BEFORE THE WHANGAREI DISTRICT COUNCIL AND NORTHLAND REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of a resource consent application by Northport Limited under section 88 of the Resource Management 1991 for a port expansion project at Marsden Point
APPLICATION NO.	APP.005055.38.01 LU 2200107

STATEMENT OF EVIDENCE OF DEANNA MARIE CLEMENT

(POTENTIAL EFFECTS OF PROPOSED NORTHPORT RECLAMATION ON MARINE MAMMALS)

24 August 2023

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INTRODUCTION

Qualifications and experience

1. My name is Deanna Marie Clement.

2. I am a marine scientist specialising in marine mammals. I hold the degrees of PhD in Zoology from the University of Otago, Master of Science from the Florida Institute of Technology (USA), and. Bachelor of Arts (Biology) from the University of Nebraska – Lincoln (USA).

3. I currently work as a marine mammal ecologist at the Cawthron Institute (Cawthron) in Nelson. I have held this position for 13 years with my work focussing primarily on assessing the effects of various anthropogenic coastal projects on New Zealand marine mammals. I have worked on a variety of impact assessments and the design of several resource consent monitoring studies. Prior to this, I worked in the University of Otago's Zoology Department as a teaching fellow while continuing to undertake research.

4. I have worked as a marine mammal scientist for almost 25 years in New Zealand and the United States, and over 20 of these years have been semi focused on studying Hector's and Maui's dolphins. My primary expertise is in spatio-temporal modelling of marine mammal distribution and density patterns while assessing species' habitat preference and behavioural patterns in relation to environmental influences.

5. I was the lead scientist and co-author for the latest three-year aerial survey of Hector's dolphin commissioned by the Ministry for Primary Industries and Department of Conservation to update its population abundance and distribution around the South Island. The survey was the most intensive marine aerial survey ever conducted in New Zealand. The final results of this work received a landmark endorsement from the International Whaling Committee (IWC) at its annual meeting in June 2016.

6. I have authored (and co-authored) a number of publications and articles for both academia and the public and private sectors. Most of my peer-reviewed journal publications have centred on Hector's dolphin and the various methods we have developed to estimate their abundance within New Zealand waters. Additional publications have focused on the various impacts of aquaculture on marine mammals as part of wider ecosystems topics. The majority of my other publications

are assessment of environmental effects reports for government and commercial industries.

7. Since joining Cawthron, I have prepared and presented evidence for several Environment Court hearings. This has included:

   (a) On behalf of McCallum Brothers Ltd for consent of sand dredging inshore and midshore of the Mangawhai- Pakiri embayment, July 2022;

   (b) On behalf of New Zealand King Salmon Company Ltd for consent to operate a new salmon farm offshore, October 2021;

   (c) On behalf of Kaipara Ltd for consent of sand dredging offshore of the Mangawhai- Pakiri embayment, February 2021;

   (d) On behalf of The New Zealand Refining Company Ltd for consent of Crude Shipping Project to dredge and realign channel entrance, January 2018;

   (e) On behalf of Lyttleton Port Company Ltd for consent of Te Awaparahi Bay Reclamation Project, September and October 2017;

   (f) On behalf of Lyttleton Port Company Ltd for consent of Capital Dredging Project, June 2017;

   (g) On behalf of Admiralty Bay Consortium (2016) in its appeal against the Marlborough District Council for marine farm extensions;

   (h) On behalf of R J Davidson Family Trust (2015) in its appeal against the Marlborough District Council for a marine farm extension in Beatrix Bay, Marlborough Sounds; and

   (i) On behalf of The Astrolabe Community Trust (2015) for consent to abandon the wreck of the MV Rena and for any future discharge of contaminants from the wreck.

8. Finally, I note that am providing technical expertise on my area of knowledge around New Zealand marine mammals. I acknowledge that marine mammals have a great importance to tangata whenua, and in particular local iwi, that I have only considered in a limited way here.

Involvement with the proposal/application

9. I was engaged by Northport Limited (NPL) in 2020 to provide an assessment of potential effects on local and regional marine mammals arising from the company's proposal to expand its facilities in Whangarei Harbour. The report detailing the proposed reclamation extension on relevant marine mammals was completed and provided to NPL in September 2022 (Cawthron Institute Report No. 3652 *Potential effects of the proposed Northport reclamation on marine mammals in the Whangārei Harbour region*), and is attached to the Assessment of Environmental Effects as Appendix 14 (the Assessment Report).

10. I am familiar with the application site and the surrounding locality. I have read the relevant parts of the application, including in particular the Pine (2022) underwater noise propagation model which estimated the potential noise levels generated by the proposed construction works, as well as submissions relevant to marine mammals, the Council officers' section 42A report, and the draft conditions proposed by NPL.

Code of Conduct

11. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2023) and I agree to comply with it. In that regard, I confirm that this evidence is written within my expertise, except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

12. In my evidence, I:

    (a) provide an executive summary of my key conclusions;

    (b) describe the existing environment;

    (c) summarise the proposal's potential effects on marine mammals;

    (d) summarise my recommendations with respect to proposed mitigation, management and other measures;

    (e) comment on submissions related to marine mammals and relevant effects;

(f) respond to relevant issues raised in the S42A Report; and

(g) comment on draft proposed conditions advanced by Northport.

13. In preparing this evidence I have reviewed (in addition to relevant submissions and the Council s42A report):

(a) Consultant report by Kelly S, Sim-Smith C on Northport East Expansion – Assessment of Marine Ecological Effects;

(b) Kerr and Associate's Methodology report mapping of significant ecological areas in Northland;

(c) MetOcean Solutions Ltd's Dredging plume modelling: Dredging sediment plume dispersion over existing and proposed port configurations;

(d) Styles Group's Assessment of underwater noise effects – percussive pile driving and capital dredging, prepared for Northport Ltd; and

(e) WSP's Northport Eastern Extension (Berth 5) – Concept Design Report.

EXECUTIVE SUMMARY

14. My evidence assesses the potential effects on marine mammals from the construction of the proposed reclamation. The evidence includes descriptions of the proposed reclamation activities and the existing environment from a marine mammal perspective.

15. A large proportion of New Zealand's marine mammals live or migrate along the north-eastern coastline of the North Island. The species most likely to be affected by the proposal are common and bottlenose dolphins, orca and Bryde's whales. Other species of interest include NZ fur seals, leopard seals, and southern right and humpback whales as they are more seasonal visitors to the wider Bream Bay area.

16. Based on the data available, I do not consider the coastal waters of Whangārei Harbour and Bream Bay to be ecologically significant habitats for any marine mammal species. Instead, this area represents only a small fraction of similar habitats available along the North Island's north-eastern coast that several species of marine mammal regularly utilise and migrate past on a regular basis.

