IN THE MATTER of the Resource Management Act 1991

AND

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

SUPPLEMENTARY STATEMENT OF EVIDENCE OF DR SHAW MEAD

28 January 2022

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1. BACKGROUND

1.1 My name is Dr Shaw Mead. I previously filed a statement of evidence on behalf of Damon Clapshaw, a submitter in opposition to this application, dated 21 February 2021, and rebuttal evidence, dated 14 May 2021.

1.2 I am a member of the Coast Processes Expert Caucusing Group (**Expert Group**) appointed by the Hearing Panel and was a signatory to the Joint Witness Statement of the Expert Group dated 13 December 2021 (**JWS**).

1.3 This supplementary evidence has been prepared in response to the Directions from the Hearing Panel on 17 December 2021, namely:

> "With respect to the *"extent to which members of the expert group may be required to participate in any reconvened hearing"* we have determined that each of the coastal process experts who presented evidence previously at the hearing, being Ms Hart, Ms Sharma, Dr Mead, Mr Todd, Ms John and Dr Shand, provide the Panel with a brief statement no later than Friday 28 January 2022. In that written statement they should clearly explain the extent to which the Expert Group caucusing outcomes change the conclusions, and the reasons for any change, in relation to their previous evidence, with respect to coastal processes, and in particular the understanding of the sediment transportation process associated with the seabed features identified by the survey."

2. CONCLUSIONS IN MY PREVIOUS EVIDENCE WITH RESPECT TO COASTAL PROCESSES

2.1 My conclusions as presented in previously submitted evidence were, in summary:

a) Investigations into the exercise of the current consent for offshore sand extraction indicate that the consent breaches and dredging practices that have occurred have likely impacted in the sediment transport processes within the Mangawhai-Pakiri embayment.

b) The concern that I presently have is that it will just be 'business as usual' without correctly addressing the management of dredging practices, the adequacy of

conditions and the regulation of the activity if they are implemented as they have been with the current consent.

c) The existence of deep, wide and long trenches in offshore dredging Area 1 identified by Mr Clapshaw/FOPB were confirmed by Mr Healy through the recent Survey Worx seabed imaging survey.

d) The theoretical limit of the depth of closure (25 m depth) does not isolate the offshore sand extraction from effects landward or on the shore. Therefore, as a result of targeting the same dredge lines repeatedly (i.e., the reduction/prevention of diabathic sediment transport) there is the potential for cumulative impacts on the beaches of the Mangawhai-Pakiri embayment.

e) The AIS data for June 2020 was reanalysed to consider a range of dredging speeds of under 3 knots to investigate the assertion by McCallum in their reply evidence that dredging only actually occurred under 2 knots. When vessel speeds of <2.25 knots, <1.9 knots, <1.75 knot and <1.5 knots are considered, it is found that the dredging vessel passes into Northland for ~1 km at speeds of below <2.25 knots and <1.5 knots. At the lower speeds of <1.75 knot and <1.5 knots, only one dredge line was identified in the Kaipara's offshore areas under 1.75 knots in the whole month, although several are present in the McCallum's nearshore consent areas, and no dredge lines were found under 1.5 knots. It is therefore my opinion that, similar to the actual extent of deep dredged trenches, there remains a lot of uncertainty and concern with respect to on-water behaviour. The clear implication is that dredging was occurring over the border (i.e., at speeds >1.75 knots and <3 knots), and that previous statements by the McCallum's are likely incorrect.

f) With respect to monitoring and reporting requirements as specified in the conditions of consent and the EMMPs for the offshore coastal permits, 5 important reports (4 surveys and 1 EIA) are not held by the AC. In addition, at no time has seabed imaging been undertaken since consent was granted (as specified in Special Condition 12c), Area 1, EMMP 1), which is why Tier 2 monitoring was not triggered even though it ought to have been, as trenches of >1.5 m deep are present.

g) Being involved in the original studies considering the sustainability of offshore dredging in the Mangawhai-Pakiri embayment in the 1990's, and also being involved in the development of parts of the conditions of consent (i.e. marine ecology), as well as in my role as an environmental scientist, I am personally disappointed with how the offshore sand extraction has been practised and managed since 2003, which has also been a lost opportunity with respect to gaining a better understanding of the potential and actual impacts of the activity so that this learning could be applied to sustainable management of our marine resources. This is relevant as to whether or not there is a sufficient foundation to consider granting any (renewed or new) consent for significant further dredging in this location.

3. CHANGES TO MY CONCLUSIONS FOLLOWING CAUCUSING

3.1 My conclusions as presented in previously submitted evidence have changed due to the Expert Group caucusing, mainly as a result of the large extent of the benthic impacts of dredging that the Discovery Marine Limited (**DML**) survey has brought to light. In short, my concerns expressed above have only increased.

3.2 The seabed imaging undertaken by DML provides further information with respect to the extent and persistence of the dredging impacts, a requirement to increase the size of the 'Swale Exclusion Area' and it removes any uncertainty surrounding breaches shoreward of the offshore consent boundary and the ability to dredge while turning. This information brings into question the validity of the existing resource consent application, since many of the assumptions with respect to effects are incorrect.

