BEFORE THE EPA

COASTAL RESOURCES LIMITED MARINE CONSENT APPLICATION

IN THE MATTER	of the Exclusive Economic Zone and continental Shelf (Environmental Effects) Act 2012
AND	
IN THE MATTER	of a decision-making committee appointed to consider a Marine consent application made by Coastal Resources Limited to Dispose of Dredged Material at the Northern Disposal Site.

STATEMENT OF EXPERT EVIDENCE OF SIMON WEST ON MARINE ECOLOGY ON BEHALF OF COASTAL RESOURCES LIMITED

DATED 25 OCTOBER 2018

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1. EXECUTIVE SUMMARY

1.1 The Northern Disposal Area sits within the continental shelf, which extends out to 60 km east from Great Barrier Island. Sea floor relief of the shelf is relatively uniform, except for small areas of basement outcrop and isolated rock pinnacles, which occur 16 km south and 20 km north west of the disposal area according the marina chart. The Northern Disposal Area ranges in depth from approximately 130 m to 140 m and is characterised by sandy muddy sediments. Within the Northern Disposal Area, the seabed contains biota (benthic biota) that live within and on the surface of the sediment. In the water column above, there are likely to be fish and marine mammals that are transient, i.e. not present all the time and able to move in and out of the disposal area. In addition, seabirds may interact with the surface waters of the Northern Disposal Area.

1.2 The disposal area is typical of large areas of the continental shelf in region of New Zealand. Studies to date have shown that the disposal area does not contain any known vulnerable ecosystems or habitats of threatened benthic species.

1.3 Biodiversity within and beyond the disposal area has not been impacted by the disposal activity to date. No sensitive species or ecosystems have been encountered in the disposal area or are expected to occur in the nearby environment.

1.4 Conditions are in place to limit the acceptable quality of sediment disposed to that of better quality than ANZECC ISQG-Low, hence contaminated sediments will not be accepted.

1.5 Disposal of marine sediments at the Northern Disposal Area will result in temporary increased turbidity via increased suspended solids at the disposal point and time. The disposal of marine sediments at the Northern Disposal Area is not expected to have significant adverse effects to aquatic life beyond the Northern Disposal Area boundary, and only short term intermittent limited local effects within 800m of the disposal point.

1.6 Disposal of marine sediments at the Northern Disposal Area will result in the build-up of a mound of sediments on the seabed. The geographical extent and thickness of mound will vary over time, as more sediment is disposed. The

disposal of sediments will bury benthic biota, however biota are expected to recolonise the surface sediments.

1.7 The relatively low concentrations and short term duration of plumes as predicted in the Northern Disposal Area are not expected to result in significant effects to fish within and beyond the Northern Disposal Area boundary.

1.8 While threatened seabirds may be present within the Northern Disposal Area on occasion, the disposal of marine sediments at the Northern Disposal Area is not expected to adversely affect any seabirds at population level.

2. QUALIFICATIONS AND EXPERIENCE

2.1 My full name is Simon Andrew West

2.2 I am an Associate with Babbage Consultants Limited, employed as a senior marine ecologist of Bioresearches (a Babbage company), specialising in benthic ecology of intertidal to continental shelf environments. I have a Bachelor of Science with Majors in both Biology and Earth Science from the University of Waikato, and a Master of Science with Honours in Zoology from the University of Auckland (1991). I have been in private practice for 27 years.

2.3 During that time, I have undertaken ecological assessments in a wide range of habitats throughout New Zealand (Whangarei to Tiwai near Bluff) in a variety of habitat types (continental shelf and coastal subtidal and intertidal areas to north island rivers lowland forests). For the past 27 years, my principal area of responsibility regarding field assessments has been the marine ecology aspects of various development proposals and ongoing monitoring of effects, including appearing as an expert witness for Council and Environment Court Hearings, and Environment Court mediation.

2.4 Bioresearches has been engaged by Coastal Resources Limited since 2010. I have conducted seabed sampling as part of the required monitoring for Deemed Marine Consent EEZ900012. I have designed and conducted source site characterisation investigations to determine the sediment quality and biota present at six sources sites that have been disposed at the disposal area under EEZ900012.

2.5 I advise that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and to the extent that I am giving

expert evidence, have complied with it in preparing this evidence. I confirm that the issues addressed in this evidence are within my area of expertise and I have not omitted material facts known to me that might alter or detract from my evidence. Other than when I state I am relying on the advice of any other person, this evidence is entirely within my area of expertise.

3. SCOPE OF EVIDENCE

3.1 I have been asked to provide evidence in relation to the effects on marine ecology from the disposal of marine sediments at the Northern Disposal Area.

3.2 I am the author of the Bioresearches report (18 May 2018) *Northern Disposal Area – Assessment of Source Material, Ecological and Sediment Quality Effects Assessment of Disposal* which was included in the application. The contents of that report forms part of my evidence, and should be read alongside this statement.

3.3 My evidence will cover the following matters

a) Ecological description of the Northern Disposal Area

b) Effects on Water Quality

c) Effects on Benthic Biota at the Northern Disposal area

d) Effects on Fin Fish

e) Effects on Seabirds

f) Cumulative effects

g) Effects of unplanned events enroute

h) Characterisation of sediment and biota undertaken on material to be disposed at the Northern Disposal Area.

i) Comments on the EPA key issues report

j) Comments on MPI additional information reports

k) Comments on submissions

3.4 In preparing this evidence, I have reviewed:

a) The Application and the supporting Impact Assessment;

b) The EPA's Key Issues Report dated September 2018 (Key Issues Report);

c) The EPA Report on the workability of the deemed consent conditions (October 2018);

d) The responses from the Gulf Harbour Forums, Department of Conservation (DoC), Biosecurity New Zealand, Auckland Council, Waikato District Council, Fisheries New Zealand (FNZ) and MNZ to requests for advice from the Committee under s56 of the EEZ Act.

e) The submissions on the Application;

f) The further information request letter to CRL from the EPA; and

g) The evidence of other Coastal Resources Ltd witnesses

4. ECOLOGICAL DESCRIPTION OF THE NORTHERN DISPOSAL AREA

4.1 The NDA sits within the continental shelf, which extends out to 60 km east from Great Barrier Island. Sea floor relief of the shelf is relatively uniform, except for small areas of basement outcrop and isolated rock pinnacles, which occur 16 km south and 20 km north west of the disposal area according to marine charts. The NDA ranges in depth from approximately 130 m to 140 m and is characterised by sandy muddy sediments. Within the NDA, the seabed contains biota (benthic biota) that live within and on the surface of the sediment. In the water column above, there are likely to be fish and marine mammals that are transient, i.e. not present all the time and able to move in and out of the disposal area. In addition, seabirds may interact with the surface waters of the NDA.

Benthic biota

4.2 Given the remote location, no known studies other than those associated with the disposal applications have been conducted. Between June 2009 and March 2018, a total of 152 samples have been collected from the seabed in and around the Northern Disposal Area. These have recorded over 130 taxa including foraminifera, polychaete worms, nemerteans, platyhelminthes, sipunculid worms, molluscs, amphipods, isopods, decapods, cumaceans, mysids,

ostracods, tanaids anthozoa, ophiuroids, echinoids, sponges and ascidians. The biota is generally numerically dominated by foraminifera.