17. The aspects of port expansion most likely to directly affect marine mammals in the Whāngarei area are the production of underwater sound from pile-driving activities, and possibly, risk of entanglement. However, I have assessed the overall risk of any significant adverse effects arising from these proposed consent activities as less than minor, based on recommended management actions.

18. Indirect effects of construction activities on marine mammals may result from physical changes to the habitat itself that adversely affect the health of the local ecosystem and / or impinge on important prey resources. However, given the location and habitats associated with the proposal, any indirect effects of project activities are not expected to be adverse or detrimental for local or visiting marine mammals in the region.

19. To ensure that the most appropriate measures are in place to minimise any potential adverse effects, several best management practices (including source noise reduction options, shut down zones, and seasonal consideration of piling stages) are recommended. Continuation of ongoing acoustic monitoring is also recommended to verify *in situ* piling sound levels and ensure the effectiveness of the management measures employed. Finally, I recommend that, consistent with best practice, a marine mammal management plan (MMMP) based on the draft MMMP provided with the application, is finalised prior to commencing operations and is duly implemented.

20. I have considered the concerns raised in submissions as they relate to marine mammals and consider these have been appropriately addressed.

21. The Section 42A report concludes that effects on marine mammals are less than minor. It recommends new or amended conditions to address effects on marine mammals, including amendments to the draft MMMP. I agree with a number of these recommendations, however, I do not agree that the following measures are necessary or appropriate:

    (a) The use of bubble curtains to reduce underwater construction noise;

    (b) A prohibition on piling works over successive seasons;

    (c) Pre-observation surveys and a requirement to cease piling activity for any cetaceans sighted or remaining within inner harbour regions.

NORTHPORT RECLAMATION PROJECT SUMMARY

22. The proposed reclamation project consists of an extension of NPL's existing footprint, which will provide more land and additional wharf length.

23. Key components of the proposal include; reclamation within the Coastal Marine Area (CMA) and earthworks to the immediate east of the existing reclamation, capital and associated maintenance dredging, and construction of a wharf.

24. The construction period of the proposed reclamation area is estimated to take approximately 3.5 years (WSP 2022). The reclamation will involve approximately 9 months of dredging while the berth construction is estimated to take 2–2.5 years, of which approximately 24 months would have some pile-driving activity.

ASSESSMENT OF EFFECTS ON MARINE MAMMALS

The Existing Environment

25. When considering the potential implications of marine activities on marine mammals, the appropriate scale of consideration is not just the level of the proposed activities but also the spatial scales relevant to the marine mammal species involved. Hence, the importance of these coastal waters needs to be considered in the context of the relevant species' regional and NZ-wide distributions.

26. My assessment collated all available species information and sighting data on marine mammals that use Whangarei Harbour and the wider area of interest waters. A list of these compiled information sources and maps are presented in Appendix 1 and summarise briefly below.

    (a) DOC opportunistic database and stranding record database.

    (b) Marine mammal tourism data in the Bay of Islands and Hauraki Gulf region.

    (c) National Aquatic Biodiversity Information System (NABIS).

    (d) Existing scientific research undertaken within the wider region by the University of Auckland (Bryde's whales, humpback whales, bottlenose dolphins, southern right whales), and Massey University (common/bottlenose dolphins, Bryde's whales, leopard seal).

    (e) Orca Research Trust – various Visser publications.

(f) Berkenbusch K, Abraham ER, Torres L 2013. New Zealand marine mammals and commercial fisheries. New Zealand Aquatic Environment and Biodiversity Report No. 119. 110 p.

(g) Clement D, Elvines D 2015. Phase 1: Preliminary review of potential dredging effects on marine mammals in the Whangarei Harbour region. Prepared for Chancery Green on behalf of Refining New Zealand Limited. Cawthron Report No. 2711. 31 p. plus appendix.

(h) Stephenson F, Goetz K, Sharp BR, Mouton TL, Beets FL, Roberts J, MacDiarmid AB, Constantine R, Lundquist CJ 2020. Modelling the spatial distribution of cetaceans in New Zealand waters. Diversity and Distributions 26: 495-516.

27. Together, this information was used to determine what is currently known about species' occurrence, behaviour, and distribution within the area of interest and to evaluate those species most likely to be affected by the proposed project. For this assessment, less emphasis is placed on the location of sightings with more importance stressed on the presence of the identified species in the wider region and timing of the sightings.

28. At least 27 cetacean (whales, dolphins and porpoises) and two pinniped (seals and sea lions) species have been recorded along the north-eastern coastline of the North Island.

29. Despite historical and ongoing disturbances within Whangarei Harbour, several marine mammal species still regularly visit harbour waters and frequent the wider region. In this regard, the Whangārei Harbour entrance represents a small (and conceivably less pristine) fraction of similar habitats available to support these species.

30. Those species occurring more commonly along the Whangārei coastline, and therefore those with the greatest potential to be affected by the proposed project, are bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), orca (*Orcinus orca*), and Bryde's whale (*Balaenoptera edeni*).

31. Other species of interest include those that may be less frequent visitors but that are more vulnerable to anthropogenic (human-made) impacts due to their current

conservation status (e.g. southern right whales are *at risk–recovering*) or are of special significance to tangata whenua[1] (Clement & Elvines 2015).

32. Marine mammal species that may be present within the area of interest (AOI) include:

(a) **Bottlenose Dolphins** - Sightings near Whangārei occurred mainly over spring and early summer months. This species is listed as nationally endangered by the New Zealand Threat Classification System (NZTCS) (Baker et al. 2019) meaning they are potentially more vulnerable to disturbance or changes within their distribution range.

(b) **Common Dolphins** – Several populations are found year-round off the east coast of the North Island from the Bay of Islands to the Bay of Plenty (Constantine & Baker 1997; Neumann et al. 2002). Several studies have suggested that the Hauraki Gulf region may be an important nursing and / or foraging area for this species (Stockin et al. 2008; Dwyer et al. 2016). This species is listed as not threatened (NZTCS – Baker et al. 2019), however, little is known about their actual population sizes and movements between these locations.

(c) **Orca** - Individuals are frequently sighted along the coastline between the Bay of Islands and Hauraki Gulf (Visser 2000). They have been observed year-round but are thought to be more common in AOI waters during late winter and early spring (Visser 1999, 2000, 2007; Hupman et al. 2014; DOC sighting database). Based on the sighting data and the timing of individual re-sightings from various Visser publications, orca do not spend a large amount of time in any one location. Orca are currently listed as nationally critical by the NZTCS (Baker et al. 2019) based on their natural low abundance.

(d) **Bryde's Whales** – This species is the most reported whale species in the AOI, particularly over late spring and summer months, passing through Whangārei offshore waters as they travel between Bay of Islands and Hauraki Gulf 'hotspots' (DOC sighting database). Their more offshore tendencies mean that this species is unlikely to move into a harbour or bay like some other whale species (e.g. southern right or humpback whale).