3.3 The results of the DML survey also provides further support to the conclusions I have so far presented, and raise concerns about the environmental impacts of dredging the offshore area of the Mangawhai-Pakiri embayment. The current application worked on the assumption that the large scale impacts now visible in seabed imaging by DML were not occurring, and as a result there are assumptions and conclusions that are likely no longer valid with respect to both physical and biological impacts. Had the conditions of the consent been correctly exercised and regulated from when dredging began and produced such as those in the recent seabed imaging, it is questionable whether

dredging would have continued in the same way it has until today, or indeed whether it would have been allowed to continue at all.

3.4 As agreed by all members of the Expert Group, the DML survey has confirmed the presence of deep shore-parallel trenches caused by the applicants repeatedly dredging the same run-line, and confirmed the widespread and persistent impacts of dredging the offshore areas of the Mangawhai-Pakiri Embayment. As stated in my Evidence in Chief, the inadequacy of the existing conditions pertaining to physical monitoring of effects, and how the conditions of the consents have been regulated, by Council meant that the impacts on the seabed were previously unknown to Council and to some of the experts for Kaipara and McCallums (although it appears from their corporate evidence that the trenches were known about by the two companies). The DML survey has shed some light on how the seabed has been continually impacted since offshore dredging began almost two decades ago, which in my opinion is far more extensive than anyone had envisaged. To clarify, I am not referring just to the impacts caused by dredging below the active sand layer, that is, repeatedly targeting the same run-lines to create trenches >2.5 m deep and dredging outside of the permitted boundaries (i.e., the breaches of conditions that would have been identified and triggered Tier 2 investigations if seabed imaging had been regularly undertaken as per the conditions). I am also referring to the widespread and persistent impact to the seabed that has been identified while dredging within the consent boundaries and not targeting the same run-lines as presented by DML. Assumptions that the current application is based upon, such as mobile sediment relatively quickly infilling the shallow skims created while dredging and recovery of the benthic community within 6 months to several years, are no longer likely to be valid; the seabed imaging indicates that the hundreds of dredge trenches caused by 'normal' dredging activity are persistent and require severe storm events to recover.

3.5 As a result of the conditions for the existing permits and the way they have been regulated, very little has been learnt with respect to the impacts and sustainable management of the offshore dredging activity in the past two decades. As a consequence, the proposed conditions for the current application do not address the issues identified with respect to consent breaches and dredging practices and seem to be less robust than the previous conditions (e.g. no sea floor imaging, single sites for the collection of monitoring, no discernible minimum offshore measure for dredging for

transparent and effective monitoring (e.g. it is based on the 25 m isobath, rather than a specified distance)).

4. EXTENT OF SEABED DISTURBANCE AND DREDGING OUTSIDE OF CONSENTED AREAS

4.1 The results of the DML seabed imaging survey can be viewed using the Fledermaus Viewer software supplied by DML. Using the Fledermaus Viewer to investigate the DML survey, the seabed can be viewed from close up (a few tens of metres) to the whole area surveyed. In addition, the boundaries of the existing dredge areas and proposed area are underlaid in the software, which means the locations with respect to the dredge impacts can also be estimated. Note, the images that I have appended below are high resolution and best viewed on a computer screen by zooming in, rather than printing and viewing as hard copy.

4.2 Figure 1 is a location map that shows the various areas of interest that I will be referring to, which include Area 1 (southern dredged area), Area 2 (northern dredged area), the proposed new consent area that extends further inshore and offshore of Areas 1 and 2, the existing southern control area, the proposed northern and southern control areas, and the 'Swales Exclusion Areas'.

4.3 As above, it is my opinion that the impacts caused by the dredging that have been revealed by the DML seabed imagery are far more extensive and persistent than anyone envisaged. This is demonstrated in Figure 2, which is a high resolution screenshot from the Fledermaus software.

4.4 Figure 2 is a close-up of the northern part of Area 1 which prompted Dr Hilton, who is a member of the Expert Group, to note:

> "The recent work, the eCoast surveys included, provide a very worrying picture of the extent and density of trenches and marks on the Pakiri seabed. Imagine a ploughed paddock ... one that is hundreds of ha in area." (M. Hilton, pers. comm.).

4.5 Over 100 shore-parallel dredged trenches are evident in Figure 2. The ploughed paddock seabed is evident in the seabed imagery from just north of the 'Swale exclusion Area' in Area 1 to just south of the Northland-Auckland boundary in Area 2 and cover an across shore distance of between 300 m and almost 1 km wide (widest in the south).

4.6 I note that the extensive dredged trenches identified in the DML survey (not including the persistent very deep trenches developed by repeatedly dredging the same run-lines present in the 'Swale Exclusion Zone') are persistent relicts from after the series of severe storm events in May 2021, or they could have been created more recently – AIS data would require detailed analysis to determine the dates that these dredge lines were undertaken. My reasoning for the trenches being relicts following the severe storm events in May 2021 is that there are no recent/shallow dredge marks within the 'Swale Exclusion Area', which Mr Todd confirmed has not been dredged since April 2021, nor are there any dredge marks in the northern part of Area 2, where dredging also ceased in early May 2021. The most northern dredged trenches are only evident to approximately 1.4 km south of the Northland-Auckland boundary, even though the AIS data indicates that the dredge regularly passed over 1 km north of this boundary prior to early May 2021. As a result of these findings, some of the assumptions that the current application is based upon, such as mobile sediment relatively quickly infilling the shallow skims created while dredging, are incorrect.