Marine mammals

4.3 The continental shelf in region east of Great Barrier Island is used by a number of whale species including Bryde's whale, Humpback whale, Fin whale and Blue whale. Of these species only the Bryde's whale is present year round. The other species are only seasonal as they pass through the area on migration to and from breeding grounds. The evidence of Mr Childerhouse provides more details on the species likely to be occasionally present with in the Northern Disposal Area.

Fin Fish.

4.4 Despite the lack of specific data on the composition and abundance of fishes present in the disposal area, pelagic fish are expected to use the area.

Birds

4.5 The Northern Disposal Area has been identified in the habitat range of some 34 species of seabird (Table 1). The majority of these birds only interact with the top few metres of the water column. Penguins are the only species capable of diving to depths greater than 30m.

4.6 On the continental shelf in this region, it has been reported (NIWA's marine database) that Scleractinia (solitary stony coral) may be present. Scleractinia corals are typically found in water depths greater than 200 m, often associated more with elevated features such as seamounts or ridges. Despite this a few species have habitat ranges that could occur in the NDA. However Scleractinia either alive or dead have not been recorded in the study area as part of either the predisposal studies (2009 to 2010) or the post disposal monitoring studies (2013 to 2018).

Table 1 List of pelagic birds, likely to utilise the inner continental shelf area east of Great Barrier Island and their current conservation status

COMMON NAME	SCIENTIFIC NAME	NEW ZEALAND CONSERVATION STATUS	WORLD POPULATION	BREEDING
Black petrel	*Procellaria parkinsoni*	THREATENED; nationally vulnerable; range restricted	38,000 individuals (nzbirdsonline)	yes GBI & LB
Caspian tern	*Hydroprogne caspia*	THREATENED; nationally vulnerable; secure overseas; sparse	24,000 - 30,000 breeding adults (NZ only)	yes
Flesh-footed shearwater	*Ardenna carneipes*	THREATENED; nationally vulnerable; range restricted; threatened overseas	148,000 breeding adults	no
Grey-backed storm petrel	*Garrodia nereis*	THREATENED; nationally vulnerable; conservation dependent; one location	200,000 individuals	
NZ storm petrel	*Fregetta maoriana*	THREATENED; nationally vulnerable; conservation dependent; one location	unknown (100's if not 1000's - nzbirdsonline)	yes LB
Antarctic prion	*Pachyptila desolata*	AT RISK; naturally uncommon; range restricted; secure overseas	50,000,000 individuals	no
Black shag	*Phalacrocorax carbo novaehollandiae*	AT RISK; naturally uncommon; secure overseas; sparse	10,000 - 20,000 breeding adults (NZ only)	yes
Broad-billed prion	*Pachyptila vittata*	AT RISK; relict; range restricted; secure overseas	15,000,000 individuals	no
Bullers shearwater	*Ardenna bulleri*	AT RISK; naturally uncommon; one location; stable	2,000,000 individuals	
Cooks petrel	*Pterodroma cookii*	AT RISK; relict; increasing; range restricted	670,000 mature individuals	
Fluttering shearwater	*Puffinus gavia*	AT RISK; relict; range restricted	100,000 individuals	yes GBI & LB
Grey petrel	*Procellaria cinerea*	AT RISK; naturally uncommon; range restricted; secure overseas	160,000 breeding adults	
Little penguin	*Eudyptula minor iredalei*	AT RISK; data poor	469,760 breeding adults	yes GBI & LB
Mottled petrel	*Pterodroma inexpectata*	AT RISK; relict; increasing; range restricted	min. 640,000 breeding adults	no
North Island little shearwater	*Puffinus assimilis haurakiensis*	AT RISK; recovering; conservation dependent; range restricted	20,000 breeding adults	no
Northern diving petrel	*Pelecanoides urinatrix urinatrix*	AT RISK; relict; increasing; range restricted; secure overseas	16,000,000 individuals	yes LB
Northern giant petrel	*Macronectes halli*	AT RISK; recovering; range restricted; secure overseas	23,600 breeding adults	no
NZ white-faced storm petrel	*Pelagodroma marina*	AT RISK; relict; range restricted	min.1,720,000 breeding adults	no
Pied shag	*Phalacrocorax varius varius*	AT RISK; recovering	2,000 - 10,000 breeding adults (NZ only)	yes
Pycrofts petrel	*Pterodroma pycrofti*	AT RISK; recovering; conservation dependent; range restricted	30,000 - 40,000 individuals	yes GBI & LB
Red-billed gull	*Larus novaehollandiae scopulinus*	AT RISK; declining	1000's in NZ	yes
Sooty shearwater	*Ardenna griseus*	AT RISK; secure overseas	min. 20,000,000 individuals	
White-fronted tern	*Sterna striata*	AT RISK; data poor		yes
Arctic skua	*Stercorarius parasiticus*	MIGRANT; secure overseas	400,000 - 560,000 breeding adults	
Australasian gannet	*Morus serrator*	NOT THREATENED; range restricted; secure overseas	min. 200,000 breeding adults (NZ only)	
Black-bellied storm petrel	*Fregetta tropica*	NOT THREATENED	500,000 individuals	
Black-winged petrel	*Pterodroma nigripennis*	NOT THREATENED; increasing; range restricted	8,000,000 - 10,000,000 individuals	
Cape petrel	*Daption capense capense*	NON-RESIDENT NATIVE; secure overseas	2,000,000 individuals	
Grey-faced petrel	*Pterodroma macroptera gouldi*	NOT THREATENED; increasing; range restricted	600,000 - 900,000 individuals	
Little shag	*Phalacrocorax melanoleucos brevirostris*	NOT THREATENED	10,000 - 14,000 breeding adults (NZ only)	
Short-tailed shearwater	*Ardenna tenuirostris*	MIGRANT; most numerous shearwater in world context	min. 23,000,000 individuals	
Southern black-backed gull	*Larus dominicanus dominicanus*	NOT THREATENED	1000's in NZ	
Thin-billed prion	*Pachyptila belcheri*	MIGRANT; secure overseas	7,000,000 individuals	
White-headed petrel	*Pterodroma lessonii*	NOT THREATENED; range resticted; secure overseas	600,000 individuals	

4.7 The disposal area is typical of large areas of the continental shelf in region of New Zealand. Studies to date have shown that the disposal area does not contain any known vulnerable ecosystems or habitats of threatened benthic species. Despite some species such as seabirds, whales and dolphins being classed as threatened, they are not considered to be affected by the disposition of material on the seabed, but are likely to avoid the disposal activity for the very short periods of the disposal events. The area is not known to be used for breeding activity by marine mammals.

4.8 Biodiversity within and beyond the disposal area has not been impacted by the disposal activity to date. No sensitive species or ecosystems have been encountered in the disposal area or are expected to occur in the nearby environment.

5. EFFECTS ON WATER QUALITY

5.1 Disposal of marine sediments at the Northern Disposal Area will result in temporary increased turbidity via increased suspended solids at the disposal point and time. Limited water quality testing of the plumes was conducted by Flaim 2012, these showed visual plumes (i.e. concentrations <15mg/L) of increased suspended solids at the surface did not cross the Northern Disposal Area boundary. Modelling conducted by BECA 2018 has confirmed this, however the modelling shows some subsurface plumes of elevated suspended solids may cross the Northern Disposal Area boundary. The geographic extent and duration of this presented in the evidence of Mr Andrews.