[1] Whangārei Heads was previously known as 'Whangārei Te Rerenga Paraoa', which translates as 'Whangārei, the gathering place of whales'.

This species is listed as nationally critical in New Zealand waters (Baker et al. 2019) due to low abundance and the high proportion of mortalities due to ship strikes (Constantine et al. 2015).

(e) **New Zealand Fur Seals** – Regular sightings of adults and pups are now common in the Hauraki Gulf region with frequent sightings around the Hen and Chickens Islands as well as the occasional visiting seal within the Whangārei region as this species appears to be expanding northward (DOC sighting database). There are several reports of solitary animals observed within Whangārei Harbour as well as various haul-out sites and marinas between Auckland and Northland (Hupman et al. 2020). However, the number of reported sightings is likely biased high.

(f) **Leopard Seals** - There are several reports of solitary animals observed within Whangārei Harbour as well as various haul-out sites and marinas between Auckland and Northland (Hupman et al. 2020). However, the number of reported sightings is likely biased high (i.e. a very small number of individuals are reported multiple times).

(g) **Southern Right Whales** – This species migrates from July to September, with a tendency to remain in shallow protected bays and coastal waters when calving. Southern right whales are considered at risk - recovering by the NZTCS (Baker et al. 2019), as their preference for shallow, protected bays and coastal waters (particularly for calving) overlaps with numerous anthropogenic activities in New Zealand's waters.

(h) **Humpback Whales** – Individuals of this species are generally reported during their returning south-bound migration (e.g. Meissner 2015). Humpbacks begin returning with their newborn calves in later September, passing through Northland waters until late November / December. While humpbacks tend to travel more directly between headlands, they can occasionally briefly enter nearby harbours and bays. The Oceania sub-population of humpbacks (including New Zealand) is considered endangered by the International Union for Conservation of Nature (IUCN) due to their slower recovery rate from whaling impacts (Childerhouse et al. 2008).

33. Potential offshore species observed within AOI waters include **pilot whales, sperm whales**, **false killer whales,** and **blue whales.** Despite few sighting data, the strong

prevalence of whale strandings from late spring to autumn suggests a general inshore movement within Northland waters for some of these species (particularly pilot whales) over summer months.

34. Based on current knowledge, the proposal area is not considered ecologically more significant in terms of feeding, resting or breeding habitats for any marine mammal species relative to other regions along the north-eastern coastline. However, these species are relevant in regard to Policy 11(a) of the New Zealand Coastal Policy Statement (NZCPS), which refers to avoiding adverse effects on nationally and / or internationally recognised threatened species.

Assessment of Effects

35. The proposed reclamation will involve temporary activities that will disturb the marine environment and increase the amount of construction noise (both airborne and underwater) produced in lower harbour areas. Interactions between marine mammals and coastal developments usually result from an overlap between the spatial location of the physical development and important habitats of the species. Recent studies revealed that this overlap is spatially larger and the effects wider ranging than previously thought.

General Construction noise

36. Increasing underwater noise can affect marine mammals as they rely heavily on underwater sounds for communication, orientation, predator avoidance and foraging. The type of response to underwater noise may be behavioural, acoustic, or physiological.

37. Reclamation and construction of the rock seawalls will involve the movement and disposal of quantities of rock, sand and gravel material, either placed individually - in the case of large boulders - or end-tipped from land. The level of disturbance and underwater noise produced by general construction activities are generally expected to be several orders of magnitude less compared to those from pile-driving and dredging activities.

38. The strongest response to underwater noise produced by any general construction activities (excluding piling and dredging activities) could be temporary avoidance of Whangārei harbour entrance waters while the activities are occurring, but more likely, directed movement away from the immediate vicinity until the activities have stopped.

39. This assessment is based on the following factors:

(a) the proposed reclamation sites are not unique or rare habitat for marine mammals;

(b) most underwater noises generated from these activities are expected to be similar to the underwater noise produced by existing commercial vessels visiting the Port; and

(c) relevant environmental factors of the proposed site (e.g. intertidal / shallow depths and soft mud) may, to some degree, naturally dampen any underwater noise production.

40. At the commencement of any construction activities, noise validation will be completed and the MMMP updated to ensure all noise management actions (i.e. size of shut down zones) are appropriate.

Pile-driving noise

41. Pile driving has been recognised as one of the noisiest of all construction sounds (e.g. Madsen et al. 2006) and has been identified as the most intense underwater noise that will be produced by the proposed reclamation project (Pine 2022). Pile driving generates sound pulses across a wide range of frequencies and has a high potential to disrupt marine mammal hearing and behaviour up to many kilometres away (Madsen et al. 2006). In closer proximity, these impulses could induce acute stress and cause hearing impairment.

42. Behavioural disturbance of marine mammals from underwater noise tends to be highly variable between species and among individual animals, as well as being context-specific (e.g. different reactions while feeding from when communicating), making responses difficult to predict. Behavioural responses can vary from lower or minor level changes in swimming direction / speed, breathing or vocalisation rates to more moderate level responses (e.g. extensive changes in swimming or cessation of vocalisations) to complete abandonment or avoidance of impacted waters (Southall et al. 2007).

43. Several driving methods have been proposed as part of the new wharf including vibro-hammer (continuous noise production) and traditional hydraulic impact hammer (impulsive noise) piling techniques. Overall, the average installation time for each pile is estimated to take 10–12 hours, approximately 4 hours of which will

involve driving using vibro and hammering methods (WSP 2022). The construction of the berth wharves is expected to take approximately 2 to 2.5 years during which pile installation is estimated to occur for varying durations throughout.

44. Pine (2022) developed an underwater noise propagation model to estimate the potential noise levels generated by the proposed construction works. This propagation model incorporated data on local bathymetry, water temperature, tidal flow and sediment type, all of which affect how noise travels through water. Acoustic models were built in order to predict the 'worst-case' distance ranges of piling-generated noise.

45. To determine at what distance predicted noise levels could cause physical impairment or injury to local species for this proposal, acoustic thresholds were based on the species most likely to visit the wider Whangārei and Bream Bay area. These thresholds are weighted based on the functional hearing ranges over which the hearing group is most sensitive and then considers the frequencies over which most sound energy might be concentrated for a particular sound source (i.e. pile-driving strikes).

46. The distance estimates of impact pile-driving generated noise for potential hearing effects suggest impact pile driving could cause the onset of temporary threshold shift (TTS) in dolphins, orca or fur seals when animals are within the immediate vicinity of the construction site (100–200 m) and permanent threshold shift (PTS) when an animal is within 26 m or less. Any visiting baleen whales or leopard seals will experience the onset of TTS at greater distances, either when they enter the harbour or if already present, as they approach the harbour entrance from inner regions. For baleen whales, this level of noise may result in a general avoidance of harbour waters while pile driving is underway and hearing injury (PTS) is possible if a whale is within 500 m of the noise source. Leopard seals are still expected to enter the harbour while piling activity occurs but their movements into some inner regions of the harbour may be affected depending on the piling location. A leopard seal may experience the onset of PTS if they approach to within 150 m of the noise source.