4.7 I have no doubts at all that the deep shore-parallel trenches identified in the area now called the 'Swale Exclusion Areas' have and will impact on sediment transport, including diabathic sediment. However, the results of the DML identifying 100's of shore-parallel dredge trenches (albeit not to the depths of those in the Swale Exclusion Areas') now also raise concerns with respect to their impacts on sediment transport and exchange from the offshore compartment to the nearshore compartment across the 25 m depth of closure. The impacts on coastal processes due to the large number and persistence of these shore-parallel dredge trenches have not been considered nor assessed in the current application.

4.8 This evidence of extensive dredged tracks confirms my concerns regarding diabathic sediment transport (especially the deep and persistently dredged trenches), that they represent sediment traps reducing diabathic sediment transport, which other coastal processes experts concur with (Paragraph 3.12 of my rebuttal evidence and Dr Hilton (pers. comm.)). The persistence and number of dredged trenches also raises the question of the extent of impacts on the benthic ecology of this area of the embayment; it is not physically recovering quickly, and resembles a ploughed paddock covering hundreds of hectares of the seabed in Mangawhai-Pakiri embayment. The ecological assessment for the current application repeatedly states that the data collected since

2003 is inadequate to sufficiently detect small changes in benthic community structure (which is the main indicator of impact on benthic ecology) and similar inadequacies due to comparable data collection methods. These deficiencies have been identified by other experts, including Dr Sivaguru at the Auckland Council. This is of extra concern with respect to continued dredging in Area 2, which the EMMP conditions indicate should not be occurring without further ecological surveys of Area 2.

4.9 As described in Annex 1 of my Evidence in Chief, the pre-dredging assessment (PDA) of Area 2 indicated several areas of high biological diversity. As a result of the PDA (Mead, 2006), no sand extraction was to be undertaken within those areas identified with high biodiversity unless a further survey of these areas was first undertaken and confirmed that they were no longer of ecological importance. This reflects that the species composition in these areas may change over time and that these areas may be suitable for sand extraction in the future. The results of the 2006 PDA indicate that 20-30% of Area 2 was classified as having high biodiversity.

4.10 Despite this condition, dredging of Area 2 commenced some 3 years ago. So the applicants failed to adhere to it and the Council did not enforce it. As stated by Mr McCallum, the trenches were first identified by them in December 2018, they were dived in January 2019 and were found to be up to 2.5m deep. In response, Kaipara Ltd instructed McCullum to focus dredging in Area 2, which began in January 2019 (it is noted that AIS data indicates Area 2 was dredged in 2018, although only a few times a month). This being without undertaking the further ecological survey work referred to above. Given the classification of areas of high biodiversity and new understanding of the impact on the seabed the dredging is having (i.e., the results of the DML survey), this further raises concerns of the ecological impact that dredging may be causing to the benthic environment.

4.11 Another aspect of the DML survey is the confirmation of condition breaches with respect to trench depth exceeding 1.5 m and dredging outside of the consented areas. As noted in the JWS, trenches of >1.5 m still remain in Area 1, despite over time being partially filled since early 2021 when dredging of them ceased, most likely the majority of filling occurred during the series of severe storm events in May 2021.

4.12 The DML survey, when the most inshore locations of the visible dredged trenches are compared to the inshore boundaries of the dredge areas, shows further evidence of breaches outside the consented areas. These dredged trenches are on the shoreward side of the area boundaries and estimated to be up to at least 80 m shoreward, which confirms similar breaches of similar magnitude as presented in Annex 1 of my Evidence in Chief.

4.13 Similar to the presence of dredged trenches outside of the consented areas, it is evident that the 'Swales Exclusion Area' does not incorporate the deep swales to the north and south of the offshore exclusion area. The deep trenches that the exclusion area is designed to protect and allow to recover can be seen extending shore parallel outside of the 'Swales Exclusion Area', and should be extended as annotated to Figure 3.

4.14 As stated above, my opinion based on the DML survey is that since there are no 'normal' dredged trenches in the exclusion zone or near the northern boundary, which were dredged up until April/May 2021 prior to the May 2021 extreme events, then the hundreds of run-lines in the DML survey are all post the May events, meaning that it takes severe storms to significantly mobilise the seabed and remove the 'normal' dredged lines and cause some infilling. However, the majority of the time these features remain and are not 'quickly' filled in as stated in Kaipara's application and also by Mr Todd's diver investigations. This is a greater impact that has been assumed in the past.

4.15 Finally, with respect to dredged trenches identified in the DML survey, is the remaining uncertainty with respect to dredging north of the Northland-Auckland boundary. There is evidence that suggests dredging did previously occur past the Northland-Auckland boundary, and the DML survey also indicates that the dredge-head does not need to be lifted to turn the dredge vessel, as previously asserted by McCallum's and Mr West. Incursions of >1 km north of the Northland-Auckland boundary are presented in Annex 1 of my Evidence in Chief, which also show a 'turning circle' of approximated 250 m (e.g. Figure 5-8). The DML survey results present multiple 'turning circles' that have been continuously dredged (i.e., 180° turns without lifting the dredge-head) north of the 'Swales Exclusion Area' which have diameters of 150-250 m (Figure 4). This indicates that it likely that dredging into Northland was previously occurring.

5. IMPACTS ON COASTAL PROCESSS

5.1 Which respect to the impacts on coastal processes caused by the offshore dredging, my concerns remain the same and have been supported by the DML survey. That is, creating deep shore-parallel trenches will prevent cross-shelf transport into the beach compartment, which my associates at eCoast, Dr Hume and Dr Hilton concur with.