5.2 The BECA 2018 modelling suggests that peak concentrations of suspended solids are highest in the upper mid water soon after disposal, but rapidly decreased by 3 hours after disposal to be less than 20mg/L with average concentrations of less than 2mg/L all within the Northern Disposal Area boundary.

5.3 Neither the ANZECC 2000 guidelines nor the updated 2018 guidelines list a guideline value for suspended solids in marine environments for New Zealand. The Canadian Environmental Quality Guidelines 2002, list a maximum increase of 25mg/L from background concentrations for short term (<24hr) exposure, and a maximum average increase of 5mg/L above background concentrations for long term exposure for the protection of aquatic life in clear flow aquatic environments. Background suspended solids concentrations in the Northern

Disposal Area are less than 5mg/L. Based on the modelling and the Canadian guidelines it is expected that suspended solids concentrations will exceed the short term guideline levels for less than 3 hours after each disposal event in a very confined plume out to distances of less than 800m from the disposal point. The BECA 2018 modelling also predicts the long term average suspended solids concentrations would not exceed 0.03mg/L above background at the Northern Disposal Area boundary.

5.4 Therefore the disposal of marine sediments at the Northern Disposal Area is not expected to have significant adverse effects on water quality beyond the Northern Disposal Area boundary, and only short term intermittent limited local effects within 800m of the disposal point.

5.5 In addition to increased suspended solids concentrations there is the potential for the disposal sediment to release contaminants bound within the sediment to the receiving environment water as they are released, mix and travel to the seabed.

5.6 The level 3 elutriation testing of relevant source site sediments prior to disposal (which is discussed in section 11 of my evidence, below), is aimed at eliminating the possibility of disposing material that is likely to release contaminants to the receiving water.

5.7 Further, the risk of such release is low. Based on the source site material characterised to date under EEZ900012, the metallic contaminants have been largely bound to the sediment. Those sediments that have shown some possible release of contaminants have not released contaminants at concentrations high enough to exceed water quality criteria once a conservative initial dilution of 10 times has been allowed for. Once the water travels further from the disposal point significant further dilution will occur.

5.8 Following disposal and deposition on the seafloor, dredged materials that are contaminated or even slightly contaminated with various heavy metals, pesticides, polychlorinated biphenyls, and petroleum hydrocarbons, there is a potential these sediments could still leach contaminants from the spoil mound. Significant leaching requires a pore water pressure (a pressure gradient from the spoil mound to the overlying surface water). Typically, a distinctive pressure gradient is only established when the mound is very large and solid.

6. EFFECTS ON BENTHIC BIOTA AT THE NORTHERN DISPOSAL AREA

6.1 Benthic biota is that which is living on or within the seabed sediments. Disposal of marine sediments at the Northern Disposal Area will result in the build-up of a mound of sediments on the seabed. The geographical extent and thickness of mound will vary over time, as more sediment is disposed.

6.2 The biota of the seabed naturally grows; reproduces and juveniles are recruited to the population over time. Frequent disturbance of the seabed by sediment disposal can interrupt this natural process, however if the gaps between disturbance are sufficient then recolonization can begin to occur in areas previously disturbed. Thus the abundance and composition of biota on and in the seabed is in a state of equilibrium, which can be altered by changes in the environment.

6.3 The initial impact on the biota living on the seabed will be via burial or smothering. The thickness or more precisely the rate of burial and frequency of events will affect different species to different levels. Some species are more tolerant than others to how much sediment burial they can move up through the newly deposited sediment, so in such disposal areas it is expected that the species composition will change.

6.4 In addition, the sediment chemistry and particle size will vary slightly from that naturally present. Some biota species are more sensitive than others to changes in sediment particle sizes, and may have narrow defined preferences while others are less specific, in that they can live in a wide range of conditions but prefer a certain set of conditions. Similarly some biota species are less tolerant of increases in specific contaminant concentrations than other biota species. Thus changes in sediment particle sizes and or sediment contaminant concentrations can result in changes in species composition and abundance.

6.5 The monitoring of the benthic biota at the Northern Disposal Area under EEZ900012 has shown benthic fauna at the disposal centre site have been affected by the disposal operations, with significant mortality of individuals inhabiting the sediments, most likely as a result of smothering and insufficient recolonization time between successive disposal events. Likewise, the individuals inhabiting the dredged sediments have not survived at the disposal site, most likely due to the change in depth and physical disturbance of dredging

and then being buried in the barge of dredge material with limited water space if any, not to mention being buried again by the next disposal event.

6.6 The current geographical extent of the high mortality zone is not known, but was limited to less than 500m from the disposal central site following disposal of 150,000m^3 as significant decreases in abundance of biota were not detected at the 500m sampling sites. Based on the information available from seabed cores and bathymetric studies, the footprint of the disposal mound is elongated west to east, and located within approximately 375m east and west of the disposal area centre and 250m north and south. This disposal mound likely corresponds to the area of reduced species composition and abundance, with the reductions likely peaking at the centre and reducing towards the edges.

6.7 The patterns in the abundance and composition of the benthic biota data following the disposal of 150,000m^3, were subjected to multiple dimensional scaling analysis. Three dimensional plots (Figure 6.1) of the averaged results showed that the disposal centre site was most different from the other sites, while the control sites were not separated from the 500m or 1500m sites. In addition it could be seen that the composition and abundance was similar in sites from a particular direction from the disposal centre site. However when 3D plot is viewed from a different angle (Figure 6.2) it can be seen that sites at different distances (500m and 1500m) from the disposal centre site were separated. Combine this with the lack of a separation between the distances for the pre disposal data. My interpretation of the 150,000m^3 data is that sites closer to the disposal centre have begun to show evidence of stress most likely from sediment disposal, yet those at 1500m have not shown any variation from those at the control site.

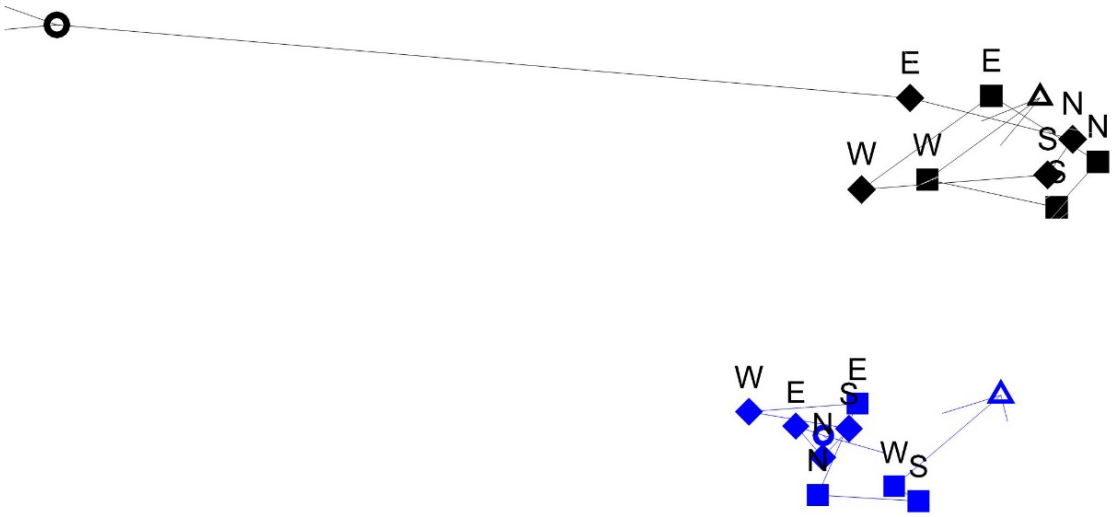

Figure 6.1 **MDS plot of site averaged area standardised benthic biota data for the pre disposal and 150,000 m^3 post disposal.** (○ DC, ◆ 500 m, ■ 1500 m, △ Control, ● pilot, ● 150k)

