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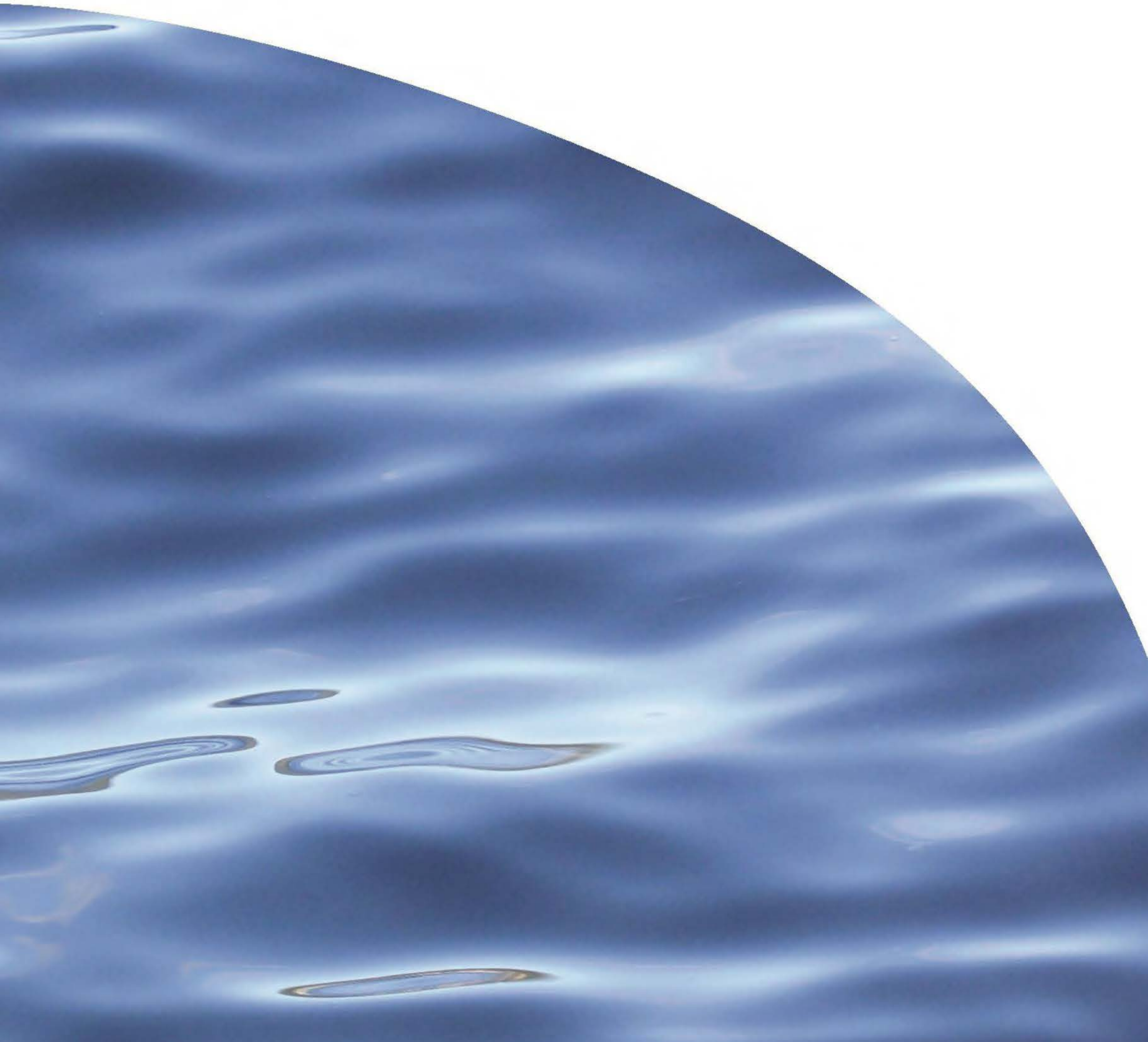
ASSESSMENT OF EFFECTS ON MARINE MAMMALS FROM PROPOSED DEEPENING AND REALIGNMENT OF THE WHANGAREI HARBOUR ENTRANCE AND APPROACHES



ASSESSMENT OF EFFECTS ON MARINE MAMMALS FROM PROPOSED DEEPENING AND REALIGNMENT OF THE WHANGAREI HARBOUR ENTRANCE AND APPROACHES

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Prepared for Chancery Green on behalf of the New Zealand Refining Company Limited (trading as 'Refining NZ')

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EXECUTIVE SUMMARY

Refining NZ (RNZ) is proposing to utilise more heavily-laden tankers to transport crude oil to its refinery in Whangarei Harbour, which would ultimately result in fewer crude oil shipping movements compared to current numbers. To accommodate heavier vessels, Whangarei's inner harbour, harbour entrance and various locations along the shipping channel would need to be dredged, some areas re-aligned and navigational aids modified accordingly. As part of the resource consent application process, RNZ contracted the Cawthron Institute to investigate possible environmental effects of the proposal on local and regional marine mammal species. This report outlines and assesses the potential effects of dredging, disposal and pile-driving activities on the relevant marine mammals.

Out of the 29 marine mammal species that have been sighted or stranded within Whangarei and Bream Bay waters, only four species regularly or seasonally frequent these coastal waters. These species are bottlenose dolphin, orca, Bryde's whale and common dolphin. Several other species, that visit the area less frequently, are also considered in this report because various life history dynamics (e.g. low population numbers) or species-specific sensitivities (e.g. acoustically sensitive) make them potentially vulnerable to effects of dredging. Tangata Whenua also hold most of these species in high regard, as their name for the harbour, Whangarei te rerenga parāoa, means 'the gathering place of whales'.

The direct effects of dredging and pile-driving activities that are most relevant to marine mammal species in the Whangarei region are: vessel strike, increased underwater sound production and possibly the risk of entanglement. While these effects have the greatest potential consequences (i.e. injury or death of a marine mammal), the actual likelihood of them occurring in this case is low, and overall the effects are deemed *de minimis* with proposed mitigation actions.

Indirect effects of dredging and disposal 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. Given the location and habitats associated with the dredging proposal, the review of possible indirect effects to the ecosystem focused on: quality of spoil; and ecological effects on the benthos and associated fish assemblages, including the effects of any resulting turbidity plumes. Overall, any indirect effects of project activities are not expected to be detrimental for local or visiting marine mammals in the region, and any such effects will be temporary.

Several avoidance/remediation/mitigation and monitoring measures are recommended, including an informative (rather than an impact) monitoring plan. Recommended measures involve a combination of visual sightings (both opportunistic and from the project vessels themselves) with simultaneous passive underwater acoustic monitoring collected within the proposal area before, during and after dredging and disposal activities. Such a programme will report on the actual effects of dredging and pile-driving on New Zealand marine mammals while also assessing the effectiveness of the mitigation measures employed.

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1. SCOPE OF WORK

1.1. Description of proposal

Refining NZ (RNZ) operates New Zealand's only oil refinery based at Marsden Point at the entrance to Whangarei Harbour. In order to improve competitiveness by reducing freight costs, the company is investigating options to deepen and realign the entrance channel to Whangarei Harbour so that more heavily-laden tankers (which require deeper drafts) can access its jetty, resulting in fewer ship movements. To accommodate heavier vessels, the inner harbour, harbour entrance and various locations along the shipping channel would need to be dredged and some areas realigned. Inner harbour dredging is likely to involve creation or deepening of 'jetty pockets' to allow for berthing of vessels with deeper drafts. The proposal will also include disposal of dredge spoil in the coastal marine area, as well as periodic maintenance dredging (every 2–20 years depending on location) to address subsequent sedimentation in the proposal area. It will also include the relocation of some existing navigation aids and installation of five new navigation aids.

1.2. Scope of assessment

This report constitutes the second of a two-phase assessment. The first (Phase 1) report (Clement & Elvines 2015) consisted of a desktop review of the marine mammal populations utilising Whangarei Harbour and the wider Bream Bay ecosystem; and a literature review of the potential effects currently associated with dredging/disposal activities and marine mammals. The Phase 1 report, along with additional information from other consultancy reports, forms the basis of the final Phase 2 assessment. This Phase 2 report is a comprehensive assessment of effects of the proposed activities on local and visiting marine mammals, with recommended avoidance, remediation and mitigation options, and is intended to support the final resource consent application. It specifically includes:

- a summary description of the existing environment in terms of those marine mammal species most susceptible to any effects of the proposed activities
- categorisation of any impacts in the context of the actual project area and environment, based on the findings of other relevant reports (e.g. underwater noise, ecology, hydrodynamics)
- categorisation of the overall risk of any resulting effects in terms of scale, duration/persistence, likelihood and possible consequences
- recommendations for avoidance, remediation and mitigation options based on the final risk assessment of effects.

2. DESCRIPTION OF EXISTING ENVIRONMENT

2.1. General site description

Whangarei Heads is also known as 'Whangarei te rerenga parāoa', which means 'Whangarei, the gathering place of whales'. While this reference is also thought to be a metaphor for the gathering place of chiefs[1], the significance of whale migrations past this region is supported by the number of whaling stations found north near Whangamumu and along the entire eastern coastline of the North Island during the late 1800s and early 1900s (Dawbin 1956).

Out of the more than 50 species of cetaceans (whales, dolphins and porpoises) and pinnipeds (seal and sea lions) known to live or migrate through New Zealand waters, at least 27 cetacean and two pinniped species have been sighted or stranded along the north-eastern coastline of the North Island. When considering potential implications of coastal developments on marine mammals, the importance of Whangarei waters needs to be considered in the context of the species' regional and New Zealand-wide distributions, given that most species regularly range for hundreds to thousands of kilometres. Hence, Figure 1 highlights the various marine mammal species found to frequent north-eastern coastal regions between the Bay of Islands to the north and the entrance to the Hauraki Gulf and Great Barrier Island to the south.