47. Based on two-tiered unweighted thresholds for behavioural disturbance (Southall et al. 2007), the distance ranges for potential low and moderate level behavioural effects from pile-driving noise were conservatively estimated for all species. While these behavioural thresholds are much lower than the noise levels generated by most commercial and recreational vessels (i.e. OSPAR 2009; Todd et al. 2015),

animals are expected to respond more adversely to intermittent and unexpected noise than more consistent or regular intervals of noise.

48. The potential behavioural responses from impact driving are expected to be confined spatially within inner Whangārei Harbour waters and the entrance. Any animal attempting to enter the harbour underwater will likely exhibit at least lower-level behavioural responses while piling is underway.

49. For all dolphin and whale species, the greatest reduction to their listening space (> 75%) would be limited to within a 400 m radius from the piling source when in operation, and out to 700 m for pinnipeds.

50. The sound modelling of Pine (2022) suggests that for most species (with the exception of visiting baleen whales and leopard seals), pile-driving noise without any mitigation has the potential to cause temporary hearing impairment and / or injury only within close proximity of the piling source. While the potential for both temporary and permanent hearing impairment is greater for visiting baleen whales and leopard seals, very few of these individuals visit these waters in any one year and these species tend to have a stronger seasonal presence. Hence, the likelihood of any TTS or PTS effects occurring is considered *low* for all species.

51. With recommended management actions (See Table 1 and 2), including the establishment of marine mammal shut down zones and soft start / ramping up procedures, any residual effects of PTS / TTS and behavioural responses are expected to be *nil* to *less than minor.*

Dredging noise

52. The associated increases in the production of underwater sound and physical disturbance within the harbour are the more likely circumstances in which marine mammals will be affected by dredging. Noises produced from dredging activities differ from pile driving in that they are non-impulsive, generally continuous, broadband sounds that tend to occur at frequencies mostly below 1 kHz (Todd et al. 2015).

53. A large portion of the seabed directly affected by the proposed dredging has already been dredged previously, been modified by the presence of artificial structures and / or been subjected to direct disturbance from propeller wash from large vessels. Hence, any indirect flow-on effects from disturbing this habitat, and thus potential prey resources, are unlikely.

54. Pine (2022) used estimated source levels (ranging between 164 and 179 dB re 1 µPa @ 1 m[2]) to spatially model the propagation of dredge-generated noise and predict the potential extent of any potential hearing threshold shifts, behavioural responses, and auditory masking ranges for local marine mammals. The approach by Pine (2022) estimates the probability of a response occurring at different noise levels (i.e. distances from the source) and can be species-specific where data are available.

55. No permanent hearing impairments (PTS) are predicted for any marine mammals and the onset of any hearing injuries, or TTS, is estimated to occur only if an animal is within one metre or less of the operating dredge, regardless of dredge type or location (Pine 2022).

56. Pine (2022) estimated the initial onset distance for any low-level behavioural responses to dredging noise to be 1.6 km or less from the dredging location. For any potentially moderate level behavioural responses, the distance reduced to within 600 m or less from the dredger. Any short-term auditory masking effects between two individuals of the same species are predicted to occur within distances similar to or less than behavioural responses.

57. Based on the modelled results, any effects from dredging-generated underwater noises will likely be transitory and non-injurious. Effects will be predominantly limited to the momentary masking of some noise signals and a range of potential behavioural responses to within a kilometre or less of the dredging location, depending on the species. The likelihood of any hearing injury effects (TTS or PTS) occurring is considered *not applicable.*

Vessel strike

58. The potential for any boat strike of local marine mammals from the proposed dredge platforms is *nil* to *negligible*.

59. Increasing NPL's capabilities and / or capacity means that more large commercial ships may be expected to visit the port.

60. The likelihood of vessel strike depends on operational factors including vessel type, speed, and location (Van Waerebeek et al. 2007). The greatest increase in both the

[2] The term 'dB *re* 1 µPa @ 1 m' represents the sound pressure level that has been back calculated to a standardised distance of one metre distance from the source and is often known as source level.

risk of a collision and the likelihood that it will result in severe injury or death occurs at speeds over 11 knots (Vanderlaan & Taggart 2007; Gende et al. 2011).

61. North-bound ships due to the proposed port project would constitute an increase in the shipping traffic moving through Bream Bay waters than has occurred to date. North-bound ships would likely either transit through the Hauraki Gulf or around Great Barrier Island before heading towards Whangārei Heads.

62. In this case, the species considered most vulnerable to any potential vessel collisions include Bryde's, humpback and southern right whales and to a lesser extent, bottlenose dolphins and orca given their current endangered species status rather than proneness for vessel strike.

63. The likelihood of a vessel strike (injury or mortality) associated with the port's extension proposals is assessed as *low* for migrating baleen whales, odontocete and pinniped species due to the following factors:

(a) Low probability of port-related commercial ships encountering a migrating whale within Whangārei Harbour and the wider Bream Bay region.

(b) The majority of migrating whales currently pass by in deeper, more offshore waters.

(c) Most whales occur in the area for a limited period each year.

(d) Most odontocete and pinniped species known to frequent Whangārei waters are in regular contact with vessels and have few to no reported ship strikes.

(e) Vessel traffic is expected to increase mainly from the south as more commercial ships may be diverted further north.

(f) Any expansion of the Hauraki Gulf Transit Protocol (i.e. reducing average speed to 10 knots) into and behind Whangārei waters provides the best chance of significantly reducing fatal injuries and mortalities of baleen whales due to vessel collisions in this region.

(g) Most dolphin species have a general attraction to boats and safely approach and / or bowride with numerous vessels. Fur seals often respond neutrally to boats when in the water.

(h) With the exception of Bryde's whales, whale species do not normally feed while migrating past New Zealand's north-eastern coastline.

(i) Whangārei Harbour and Bream Bay are not considered unique or important feeding, resting or nursery habitats for any visiting species.

Operational loss and possible entanglements

64. Potentially harmful operational by-products from coastal development activities can include such items as lost ropes, support buoys, nets, bags and plastics (e.g. Weeber & Gibbs 1998).

65. A hazard associated with marine debris and construction activities for marine mammals is the possibility of entanglement (Laist et al. 1999). Whales, dolphins and pinnipeds are often attracted to floating debris with a potential risk of becoming entangled in floating lines and netting (e.g. Suisted & Neale 2004; Groom & Coughran 2012).