5.2 The findings of the Sand Study (Hume *et al*., 1999), that very large amounts of sand are mobilised and in re-circulation in the embayment during periods of moderate-to-high wave activity, are further supported by Mr Todd's recent work. While I disagree that the depth of closure is likely to be further offshore (by definition of the outer depth of closure it cannot be), Mr Todd's investigations also show that a lot of sediment is moving across the seabed at depths of 30-35 m, which has now been confirmed by the repeat seabed surveys and DML's analysis, although the evidence suggests it takes severe events to mobilise due to the persist dredge lines giving the seabed the appearance of a ploughed field.

5.3 While this material is not all destined for the nearshore (i.e., <25 m deep), it is very likely that a significant proportion of the 12,000 m^3/yr on average of sediment that moves into the nearshore is being trapped and dredged, and so removed from the nearshore system, which could be compounded with each consent renewal and is a cumulative impact. As I stated in my Evidence in Chief, the reason why the deep trench features remained present from prior to February 2019 to March 2021 is because these areas have been targeted by repeated dredging, removing the 'new' material that enters them and getting slightly deeper with each dredge.

5.4 The May 2021 severe storm events would have instigated large amounts of sediment transport, due to the long period waves, likely moving large volumes of sand throughout the embayment. Cross-shelf transport of sands across the entire embayment accounts for an average 340,000 m3/yr moving back and forth across the shelf, with up to 874,000 m3/yr of alongshore sediment transport over the 1.5 km nearshore area out to 25 m deep (Sand Study, 1999). While it requires analysis of wave data and consequent sediment transport, it is likely that the onshore sediment transport into the nearshore compartment (i.e., <25 m) was nearing the upper limit of 64,000 m^3/yr determined by the Sand Study (Hume *et al*., 1999).

5.5 However, the presence of deep shore-parallel trenches would have greatly reduced the volume of sediment transported, which is evidenced by the infilling identified by the multiple seabed surveys, although as agreed in the JWS it is not possible to estimate the volume of infilling and these data provide no information on the directions that sediment was likely to be moving throughout the intervening period. Given the new evidence of the impacts of 'normal' dredging (Figures 2 & 4), the impacts on diabathic sediment transport of infilling hundreds of dredged trenches also needs to be assessed; even if the embayment was an 'open' system (which is it not), the dredging practise could be greatly reducing the volume of sediment moving into the nearshore compartment.

5.6 It is important to acknowledge that even though aggressive erosion of the beaches occurred during this period due to the accompanying onshore winds (Figure 5), this material would have likely remained in the nearshore compartment. It is noted that some 4,400,000 m^3 of sand has been removed from the Mangawhai-Pakiri embayment through sand-mining: "sand extraction is depleting the sand storage in this sediment system at a very slow rate" (Sand Study, 1999), which can be visualised as 4,200 piles of sand 10 m high and 20 m in diameter with the top of the piles 6 m apart (i.e., 4,200 over-lapping piles along 26 km of coast line. With the additional effects of sea level rise during the period that 4,400,000 m^3 of sand has been removed from the Mangawhai-Pakiri embayment, it is difficult to argue that the beach's resilience is not being undermined.

5.7 Repeatedly dredging the same shore-parallel dredge lines has been identified as the cause and persistence of multiple lines of trenches over 1 m deep, with some parts of the features surveyed >2.5 m deep. These features have been found to be persistent for at least 3 years, and have very likely resulted in negative environmental impacts to the sediment transport processes within the Mangawhai-Pakiri embayment.

5.8 As concluded in my Evidence in Chief, it is very likely that these deep trenches capture shoreward moving sediment during large storm events and during any period when wave orbitals have sufficient velocity to lift sediment off the seabed for even very short periods of time (i.e. seabed creep). However, this material is then dredged from the trenches/sediment traps and the process of diabathic sediment transport is interrupted and/or stopped altogether. This has been confirmed by the DML analysis of repeat surveys, and although as agreed in the JWS that the volumes trapped are hard to determine, and that the direction and fate of sand that moved during the intervening

periods is impossible to determine (without numerical modelling), a proportion of the material captured in the deep trenches was destined for the nearshore compartment and beaches of the Mangawhai-Pakiri embayment.

5.9 The Expert Group agree that we do not know which direction sediment is moving (although the calibrated sediment transport modelling of the Sand Study provides the most reliable information supported by field investigations), although we have found evidence of some infilling of the larger trenches. It is noted that some of this apparent infilling maybe due to the steep side walls collapsing into the trenches. The DML analysis indicates that side slopes of the trenches has reduced in gradient between the September 2020 survey and the October 2021 survey in many areas, although in some cases side walls as steep as 1:2.5 (V:H) were still present in the October 2021 survey. However, the hundreds of hectares of ploughed paddock suggest that there is not a great deal of sediment transport occurring on a regular basis; it is likely that the majority infilling that has been found with the comparison of the eCoast and DML surveys occurred during May 2021 series of severe storm events. Nevertheless, substantive depressions persist.

6. MONITORING CONDITIONS

6.1 Given the situation as I have described above, including the worrying results of the DML surveys, a major question arises as to whether there is an adequate foundation and assessment of effects to grant a new consent for the offshore area. If a resource consent were to be granted, despite those significant issues, the Expert Group agreed that improved monitoring conditions should be required,.