2.2. Species of concern

The marine mammals most likely to be affected by the proposed project include those species that frequent the Whangarei Harbour and Bream Bay regions year-round or on a semi-regular basis, including bottlenose dolphins (*Tursiops truncatus*), orca (*Orcinus orca*), Bryde's whale (*Balaenoptera edeni)* and common dolphins (*Delphinus delphis*; Clement & Elvines 2015). Although infrequent visitors, other species of concern include those that are more vulnerable to anthropogenic (human-made) impacts due to various life-history dynamics (e.g. southern right whales due to low population numbers) or species-specific sensitivities (e.g. pilot whales due to underwater noise sensitivities). Given the reference to whales in their name for the harbour, Tangata Whenua o Whangarei Te Rerenga Paraoa are also concerned about the continued presence of several marine mammals in the region. Table 1 summarises those marine mammal species considered further in terms of any dredging/disposal effects associated with this proposal.

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[1] A history of Ngati Wai – First of Four Instalments by Morore Piripi (http://teaohou.natlib.govt.nz/journals/teaohou/image/Mao37TeA/Mao37TeA018.html).

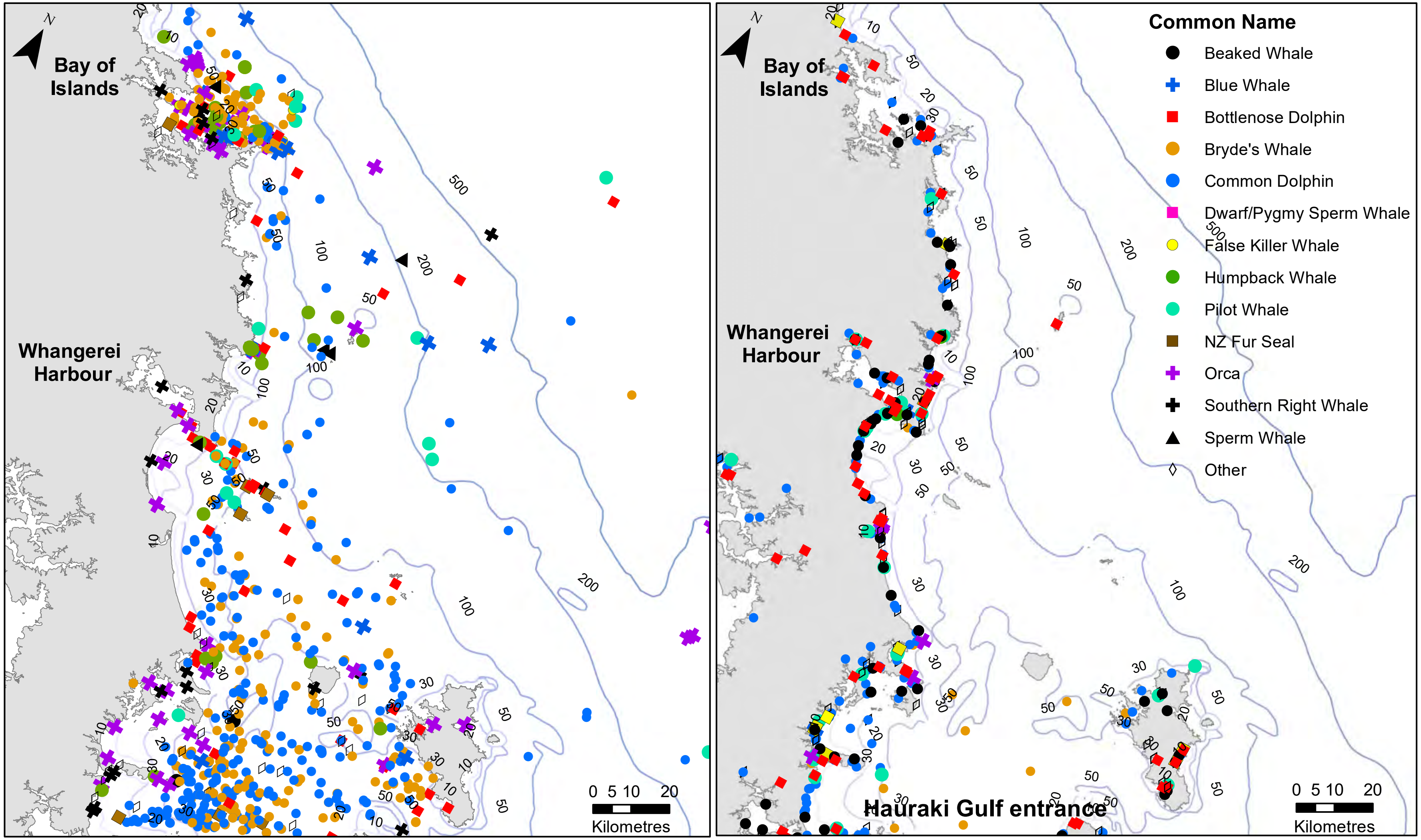

Figure 1. Opportunistic sightings (left) and strandings (right) of marine mammals prevalent in north-eastern coastal waters between the Bay of Islands to the north and Whangaparaoa and Great Barrier Island to the south (Department of Conservation's sighting and stranding database).

Table 1. Marine mammal species potentially affected by the proposal and areas of concern (modified from Clement & Elvines 2015).

Species	**Resident or semi-resident**	**Conservation concern**	**Acoustic concern**	**Tangata whenua concern**
Bottlenose dolphin	✓	NE	MF	✓
Orca	✓	NC	MF	✓
Bryde's whale	✓	NC	LF	✓
Common dolphin	✓		MF	✓
NZ fur seal			OP	✓
Pilot whale			MF/AS	✓
Beaked whale			MF/AS	✓
Southern right whale		NV	LF	✓
Humpback whale			LF	✓
Sperm whale			MF	✓
Pygmy sperm whale			HF/AS	✓

The definitions used in the table are:

- NC – Nationally Critical, NE- Nationally Endangered, NV – Nationally Vulnerable (Baker et al. 2016)
- LF – Low-Frequency cetacean hearing group; 7 Hz-35 kHz, all baleen whales
- MF - Mid-Frequency cetaceans – 150 Hz-160 kHz, all toothed cetaceans except those listed in high-frequency category
- HF - High-Frequency cetaceans - 275 Hz-160 kHz (i.e. *Kogia*, cephalorhynchid (Hector's dolphin) (NOAA 2016)
- AS – species thought to be more Acoustically Sensitive to underwater noise than other species (Clement & Elvines 2015, Appendix 1)
- OP – acoustic sensitivity (60 Hz to 39 kHz) consistent with the generalised Otariid Pinniped group for sea lions and fur seals underwater (NOAA 2016).

This north-eastern coastline represents some of the largest groupings of common dolphins and beaked whale species around the North Island, while potentially supporting isolated sub-populations of bottlenose dolphins, orca and Bryde's whale (Clement & Elvines 2015). However, based on the available species data, and in reference to Section 6(c) of the Resource Management Act (RMA) [2], Policy 11 of the New Zealand Coastal Policy Statement (NZCPS), and Method 9.2.5.2 of Northland's Regional Coastal Policy (RCP)[3], Whangarei Harbour and nearby Bream Bay waters are not considered ecologically significant in terms of feeding, resting or breeding habitats for any particular species relative to other regions along the north-eastern coastline. Instead, Whangarei Harbour and Bream Bay coastal waters represent a small fraction of similar habitats available to support these species that utilise the larger north-eastern coastal region (Clement & Elvines 2015). While several whale species have their regular migration routes through this region, the Harbour and Bream Bay are not considered as ecologically important migration corridors as most animals generally pass by the area further offshore.

[2] Section 6(c) - the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

[3] Appendix 9 - The Council has used the following criteria to determine those areas of important conservation value identified in the Plan as Marine 1 Management Areas. 5 – Marine Mammals and Birds Area including or near any: (a) marine mammal breeding or haul-out site.

3. ASSESSMENT OF ACTUAL AND POTENTIAL EFFECTS

The purpose of the Phase 1 report was to review and determine which effects of dredging and / or disposal on marine mammals needed to be considered further in the context of this proposal. These effects, including any associated with pile driving, are outlined in this section and discussed in further detail below.

3.1. Direct effects

Most consequential interactions between marine mammals and coastal development usually result from a direct overlap between the spatial location of anthropogenic activity and important habitats of the species (i.e. feeding or nursing grounds). The act of disturbing and / or removing bottom substrate in itself is not expected to directly affect any marine mammals known to frequent Whangarei waters. Instead, the associated increase in vessel activity, resulting production of underwater sound, and physical activities within the general harbour entrance region are the more likely factors by which marine mammals will be affected.

3.1.1. Vessel strikes

A recent worldwide review of dredging effects suggests that the risk of collision between dredge vessels and marine mammals will be minimal if the activity avoids critical habitats and seasons when the species of concern may be more ‘distracted’ while feeding or resting (Todd et al. 2015). Particular species (i.e. baleen whales) and certain age groups (i.e. calves and juveniles) are noted as being more susceptible to vessel strike than others. 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.

The likelihood of vessel strike also depends on a number of operational factors including vessel type, speed, and location (Van Waerebeek et al. 2007). The greatest increase in both the 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). This might explain why dredge vessels, which generally have maximum transit speeds of only 12–16 knots (Brunn et al. 2005), have been involved in only one out of the 134 worldwide collision cases (in which the vessel type was known) reported between 1975 and 2002 (Jensen & Silber 2004).

The proposed capital dredging of the Whangarei Harbour entrance will involve the removal of up to 3,700,000 m^3 of dredge spoil to the proposed disposal site(s) in Bream Bay. Sediment volumes for maintenance dredging are likely to be ~3.4% (per annum) of the capital disposal volume. Depending on the type of dredge vessel used, this removal will involve several thousand return trips (relatively fewer trips will be associated with larger vessels) between the various locations over an approximate six-month period of capital dredging. Significantly reduced time scales and vessel movements will be associated with maintenance dredging (Tonkin & Taylor 2016).