66. Construction associated debris generation can generally be prevented in well-maintained coastal projects with proper waste management programmes in place (e.g. secure onboard storage of lines, nets, and waste) in order to comply with the NZ Maritime Rules Part 180. I have recommended a condition to ensure the appropriate management of construction-related debris.

67. Effects to marine mammals from operational by-products are expected to be *nil to negligible.*

Ecological effects of habitat and prey species

68. The ecological effects associated with the permanent loss of approximately 6.2 ha of intertidal and 5.5 ha of subtidal habitats to reclamation is significant at the project footprint scale, however, extensive habitats of similar biotic composition are found nearby and throughout the lower harbour. Similarly, the effects of dredging are expected to be temporary and potentially reversible given the types of exposed seabed and depending on the need for future maintenance dredging (MetOcean 2022).

69. The limited effect (both spatially and temporally) that the proposed construction activities are expected to have on local habitats and associated prey resources

means that there is unlikely to be any material or longer-term effects to local marine mammals.

Cumulative impacts

70. It is important to note that those marine mammals passing through Whangārei and the wider Bream Bay region are exposed to a variety of other anthropogenic activities that generate underwater noise including large-scale commercial shipping and recreational boating as well as commercial fishing vessels. However, underwater noise generated by different activities within proximity of each other and the wider harbour are not usually additive.

71. If pile driving and dredging (or similar underwater noise generating activity) are taking place in the vicinity of the proposal site at the same time, the louder pulses of piling will be heard over the top of the more constant low frequency noise of the dredger, however cumulative noise effects are not expected.

72. It is my understanding that if the Channel Infrastructure Channel Deepening Project is implemented and capital dredging associated with that project occurs within a certain distance of NPL's proposed dredging area, the conditions proposed by NPL require that NPL must not commence capital dredging for a 6-month period following the completion of capital dredging by Channel Infrastructure. This will avoid concurrent dredging operations and will manage the potential cumulative marine ecology effects associated with capital dredging by NPL.

73. Construction of NPL's Berth 4 and Berth 5 is likely to result in variable and intermittent increases in underwater noise levels.

Effects Management

74. Overall, the residual effect of any impacts from the proposal on local and visiting marine mammals is considered to be *less than minor* to *nil*. This assessment is based on the consideration of the types of effects, their spatial scales and durations, and relevant species' presence and habits.

75. To ensure that the most appropriate measures are in place, a draft marine mammal management plan (MMMP) was developed by NPL in consultation with me and with underwater acoustic experts. This draft plan outlines in detail the procedures necessary to reduce or manage the effects of underwater noise, as well as other effects.

76. The draft MMMP requires the consent holder to identify and adopt accepted best practices to minimise the adverse effects on the environment of underwater noise emissions (see Table 2).

77. Reporting by marine mammal observers alongside continued underwater acoustic monitoring across Whangārei Harbour while pile-driving and dredging activities are underway is recommended. This informative monitoring can help assist in both verifying actual sound levels while determining the potential presence of any behavioural effect(s) and at what sound level(s) they may be occurring. These results can then help determine the efficacy of implemented management actions for further monitoring throughout the reclamation project.

Key findings as to effects on marine mammals

78. The species of marine mammals identified as being potentially affected by the project include bottlenose dolphins, common dolphins, and orca, and occasional visitors such as NZ fur seals, leopard seals and Bryde's, southern right and humpback whales.

79. Pile driving was identified as the main activity that could adversely affect marine mammals in the vicinity through high underwater noise levels.

80. Preliminary underwater acoustic modelling work undertaken within the proposed reclamation sites suggests pile-driving noise is expected to be detectable within the entrance and lower harbour waters, depending on the piling location.

81. Given the potential for temporary hearing impairment near the piling source for endangered species, such as bottlenose dolphins and orca, and at further distances for visiting baleen whale species (e.g. Bryde's whale), actions are necessary to avoid these effects.

82. With appropriate actions in place, piling and dredging activities are expected to only elicit short-term, non-injurious behavioural responses with the potential for momentary masking of some acoustic signals from visiting marine mammals while in close proximity to construction activities.

83. Further development of the draft marine mammal management plan by marine mammal and underwater acoustic experts in consultation with DOC is recommended.

RESPONSE TO THIRD PARTY SUBMISSIONS

84. I have read and considered the written submissions relating to effects on marine mammals (post-application) and set out my comments below. The relevant submissions were made by Mountains to Sea Conservation Trust,[3] R Twyman,[4] Dr Visser (Orca Research Trust)[5] and Patuharakeke Te Iwi Trust Board.[6]

Concern over Impacts to Marine Life and Habitats

85. Dr Ingrid Visser, from the Orca Research Trust, opposes the proposal due to the possible impacts on marine life and in particular, habitat destruction, habitat exclusion, habitat being compromised, noise and water pollution and the welfare of animals.

86. My evidence (and, in more detail, my Assessment Report[7]) clearly discusses each of the above points listed in Dr Visser's submission that are relevant to local marine mammals; specifically the direct effects on marine mammals from underwater noise and construction disturbance effects, vessel strike, and entanglement risk as well as the indirect effects of habitat loss, contaminants and prey disturbance.

87. Dr Visser provides a thorough list of the various marine species she has sighted in the region, which is in agreement with my summary of species provided in Clement (2022) and Clement & Elvines (2015). Her table of *Cetacean Species Status* is based on much older references (IUCN 2004, NZTCS – Hitchmough et al. 2002) than my species status table (IUCN, ver 3.1, NZTCS – Baker et al. 2019) and hence, differences occur.

88. As I have set out above at 74, I consider that the adverse effects of the proposal on marine mammals will be less than minor to nil. Dr Visser's submission does not cause me to change my conclusions.

Concern over Potential Acoustic Effects

89. The Northland-based Mountains to Sea Conservation Trust (MTSCT) is a support organisation for the education programmes 'Experiencing Marine Reserves' (EMR) and 'Whitebait Connection' (WBC). MTSCT oppose the extension of Northport due to its potential to impact the Whangarei Harbour Marine Reserve, Motukaroro /

[3] Submission number 202.
[4] Submission number 203.
[5] Submission number 227.
[6] Submission number 181.
[7] Appendix 14 to the Assessment of Environmental Effects.

Reotahi site. While MTSCT do not mention marine mammals specifically in their submission, they communicate concern over the effects that the port expansion and noise pollution will have on marine life in the area.

90. The submission by R Twyman raises concern that NPL's proposed expansion will impact on the ability of orca, dolphins, and seals to use Whāngarei Harbour and more broadly the potential for noise pollution to disturb fish and marine mammal populations. They request that an alternative method of piling be adopted to reduce noise during the port expansion, and that monitoring of underwater noise be performed by an independent organisation.