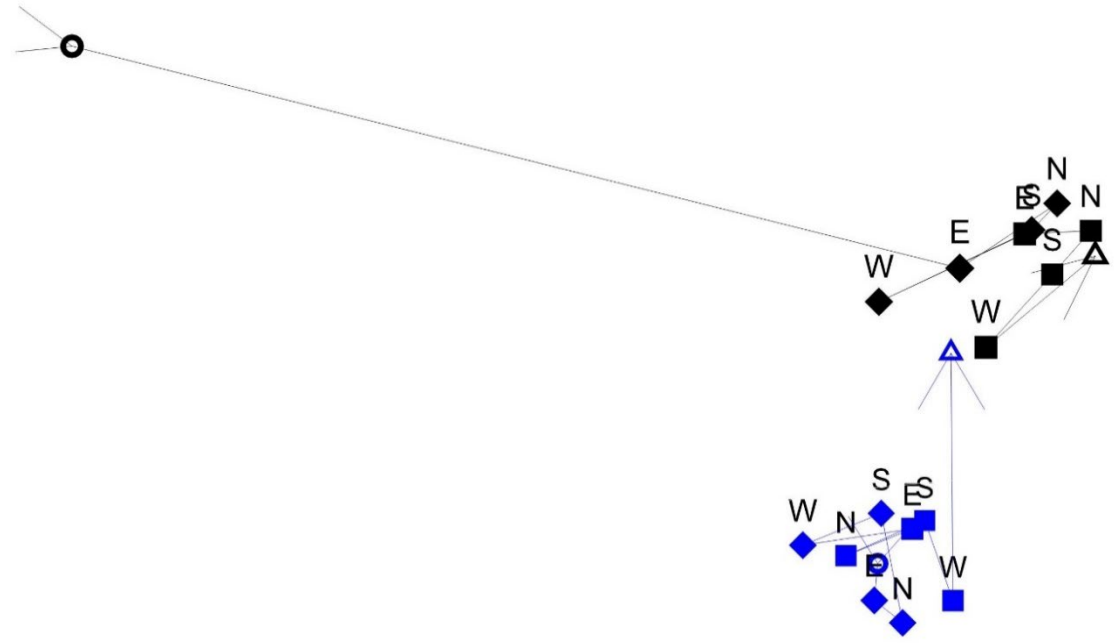

Figure 6.2 **MDS plot of site averaged area standardised benthic biota data for the pre disposal and 150,000 m^3 post disposal.** (○ DC, ◆ 500 m, ■ 1500 m, △ Control, ● pilot, ● 150k)

6.8 The presence of disposal material was not visually detectable at the 500m sites, as shown by the core samples collected. When the sediment particle sizes and contaminant concentrations data were subjected to multiple dimensional scaling analysis (Figure 6.3), again the disposal centre site was the most different from

the other sites. Correlation analysis showed this was largely due to increased sand, and concentrations of arsenic, copper, lead, mercury and zinc. The 500m, 1500m and control sites were not well separated all showing some overlaps.

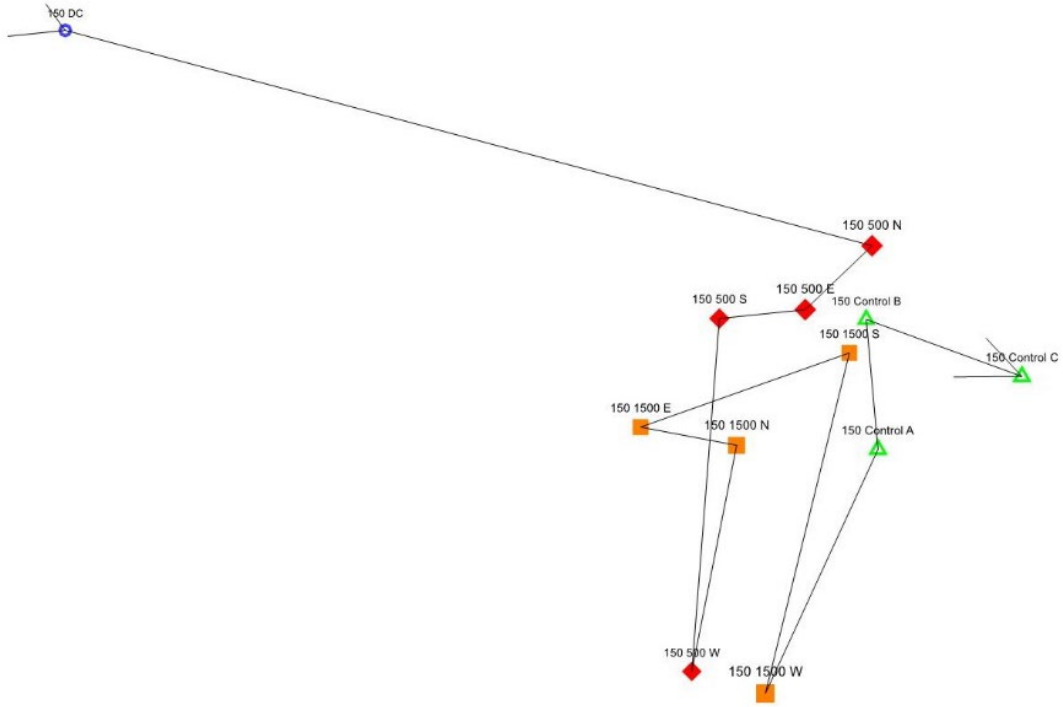

Figure 6.3 MDS plot of normalised environmental data for the 150,000 m^3 post disposal. (○ DC, ◆ 500 m, ■ 1500 m, △ Control)

6.9 Monitoring of sediment quality and benthic biota under EEZ900012 has provided evidence that adverse effects as proscribed by the proposed condition 5c have not been not been triggered. Based on the monitoring data to date we understand that

a) The majority of sediment settles on the sea bed very close to the location it was disposed, with relatively little traveling further afield as shown in evidence by Mr Andrews

b) The location and extent of mound material can be detected by sediment cores,

c) The adverse effects to biota have not been observed beyond the mound,

6.10 The continued use of the NDA and monitoring as set out in the proposed conditions will allow detection of expansion of the mound, and thus the likely

geographic limits of effects to biota, and the proposed condition 5c will determine if adverse effects to biota occur at the boundary.

7. EFFECTS ON FIN FISH

7.1 The increased suspended solids in temporary plumes following disposal have the potential for the following effects on fishes:

a) behavioral effects, such as inability to see prey or feed normally;

b) physiological effects, such as gill clogging; and

c) effects due to sediment deposition, such as burial and suffocation of eggs and larvae.

Physiological effects of increased suspended solids can result in impaired growth, histological changes to gill tissue, alterations in blood chemistry, and an overall decrease in health and resistance to parasitism and disease.

7.2 The relatively low concentrations and short term duration of plumes as predicted in the Northern Disposal Area are not expected to result in significant effects to fish within and beyond the Northern Disposal Area boundary.