Despite an overall increase in vessel traffic during dredging[4], the likelihood of a vessel strike (injury or mortality) associated with the proposal is assessed as *low* for migrating baleen whales, odontocete and pinniped species and the significance of the effect is considered *de minimis* with proposed mitigation actions (Table 2, see Section 3.3 for details). This conclusion is based on local species information (Clement & Elvines 2015) and relevant factors as summarised below:

Spatial and temporal factors

- Relatively temporary increase in capital dredge vessel traffic (approximately six months) within a fairly localised area compared to the rest of Whangarei Harbour and the wider Bream Bay system (i.e. ~3–7 km distance between proposed channel and disposal sites).
- Low probability of the dredge vessel encountering a migrating whale as currently only 1–3 individual whales are sighted within Whangarei Harbour and Bream Bay each year; the majority passing by Hen (Taranga) and Chicken Islands in deeper, more offshore waters (e.g. further than 5 to 10 nm) (Clement & Elvines 2015).
- Most whales occur in the area for a limited period each year; mainly in the winter months and some spring months, and most only remain for a day up to a week (the exception being Bryde's whales).
- Most odontocete and pinniped species known to frequent Whangarei waters are in regular contact with all types and speeds of commercial and recreational vessels throughout their entire distributional range.

Known collision factors

- Low probability of the dredge vessel striking an individual animal given the vessel will be stationary (cutter-suction dredges and back-hoe dredges) or slow moving (trailer-suction hopper dredges) while dredging. When travelling to the disposal site, the normal operating speed of the dredge vessel (15 knots or less, depending on dredge vessel used; Tonkin & Taylor Ltd 2016) should be slow enough for the animals to manoeuvre out of the path of the vessel.
- 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 (although they may bowride occasionally).
- Whangarei Harbour and Bream Bay are not considered unique or important feeding, resting or nursery habitats for any residential or visiting species, hence

[4] While harbour traffic will temporarily increase during the capital dredging project, it will decrease over the long-term as the same, but more heavily-laden, tankers will result in fewer overall ship movements (Navigatus 2016; section 4.5, pg. 12).

individuals are less likely to be 'distracted' by such activities, and are thus less vulnerable to collision risk.

3.1.2. Underwater noise

The proposed capital and maintenance dredging activities, as well as the relocation and placement of navigation aids, will introduce a source of vessel traffic and mechanical activities that will generally increase the amount of anthropogenic underwater sound produced in the area (e.g. CEDA 2011; WODA 2013). Materially increasing underwater noise can affect marine mammals because they rely heavily on underwater sounds for communication, orientation, predator avoidance and foraging. Additional underwater noise may adversely affect marine mammals through changes in behaviour, masking of important noise signals, temporary auditory shifts (TTS; temporary threshold shift), or permanent injury (PTS; permanent threshold shift) (Todd et al 2015; Clement & Elvines 2015, Madsen et al. 2006).

Dredge noise

Generally, the noises produced from dredging activities are continuous, broad-band sounds at frequencies mostly below 1 kHz (Todd et al. 2015). Underwater noise reviews by CEDA (2011) and WODA (2013) found that trailer-suction hopper dredges (TSHD), cutter-suction dredges (CSD) and back-hoe dredges (BHD), [the main types of dredges considered for this proposal], produce mostly low frequency, omni-directional sounds between 100-500 Hz (Figure 2). Their bandwidths can fluctuate as low as 20 Hz and as high as 20 kHz. Dredge-related sound levels will be dependent on the specific vessel selected to undertake the proposed works (Pine & Styles 2016). However, sound levels generated from dredgers similar to that considered for this proposal generally range between 164 and 185 dB *re*1 µPa rms @ 1 m [5] (Pine & Styles 2016). These are generally lower sound levels than a powerful ship which is between 180-190 dB *re*1 µPa rms @ 1 m (OSPAR 2009; Todd et al. 2015). The exact sound ranges of dredges are also dependent more on the sediment extraction process and the types of sediment being extracted, with coarser gravel causing greater sound levels (WODA 2013 and references therein). Sediments being removed for the proposal are predominantly sand and shell fragments (MSL 2016).

[5] The term 'dB *re*1 µPa rms @ 1 m' represents the sound pressure level that has been back calculated to a standardised distance of one metre distance from the source, and termed source level. RMS = root mean square or mean squared pressure and rms levels are often used for the assessment of continuous noise sources. The averaged square pressure is measured across some defined time window that encompasses the signal.

Table 2. Summary of potential effects on marine mammal species from the dredging of Whangarei Harbour entrance and associated disposal within Bream Bay with mitigation measures.

Potential environmental effects	Spatial scale of effect on marine mammals	Persistence / duration of effect for marine mammals	Consequences for marine mammals	Likelihood of effect	Avoidance Factors / Mitigation Options (see Section 3.3 and Table 4 for more details)	Significance Level of Residual Effect
Marine mammal / vessel strike due to increased vessel activity	**Medium to Large** Limited to vessel movements between the harbour entrance and disposal site (~3-7km)	**Short to Moderate** Whales are only present in area for a day to weeks; approximately 6 months for local dolphins and pinnipeds (during capital dredging), and < 6 months periodically every 2–20 years (for maintenance dredging).	**Population Level:** Death or injury of endangered or threatened species **Individual Level** Death or injury of non-threatened species	**Low**	• Very low probability of whale encounter • Often stationary and relatively slow speeds of dredging vessels • Adoption of boating behaviour guidelines • Liaison with DOC about possible whale presence in area while dredging	***De Minimis***
Behavioural and / or physical responses to underwater sound from: • **Dredging / disposal activities**	**Small to Large** Dependent on sounds produced; behavioural / masking responses predicted at large distances (several kms), potential TTS within close proximity (< 10 m)	**Short to Moderate** Whales are only present in area for a day to weeks; approximately 6 months for local dolphins and pinnipeds (during capital dredging), and < 6 months periodically every 2–20 years (for maintenance dredging).	**Individual to Regional Level:** Individuals may avoid or approach dredging activities; individuals subject to potential TTS; possible acoustic masking between conspecifics (regional).	**Low -** TTS, masking **to** **Moderate -** behavioural	• Very low probability of whale presence • BPO (best practicable option) used in dredge vessel selection • Regular maintenance and proper up-keep of all dredging equipment and the vessel • Designated marine mammal observer and precautionary safety zone (50 m) for cessation of active dredging while any marine mammals present within zone (daylight hours only)	**Nil –** TTS (daylight) **to** ***De Minimis* –** TTS (overnight), behavioural, masking
• **Pile driving for navigational aids**	**Small to Large** Behavioural / masking responses predicted at large distances (several kms), potential hearing injury/impairment with close proximity	**Short** Estimated 2 days	**Individual to Regional Level**: Individual avoidance or hearing injury/impairment (TTS/PTS), possible acoustic masking between conspecifics (regional)	**Low –** PTS, TTS **to** **High** - masking, behavioural	• BPO used in pile and pile-driving technique selection • Regular maintenance and up-keep of equipment • Ramping up and/or soft starts • Safety zone enforced by marine mammal observer	**Nil –** TTS / PTS **to** ***De Minimis* –**, behavioural, masking
Marine mammal entanglement in operational gear and / or debris	**Small to Medium** Limited to immediate waters around operating dredge vessels	**Short to Moderate** Mainly while dredge vessel is operating; approximately 6 months (during capital dredging), and < 6 months periodically every 2–20 years (during maintenance dredging).	**Population Level:** Death or injury of endangered or threatened species **Individual Level** Death or injury of pinniped or dolphin	**Low**	• Avoid use of loose rope and other lines • Compliance with NZ Maritime Rules Part 180	***De Minimis***
Contaminant effects on marine mammals from dredge sediments and / or spoil	**Medium to Large** Limited to immediate waters and habitats adjacent to dredge and disposal sites (< 1–3 km)	**Short to Persistent** Dependent on type and level of contamination in sediments	**Individual Level** Limited potential for any individual to consume more than few prey species exposed to dredging sediments	**Not Applicable to Low**	• Tested sediments have low to less than trace levels of contaminants and a low silt content (i.e. relatively lower potential for contaminant accumulation), with limited bioavailability and solubility • Continue to test sediments to ensure no contamination (i.e. prior to maintenance dredging)	**Nil to *De Minimis***
Marine mammal habitat and / or prey disturbance from loss of benthic habitat and increased turbidity from dredging and spoil disposal	**Medium to Large** Limited to immediate waters and habitats adjacent to dredge and disposal sites (< 1–3 km)	**Short to Persistent** Re-colonisation of benthos will begin during ongoing activities, and recovery within disposal site only after disturbance has ceased (e.g. 6-24 months). 99% of any given turbidity plume expected to settle out within less than a day.	**Individual Level** Possible avoidance of disturbed area, some individuals may approach disposal site(s) for foraging	**Not Applicable to Low**	• No unique feeding habitats in the proposed areas, and areas represent only a small portion of similar available habitat • Use of green valve disposal and monitoring thresholds to ensure turbidity limits	**Nil to *De Minimis***

Ranking of terms used in table:
- Spatial scale of effect: Small (tens of metres), Medium (hundreds of metres), Large (> 1 km)
- Duration of effect: Short (days to weeks), Moderate (weeks to months), Persistent (years or more)
- Consequence: Individual, Regional, Population
- Likelihood of effect: Not Applicable (NA), Low (< 25%), Moderate (25–75%), High (> 75%)
- Significance of effect: Nil (no effects at all), De Minimis (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 mitigated)

Understanding ambient underwater sound levels is important in assessing the potential scale and impact of additional underwater noises as these background noises, along with the physical environment, will influence the propagation and detection of any introduced sounds. In a study undertaken by Pine and Styles (2015; Appendix 1), the ambient background sound levels for the Whangarei Harbour region varied but were generally less than 119 ± 0.08 dB_{rms} re 1 μPa (based on no shipping in the area) and considered comparable to other nearshore habitats around New Zealand. The harbour was also similar to other New Zealand harbours in that lower frequencies (below 1 kHz) tended to dominate due to high vessel activity.

