DML Ltd to McCallum's Ltd, on the 25th October, then to the CPECG, are included below:

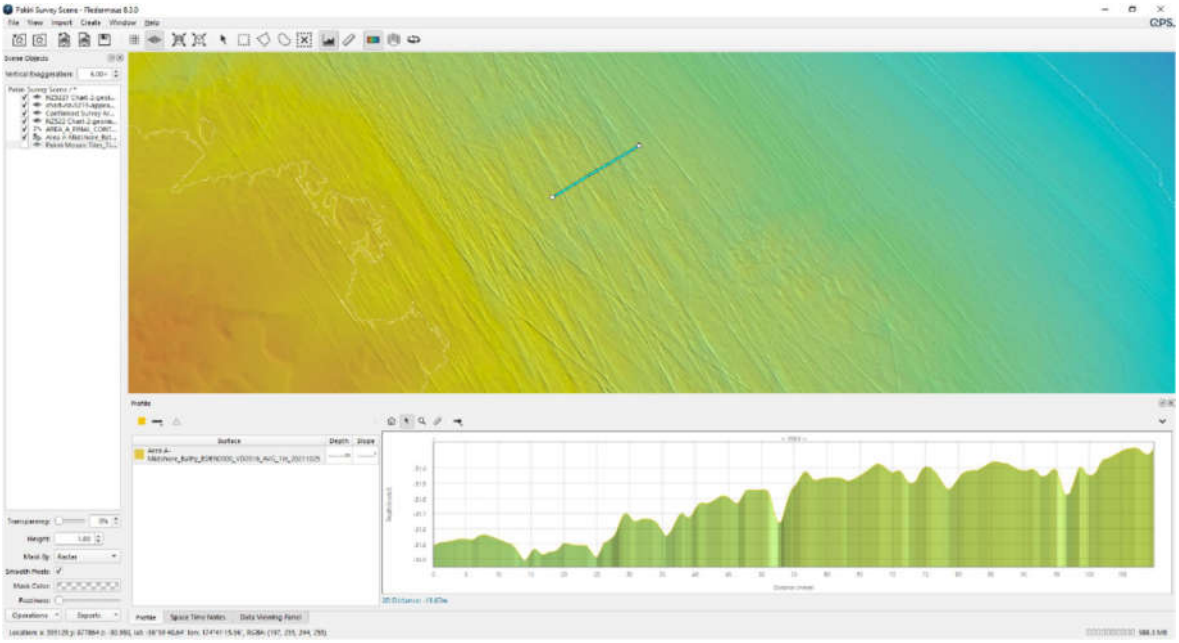
Type I: large trench



Type 2: multiple shallow trenches (medium density)



Type 3: multiple shallow trenches (high density)



3.3 The implications of sand mining at these depths across a wide area of the Pakiri-Mangawhai Sand System will be argued during the current hearing. However, the data gained by DML Ltd provides a very worrying picture of the extent and density of trenches and marks on the surface character of the Pakiri seabed. The pattern and close spacing of trenches, compared with areas of seabed outside the mining areas, is suggestive of a 'ploughed paddock', one that is tens to hundreds of hectares in area. This intensity of extraction, over a large area, must raise questions as to the extent to which the activity is consistent with the imperative to preserve the natural character of the coastal environment.