91. In response, the effects of underwater noise have been specifically addressed in my Assessment Report and in my evidence. All acoustic models and assumptions around the potential effects of underwater noise have considered the worst-case scenario (e.g. loudest known source levels for potential dredger). The draft MMMP recommends that the consent holder (NPL) verify the *in situ* noise levels produced from pile-driving activities by measuring the associated underwater noises of these activities as soon as practicable once the project has begun. These measurements will be compared to values from modelling to determine if adjustments to mitigation actions are needed.

92. In addition, best management practices have been recommended for managing / minimising effects of noise from pile driving. These practices include the use of vibro-driving over impact driving where possible (due to lower level of sound generated), use of ramping up and / or soft starts, use of a non-metallic hammer cushion cap, modification of the contact time of the hammer during pile strike, and use of the smallest possible pile size. Precisely which management practices are most suited will depend on a number of variables, including in the latest available technology for reducing noise at the source, e.g. bubble curtains. In addition, pile driving will take place in daylight hours only (so as to allow for visual observation of marine mammals) and where practicable, with proactive staging to potentially prevent piling activities over successive seasons.

93. With these measures in place, I am comfortable that adverse effects on marine mammals will be adequately avoided, and that the establishment of shut down zones (in which piling activities will cease if an animal enters) are aimed at managing any remaining residual effects on individual animals.

Cultural effects and further concerns

94. At the outset I note that it is my understanding that only tangata whenua and those with mana moana can identify and articulate the cultural values and associations of an area. In this case, Patuharakeke Te Iwi Trust Board (PTB), Te Parawhau, and Ngatiwai Trust Board (A. Te Huna)[8] have submitted on the application.[9] I understand that engagement is ongoing - I was involved in one of the three hui between NPL and PTB.

95. In their submission, PTB have stated that they are concerned over the potential for the port expansion to have a significant impact on the natural environment and their ability to perform traditional practices and cultural obligations. They express concern over how the development will impact taonga species and the relationship of tangata whenua with these species, over the failings of past mitigation measures conditioned in the original port development consent, and over the failure to provide a kaitiaki role in respect of taonga species.

96. It is important to note that the Assessment Report addressed the potential effects on marine mammals from a physiological, behavioural and ecological perspective. As a cultural assessment is outside the realm of my expertise, I cannot comment on the impact of the development on the relationship of PTB with taonga species, nor the provision of a kaitiaki role in respect to these species.

97. However, I agree that involvement of PTB as kaitiaki, including to share any marine mammal related knowledge, as well as involvement in scoping and carrying out proposed monitoring would be beneficial. I have found PTB's contribution in similar resource consent assessments invaluable previously (i.e. Refining NZ's channel deepening consent). Using just one specific example, given the duration of the proposed dredging and pile driving schedule, multiple trained marine mammal observers will be necessary to fulfil the monitoring conditions. Based on previous experience, I know the best observers are those that have an inherent interest in the animals and the local environment, hence, the use of mana whenua and other local community members are always preferred for these roles.

[8] Submission number 163.
[9] My response focuses on the submission by PTB as it raises detailed issues regarding marine mammals.

98. In the written submission, PTB also expressed concern over:

(a) the lack of consideration of the potential effects of increased ship movements on marine mammals in the AEE,

(b) the suitability of the DOC dataset for assessing the importance of the harbour for marine mammals, and

(c) the assumptions made regarding the lack of coinciding / cumulative impacts with respect to climate change.

I address each of these issues below.

99. Increased shipping - The harbour entrance and main shipping channel currently experience heavy vessel traffic year-round by a variety of commercial and recreational vessels. My understanding is that the development facilitated by the current application will not materially change this, nor does this application seek consent for any operational vessel movements. Nonetheless, the PTB submission raises the issue of increased shipping, and this is consistent with concern expressed on behalf of PTB at the hui I attended.

100. In response, I acknowledge that, without appropriate management, daily ship movements between ports and along the north-eastern coastline of New Zealand have the potential to cause less than minor to more than minor effects on marine mammals. However, I note that because:

(a) the Whangārei Harbour entrance represents only a small (and conceivably less pristine) fraction of similar habitats available to support the various species that utilise the harbour and wider Bream Bay ecosystem, and

(b) the expansion and uptake of the Hauraki Gulf transit protocol for shipping that include speed limits and crew member on watch, along with the adoption of boating behaviour guidelines,

the level of potential effect on marine mammals is reduced to between negligible and less than minor. Risks associated with vessel strike, and management of that potential effect is discussed in further detail in paragraphs58 to 63 above.

101. Suitability of datasets - To establish relative marine mammal occurrence within the harbour entrance area prior to any proposed development activities, all available

information on marine mammals that use Whangārei Harbour and the wider AOI waters were collated (see paragraph 26 above). It is acknowledged in the AEE that the compiled datasets are limited by the fact that many sighting records are collected opportunistically from public sources (e.g. Department of Conservation sighting and stranding databases). Nevertheless, available scientific research and peer-reviewed publications made contributions to the studies and databases used to make summaries and assessments on marine mammal species.

102. From these data (and in context of the RMA, NZCPS, Regional Policy Statement for Northland, Northland's Regional Coastal Plan, and the Regional Plan for Northland), I am confident that there is no biological or ecological evidence based on western science concepts indicating that any species is found solely in the region of the harbour or is a resident of the harbour. I acknowledge that this may be contrary to PTB's cultural perception or assessment of a species' ecological needs.

103. Instead, all of the species of interest are known to live over much larger home ranges along the north-eastern coastal area, taking advantage of the various habitats at different times of the years. As they are long-lived, their habits tend to vary from year to year and they can use several areas for the same or differing aspects of their life (e.g. feeding, breeding, resting, and migrating).

104. The potential risks of the proposed construction activities were then assessed based on species' life history dynamics as surmised from New Zealand and international data sources. My assessment has made the worst-case assumption that any or all of these species may be present in the harbour and near the Port at same point (regardless of migration paths or season). As a result, the recommended mitigation and draft MMMP addresses how the management measures will avoid or mitigate any adverse effects when any marine mammals are present.

105. Cumulative effects of climate change - The distribution of marine mammals in New Zealand waters is changing in relation to climate change effects and is expected to continue to do so into the future. The current home ranges and distributions of marine mammals are expected to shift as water temperatures rise and the climate-driven factors affect coastal and more offshore waters. Attempts are being made to predict what these patterns may look like for some better-studied species (e.g. Peters et al. 2022), mainly in association with water temperatures and depth preferences.

106. Any noise effects from pile driving and other construction activities will cease once the proposed development is complete. While some (albeit spatially very limited) local habitats will be permanently lost due to the port expansion, the effects on other nearby habitats are expected to be temporary, with habitats fully recovering in a few years. As a result, port construction effects will occur over much shorter timescales than the longer-term shift in regional weather patterns caused by climate change and will not necessarily be compounding for marine mammals.