Marine mammal hearing

The lower frequency vocalisation ranges of southern right whales suggest their best hearing capabilities are at least between 50 Hz and 2 kHz (Parks & Tyack 2005) and 20 Hz to 12 kHz for humpbacks (McCauley & Cato 2003), while the generalised hearing range of most baleen whales is thought to be between 7 Hz and 35 kHz (NOAA 2016). These frequency ranges overlap with most anthropogenic underwater noise, including dredging activities as discussed above, meaning baleen whales are the species most susceptible to any noise effects from dredging (e.g. Clark et al. 2009).

Odontocetes (e.g. orca, bottlenose and common dolphins) generally communicate over a wider frequency range than baleen whales. They also have the capability to echolocate (produce biological sonar) for navigation and hunting. While most dolphins' functional hearing ranges are estimated to be quite large (mid-frequency hearing groups 150 Hz–160 kHz; NOAA 2016), and they can likely detect low-frequency sounds, their sensitivity significantly decreases at frequencies below 1–2 kHz (Au 2000; Southall et al. 2007). Pinnipeds' hearing ranges are thought to vary more widely (otariid pinnipeds e.g. NZ fur seal; 60 Hz–39 kHz; NOAA 2016), including some ultrasonic frequencies, and are quite sensitive to frequencies below 1 kHz (based on overseas research on Atlantic grey and harbour seals; Thomsen et al. 2009).

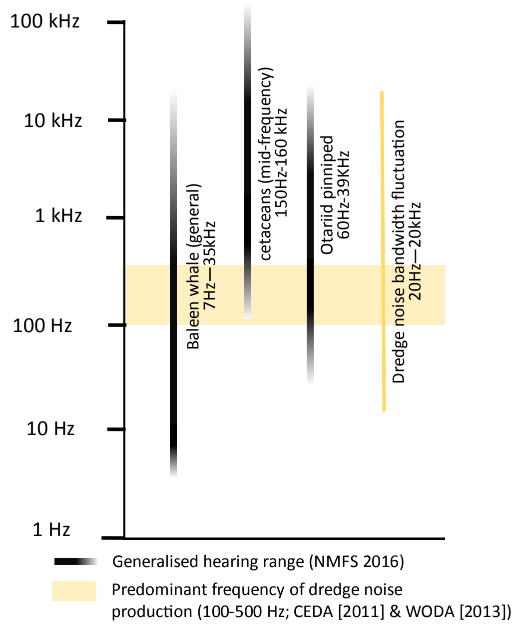

Figure 2. Schematic summary of overlap in frequency of marine mammal communication/hearing, dredge noise production.

Potential underwater noise effects

As evidenced by the spatial modelling results of Pine and Styles (2016) and local species information, the likelihood of any migrating baleen whales, odontocetes and fur seals being able to hear and behaviourally respond to underwater noise produced by dredging activity in the proposal areas is *low* to *moderate* (Table 2). This is dependent on the location of the animal in relation to the harbour, the dredge's location in the harbour entrance, and the size of the dredge vessel. A TSHD dredging in the outer channel location is expected to generate the largest spatial extent of noise, which is estimated to extend throughout the vicinity of Bream Bay (Figure 3), compared to other dredge types (CSD, BHD) and dredge locations (mid- and inner channel; Pine & Styles 2016).

The precautionary modelled scenarios in Pine and Styles (2016) estimate the potential onset for behavioural responses (e.g. changes in swimming direction, speed, surface intervals, respiration rates, vocalisation behaviours) in baleen whales to dredging noises may occur as far away as 18.5 km when using a medium-sized TSHD in the outer channel (Figure 3 and Table 3), and are based on NOAA's 120 dB re 1 μPa rms threshold[6] (Appendix 2). This radius is significantly less for mid-

[6] The 120 dB threshold has been used as a general guideline for assessing the possible spatial extent in which various marine mammals may detect and / or react behavioural to capital dredging sounds in the Whangarei and Bream Bay region. We have applied this particular threshold in the absence of any more up-to-date threshold information but acknowledge that this threshold, and its site- and species-specific approach in this proposal, is not necessarily the most appropriate threshold or approach for other such applications. See Appendix 2 for more details.

frequency cetaceans (i.e. orca, bottlenose, common dolphins) and otariid pinnipeds (i.e. fur seals). Any short-term auditory masking of particular communication signals for orca, bottlenose dolphin and NZ fur seal would be limited to 7.6, 4.7, and 14.7 km radius (respectively) from the dredge location when in the outer channel (Table 3) as a worst-case scenario.

The potential for the onset of temporary threshold shifts (TTS) are estimated to occur only when an animal is within 1–10 m of the TSHD during dredging operations, and only within 1 m for other dredge types (Pines & Styles 2016). No permanent hearing injuries (PTS) are predicted for any marine mammals regardless of dredge type or location, based on the estimated sound exposure levels being below the PTS thresholds. Noise generated from spoil disposal will be significantly lower than dredge noise, and will have a short duration (several minutes).

Table 3. Auditory masking and behavioural impact ranges for the three modelled species in Pine and Styles (2016), using both the small- and medium-sized trailing suction hopper dredge (TSHD) in the various channel locations. OP = Otariid Pinniped group, LF = Low Frequency group, MF = Mid-Frequency group (includes all other cetaceans considered for this proposal except pygmy sperm whale).

	Masking range (km)*		Behavioural response range (km)†	
Small TSHD	**Inner/mid-channel**	**Outer-channel**	**Inner/mid-channel**	**Outer-channel**
Orca	1.0	3.4	-	-
Bottlenose dolphin	1.1	3.3	-	-
Fur seal**	2.3	13.3		
LF (includes baleen whales)	-	-	2.2	17.8
MF (orca, bottlenose & common dolphin)	-	-	0.7	1.2
OP (i.e. fur seal)			1.1	5.2
Medium TSHD				
Orca	3.5	7.6	-	-
Bottlenose dolphin	3.2	4.7	-	-
Fur seal*	3.7	14.7	-	-
LF (i.e. baleen whales)	-	-	5.1	18.5
MF (e.g. orca, bottlenose & common dolphin)	-	-	1.1	1.8
OP (i.e. fur seal)			1.9	6.2

* Where available, these were based on the relevant species audiogram data (Pine & Styles 2016).

† Based on NOAA interim sound threshold guideline of 120 dB for behavioural disturbance, using hearing frequency for generalised group rather than individual species (see details in Appendix 2).

** Masking range based on northern fur seal audiogram data in the absence of NZ fur seal audiogram.

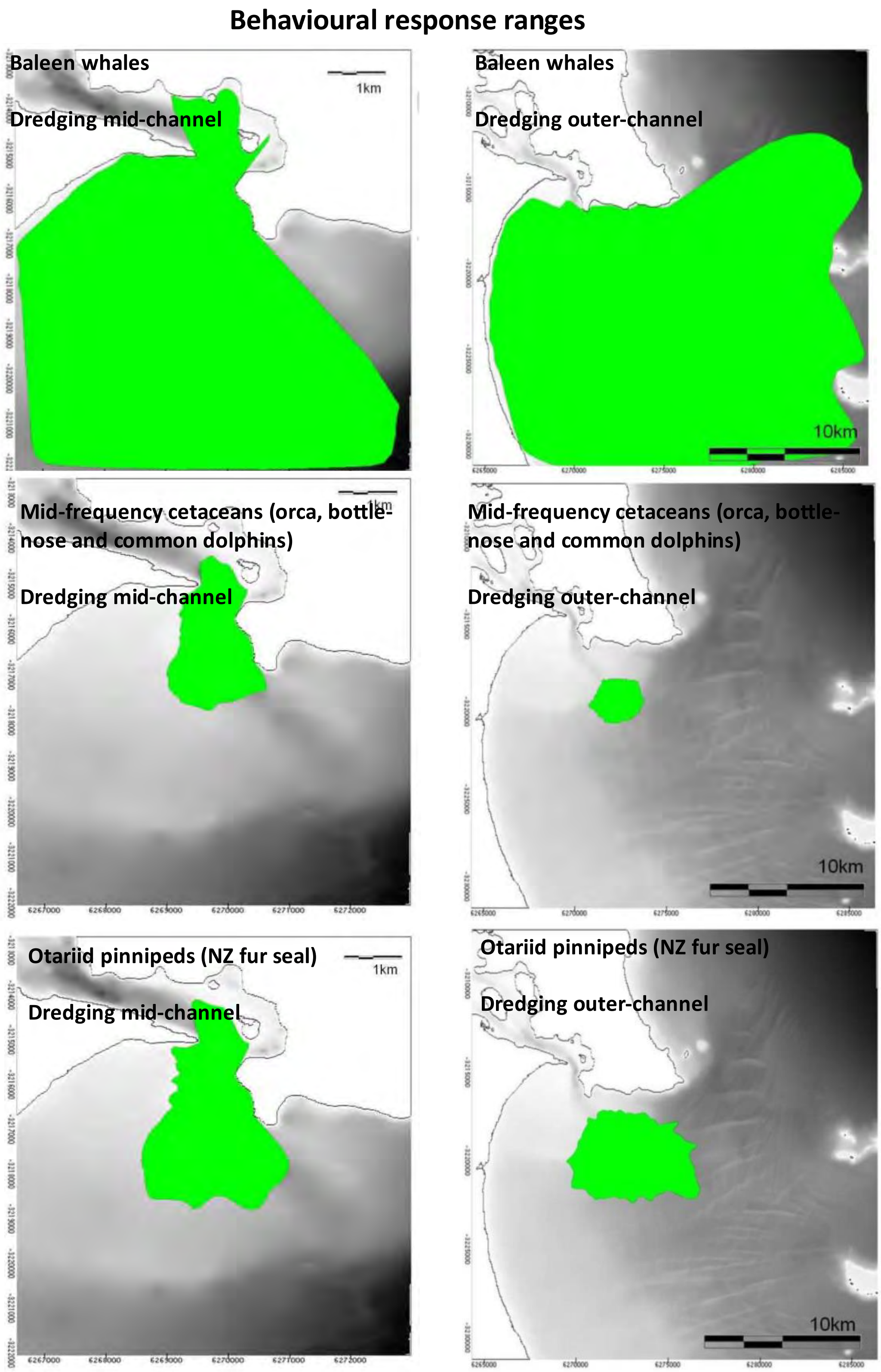

Figure 3. Expected behavioural response range for marine mammal groups during dredging using the medium-sized trailing suction hopper dredge at both the mid- and outer-channel locations. Note the change in map extent between dredge locations. Figures from Pine and Styles (2016).