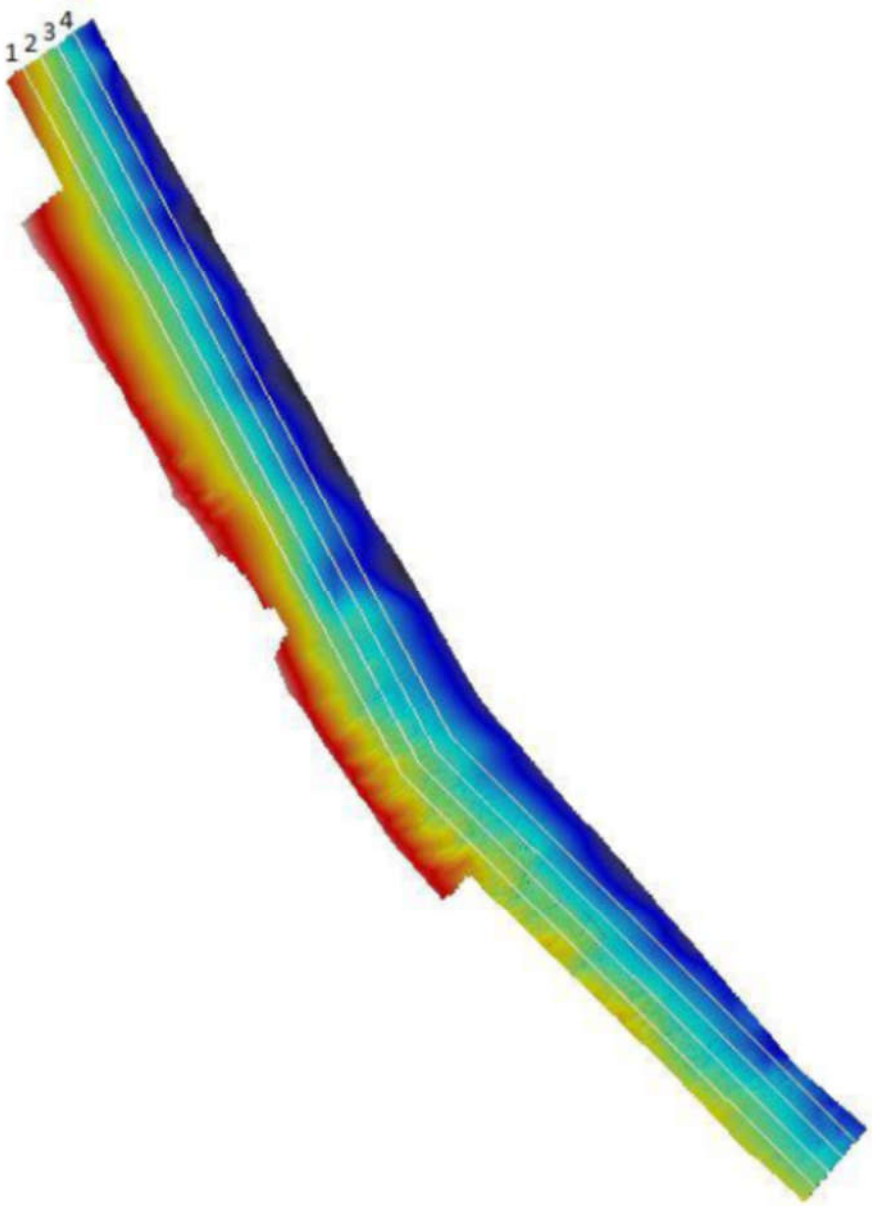
3.4 The CPECG made some attempt, with DML's support, to overlay the March 2021 and October 2021 surveys to determine whether sediment had accumulated in the trenches since the earlier survey. Infilling would suggest sediment transport is occurring at significant depth, albeit we already suspect that large waves generated during storm events have the potential to disturb and transport sediment short distances; without indicating significant net transport in any direction. Some sediment accretion within the trenches was noted, however, no conclusions could be drawn about the quantity or mechanism of the 'partial infilling' suggested, because of the differences in survey method and related accuracies. We are sure that large trenches present in March of

2021 were still present in October 2021, but very little else can be concluded or inferred from the comparisons. I suggest more can be inferred from the above figures, that suggest that trenches excavated by the mining company, presumably across months or years, were still conspicuous features of the seabed when surveyed in October 2021. One would expect trenches to be erased, or made less conspicuous, over relatively short periods (months to years), if sediment transport across these surfaces occurred frequently or at a significant rate.