8. EFFECTS ON SEABIRDS

8.1 The Northern Disposal Area and Hauraki Gulf are within a wider area proposed as a New Zealand Pelagic Important Bird Area. The Northern Disposal Area is in proximity to known seabird breeding colonies on Little Barrier Island, Great Barrier Island and Cuvier Island.

8.2 Of the 34 species listed in Table 1 the Black petrel is the species of greatest potential concern. In summary:

a) It has a relatively low world population.

b) It is a threatened, endemic species (range restricted)

c) Great Barrier Island is the most significant world breeding colony.

d) It is the species most at risk of population decline as a result of incidental captures in commercial fisheries within NZ waters.

e) It is known to feed at night; 84% of dives were during the day but 16% at night, however adults during chick rearing feed further offshore on the edge of the continental shelf in water 600 -1000m deep.

f) The risk of attraction to lights of a small tug & barge is low relative to that from large ships and no greater than the risk of attraction to land-based lights on Great Barrier Island.

8.3 The sediment disposal at Northern Disposal Area will not result in the following issues that are relevant to coastal and pelagic birds

a) There will be no permanent loss of feeding habitat.

b) No nesting habitat will be adversely affected.

8.4 The following potential adverse effects associated with the disposal of sediments at the Northern Disposal Area were considered for marine avifauna species:

a) Indirect effects of impacts on benthic and fish communities (and therefore food supply);

b) Indirect effect on foraging ability due to increased water turbidity associated with the disposal of sediments;

c) Both direct and indirect effects associated with contaminants.

d) Increase in vessel movements

e) Vessel lighting

f) Underwater noise

g) Cumulative effects

8.5 The soft sediment habitat and communities of the Northern Disposal Area are considered to be typical of much larger areas of seabed in similar water depths on the inner continental shelf east of Great Barrier Island. Hence the temporary loss and/or alteration of habitat within the Northern Disposal Area are not considered to be significant with respect to the marine ecology of the wider area. The dominant taxa of these communities are furthermore considered to be capable of relatively rapid recolonisation and re-establishment due to their relatively short life spans.

8.6 Given the predicted levels of suspended sediment concentration within mid-water and surface layers, the restricted location of these plumes, combined with the highly mobile nature of the marine avifauna species and their large foraging ranges, any effects on the foraging ability of those species which forage in the top 10 m of the water column will be short-term and negligible.

8.7 Based on sampling of contaminants from the source sites and the limitation of disposed sediments not exceeding the ANZECC ISQG-Low trigger values sediment disposed at the Northern Disposal Area will have generally low levels of trace metals and other contaminants.

8.8 Any loss of fuel or other materials from the vessels working in the Northern Disposal Area or en route via the Hauraki Gulf has the potential to adversely affect marine avifauna. However, this potential risk already exists for any vessel operating within the Hauraki Gulf and wider area. The proposed vessel usage creates no greater risk than other vessels utilising the area.

8.9 Light is well known to attract a variety of marine birds. The adverse attraction to vessel lights by seabirds is considered to be more likely in those areas more remote from land and other light sources. On balance the general risk of light attraction and collision with the disposal barge would be similar or less to that of any other large vessel and would not be significant on a population level but would increase during the post-fledging period.

8.10 The proposed condition 24(i) has been added to reduce the likelihood of seabirds being attracted to the disposal vessels, and thus reduce potential effects to nocturnal seabirds.

8.11 The probability of a noise-induced adverse effect on swimming and diving birds is considered negligible.

8.12 On balance it is concluded that the cumulative effects (i.e. general combined overall disruption) on coastal and pelagic birds and their habitats will be less than minor, especially in the context of the proposed conditions and activities.

9. CUMULATIVE EFFECTS

9.1 Since filing the present application there has been further monitoring of the Northern Disposal Area under EEZ900012 (and reporting to the EPA), as the total cumulative disposal under that consent reached 200,000 m^3. The data reported post 200,000 m^3 shows no greater effects than the data following 150,000 m^3, which was reported in the application.

9.2 Increasing the rate of disposal through more regular disposal events has the potential to increase stress to biota either on the seabed or in the water column.

While the in water effects are predicted to be sub lethal to fish, mammals and seabirds the increased frequency of events will add stress to these biota.

9.3 The increased volume and frequency of disposal events will result in a faster growth of the mound footprint. However with a greater frequency of disposal events it is likely that the area of greatest effect to benthic biota will be larger than that if a slower rate of disposal was to occur. The reasoning behind this is that the biota will constantly be attempting to recolonise the sea bed affected by disposal, the biota will be able to survive an unknown level of burial at an unknown frequency, hence an equilibrium is expected to establish at a distance from the disposal point based on volume and frequency. Hence if the volume and frequency of disposal is increased then it is expected the equilibrium distance will increase.

9.4 Water quality effects have been estimated by Mr Andrews based on the barges currently in operation however it is always possible for new vessels to be used. Variations in initial dilution (that which occurs in the first four hours) will depend on barge volume and dimensions. It is likely that events further apart than one hour are unlike to interact as the water body into which disposal occurs will have moved by the time of the next disposal event.

10. EFFECTS OF UNPLANNED EVENTS EN ROUTE

10.1 The likelihood of unplanned spillage enroute is not within my expertise, and I rely on Mr Male's evidence about the two emergency disposals that have occurred en route out of 545 successful disposal trips, and Mr Hay's assessment. On the basis that the risk is unavoidable but very low, I do not consider it has a bearing on the overall ecological effects of the proposal, and nor could anything be done to further lessen the risk of a spill, or manage any effects that could arise.

11. CHARACTERISATION OF SEDIMENT AND BIOTA UNDERTAKEN ON MATERIAL TO BE DISPOSED AT THE NORTHERN DISPOSAL AREA.

11.1 CRL's current Deemed Marine Consent EEZ900012 requires a series of assessments to be completed prior to disposal of dredged material. The first and foremost of these is, is disposal at sea the best option, or are there other practical options such as reclamation/land based disposal? Once disposal at sea has been determined as the best option then the quality of the sediment at the source to be disposed is required to be characterised, as is the presence of

biota that could pose a risk of adverse effects if disposed at the Northern Disposal Area. Under EEZ900012 such characterisation was required to be submitted to the EPA (and, formerly, MNZ) and approved, prior to any disposal.

11.2 The application as lodged recommended conditions of consent in similar terms. Since then refinements have been made to the recommended conditions in response to the prohibition on adaptive management conditions for marine dumping consents. In particular, the focus of the conditions is no longer on sediment characterisation of source sites as the appropriate mechanism to control environmental outcomes. Rather the conditions focus on setting controls at the NDA, involving strict limits on sediment quality in the disposal area following disposal. Characterisation of source sites remains best practice, and will continue to be undertaken as part of the methodology to achieve compliance with the limits at the NDA; and the proposed conditions still require characterisation to be provided to the EPA. But the proposed conditions no longer incorporate a requirement for the EPA to approve source sites. The provision of characterisation reports will ensure the EPA continues to have the best available information on source sites, but the focus for compliance will be the strict sediment quality limts at the NDA following disposal.

11.3 I consider the controls on EEZ900012 were appropriate to manage ecological effects of dumping under that consent, and I consider similar controls on the present proposal would have been equally appropriate. I have been guided by legal and planning advice on the need to avoid conditions that are or may contribute to an adaptive management approach. I understand the conditions as now proposed will achieve that requirement, and I fully support them. I consider they too will apporpriately manage all ecological effects of the proposed disposal of dredged sediment at the NDA.