107. I do not expect that climate change will worsen the effects that could occur from this proposal. In that regard, the prospect of climate change does not cause me to alter my opinion that any adverse effects on marine mammals will be minimal.

108. Overall, I have reviewed the submissions that relate to marine mammal issues and consider the proposal design, management approaches, and recommended consent conditions appropriately address the issues raised.

RESPONSE TO THE SECTION 42A REPORT

109. I have read and reviewed the Section 42A report that applies directly to marine mammals including sections 10.4.1.1, 10.4.1.2, 10.5, 13.4.2, and in particular sections 10.4.7, 14.3, 16 and Appendix C5 (the specialist review by Ms McConnell).

110. Section 14.3 and paragraph 631(f) of the Section 42A report recommend new or amended conditions for marine mammals including:

(a) strengthening the condition for navigation control to be equivalent to the Hauraki Gulf Transit Protocol for all project vessels; and

(b) Use of bubble curtains to reduce underwater construction noise,

111. I agree with extending the current condition to require project vessels to adopt the Hauraki Gulf Transit Protocol (or equivalent controls) throughout the construction project.

112. While my assessment has been based on the currently predicted sound levels,[10] I am in agreement with the use of any practicable mitigations to help reduce piling noise levels as large Marine Mammal Observation Zones (MMOZs) are harder to protect as well as often proving disruptive to construction. However, I feel a

[10] With those mitigations listed in Table 1.

requirement to rely only on bubble curtain technology may not be the best reduction technology for NPL particularly given environmental factors, such as the amount of water current in the construction area – the implication being that bubble curtains simply may not work to their design criteria (see Mr Pettersson's evidence for further details). Instead, other operational changes are more likely to reduce noise reliably and consistently at the source, in addition to other potentially new and developing technologies, and should be considered closer to the time of actual construction.

113. The Section 42A report (631f) also suggests several amendments to the MMMP based on Table 1 and Section 8.3 of Ms McConnell's review report.

114. I agree with most of these amendments and note that they are already addressed and / or in agreement with several of the conditions proposed by NPL, as indicated by Ms McConnell's in her review report. Hence, her recommendation is to ensure they are reflected in the final version of the MMMP as well.

115. Mr Pettersson addresses the following proposed amendments to the MMMP. I have read and am in agreement with his comments:

(a) Timing of noise measurements;

(b) Soft start procedures;

(c) Hours of operation;

(d) Concurrent piling / dredging projects and cumulative noise;

(e) Silt curtains;

(f) MMO training; and

(g) Communications with third parties.

116. I consider that some of the proposed amendments are already incorporated in the MMMP, and some need further modification or are not necessary in my opinions and these include:

(a) Successive seasons – Piling activity can vary greatly from small, intermittent work to continuous multiple pile staging. Hence, I do not support a complete prohibition on piling works over successive seasons (i.e. winter months of July – September for visiting whales). Instead, piling schedules

will need to consider undertaking smaller piling activities or reducing noise levels during the second winter season. This is discussed in more detail in the evidence of Mr Pettersson.

(b) Pre-observation surveys / animals in harbour– as the harbour is over 20 km, it would be impractical to cease all piling activity for any cetaceans / pinnipeds sighted or remaining within inner harbour regions. An alternative option, based on the noise propagation models, would be to station a Marine Mammal Observer (MMO) on One Tree Point if cetaceans have been detected or reported from the inner harbour region (see Mr Pettersson's evidence further details). This MMO would keep watch directed towards inner harbour waters for any signs of cetacean movements towards the Harbour entrance. If sighted by the MMO, any active piling operations would temporarily cease and should not recommence until animals are observed to leave the harbour or return back to inner harbour regions.

(c) Reference to regular maintenance and upkeep of piling and dredge equipment as a BPO in Section 4.2.1 of the MMMP is not necessary as it is already included in Section 4.1 Operational Best Management Practices of the MMMP.

117. Overall, I note that the Section 42 report in Table 8 and Section 16 has a similar conclusion to mine that any effects on marine mammals are considered less than minor.

PROPOSED CONDITIONS ADVANCED BY NORTHPORT

118. I have reviewed the proposed conditions for marine mammals. These conditions incorporate mitigation measures and best management practice for marine mammals that are in agreement with my recommendations in Table 2.

Deanna Clement
Cawthron Institute

24 August 2023

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TABLES

Table 1. Summary of potential effects on relevant marine mammal species from the proposed NPL proposed reclamation extension. TTS = temporary auditory threshold shift. PTS = permanent auditory threshold shift. MMMP = Marine Mammal Management Plan