Based on these modelled results and our Phase 1 review, any effects from additional underwater noise generated from the dredging proposal will likely be transitory and non-injurious. The overall levels and character of dredging noise will be generally comparable to existing vessel movements currently travelling to and from the harbour. Effects will be predominantly limited to the momentary masking of some noise signals (for example, members of the same species may find it more difficult to communicate across particular frequencies / levels while in proximity of the operating dredge); and a range of potential behavioural responses (for example, avoidance by mothers with calves but equally possible, attraction of lone males to areas in proximity of the operating dredge) depending on the species and individual animal (Pine & Styles 2016). The likelihood of any TTS effects occurring is considered *low* and any hearing injury effects (PTS) are *not applicable* based on modelling results. Therefore, with the recommended mitigation actions, the significance of any acoustic effects are considered to be *nil* to *de minimis* for both local and visiting species (Table 2; see Section 3.3 for more details). The most relevant factors contributing to this assessment are summarised below:

Spatial and temporal factors

- Relatively temporary increase in underwater noise from capital (approximately 6 months) and maintenance dredging activities based on proposed dredge schedule.
- Mainly lower-frequency noise generated by proposed dredge vessels and activities propagate farther underwater and may be detected several kilometres away (e.g. Figure 3); similar to the majority of commercial vessels currently entering and leaving the harbour.
- Only 1-3 migrating whales are sighted within the wider Bream Bay area each year, the majority pass by Hen (Taranga) and Chicken Islands in deeper, more offshore waters (e.g. further than 5 to 10 nm; Clement & Elvines 2015).
- Most whales occur in the area for a limited period each year; restricted mainly to winter months and some spring months when most only remain for a day or up to a week (the exception being Bryde's whales).
- Most odontocete and pinniped species known to frequent Whangarei waters are regularly exposed to similar types and levels of underwater noise from commercial and recreational vessels throughout their entire distributional range.
- Marine mammals may travel past the vessel while dredging is underway in order to enter or leave the harbour. However, no individuals are expected to approach and remain in close enough proximity to the vessel (i.e. 1–10 m) long enough for more than minor adverse effects to occur.

Known acoustic factors

- Dredge sound levels are not expected to exceed any permanent injury threshold criteria (Pine & Styles 2016, Appendix 2).

- Extremely close proximity to the dredge vessel sufficient for the onset of TTS to occur combined with visiting marine mammals' short-term visits to the area (i.e. dolphins—hours to days; and whales—days to weeks) ensure that the likelihood of exposure effects will be *low* to *not applicable* with mitigation (for more details see Section 3.3),
- Relevant environmental factors (i.e. shallow depths, relatively soft sediments; Coffey 2017; Pine & Styles 2016) may help dampen some underwater noise production in the lower, and some higher, frequency ranges.
- Limited overlap between the lower frequency sounds produced by dredge activities, and the functional hearing frequency ranges and sensitivities of odontocetes and pinnipeds.
- Whangarei Harbour and Bream Bay are not considered unique or particularly important feeding, resting or nursery habitats for any residential or visiting species.

Pile driving noise

Pile driving has been identified as one of the 'noisiest' of all construction sounds. It produces a very high source level as broadband impulses and has a high potential to disrupt marine mammal behaviour up to many kilometres away (Madsen et al. 2006). In close proximity, these impulses could induce acute stress and hearing impairment (i.e. permanent auditory threshold shift-PTS).

Bailey et al. (2010) measured actual pile-driving sounds off northeast Scotland at various distances ranging from 100 m to 80 km away from the source to determine potential impacts on marine mammals in the vicinity. The authors found any possible hearing impairments or injuries (TTS or PTS) were only possible within 100 m or less from the source and depended on exposure duration. Within 2 km of the source, peak sound energy was recorded between 100 Hz to 2 kHz, which decreased with increasing distance. The authors suggested, in this case, noise levels would more likely affect low- to mid-frequency marine mammals (e.g. baleen whales, orca, bottlenose and common dolphins).

To date, no known published studies have focused on the reactions of baleen whales to pile-driving activities and very few have observed cetaceans other than harbour porpoises. Based on their *in situ* measurements, Bailey et al. (2010) predicted that pile-driving sounds have the potential to elicit disturbance behaviours in minke whales and bottlenose dolphins as far as 40 and 50 km from the source, respectively.

The effect of pile driving on pinnipeds is less straightforward, with reported reactions of overseas pinnipeds ranging from little to no response in ringed seals (*Phoca hispida*: Blackwell et al. 2004) to significantly fewer harbour seals (*Phoca vitulina*) observed in haul-out areas located 10 km from pile-driving activities (Edrén et al. 2004). However, the authors noted that changes in haul-out numbers were short term as the general abundance of seals showed no decrease over the whole construction period.

High-frequency cetaceans (*e.g.* pygmy sperm whales) will detect pile-driving sounds at similar distances to low- and mid-frequency cetaceans. However, as greater energy was generally found in the lower frequencies, Bailey et al. (2010) predicted strong avoidance behaviours occurring only within 20 km or less of the source for these species. For example, Tougaard et al. (2003) noted that harbour porpoises (a high frequency cetacean) in Danish waters showed strong negative responses to pile driving up to 15 km away with all porpoises leaving the area when the driving began, but later returning once the activity finished.

The proposed pile-driving activities will be of very short duration (approximately 4 hours per pile, or up to 2 days in total) and will involve the driving of steel tube piles at two different locations within Calliope Bay, just past the harbour entrance (RHDHV 2016; see figure E3 or appendix A drawing PA1028-MA-1121). It will likely involve either vibro hammer (continuous noise production) or traditional hammer (impulsive noise) piling techniques (summarised in RHDHV 2016). Bottom substrates at these locations are predominantly soft-sediments and within relatively shallow depths (~10 m), which means fewer impacts (or shorter duration vibro-hammer bursts) will be needed to drive the pile to the required sediment depth. In addition, soft sediments help attenuate (absorb or dampen) some of the lower frequency sounds and thus reduce the distance at which they can be detected (e.g. Gerstein & Blue 2006).

Underwater noise propagation modelling undertaken for similar coastal pile-driving activities in New Zealand suggest pile-driving noise may be detectable and with potential behavioural responses (e.g. avoidance / abandonment of the area) occurring at a scale of several kilometres (pers. comm. M Pine, Styles Acoustic Group). However, the distance within which PTS and TTS could occur are likely to be relatively small (e.g. < 300 m from work area; DPTI 2012). While pile-driving activities do have the potential to cause injury within a small radius, it is unlikely that PTS would be caused by a single impact nor would an individual animal remain within close enough proximity of the source for an extended period for any cumulative exposure to occur.

In this case, effects from piling noise are more likely to involve temporary acoustic masking or behavioural responses of marine mammals in the immediate vicinity (several kilometres) of the pile-driving works, which may see animals moving to other regions of the proposal area (e.g. up into the inner harbour or other areas of the wider Bream Bay area) while piling is underway. The likelihood of TTS or PTS as a result of pile driving is considered *low* due to the short duration, expected small spatial envelope for the onset of any physical hearing effects and an extremely short exposure time to any individual marine mammal; and with the recommended mitigation actions, the effects will be *nil* to *de minimis*. The relevant factors contributing to this conclusion are very similar to those listed above for dredging effects. Any additional factors specific to pile driving are summarised below:

Spatial and temporal factors

- Any underwater noise produced from the proposed pile driving will be extremely short-term (~4 hrs and up to 2 days) and localised mainly to the surrounding harbour entrance area and some nearby Bream Bay areas.

Known acoustic factors

- A small estimated spatial zone for the onset of TTS or PTS to occur,(e.g., < 300 m; DPTI 2012) will be confined mainly to Calliope Bay and ensures that the likelihood of exposure effects will be *low to not applicable* with mitigation (for more details see Section 3.3).
- The semi-confined nature of the pile-driving locations means the spatial area for any behavioural responses will be relatively small (several kilometres) and unlikely to affect most odontocetes or any whales migrating offshore.
- All pile driving will occur in shallow (~10 m) and soft sediment areas, which has natural attenuation properties that will help dampen some noise production.

3.1.3. Possible entanglement in operational debris

The major hazard associated with marine debris from coastal development projects to 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). Loose, thin lines pose the greatest entanglement risk (e.g. lines used to tie up boats, floats and other equipment) and especially lost ropes and lines.

However, the only ropes required as part of this proposal are to secure the barge to the BHD or CSD during dredging of the inner- or mid-channel. Thus, the nature of dredge operating activities and equipment involved means the likelihood of entanglement in marine debris from dredging and disposal is *low* (Table 2). Any subsequent effects to marine mammals are expected to be *de minimis* in well-maintained coastal development projects with proper waste management programmes in place (e.g. secure onboard storage of lines, ropes, and waste) in order to comply with the NZ Maritime Rules Part 180.

3.2. Indirect effects

Coastal dredging and the associated spoil disposal within any established ecosystem will result in some change to that system (e.g. loss of habitat; Todd et al. 2015). It is unlikely that the actual changes themselves will affect marine mammals directly; rather, concern relates to possible indirect flow-on effects that these changes might have on the ecosystem as a whole and, more specifically, on the health of prey resources of marine mammals. As such, potential indirect effects from this proposal that may affect marine mammals include bioaccumulation of contaminants that may be associated with dredge spoil, loss or disturbance of prey species due to habitat loss, benthic disturbance or turbidity plumes.