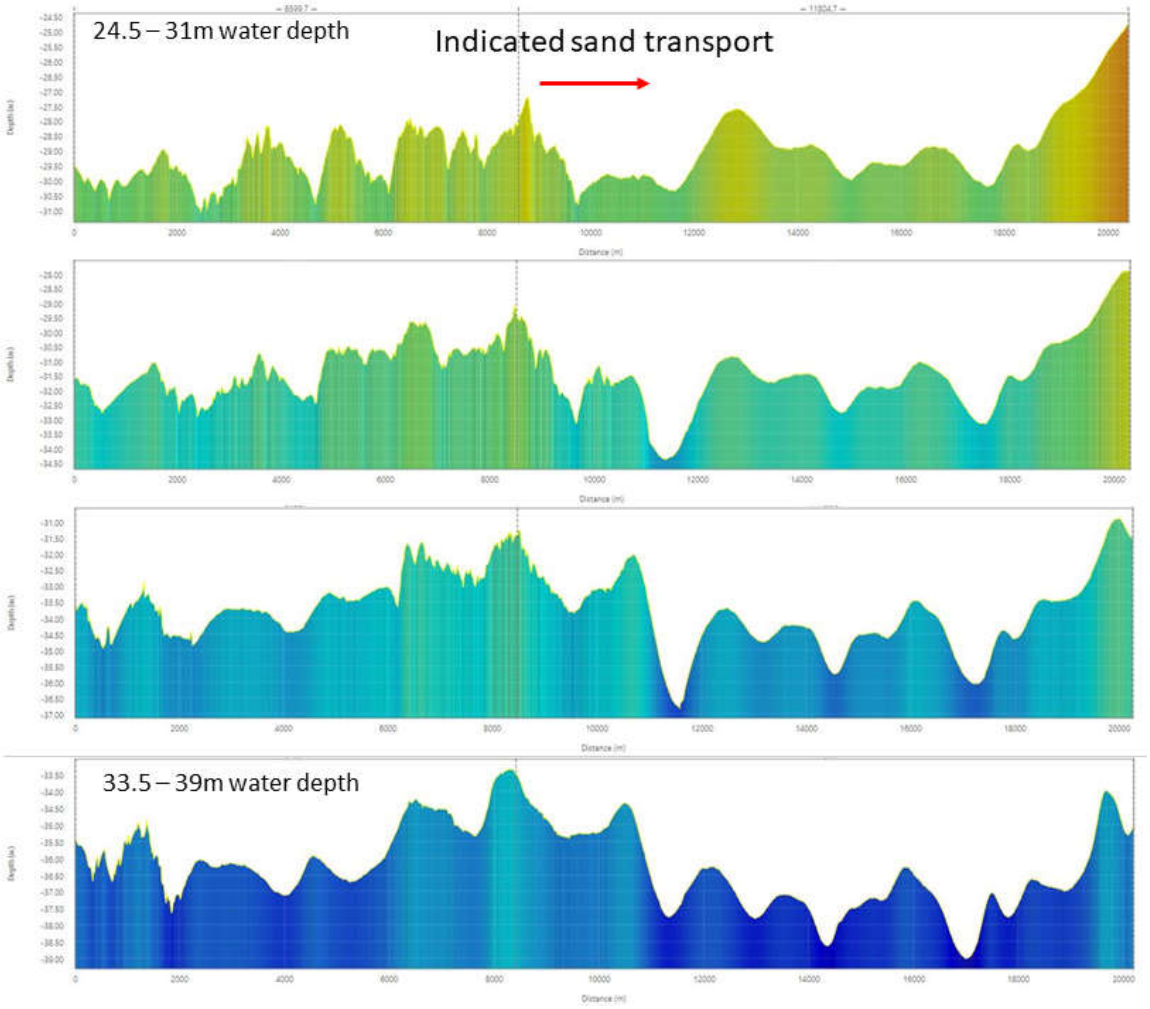
3.5 The October 2021 survey also revealed the presence of a cyclic pattern of large scale bedforms on the seabed between Mangawhai and Pakiri, but particularly south of Te Arai Point. These are indeed 'large-scale' features, with a crest to crest length of 1-2,000m (in most cases); an amplitude up to 4m; and individual features occur across the width of the survey area. Their amplitude is higher further offshore and lower towards the landward limit of the survey. Unfortunately, the survey does not extend further inshore, and so we do not know their western limit, but it is likely to be a little further inshore than the survey, based on data presented by DML and shore profile data gathered by myself prior to 1990.

3.6 The origin of these features has implications for understanding coastal processes in the Pakiri-Mangawhai embayment. They are bedforms, accumulations of sand similar to sand dunes, likely generated by currents, or a combination of currents. Their morphology suggests net sand transport from north to south. I measured tidal currents near the seabed, with NIWA's assistance, prior to 1990, in water depths of around 25m. The current speeds recorded were then considered insufficient to transport sand-sized grains; however, I did conclude, in my doctoral thesis, that combined tidal/wave currents might be capable of significant sand transport at these depths.