6.2 I agree that the Mangawhai-Pakiri embayment is basically a compartment, or whole system as identified by the Sand Study, so requires a whole system monitoring approach (as also advocated by Dr Hilton (pers. comm.). Multibeam eco-sounder and side-scan sonar imagery should be used to regularly survey out to at least the offshore boundary of the proposed dredge area to Bream Tail in the north and Goat Island in the south, as well as extending some 200 m shoreward of the inshore dredging boundary. This represents an approximate doubling of the area surveyed by DML.

6.3 As stated in my Evidence in Chief, more detail is required, more frequent monitoring is required, clarification of aspects such as depth of dredge trenches is needed, and monitoring connected with the beach system and measures to prevent the formation of

deep shore-parallel trenches also need to be incorporated (e.g. sea floor imaging directed by AIS/DGPS records, noting that seafloor imaging is not included in the proposed conditions).

6.4 Monitoring issues are addressed specially at paragraph 29 of the JWS, under the heading "Issues Outstanding", where the Expert Group states that:

> … a coordinated and sustained monitoring programme needs to be developed, approved and implemented for any sand extraction activities in the Mangawhai – Pakiri embayment, and linked to an adaptive management plan for those sand extraction activities.

6.5 In addition, as recommended by the Expert Group, further fail safes should also be incorporated such as access to all raw survey data and interpretation by an independent expert, or preferably a group of independent experts.

6.6 Similarly, as advocated by Dr Single and Dr Mitchell, the beaches and nearshore (i.e., shallower than 25 m deep) must also be incorporated into the offshore monitoring strategy. As detailed in my Rebuttal Evidence, I strongly disagree with Ms Hart and Ms Sharma's interpretation of the depth of closure. It is not a wall that no sediment can move past, it is a leaky boundary and an important component of sediment supply/budget for the nearshore and beaches.

6.7 A major flaw in the monitoring to date, for both the offshore and inshore dredging consents, is the inadequacy of the control sites with which to compare change. The whole embayment is the impact site, it is subject to massive volumes of sediment transport, responses to medium term cycles such as the El Nino Southern Oscillation), as well as longer term cycles such as the Inter-decadal Pacific Oscillation and Southern Annular Mode, which are not well identified if the whole of the embayment is not considered.

6.8 Controls sites must be away from the area of influence, whereas the proposed and existing conditions only have control sites that are within the impact area (i.e. the whole embayment). As a result, we currently have conclusions of little change found between impact and control sites when the inshore monitoring is considered, which is very likely due to the high volumes of active sediment transport that occur during severe storm

events ‘mixing’ the surficial sediments in adjacent areas, and other phenomena such as gross reorientation of the embayment beaches between El Nino and La Nina phases. Accordingly, an embayment on the northeast coast that does not have large sand-mining activity is required as a control site with respect to impacts on sediment supply to the beaches.

7. SUMMARY

7.1 The DML survey has confirmed the presence and persistence of long deep shore-parallel trenches, and that the impacts of ‘normal’ dredging are worse that had previously been assumed. It is likely that the sand-mining activity is impacting on coastal processes and likely also marine ecology.

7.2 The DML survey has provided evidence that confirms the consent condition breaches identified in my Evidence in Chief and Rebuttal Evidence with respect to dredging outside of the consented areas.

7.3 The same concerns that I have previously stated with respect to dredging impacting on diabathic transport in a closed system remain and have been supported by the DML survey. No matter the volume of diabathic transport that is being prevented/reduced, this continues to accumulate to large volumes year upon year that are likely to be negatively impacting the beaches of the Mangawhai-Pakiri embayment.

7.4 The current application is based on incorrect assumptions with respect to the impacts of dredging on the seabed and the beaches of the Mangawhai-Pakiri embayment, and it also omits the presence of the long and deep shore-parallel trenches, and also makes incorrect/false claims with respect to the many historic breaches of the existing consents on and off the water.

7.5 As a result of inadequate conditions in relation to physical processes (e.g., the maximum depth of dredged trenches up to 1.5 m deep) and lack of monitoring the seabed with imagery that was required in the conditions of the existing consent, very little, if anything, has been learnt in the past almost 20 years that can be applied to the sustainable management of offshore seabed mining in the Mangawhai-Pakiri embayment. Other than the sediment budget from the Sand Study (Hume *et al*., 1999), the physical

processes that have been identified to operate within the embayment have been basically ignored.[1]

7.6 As a result, there are a number of unknowns that are not addressed in the current application. In my opinion these issues need to be addressed before the consenting process continues, since the current application is inadequate and does not appropriately address the environmental effects of the activity.

Shaw Mead
28 January 2022

[1] The Sand Study (Hume et al., 1999) undertaken by NIWA, the University of Waikato and the University of Auckland integrates large scale field data collection, geomorphology, data analysis, oceanography and numerical modelling, and represents one of the most thorough studies of physical oceanography and sediment transport ever undertaken in New Zealand. It represents a significant resource with respect to the coastal processes operating within the embayment and included recommendations on the future monitoring and management of the embayment (including revision of the monitoring programme and monitoring of locations as recommended above), and sets the foundation for monitoring that could have continued to build our understanding of the sediment dynamics of the Mangawhai-Pakiri embayment.