3.2.1. Quality of dredge spoil

The level of exposure to contaminants for any local marine mammals will depend on the chemical characteristics of the dredge spoil and the subsequent uptake by relevant prey resources (e.g. plankton, fish, rays, cephalopods), as well as the feeding habits and ranges of the marine mammal species (e.g. Jones 1998; Evans 2003). Whangarei Harbour and Bream Bay, relative to other regions along the north-eastern coastline, are not currently considered unique or important feeding habitats for local or visiting marine mammals (see Section 2.2). In fact, most local species, such as bottlenose dolphins, common dolphins and fur seals, are generalist feeders that will opportunistically forage throughout the entire proposal area as well as more offshore waters, and along most north-eastern coastal regions (see Clement & Elvines 2015). While orca are considered more specialist feeders, they regularly forage for rays among estuarine mud and sand flats areas from the Bay of Islands to Auckland Harbour (Visser 1999). Some migrating species (i.e. humpback whales), may not even feed while passing through New Zealand waters during parts of their migration (Dawbin 1956).

Todd et al. (2015) noted that risks are greatest to marine mammals only when dredging *contaminated* sediments (i.e. not all sediments have heavy contaminant loads), and concluded that in even those cases, exposure was still spatially restricted. Sediment sampling associated with the capital dredge spoil has not identified any contaminants that represent a risk for the ecology of Whangarei Harbour or the specified spoil ground (Coffey 2017). Therefore, the likelihood for bioaccumulation and biomagnification effects on local marine mammal species from the resuspension and dispersal of any contaminants in dredge sediments is *not applicable* to *low* and the overall effect assessed as *nil to de minimis*. This conclusion is supported by the following factors:

- low contaminant levels in sampled sediments (Coffey 2017)
- generalist diet and roving nature of local marine mammal individuals is expected to limit contact with any prey species exposed to dredged sediments
- rapid settlement of dredged sediments resulting in limited spatial exposure to individual prey species (99% of the plume expected to settle within 14 hrs; MSL 2016)
- insolubility of some contaminants while others are not expected to be bioavailable (i.e. bound in mineral forms with very limited solubility).

3.2.2. Effects on habitat and prey species

Benthic disturbance and loss

Capital and maintenance dredging of the entrance channel is expected to cause immediate loss of the existing benthic biota and alteration of the habitat within the immediate region of the activity (Coffey 2016). However, Coffey (2016) concluded that this habitat loss is unlikely to affect the bay ecosystem to more than a moderate degree as it constitutes only a small proportion[7] of similar and available benthic habitat in the harbour and bay as a whole. Once capital dredging and channel construction is finished, it is likely that a temporary colonisation of some benthic species, along with the re-establishment of soft sediments in the channel itself, will occur between periodic maintenance dredging (Coffey 2017).

Coffey (2016) also concluded that while smothering of benthic communities within the disposal site will initially take place, it will involve an incremental build-up of the deposited layer over time. Benthic recovery will continue at any single location as soon as a single depositional event[8] takes place and will not be interrupted until another deposition happens in that same location. Benthic survival and recovery around the spoil grounds will be dictated by the adopted dump release pattern and rate of spoil deposition, rather than the nominal thickness of the final deposition layer. The benthic communities within the spoil grounds are expected to effectively recover between 6–24 months after spoil disposal ceases (Coffey 2017).

Based on the above ecological effects, Coffey (2016) suggested that most finfish are expected to temporarily leave the immediate vicinity due to the physical disturbance and subsequent loss of existing food sources. However, some fish species, including known prey species of orca (e.g. various ray species) and bottlenose and common dolphins (e.g. mullet; *Aldrichetta forsteri*) are likely to be attracted to and / or forage in the disturbance area (Coffey 2016). As a result, any associated benthic changes at these project sites are expected to affect only individual fish, and not any particular species as a whole.

Coffey's (2016) conclusion that the ecological effects of dredging activities will be limited in their spatial extent, displacing (or even attracting) a small portion of individual fish temporarily from disturbance sites means that any short or long-term flow-on effects to local marine mammals will be *nil* to *de minimis*.

This conclusion is based on the following factors:

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[7] For the capital dredging, the total 'disturbance' area is 4.37 km^2. Maintenance dredging disturbance area will be less than this.

[8] Within each dredging event (i.e. capital dredging event or maintenance dredging event), disposal events will occur on the order of several hours. Each dredge cycle will typically have a single disposal 'phase'. Maintenance dredging events are likely to occur at a frequency ranging from 2 – 20 years.

- a relatively small percent of benthic habitat loss within the Harbour entrance and Bay, which is expected to periodically recover after capital dredging and between maintenance dredging
- benthic smothering effects are predicted to be confined to a limited region around the spoil disposal site, and affected fauna expected to fully recover
- only temporary and localised avoidance of capital and/or disposal sites by individual prey fish with no effect on species recruitment
- general lack of evidence that dredging and disposal sites serve as unique and / or rare habitat for any marine mammal species in terms of feeding activities
- home ranges of local species are large and overlap with similar types of habitats in other parts of the Bay and along other north-eastern coastline regions.

Turbidity plumes

Increased turbidity/turbidity plumes are generated from the re-suspension of sediments at the dredging site and any marine location where dredged spoil is later deposited. High turbidity levels and movements of any sediment plumes created by dredging and / or disposal activities can be of concern to some fauna within or adjacent to work sites (e.g. Coffey 2017). However, marine mammals are known to inhabit fairly turbid environments worldwide and especially within New Zealand's nearshore environments (Clement & Elvines 2015). While they have very good vision, it does not appear to be the sense marine mammals rely upon most for foraging. Instead, odontocetes mainly depend on echolocation systems for underwater navigation and searching for food, hence, elevated turbidity does not directly affect these species' general movements or ability to find prey. Even baleen whales, which do not have the ability to echolocate, regularly forage in dark, benthic environments stirring up sediments to find prey. Gibbs and Childerhouse (2000 and references therein) noted that turbidity, along with similar environmental factors, is unlikely to have any direct effects on humpback migration routes. Turbidity plumes are thus more likely to only indirectly affect marine mammals via their prey resources.

Hydrodynamic modelling by MSL (2016) has demonstrated that plumes associated with the actual dredging (draghead and overflow) will generally settle onto the seabed in a relatively short timeframe, due to the sandy nature of the sediments. Due to this rapid settlement, modelled total suspended sediment (TSS) concentrations greater than 12 mg/L were spatially constrained to within a 1.2 km radius around the dredging footprint. During spoil disposal, TSS concentrations are not likely to exceed 10 mg/L above ambient levels greater than 3 km from the disposal location as 99% of the spoil sediment is likely to settle onto the seabed within 14 hours of disposal. As a precautionary monitoring measure, Coffey (2017; table 8) has proposed real-time turbidity plume monitoring near several management area boundaries to ensure actual turbidity levels from an project dredging and disposal plumes do not exceed acceptable threshold levels.

As discussed earlier in this section, any effects of increased turbidity from dredging activities will be limited in their spatial extent and displace only a small portion of the fish population (i.e. individual fish) temporarily from sites of the proposed activity or areas affected by the plume. Overall, any indirect effects of turbidity plumes from dredging activities are not expected to have any detrimental or long-term flow-on effects to local marine mammals in the region, and therefore will be *nil* to *de minimis*.

This conclusion is based on the following factors:

- resulting turbidity plumes from dredging or disposal activities are expected to settle out relatively quickly and are not expected to adversely affect nearby habitats
- short term displacement of only individual prey as a result of the small spatial scale of disturbance
- it is unlikely that whales would be affected by, or intentionally avoid, any localised turbidity plumes as they regularly migrate through highly turbid coastal waters around New Zealand each year.

3.3. Recommended avoidance, remediation and mitigation measures

Sections of Policy 11 of the New Zealand Coastal Policy Statement (NZCPS) relevant to the potential effects to marine mammals from the proposal are:

(a) avoid adverse effects of activities on:
(i) indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System (NZTCS) lists;
(ii) taxa that are listed by the International Union for Conservation of Nature and Natural Resources (IUCN)

(b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on:
(ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;
(iv) habitats, including areas and routes, important to migratory species.

Species' status under the NZTCS and IUCN systems are listed in Clement and Elvines (2015), and were considered when assessing the consequence of potential effects on the relevant species (i.e. bottlenose dolphins, orca, Bryde's and southern right whales). Any potential adverse effects to threatened marine mammals species from the proposal, in relation to 11(a) of the NZCPS[9], have been assessed as *de minimis* if the recommended mitigation plans are followed. In regards to 11(b) of the NZCPS[10], Whangarei Harbour and nearby Bream Bay waters are not considered to be of ecological significance in terms of feeding, resting or breeding habitats. They represent a small fraction of similar habitats available along the north-eastern coastal region (Clement & Elvines 2015 and Section 2.2). Neither the Harbour nor Bream Bay is considered an ecologically important migration corridor as most whales generally pass by the area further offshore. Finally, any associated effects of climate change on marine mammals within this region[11] will be a gradual drift in their overall distribution range to the south over several decades. The only remaining effects of this proposal at that stage will be fewer (but more heavily laden) oil tankers using the harbour entrance and occasional maintenance dredging.

Overall, any adverse effects from dredging activities on local and visiting marine mammals are assessed as *de minimis* when considering the types of effects, their spatial scales and durations, likelihood, and potential consequences (Table 2). However, given that some of the possible consequences of rare events (i.e. vessel collision or entanglement) could have population level effects (i.e. injury or death of an endangered animal), several best management practices (BMPs) are recommended as mitigation actions in relation to marine mammals and dredging in Whangarei Harbour entrance (Table 4 and Appendix 3). Importantly, BMPs are recommended even where the likelihood is assessed as *low* given the concerns that Tangata Whenua o Whangarei Te Rerenga Paraoa have about maintaining and protecting the continued presence of these species in the region.

To ensure that the most appropriate measures are in place, it is suggested that a marine wildlife management plan (MWMP; Appendix 3) is finalised in consultation with DOC before commencing operations. The plan should detail the procedures referred to in Table 4, and may also include timelines for any on-going monitoring and / or any implemented procedures that will need to be reviewed for effectiveness during operations (Appendix 4).