11.4 The following outlines the steps of these characterisations, which are also included as Schedules 3 and 4 in the draft conditions presented in the evidence of Mr Hay.

Sediment Quality Characterisation

11.5 Characterisation of the sediment quality at a source site generally follows a series of three levels of assessment, which is consistent with international best practice, upon which the New Zealand Guidelines for Sea Disposal of Waste 1999 were based.

11.6 Characterisation for the purposes of this proposal has been further refined to prescribe that levels 1 and 2 are mandatory in relation to an identified list of "Primary Contaminants". These are the contaminants listed in Schedule 2 of the recommended conditions of consent as appended to Mr Hay's evidence.

11.7 It would be prohibitively onerous to test for every possible contaminant, and unnecessary in my view when the contaminants most likely to be present, or most likely to give rise to a potential ecological impact, can be identified. Accordingly, I have compiled the list of Primary Contaminants to include the contaminants most likely to be present within dredged material to warrant testing. The heavy metals (e.g. copper, lead, mercury, zinc) and metalloids (e.g. arsenic) are among the most common and widespread pollutants in New Zealand. They are present in most contaminated sediments, sometimes at very high levels.

11.8 The characterisation will in any event be required to identify in a level 1 investigation the potential for Other Contaminants to be present, and if such potential is identified, those Other Contaminants will be subject to a level 2 investigation.

11.9 **A level 1 investigation** reviews the existing information on the dredge material, in the manner described in Schedule 3 of the draft conditions. In addition to establishing what existing data is available, this enables consideration to be given to any contaminants other than the Primary Contaminants that have the potential to be present, and therefore warrant level 2 investigation.

11.10 **A level 2 investigation** requires a comprehensive physical and chemical characterisation based on samples of the dredge material concerned. The sampling methodology is described in Schedule 3 of the draft conditions. Particular directions are given for sampling for Primary Contaminants.

11.11 Detection limits should be sufficient to allow comparison with the ANZECC ISQG-Low trigger values, or any future updated values.

11.12 To limit ecological effects at the disposal site I consider that an appropriate control would be to limit sediment concentrations at the disposal site to the ANZECC ISQG-Low trigger values for all of the Primary Contaminants. To ensure this is achieved, the characterisation methodology in Schedule 3 of the proposed conditions incorporates a requirement not to dispose of material from

any source site where the volumetric mean concentrations for a Primary Contaminant is above the ANZECC ISQG-Low.

11.13 In addition, there are well established water quality standards in relation to some of the Primary Contaminants, namely arsenic, cadmium, chromium, copper, lead, mercury, nickel or zinc. Therefore, if any of those are detected in one or more level 2 investigation samples at concentrations above the ANZECC ISQG-Low trigger values, then dredge material will require a level 3 investigation.

11.14 **A level 3 investigation** involves elutriate testing, which determines whether contaminants present in the dredge material are mobile and will transfer to the water during dredging or disposal. The results of elutriate testing are to be compared to the established water quality criteria (ANZECC and USEPA, as specified in Schedule 3 to the draft conditions) after the application of an appropriate initial dilution factor. Initial dilution is defined as that which occurs within four hours after dumping.

11.15 If results from elutriate testing exceed the relevant water quality criteria after initial dilution, then the material is not suitable for disposal at the NDA.

Biological Characterisation

11.16 Introduced (non-indigenous) plants and animals are recognised as one of the most serious threats to the natural ecology of biological systems worldwide. The numbers, identity, distribution and impacts of non-indigenous species (NIS) in New Zealand's marine environments are relatively poorly known and changing as new species arrive.

11.17 That said, as covered earlier in my evidence, and in particular in relation to the assessments provided by MPI, there is limited biosecurity risk associated with the proposal. There is no assessed likelihood that the current invasive species present at assessed source sites could establish at the Northern Disposal Area, nor that they could disperse from the Northern Disposal Area back to the coastal environment. The most likely path for possible spread of invasive species is from hull biofouling, which can be managed (in accordance with MPI's recommendations) through conditions imposing clean hull standards.

11.18 Further, biological characterisation for all source sites is proposed, and I have prepared a methodology for this based on best practice, which is included in Schedule 4 of the draft conditions of consent attached to Mr Hay's evidence. A condition is also proposed that will require such characterisation to be provided

both to the EPA and to MPI prior to disposal of any material from the relevant site. This will ensure any risk from new or unforeseen species can be managed as appropriate by MPI under the Biosecurity Act if necessary.

12. COMMENTS ON THE EPA KEY ISSUES REPORT

12.1 Key issue 53 makes note that "Contaminant levels at the source sites have on occasion breached the ANZECC ISQG- Low (ISQG-Low) threshold." The compliance focus under the proposed conditions is on achieving the ISQG-Low values for all known contaminants of potential concern *at the Northern Disposal Area*. Source site characterisation is one of the tools to achieve that, but the characterisation (as refined in Schedule 3 of the proposed conditions attached to Mr Hay's evidence) seeks to define the *average* concentrations of contaminants from multiple sample locations, representative of the area from which material will be dredged. If the average concentration by volume is below the ANZECC ISQG-Low values, then disposal will comply with the strict limits applied at the Northern Disposal Area.

12.2 Key issue 54 "Section 2.2.2 of appendix 5 to the application, notes that past elutriate tests have shown that dredged material may release some contaminants to surrounding seawater. The levels observed were not noted in the application. To date, analysis of water quality has not been carried out at the NDA." I agree that pre dredging characterisation elutriation testing has shown some contaminants would be released into the water from the sediment as it is mixed on disposal. The raw elutriate extract data has been included in all the characterisation reports when tested.

The results of elutriate testing are to be compared to the ANZECC marine water quality criteria after the application of an appropriate dilution factor. Initial mixing is defined as that which occurs within four hours after dumping. The elutriate test uses a dilution of 1:4, which greatly overestimates water quality impacts because within a four hour period dilutions would normally be hundreds of times that, or greater still if disposal is to an open ocean site. The test data must therefore be entered into the model, if available, or multiplied by an appropriate dilution factor after four hours in order to assess whether or not the water quality criteria will be exceeded after disposal. In the absence of such a model, a conservative estimated initial dilution of 10 times was applied, and all of the elutriation concentrations were below the ANZECC marine water quality triggers, indicating no adverse effects were likely to occur.

12.3 Key issue 62 "The application further notes in section 3.6 that monitoring carried out in 2016 at the NDA for EEZ900012 did not identify dredged material beyond 375m from the geographical centre of the NDA. Prior to that monitoring event, however, only 150,000m^3 had been dumped at the site. Depending on the extent to which material was dispersed, but considering the relatively small volume (i.e. 150,000m^3), and the sampling methodology which analysed a mixed sample from the top 5cm, it may be questioned to what degree robust conclusions can be drawn on this basis, regarding the dispersal of fines within and beyond the site." The sampling for sediments at the disposal site monitoring stations followed the permit condition 6.b.ii which required the analysis to be conducted on the top 5 cm of sediment in the sediment core. I agree fine sediments which settle to the seabed beyond the identifiable mound footprint are likely to be in a thin layer in the order of 1 cm or less. Thus sampling the top 5 cm will dilute the concentration of disposal sediments with natural background sediments. However this assumes that the settled sediment stays on the seabed surface. Biota living within the surface 5 to 10 cm of sediment on the seafloor rework the sediments by burrowing, ingestion and defecation. The sediment cores from the control stations and those further from the disposal centre site show evidence that this bioturbation occurs to a depth of about 7 cm. This makes sampling a thinner layer from the surface to detect settled disposal sediments pointless as the sediment has already been mixed with natural sediments below to a depth of 7 cm.