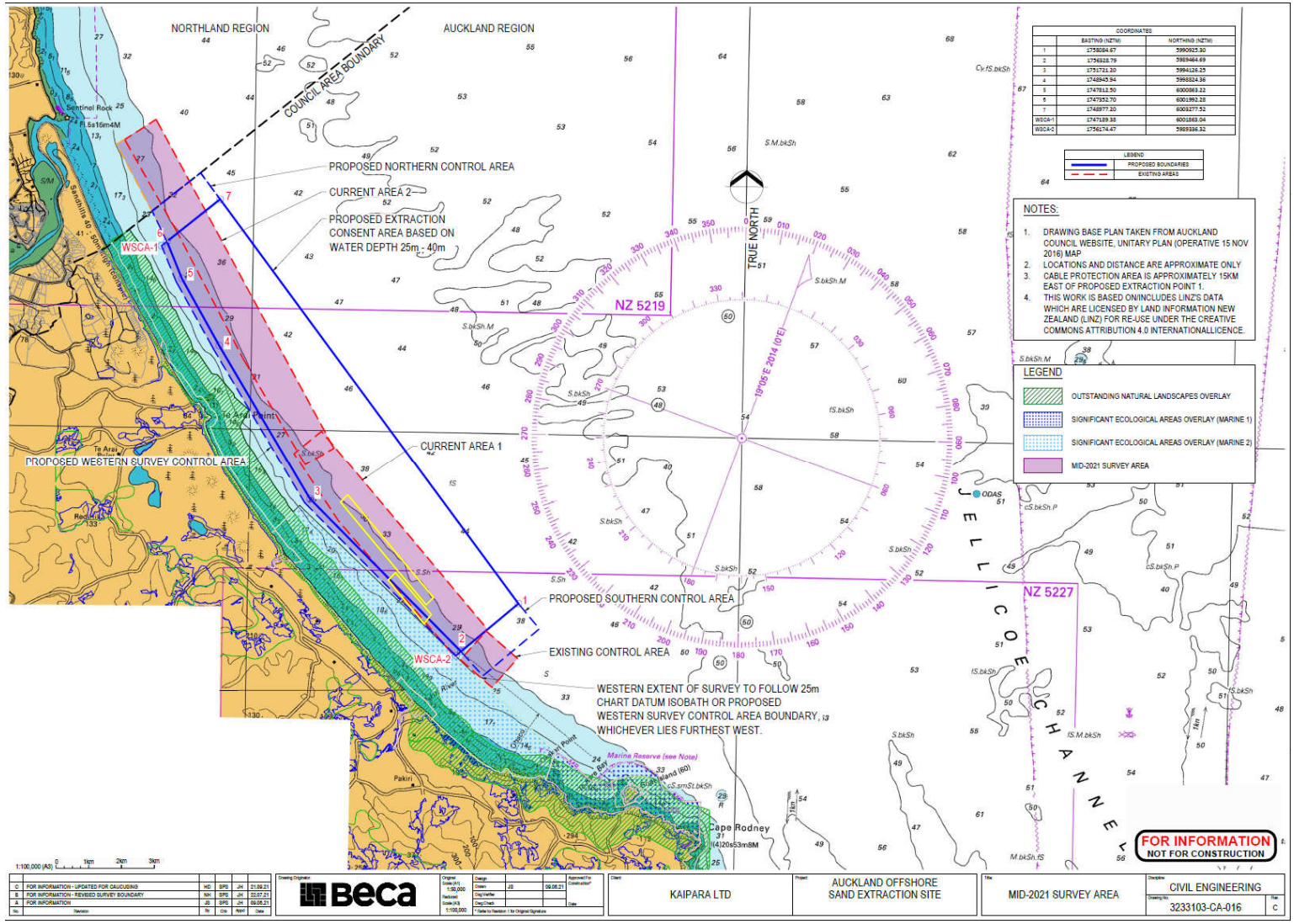

Figure 1. Location plan showing Areas 1, 2 and control in dashed red lines, the proposed new consent area and controls (solid blue and dashed blue lines, respectively), and the 'Swales Exclusion Areas' as yellow boxes.