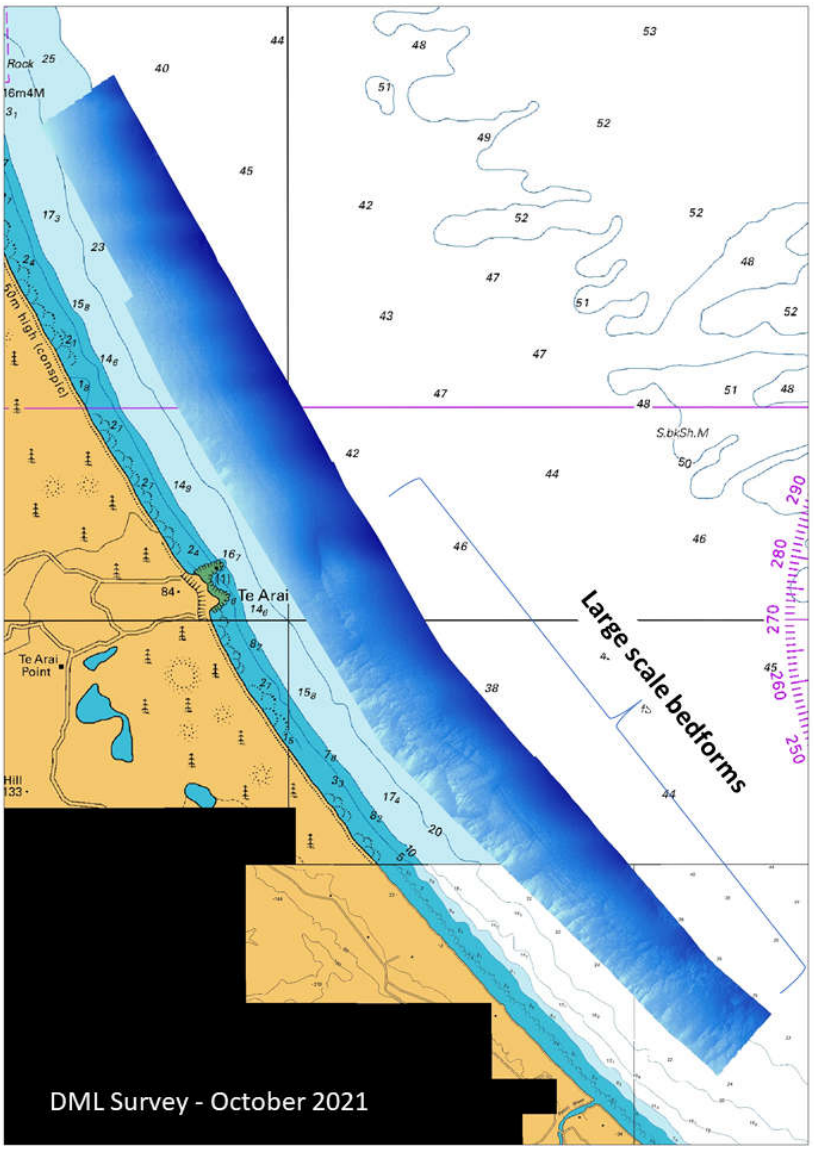
3.7 The presence of these features points to how little we know about the Pakiri-Mangawhai Sand System, and how much should be established before further consents to mine sand are granted. Their extent and orientation are inconsistent with arguments for significant diabathic (onshore) sand transport into the mining area to replace sand extracted. If significant sand transport within the sand system does occur, such transport appears to be from north to south; although over what time scale, and at what rate, remains to be investigated and confirmed.



Shore-parallel survey lines 1 (western) to 4 (eastern) (DML Ltd., October 2021).



Large-scale bedforms revealed by shore-parallel surveys by DML Ltd (October 2021).



Surface model of seabed showing presence and extent of large-scale bedforms.

4. CONCLUSION

4.1 Bathymetric data provided by DML Ltd. (October 2021) has provided the first synoptic overview of the seabed over a wide section of the Pakiri-Mangawhai embayment. Trenches arising from offshore sand mining are a conspicuous and worrying feature of this data. The extent, dimensions and persistence of these trenches suggests rates of sand transport and accretion are less than rates of sand mining in this area of seabed.

4.2 Future surveys, consistent with the methodology recommended by the CPECG, will help resolve the direction and rate of sand transport; by comparing a time series of trench surveys over years. However, the above observations, particularly the extent and number of trenches, is consistent with past work by me, and others, that sand transport at water depths greater than 25m is likely to be low and that replenishment of sand extracted at these depths is unlikely.

4.3 The October 2021 survey confirmed the widespread occurrence of large-scale bedforms within the survey area. They indicate north to south sand transport, but at what rate, and under what conditions, is unknown. They were recognised by me prior to 1990, from a limited side-scan sonar by the Royal New Zealand Navy; but were not known to occur so extensively. Again, comparisons of future surveys will help resolve whether they result from significant sand transport, and whether they are germane to understanding the impact of nearshore and offshore sand mining. However, I conclude by emphasizing there are large gaps in our knowledge of the Pakiri-Mangawhai Sand System, indicated by the astonishing results of the October 2021 survey, and that it is timely to exercise much greater caution in the management of this System.

Associate Professor Mike Hilton
9 February 2022

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