12.4 Key issue 67 "Contaminants may be present in the dredged material. During the dumping process these contaminants may be released into the water column. The degree to which this may take place will depend on the:

a) type of contaminant present;

b) degree of disturbance to the dredged material and the contaminant's affinity for the material;

c) reactions in the receiving environment (e.g. oxygenation of anoxic material); and

d) pore water pressure of the developing mound."

I agree there are likely to be contaminants in the sediments albeit at low levels as a result of pre characterisation. The process of dumping is likely to release some contaminants, and this will be dependant on the type, degree of affinity and reactions with receiving environment, this is what the elutriation analysis in

pre characterisation is designed to estimate. Changes in pore water pressure of the mound is a different process and could occur if the force of the sediment hitting the mound is sufficient to compact the mound forcing pore water out of the mound. This is likely to be significantly less of an issue than the mixing of sediment with the receiving water on the way down to the seabed.

12.5 Key issue 68 ".. elutriate testing is only carried out where analysis of the sediment indicates that contamination exceed the ISQG-Low in the sediment. It is not given, however, that disturbance of the same sediment will not result in breach of ISQG-low for water quality, also for contaminants present in the sediment at levels below the ISQG-low. I note that due to the intermittent nature of release and further dilution of the contaminants in the environment, any adverse effect may be limited in temporal and spatial scale. Potential adverse effect posed by the release of contaminants can be further minimised by robust testing of sediment before dumping and by limiting the disposal of contaminated dredged material."

I agree that it is possible for contaminants in sediments to be released to water if the sediment contaminant concentrations are below ANZECC ISQG-Low trigger values, however it is my opinion that it is more likely that higher concentrations in the sediment will result in higher concentrations released to water. The point is moot in that to date after allowing for initial dilution the concentration of contaminants released to water has been lower than the concentrations that would result in adverse effects to biota.

12.6 Key issue 82 "Dumping at locations closer to the NDA site boundary may result in a higher accumulated volume of dispersed sediment settling outside the NDA. The potential rate or volume of dispersal beyond the Northern Disposal Area is not discussed in the application. I note, however, that sediment which is dispersed beyond the Northern Disposal Area and settle there, depending on rate and presence of contaminants in the material, may not have a detectable adverse effect."

Dispersal beyond the Northern Disposal Area is addressed in Mr Andrews' evidence. It is possible that disposal closer to the boundary could result in a higher volume accumulated outside. This volume is likely to be small resulting in a very thin layer if at all. As discussed above bioturbation will mask the presence of these thin layers making it virtually impossible to detect their

presence or absence. The concentration of any contaminants is very unlikely to be high enough to cause adverse effects.

12.7 Key issue 90 "Depending on dumping operations, the sea state, and water column conditions at the time of dumping, the proposed activity could potentially result in a significant increase in hours with elevated turbidity at the NDA, and that over the lifetime of the consent, if it was to be granted, a larger volume of dispersed sediment could settle beyond the boundary of the NDA. I note, however, that although levels of turbidity may persist for a time after dumping, the plumes are still likely to be transient, and although elevated above background levels may not be above a level harmful to marine life. Furthermore, sediment which is dispersed beyond the NDA and settle there, depending on rate and presence of contaminants in the material, may not have a detectable adverse effect."

Turbidity is a non toxic naturally occurring ecosystem stressor. Different biota tolerate and react to different levels of intensity of turbidity but also to different periods and frequency's of exposure to turbidity. The main effect of increased turbidity is to decrease light penetration into the water column affecting primary production of pelagic phytoplankton and thus reducing a key food component to suspension feeders. Given that the majority of disposal events are likely to occur at night and any plumes dissipated by morning the effects on primary production are negated.

At the Northern Disposal Area the primary cause of increased turbidity is increased suspended solids. With no New Zealand or Australian guidelines, for the protection of life based on suspended solids, the Canadian Environmental Quality Guidelines 2002 should be adopted. The BECA 2018 modelling suggests that peak concentrations of suspended solids are highest in the upper mid water soon after disposal, but rapidly decreased by 3 hours after disposal to be less than 20mg/L with average concentrations of less than 2 mg/L all within the Northern Disposal Area boundary. If fish are present within the area affected by the plume they have the option to react by moving the short distance (in order of less than 200 meters) to avoid it. Since the fish species most likely to be present are pelagic, it is against their natural behaviour to stay in one location unless feeding. It is also possible they could take advantage of its effects on other biota by feeding around its edges. The plumes will not result in fatal harm or wide scale permanent migration away from the Northern Disposal Area.

13. COMMENTS ON MPI ADDITIONAL INFORMATION REPORTS

MPI's response dated 24 July 2018 to the EPA biosecurity question 1

13.1 MPI's response largely confirms the information provided to EPA as part of the application.

13.2 I note and accept MPI's opinion that the model and approach used to determine the potential for spread of invasive species is a conservative worst-case approach. I agree the invasive species listed are very unlikely to survive or establish at the Northern Disposal Area.

13.3 I agree that *Eudistoma* and *Sabella* are the invasive species of most risk of spreading via larva dispersion. The chance of larva surviving to reach the shore and suitable habitat to settle is negligible based on the dispersion model by Metocean.

13.4 I agree that the transport on the hulls of vessels traveling to and from the Northern Disposal Area is the most likely vector of spreading invasive species, and that suitable measures should be regularly taken to clean these surfaces. I note the proposed conditions of consent attached to Mr Hay's evidence include a requirement to comply with MPI's clean hull standards.

13.5 I also note that the vessels involved in the disposal operations are not the only vessels in operation within the wider area and that spread of invasive species could occur from these vessels as well, particularly if the traveling from infected areas to uninfected areas.

MPI's response dated 6 August 2018 to the EPA biosecurity question 2

13.6 I agree with the comments made on potential effects of both *Sabella* and *Eudistoma*. However I note the response states that "In situations where *Sabella* is widespread and occurs at high densities in soft sediments". *Sabella* requires a hard substrate to attach to. This could be rock, shell or manmade structure in marinas. The soft sediments in the source site marinas which are dredged to maintain depth, generally have very little shell in the sediments as the sediments have been washed into these marinas and settled. To date none of the source sites have had high density populations of *Sabella* in the soft sediment. If such a situation was to occur the numbers of *Sabella* included in the dredging would be significantly higher and as a result likely fail to be

approved for disposal based on this increased risk factor. At present the inclusion of *Sabella* in the dredging is thought to only be through dislodgement of *Sabella* from marina structures.

13.7 Finally, I also note the proposed conditions of consent incorporate a requirement for biological characterisation of source sites to be provided to both the EPA and MPI prior to disposal from any source site, which is discussed further above.

14. COMMENTS ON SUBMISSIONS

14.1 In this section I cover those matters raised in submissions which are relevant to my areas of expertise.

14.2 A number of submitters have raised concerns with regard to contaminated material either having adverse effects on water quality and or on marina biota.

14.3 Under the proposed conditions of consent the consent holder is required to maintain the sediment on the seabed at the Northern Disposal Area at below the ANZECC ISQG Low trigger values for all likely contaminants of concern. Sediment of this quality by definition will not cause adverse effects to the biota.