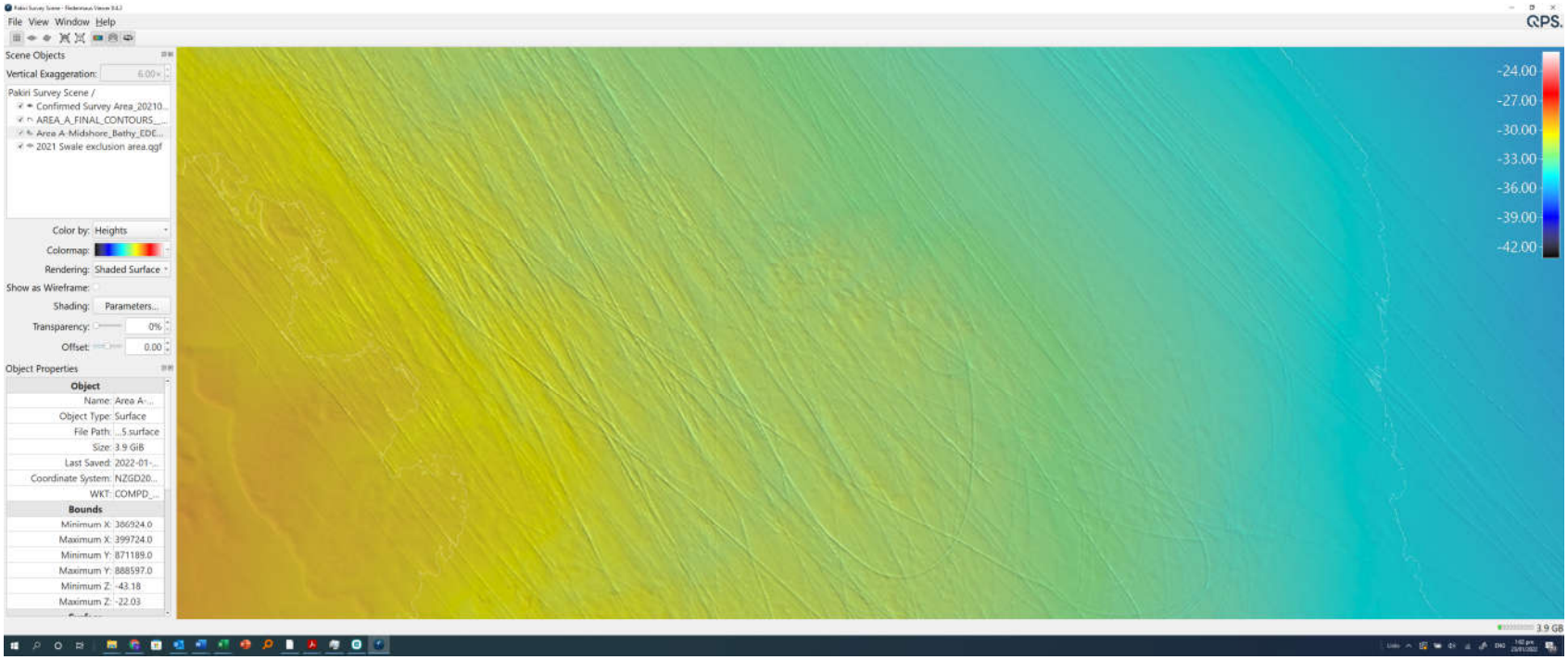

Figure 2. The northern part of Area 1 showing that Dr Hilton says, “provide a very worrying picture of the extent and density of trenches and marks on the Pakiri seabed. Imagine a ploughed paddock ... one that is hundreds of ha in area.” Over 100 dredged trenches are evident, which are the multiple dark lines running NNW to SSE, crossing over each other and the curving features at the mid-bottom of the image where dredging is continued while turning. The plough paddock seabed is evident in the seabed imagery from just north of the ‘Swale exclusion Zone in Area 1 to just south of the Northland-Auckland boundary in Area 2 and cover an across shore distance of between 300 m and almost 1 km wide (widest in the south, this image).