In regards to vessel strike, researchers have found that when given a chance, most marine mammal species will exhibit avoidance behaviours when approached by a vessel moving at speed, a vessel producing rapidly changing noises and / or when a vessel directly approaches the animal (Richardson 1995). There will be few occasions when the dredge could be operating at the same time as commercial vessels are entering or leaving the harbour, given the narrow entrance channel and shallow depths associated with this particular section of the project area (e.g. Tonkin & Taylor

[9] As well as considering the tiered protection provided for in Policy 4.4.1 of the Northland's Regional Policy Statement (NRPS).

[10] Including Objective 9.2.3 of Northland's RCP.

[11] In regards to Section 7(i) of the RMA that requires Council to have particular regard to the effects of climate change.

2016; Appendix A, section 9.6). This reduces any potential cumulative effects from multiple vessel presence (and any associated masking effects on noise) leading to possible vessel strike.The adoption and use of simple and commonsense boating behaviour guidelines around marine mammals by the dredge vessel (as proposed in the MWMP; Appendix 3), particularly around baleen whales and any calves, are expected to reduce the already *low* risk of collision to near zero (see Table 2 and Table 4 for further details). In addition, it is recommend that real-time / recent sighting information is obtained from DOC (or other project vessels), in order to anticipate and mitigate potential interactions with any whale species sighted in and near the project area.

In the case of underwater noise effects, we recommend adopting the best practicable option (BPO) in terms of Part 1 Interpretation and application, section 2(1) of the Resource Management Act 1991 (the Act), which states:

> **best practicable option**, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to -
>
> a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and
> b) the financial implications, and the effects on the environment, of that option when compared with other options; and
> c) the current state of technical knowledge and the likelihood that the option can be successfully applied.

For this proposal, the most effective options for minimising underwater noise in the first instance would be the selection of the smallest practical dredge vessel[12] and the least acoustically invasive pile-driving technique[13] practically suited for the conditions, as well as ensuring both the dredge and pile driver are regularly maintained to a high standard. However, as per (b) above, the BPO must also consider financial and other environmental implications, such as the use of a smaller dredge vessel will likely lengthen the overall duration of the project (and potentially other effects). Using the BPO at all times will ensure noise emissions are minimised to the lowest practicable level, thereby minimising any subsequent underwater noise effects to marine mammals.

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[12]Also see comment in Pine and Styles 2016: "The use of smaller dredgers may reduce the broadband noise levels however, smaller dredgers will likely have a different source spectra that for some marine mammals, might contain more acoustic energy in certain frequencies that they are more sensitive to. In this case, smaller and older dredgers may have impact zones commensurate with the larger TSHDs and CSD modelled in this report. After the commencement of dredging, in-field measurements of the actual plant should be undertaken and compared to the modelled impact zones presented in [Pine & Styles 2016], and mitigation strategies or monitoring could be updated accordingly."

[13] Although the proposal suggest using either traditional or vibro-driving techniques, additional considerations for pile-driving techniques and pile types are listed in the underwater noise management section (1.3.3) of the MWMP.

It is recommended that the actual noise levels produced from dredging activities be confirmed by measuring the associated underwater noises of these activities as soon as practical once the project has begun (see MWMP; Appendix 3 - 1.3.1). Using these measurements, spatial acoustic modelling should be completed or confirmed to understand the scale of any actual TTS effects before any further dredging activities take place.

In this case, acoustic modelling suggests that the chance of any auditory effects on marine mammal hearing (i.e. TTS) is extremely small based on how close an animal must approach (i.e. 1–10 m) an operating dredge vessel, and that the degree of any TTS effects is also dependent on how long the animal remains within close proximity to the dredge vessel. As discussed in Section 3.1.2, the likelihood of this overlap occurring is extremely *low* for this proposal. As such, intensive 24-hour monitoring is not warranted in terms of expense or practicality. Instead, and as an additional precaution only, we recommend the establishment of a precautionary safety zone (enforced by a marine-mammal observer) around an active dredge vessel during daylight hours, which would be sufficient to reduce this effect to effectively zero (*nil*) for a large portion of the project. If a marine mammal is sighted within or entering the precautionary zone, active sediment extraction (which generates the highest noise levels) would temporarily cease until the animal has exited the zone. Cessation of sediment extraction in this case refers to (for example): lifting the draghead from seafloor and ramping down the suction pump (TSHD); or cessation of on-going removal (BHD) or cutting (CSD) of the seabed.

Although no guidelines exist for pile driving within New Zealand, the government of South Australia has developed *Underwater Piling Noise Guidelines* (DPTI 2012) that provide excellent context and guidance on appropriate mitigation measures for the potential effects of pile driving activities on marine mammals. As mitigation actions for pile-driving noise we recommend the standard operational procedures and noise exposure thresholds from the DPTI guidelines (Appendix 3 - 1.3.2) are followed. These include, but are not limited to, soft-starts and a safety / shut-down zone around the work area to further minimise any risk of hearing impairment or injury to marine mammals from the proposed modifications to navigation aids. The key mitigation considerations are briefly described below:

- The **preferred method** of pile driving for this proposal is vibro-driving, due to the lower level of sound produced using this technique compared to impact-driving.
- **Soft-start / ramp-up** procedures in which the pile drive slowly increases the energy of the emitted sound giving any animals in the area time to move a safe distance away (Richardson et al. 1995).
- **Marine mammal observer and safety zone**. This involves a dedicated observer scanning a defined radius of the water's surface and coastal shoreline around the construction area for the presence of fur seals, dolphins or whales prior to commencement of pile-driving activities. If present, ramp-up procedures should

only commence once they have moved out of the zone. The size of the zone will be dependent on the technique used for pile driving, with vibro-driving having a smaller safety zone (100 m) than impact driving (300 m; DPTI 2012).

Table 4. Proposed mitigation goals and practices to mitigate or minimise the risk of any adverse effects of dredging activities on marine mammals in Whangarei Harbour and Bream Bay.

Potential effects	Mitigation goal	Best Management Practice	Reporting and monitoring (see Section 3.4, Appendix 3 and Appendix 4 for more detail)
Marine mammal / vessel strike due to increased vessel activity	1. Minimise the risk of dredge vessel collisions with any marine mammal and aim for zero injury/mortality.	1a. Adoption of best boating guidelines for marine mammals, including speed limits, to reduce any chances of mortality from vessel strikes (see Appendix 3). 1b. Liaise with the Department of Conservation (DOC) over the project period for real-time/recent sighting information, in order to anticipate and mitigate potential interactions with any whale species sighted in and near the project area.	• Record all vessel strike incidents or near incidents regardless of outcome (e.g. injury or mortality). • 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.
Increase in underwater sound from dredging / disposal or pile-driving activities	2. Minimise the avoidance (attraction) or potential for injury of marine mammals due to dredging or pile-driving activities.	Dredging 2a. Use BPO to minimise underwater noise effects. 2b. Regular maintenance and proper up-keep of all dredging equipment and the vessel (e.g. lubrication and repair of winches, generators). 2b. Establish a designated observer on the dredge vessel and maintain a watch for marine mammals during any dredging and disposal activities over daylight hours. 2c. Establish a designated 'precautionary' safety zone (50 m) that marine mammal observers can enforce temporary cessation of active dredge operations when marine mammals are present (over daylight hours only), until any marine mammal leaves the zone. Pile driving 2d. Adoption of standard operating procedures, including the establishment of safety and observation zones, enforced by a dedicated marine mammal observer. 2e. Choose plant/techniques on the basis of minimisation of underwater noise levels (e.g. vibro-driving preferred over impact-driving).	• Measure actual underwater noise levels from dredging, and adjust modelling results and monitoring zones based on these data, if necessary (Appendix 4). • Record and report the type and frequency of any marine mammal sighted (or acoustically recorded) before, during or after transiting to or from the dredging/disposal site and pile-driving activities. Include behavioural data if possible. • Project sightings from 2b and 2d should be reported to DOC for input to database. • Passive acoustic monitoring of marine mammals' presence near dredging activities (see Section 3.4)

Potential effects	Mitigation goal	Best Management Practice	Reporting and monitoring (see Section 3.4, Appendix 3 and Appendix 4 for more detail)
Marine mammal entangle-ment in operational gear and / or debris	3. Minimise entanglement and aim for zero injury/mortality	3a. Avoid loose rope and other lines (keep them taut). 3b. Ensure that all dredging, support vessels and other project activities have waste management plans in place before the commencement of works.	• Record all entanglement incidents or near incidents regardless of outcome (e.g. injury or mortality). • 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.
Contaminant effects on marine mammals from maintenance dredging activities	4. Minimise or lower the risk of exposure to any contaminated sediments	4a. Test spoil sediments before maintenance dredging (sediment testing has already been undertaken for this proposal for capital dredge spoil).	

3.4. Recommended monitoring

Given the generally *low* likelihood and *de minimis* effect levels in this case, informative, rather than impact monitoring, is recommended for capital dredging as systematic marine mammal surveys to assess cause-effect relationships are not warranted or practical for this proposal[14]. Our recommendations are considered a more realistic monitoring option (scientifically and economically) because the programme will be focused on simple and answerable questions related to specific effects of the dredging, such as recording actual behavioural responses of local and visiting marine mammals. In this regard, monitoring is not intended to statistically assess the impact of dredging on local marine mammal populations in relation to pre-determined indicators or thresholds. Instead, the monitoring programme has been designed to help validate any potential assumptions of the AEE (e.g. underwater noise levels of dredge vessels given the lack of New Zealand data available) and further fine-tune mitigation options.

[14] There are inherent problems associated with implementing comprehensive monitoring programmes for marine mammals around cause-effect relationships. This is due to their mobility and flexible behaviour, highly variable population dynamics, and low sample sizes, with the manifestation of impacts from dredging likely to be very small relative to other stressors (and consequently lost in the 'noise' of background variability). As such, even with an established baseline dataset (such as exists for orca) and a high level of long-term effort, it would be highly unlikely that any statistically-valid conclusion could be reached in terms of a dredging effect on the population.