Potential environmental effects	Spatial scale of effect on marine mammals	Persistence / duration of effect for marine mammals	Consequences for marine mammals	Likelihood of effect	Significance Level of Effect (without proposed management approaches)	Proposed management approaches / effects analysis	Significance Level of Residual Effect (with proposed management approaches)
Behavioural and / or physical responses to: • **General construction activities**	**Small to Large** - dependent on final method / sounds produced - behavioural responses (BR) predicted at larger distances	**Short to Persistent** - construction expected to be completed within 2–3 years - various activities will produce more or less noise	**Individual Level** - individuals may avoid or approach activities	**NA / Low** - TTS - masking - behavioural	**Nil to Negligible**	• Localised, intermittent activity of short durations but continuing for months and / or years • Relevant environmental factors (may naturally help dampen underwater noise production) • *In situ* measurements of underwater noise levels from construction activities and adjust mitigation if necessary (MMMP)	**Nil to Negligible**
• **Pile-driving activities:** **Physical injury (TTS / PTS)**	**Small to Large** - PTS and TTS vary with species, up to 1.3 km	**Short to Persistent** - dependent on exposure, damage and recovery periods between events, eastern construction over 2–3 years	**Individual to Regional Level** - hearing impairment or injury of endangered individual (i.e. breeding female) to potential attraction of juvenile animals	**Low** - PTS - TTS	**Less than Minor to More than Minor** - PTS - TTS	• BPO used in method selection (MMMP) • Regular maintenance and upkeep of piling equipment (MMMP) • Explore reducing noise at source developments • Reduce unexpected noise by using ramping up and / or soft starts (MMMP) • *In situ* verification of underwater noise levels from piling activities and adjust mitigation if necessary (MMMP) • Establishment of shut down zones in which piling activities will cease if an animal enters (MMMP) • Daylight hours operations only (MMMP) • Intermittent piling (1–4 piles per day) • Very low probability of whale presence near proposal area • Proactive staging may prevent piling activities over successive seasons (i.e. 2 consecutive winter seasons) (MMMP)	**Nil to Negligible** - PTS - TTS
Displacement effects (Behavioural / masking)	**Large** - behavioural responses (BR) / masking over 1–2 km	**Short to Persistent** - dependent on exposure and recovery periods between events; eastern construction over 2–3 years	**Individual to Regional Level** - abandonment or avoidance by particular age groups (e.g. mother / calves) or individuals - possible acoustic masking between conspecifics only within harbour waters	**Moderate** - behavioural avoidance / attraction - masking	**Less than Minor to Minor**		**Negligible to Less than Minor** - behavioural - masking
• **Dredging activities**	**Small to Medium** - behavioural / masking responses predicted at < 600 m - potential TTS only when next to dredger (< 1 m)	**Short to Persistent** - possibly intermittent over weeks / months - eastern construction over a few months	**Individual Level** - individuals may avoid or approach dredge activities, individuals subject to potential behavioural responses and acoustic masking when within close proximity	**NA** - PTS / TTS **Low to Moderate** - behavioural - masking	**Nil to Less than Minor**	• Regular maintenance and proper upkeep of all dredging equipment and the vessel / platform (MMMP) • *In situ* verification of underwater noise levels from dredging activities and adjust mitigation if necessary (MMMP) • Localised activity of short durations (hours to months) • Very low probability of whale presence near proposal area	**Nil to Less than Minor**
Marine mammal / vessel collision risk	**Large** - daily ship movements between ports and along the north-eastern coastline	**Short to Persistent** - daily transits through region limited duration but for length of consent, - animals only present in region for a day to weeks	**Individual to Population Level** - death or injury of endangered or threatened species vs death of non-threatened dolphin or pinniped	**Low**	**Less than Minor to More than Minor**	• Very low probability of whale encounter (other than Bryde's whales mainly in Gulf waters) • Adoption of boating behaviour guidelines (MMMP) • Support / encourage expansion and uptake of the Hauraki Gulf transit protocol for shipping that include speed limits and crew member on watch while transiting through destinated waters in daylight hours	**Negligible to Less than Minor**
Marine mammal entanglement in operational gear and / or debris	**Small to Medium** - limited to immediate waters around construction sites	**Short to Persistent** - construction expected to be completed within 2–3 years -different activities have variable risk	**Individual to Population Level** - death or injury of endangered or threatened species vs death of non-threatened dolphin or pinniped	**NA to Low**	**Nil to Less than Minor**	• Avoid loose rope, lines, nets or other debris (MMMP) • Compliance with NZ Maritime Rules Part 180 (MMMP) • Regular maintenance / inspection of properly tensioned silt curtains or other sediment containment gear (MMMP)	**Nil to Negligible**
Marine mammal habitat loss and / or prey disturbance	**Medium to Large** - complete loss of reclaimed habitat; disturbance limited to immediate waters and habitats adjacent to construction sites	**Short to Persistent** - re-colonisation of most habitats (except reclaimed areas) will begin after disturbance has ceased, boat scour persistent for wharf lifetime	**Individual Level** - individuals may avoid or approach activities	**NA to Low**	**Nil to Negligible**	• Previous or ongoing disturbance to nearby seabed from associated Port activities • No unique feeding habitats in the proposed areas	**Nil to Negligible**

Definition of terms used in table:

- Spatial scale of effect: Small (tens of metres), Medium (hundreds of metres), Large (> 1 km)
- Persistence of effect: Short (days to weeks), Moderate (weeks to months), Persistent (years or more)
- Consequence: Individual, Regional, Population level
- Likelihood of effect: Not Applicable (NA), Low (< 25%), Moderate (25–75%), High (> 75%)
- Significance level: Nil (no effects at all), Negligible (effect too small to be discernible or of concern), Less than Minor (discernible effect but too small to affect others), Minor (noticeable but will not cause any significant adverse effects), More than Minor (noticeable that may cause adverse impact but could be mitigated), Significant (noticeable and will have serious adverse impact but could be potential for mitigation).

Table 2. Proposed management goals and practices to reduce or avoid the risk of any adverse effects of construction activities on marine mammals in Whangārei Harbour. DOC = Department of Conservation, NRC = Northland Regional Council. BPO = best practical option.

Potential effects	Management goal	Best Management Practice	Reporting / monitoring
Physical and / or behavioural responses to underwater sound from construction activities	1. Avoid acoustic injury and minimise disturbance to marine mammals	1a. Use BPO to minimise underwater noise effects. 1b. Establish a marine mammal management plan (MMMP) for: <u>Dredging activities</u> 1c. Regular maintenance, proper up-keep of all dredging equipment and vessels (e.g. lubrication and repair of winches, generators). <u>Pile-driving activities</u> 1d. Adopt soft-start / ramping up procedures and choose plant / techniques on the basis of BPO. 1e. Designated shut down zones with dedicated, experienced marine mammal observer(s) to maintain a watch before, during and after any pile-driving activities (during daylight hours only). 1f. Minimise the spreading of piling stages over successive seasons.	• Measure actual underwater noise levels from pile driving, dredging and other construction activities and adjust / implement any mitigation actions based on these data, if necessary. • Record and report the type and frequency of any marine mammal sightings (i.e. visual and acoustic) and interactions before, during and after pile-driving activities (including absences and effort), in a standardised format. Annual records provided to DOC and NRC and made publicly available (e.g. web). Include behavioural data if possible. • Any project sightings should be reported to DOC for input to their national database.
Marine mammal / vessel strike due to increased vessel activity	2. Minimise the risk of vessel collisions with any marine mammal and aim for zero injury / mortality	2a. Encourage port-related ships to adopt best boating guidelines for marine mammals (see **Error! Reference source not found.**). 2b. Formally support and establish a similar protocol to the Hauraki Gulf Transit Protocol for Commercial Shipping that includes speed limits, crew watches and reporting of sightings to reduce any chances of mortality from vessel strikes.	• Consistent with the Hauraki Gulf's voluntary shipping protocol, NPL will maintain records of all reported vessel strike incidents or near incidents regardless of outcome. • In case of a fatal marine mammal incident, carcass(es) recovered (if possible) and given to DOC, and further steps taken in consultation with DOC to reduce the risk of future incidences. Tangata Whenua notified.
Marine mammal entanglement in operational gear and / or debris	3. Minimise entanglement and aim for zero mortality	3a. Avoid loose rope and / or nets (i.e. keep all ropes and nets taut). All deck lines should be tied up when not in use or under some degree of tension. 3b. Regular maintenance / inspection of properly tensioned silt curtains or other sediment containment gear. 3c. Ensure that all support vessels and other project activities have waste management plans in place. 3d. Record all entanglement incidents or near incidents regardless of outcome (e.g. injury or mortality).	• Nothing required, self-checking with up-to-date records available. • In case of a fatal marine mammal incident, carcass(es) recovered and given to DOC, and further steps taken in consultation with DOC to reduce the risk of future incidences. Tangata Whenua notified.