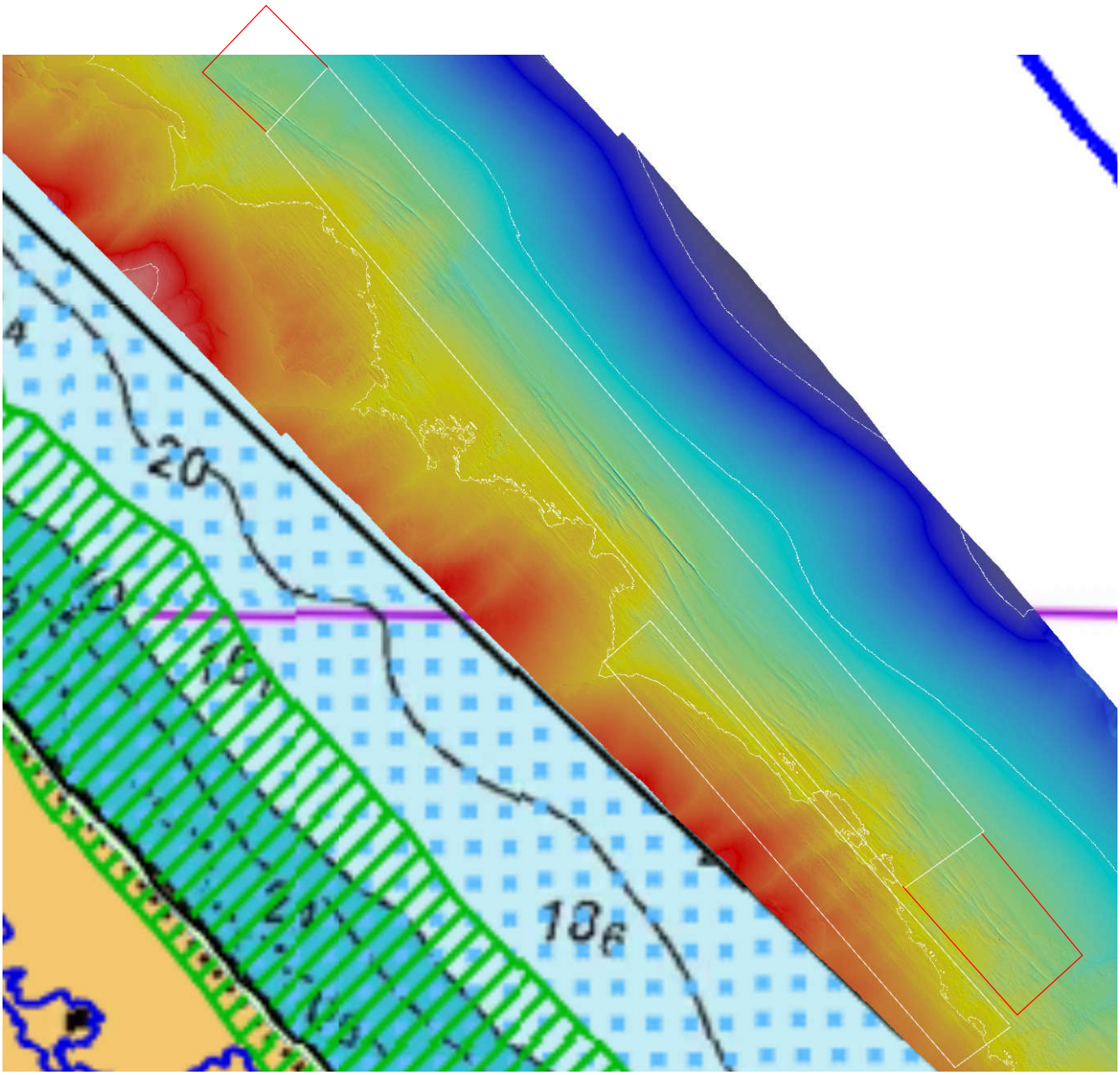

Figure 3. The DML indicates that the 'Swales Exclusion Area' does not incorporate the deep swales to the north and south of the offshore exclusion area. Potential extensions of the exclusion zone to incorporate the deep swales are shown in red.

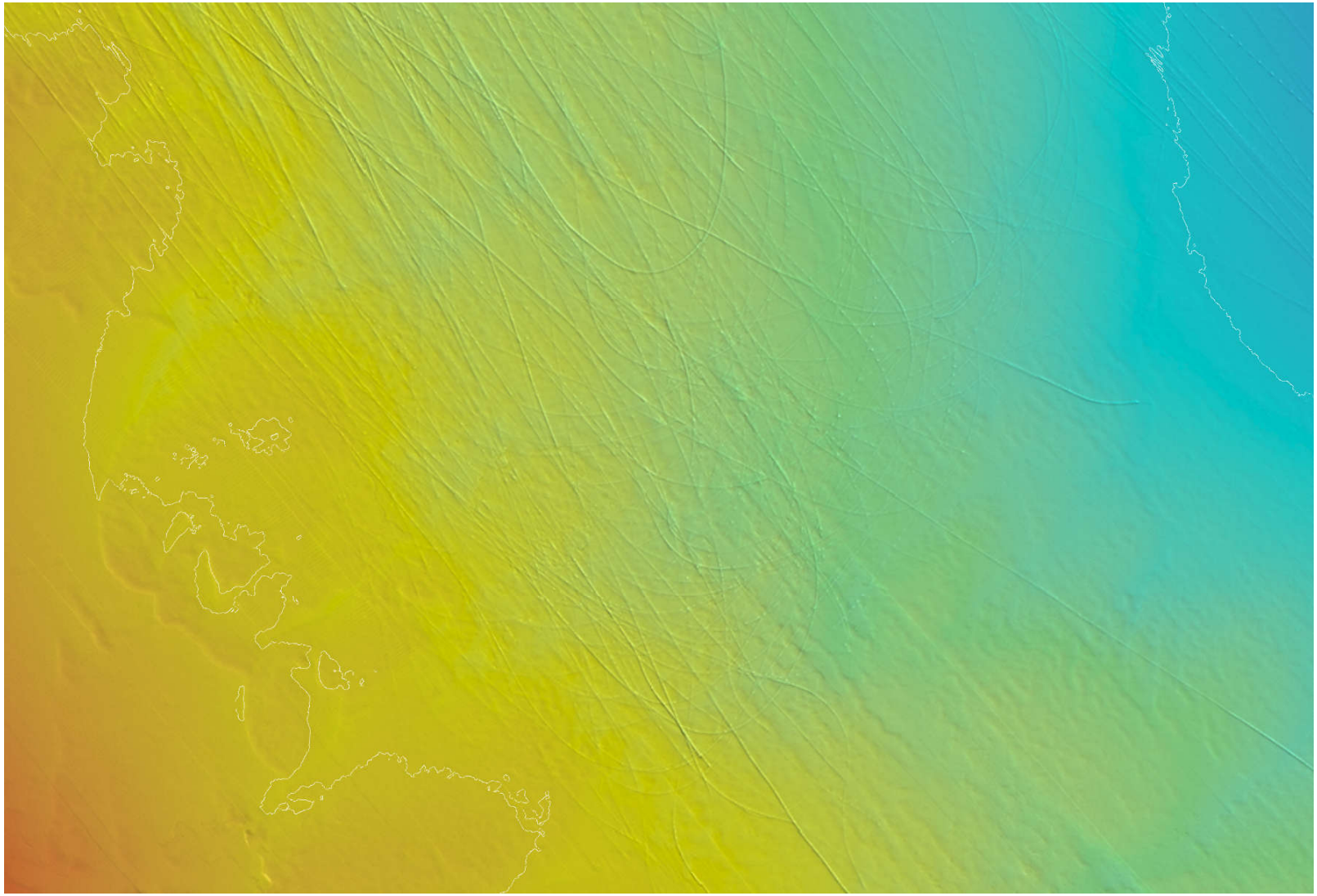

Figure 4. The DML survey results present multiple ‘turning circles’ that have been continuously dredged (i.e., 180° turns without lifting the dredge-head) north of the ‘Swales Exclusion Area’ which have diameters of 150-200 m.

Figure 5. Pakiri Beach before (top) and after (bottom) the series of storm events through May 2021. The green marker in the upper image constituting the edge of the scarp/cliff in the lower photo.