14.4 Since the sediments to be disposed of are dredged from the sea bed any material included will therefore be negatively buoyant. This includes micro plastics, larger plastics and other debris. Negatively buoyant material has been shown to not be transported to coastal areas.

14.5 One possibility for seawater at the Northern Disposal Area to become contaminated is via the mixing of disposal sediments resulting in the release of contaminants. If the sediment to be dredged shows elevated contaminant concentrations then as part of the sediment pre dredging characterisation the sediment will be subjected to elutriation testing. Elutriation testing involves the shaking / mixing of a portion of sediment with seawater and then the extraction and testing of water sample from the mixture once the sediment has settled. The contaminant concentrations in the water are then compared with the relevant water quality guidelines. This produces a standard concentration expected to be released, but does not allow for initial mixing during discharge at the Northern Disposal Area. The level of initial mixing varies based on the characteristics of the disposal site and the vessel used. It has not been precisely defined at the Northern Disposal Area but I estimated it would be in

the order of 100's of times dilution. The results of all of the elutriate testing results from all source sites tested to date under the existing disposal permit have shown that an initial dilution in the order of 10 times is all that is required to bring the elutriate extract concentrations below the water quality guidelines for continuous exposure. Therefore the water quality at the disposal site is not expected to be adversely effected.

14.6 The disposal of fine sediments at the Northern Disposal Area will result in the formation of plumes of increased turbidity water. The level of increase in turbidity, the extent and duration of these plumes is addressed by Mr Andrews, but as addressed above, I do not have any concerns that the increased turbidity will have any significant ecological effect.

14.7 Once the sediment has reached the seabed and formed a disposal mound there is the potential for compaction of the mound, either by reaching a critical size or from continued impact from subsequent disposals. Compaction of the mound has the potential to force pore water out of the mound into the near bed water column. The level of contamination in the pore water is currently unknown but not expected to be significant due to the low sediment quality concentrations and low elutriate extract concentrations. Therefore the effects of leaching or pore water release are not expected to be significant.

14.8 A number of submitters have raised concerns over biosecurity. The transfer of non native invasive species to the Northern Disposal Area can occur in a number of ways, however given the differing environments between a ship's hull or shallow water marina habitats and the 140 m deep open sea disposal site the invasive biota it is not expected to survive at the site.

a) Biofouling on the barge and tug are one such pathway. It is my understanding that all vessels involved will undergo regular inspections and cleaning as required, and as recommended by Biosecurity New Zealand (MPI), thus virtually eliminating this pathway for transfer of invasive biota to the Northern Disposal Area.

b) Invasive biota found in marinas can be entrained in the dredge material either as part of the sediment or by dislodgement from adjacent structures, thus they become part of the disposal material. As stated above the invasive biota is unlikely to survive in the deep water at the disposal site as the biota is generally suited to shallow water habitats,

in addition the invasive biota that has been dredged and loaded into a barge has undergone significant disturbance at up to a lethal level.

14.9 While the adults invasive species are unlikely to survive at the Northern Disposal Area and have not been detected in any of the Northern Disposal Area biota monitoring to date, there is there potential for water born transfer of larval stages if spawning has occurred in the barge prior to disposal. As discussed in the application different species have different biology resulting in different lengths of time in larval mobile forms before settling on the seabed or structures to grow. The life history data combined with an assessment of water movements shows that none of the invasive species identified to date in the source site are likely to survive until they reach a suitable habitat to settle. In the unforeseen case of an accidental introduction occurring to the nearby coast via disposal activity, if the invasive species has already established itself then the number of new recruits to the environment from the disposal activity will be small compared to that from the local population. In addition to that posed by the disposal activity there are many other pathways for dispersal of invasive species including other commercial boats and pleasure craft, natural spread of planktonic larvae.

14.10 The submission by Professor Andrew Jeffs mentions the lack of inclusion of an invasive seaweed *Undaria pinnatifida* in the list of species assessed. To date *Undaria* has not been detected as part of the source sites assessments. The MPI database only shows it as having been recorded at in the past at three of the source sites approved to date. *Undaria* being a seaweed that grows on rock walls and structures requires a firm substrate to attach to and light to survive. *Undaria* will not survive on the seabed at the Northern Disposal Area. *Undaria* has no flotation organs, bladders, or air sacs, so it does not drift as easily as seaweeds which have these, such as *Macrocystis*. The parts of the blade of *Undaria* that are readily torn off do not contain any reproductive tissue. It is not known how long whole plants would continue to produce zoospores should they float free. Drift is not likely to be a factor in the spread of *Undaria* in New Zealand waters. As such spread by disposal at the Northern Disposal Area is considered unlikely. The distribution of *Undaria* in New Zealand is strongly linked to commercial ports, which suggests it is being transported around the regions by attachment to commercial shipping.

14.11 I have addressed the likelihood of spillage enroute elsewhere.

14.12 The disposal of sediments at the Northern Disposal Area will have effects on the marine life on the seabed spreading out from the disposal point and decreasing in severity with distance from the disposal point. The footprint of the disposal mound will largely define the area most effected. Recolonization of the disposal mound will be occurring continuously, however until the disturbance via disposal activity has ceased the distribution and abundance of biota will be governed by an equilibrium between distance and recolonization. In addition to the biota on the seabed the disposal activity has the potential to affect transient larger biota in the water column and above.

a) Marine mammals such as whales and dolphins, may be present within the Northern Disposal Area from time to time. Prior to disposal the consent holder is required (by the proposed conditions) to conduct marine mammal detection for 30 minutes, and can only begin disposal if no marine mammals are detected. Effects of the disposal activity on water quality and sediment quality are unlikely to be at levels at which effects are likely to be observed in marine mammals, particularly given their transient short term occurrence in the Northern Disposal Area.

b) A number of threatened seabirds are known to inhabit the wider coastal area including the Northern Disposal Area, however the effects of disposal activity is not expected to have any greater effects than current activity in the wider coastal area.

c) A number of pelagic fin fish are likely to frequent the Northern Disposal Area, however they are only expected to include the Northern Disposal Area as part of a larger habitat range. The activity of disposal will lead to increased turbidity, which could lead to short term reductions in feeding abilities of visual predators is the location of the small plume produced. Turbidity levels are not expected to reach levels at which harmful effects to fish will occur.

14.13 The disposal activity is not expected to produce under water noise at harmful levels to any biota present within the Northern Disposal Area.

14.14 Information provide to the DMC by the MPI on fisheries shows that the fishing efforts in the Northern Disposal Area are low, suggesting that effects on fishers and fisheries as a result of disposal activity in the Northern Disposal Area will be minimal.

14.15 The Department of Conservation suggested other habitats could be present within or near the Northern Disposal Area. On examination of the biological and physical databases available and actual biota samples from within and around the Northern Disposal Area the habitat with in the Northern Disposal Area is relatively homogenous flat sandy mud numerically dominated by foraminifera with a number of polychaete worms, molluscs and crustacea. Any reference to other habitats is from a significant distance outside the Northern Disposal Area. The nearest rocky reef structures identified are small areas of basement outcrop and isolated rock pinnacles, which occur 16 km south and 20 km north west of the disposal area according the marina chart and Hauraki Gulf Marine Spatial Plan via the seasketch.org website.

Simon West
25 October 2018