Informative monitoring questions should include:

- What are marine mammal behavioural reactions to the presence of dredge vessels during active versus non-active operations? For example, if present before dredging start-up, do animals immediately leave at start up?
- What are marine mammal behavioural reactions to spoil disposal? For example, if they are present before disposal, do animals immediately leave once disposal begins? If so, what is the mean time it takes them to return (if at all)?
- Are marine mammals visiting/passing through the dredging or spoil area in between dredging/disposals?
- What are the actual noise levels and frequencies produced from dredging and disposal activities within the Harbour entrance and at the disposal sites?
- How many delayed starts or shutdowns occurred due to marine mammal presence (and what species were these) during a single daylight period during pile driving?

Industry and DOC can use the information gained through the proposed capital dredge monitoring plan to further understand any actual effects of dredging activities on marine mammals and, if necessary, help reduce the risk of similar incidences with any future maintenance dredging.

3.4.1. Capital dredging

Pre- and post-dredging and disposal monitoring

Recommended monitoring involves the collection of opportunistic visual sightings and passive underwater acoustic monitoring before, and after capital dredging has ceased over a relatively short time period (approximately one month for each, depending on time of year). These data sources together will confirm which species are present in the proposal areas prior to the start of any dredging activities and assess marine mammals continued presence in the area once dredging has ceased. The recommended monitoring protocol is also described in Appendix 4.

Collection of sighting data

Any sightings collected before capital dredging will confirm which species may be currently using habitats in the vicinity of the project as discussed in the Phase 1 assessment. Post-dredge sightings (and acoustic monitoring) will mainly be used to assess the continued presence of any marine mammals within the project area after capital dredging activities have stopped. Opportunistic sightings have already been recorded by vessels collecting preliminary information for the project in the vicinity of the proposal and other nearby regions (i.e. benthic sampling in channel and proposed spoil disposal areas; Appendix 5). For instance, opportunistic sightings gathered by other consultants and the general public since March 2015 have helped reaffirm the limited presence of baleen whales in the Harbour region, as predicted based on the earlier Phase 1 literature and DOC national databases review.

Similar sources would be sufficient to collect opportunistic sightings on species' presence in the proposal areas for at least a month before and after any capital dredging activity. Any regular (non-project) users of the Whangarei Harbour entrance (e.g. tug boats) could also be encouraged to record and report opportunistic marine mammal sightings. Sighting data gained through the project should be exchanged with DOC for collation to the national database.

Passive acoustic monitoring

Passive acoustic recorders (i.e. moored underwater acoustic recorders) automatically listen and record any underwater sound at frequencies likely to be from marine mammal vocalisations. These recordings (also known as detections) are downloaded at a later date and used to assess whether marine mammals may have been present in a particular area. Pine and Styles (2015; Appendix 1) recorded marine mammal clicks and whistles (characteristic of dolphins) at four passive acoustic moorings over a single ~10-day period while undertaking preliminary ambient sound recordings around the Whangarei Harbour entrance. Although acoustic recorders are limited in range (usually within a few hundred metres of the device), and cannot assess if marine mammals are truly absent (versus present but not vocalising or echo-locating), the advantage of using passive acoustic moorings is that they can 'listen' for the presence of any marine mammals both day and night and when sea conditions are not favourable for visual sightings, thus helping to supplement and confirm sighting data. We recommend placing a limited number of passive acoustic moorings (~4) near the Harbour entrance, disposal area and near the 120 dB underwater noise boundary to record marine mammal detections over the same time period that opportunistic sighting data are collected (for one month before capital dredging, and for one month after).

3.4.2. Monitoring during dredging and disposal

The recommended monitoring during dredging and disposal activities also includes collecting general information on species presence within the project vicinity while assessing specific questions related to the actual versus potential responses of local and visiting marine mammals to dredging and disposal activities. This includes a marine mammal observer on board the dredge vessel and passive underwater acoustic monitoring for both marine mammal presence in the project area and dredge noise.

Marine mammal observer

A designated marine mammal observer should maintain a watch on the dredge vessel whenever dredging or disposal activities are underway (including transiting) over daylight hours only (Appendix 3). The observer does not need to be a qualified marine mammal observer (e.g. an existing crew member can be inducted and designated to fill the role of the observer).

The primary objective would be to enforce a precautionary safety zone of 50 m around dredging operations to avoid any TTS effects. The presence of any marine mammal within the zone would result in cessation of active dredging (i.e. cease suction, cutting or digging—depending on the dredge type being used at the time), until the animal leaves the pre-determined zone. An additional advantage of such observation is that it will allow for the effectiveness of any mitigation measures (e.g. boating behaviour guidelines) put in place to be reported and amended, if necessary, while dredging operations are underway.

While the observer is primarily recommended for implementing mitigation measures (i.e. shut-down of sediment extraction when marine mammals are in the vicinity), there will also be information-gathering benefits. The secondary objective would therefore be for the observer to record opportunistic sightings and observation data (e.g. behavioural information) on marine mammals in the general area, with an emphasis on those nearest to the dredging and disposal sites.

In addition, a central contact point should be established (e.g. with DOC and other project staff) to obtain up-to-date regional sighting information, so the observer onboard the dredge vessel can anticipate the presence of any marine mammals previously sighted in or near the area.

Passive underwater acoustic monitoring

Given the use of onboard observers, passive acoustic monitoring is necessary to assess whether marine mammals are passing through project areas when the dredge vessel is absent (i.e. transiting to/from spoil disposal site or during rough weather). This monitoring is not intended to assess species frequency or intensity of use but rather simply determine whether any marine mammals are present within project areas during different cycles and noise levels of the capital dredging project. Hence, only two separate monitoring periods of approximately 14 days each are necessary within the estimated six-month project duration to sufficiently detect the potential presence of marine mammals across several dredging cycles.

Measuring underwater noise produced from dredging works.

Actual dredging noise levels should be monitored periodically throughout different work phases. The monitoring periods should represent variation in dredging noise, for example noise associated with dredging different sediment types and different parts of the dredging cycle; and transiting vs. extraction vs. disposal.

Both datasets should be used to validate some of the assumptions made in this assessment. Of particular interest are marine mammal observations near the operating dredge vessel (i.e. out to 300 m), as these could provide some context around the underwater noise effects when coupled with actual acoustic data taken from the dredging operation (for example, ‘when starting to dredge sediment and the noise levels were approximately ‘x’ dB, the animals approached/avoided the vessel’).

Sighting data (from the observer, acoustic monitoring or that reported from other vessels or the public) would ideally be reviewed with the predicted TTS, auditory masking or behavioural spatial ranges (as determined in Pine and Styles 2016) to refine the assumptions of the acoustic modelling and any associated effects (as outlined in this report) prior to maintenance dredging.

3.4.3. Maintenance dredging

The consideration of possible monitoring options for capital dredging and spoil disposal also applies to any ongoing maintenance dredging, but more so in relation to operational practices in proximity to sighted marine mammals. The assumed smaller-scale aspects of maintenance dredging and disposal, along with smaller dredge vessel size, will likely require less extensive monitoring than that proposed for the capital dredging. At a minimum, best management practices should still be adopted (i.e. as part of the Marine Wildlife Management Plan). A designated marine mammal observer should also maintain a watch on the dredge vessel whenever dredging or disposal activities are underway (including transiting) over daylight hours only. The purpose of this observer would be to record opportunistic sightings and observation data (e.g. behavioural information) on marine mammals in the general area, with an emphasis on those nearest to the dredging and disposal sites; and secondarily, to avoid vessel strike / marine mammal interactions. As with capital dredging activities, a central contact point should be established (e.g. with DOC and other project staff) to obtain up-to-date regional sighting information, so the observer onboard the dredge vessel can anticipate the presence of any marine mammals previously sighted in or near the area.

The information compiled via direct observation and passive acoustic monitoring during the capital dredging project can be used to inform aspects of any program for maintenance dredging; especially regarding marine mammal response to dredging and spoil disposal operations and seasonal use of the area by individual species. Any additional monitoring practices, if required, will be determined after analysis of the capital dredging project data.

3.4.4. Pile driving

The recommended monitoring during pile-driving activities includes a marine mammal observer on board the pile-driving vessel (i.e. additional to the observer on-board the dredge vessel) and / or a separate support vessel in order to monitor for marine mammal presence within the observation zone and safety zone, if the size of these zones is not able to be surveyed effectively from a fixed platform.

Marine mammal observer

A designated marine mammal observer should maintain a watch on the pile-driving vessel whenever pile driving is underway (constrained to daylight hours; see Appendix 3 for more details). The observer does not need to be a qualified marine mammal observer (e.g. an existing crew member can be inducted and designated to fill the role of the observer).

The primary objective would be to enforce a safety zone around pile-driving activities to reduce the risk of any TTS/PTS. The presence of any marine mammal within the zone would result in cessation of pile driving until the animal leaves the pre-determined zone. The size of the zone would be determined as part of the underwater noise management plan (Appendix 3, Section 1.3). In addition, the observer onboard the pile-driving vessel should be kept up to date with regional sighting information (as exchanged with DOC, Section 3.4.2), so they can anticipate the presence of any marine mammals previously sighted in or near the area.

4. PRE-SUBMISSION CONSULTATION

Consultation has been undertaken with the general public (via open days) and with all relevant stakeholders (at least attempted in some cases) throughout the writing of the Phase 1 report (Clement & Elvines 2015) and this Phase 2 marine mammal report . Specific concerns are highlighted and discussed further in this section.

4.1. Issues raised in the Tangata Whenua O Whangarei Te Rerenga Paraoa draft cultural effects assessment

The cultural assessment highlights that tangata whenua are concerned that some of the potential effects on marine mammals from the RNZ capital dredging proposal are considered 'low probability' but 'high impact'. In fact, the cultural assessment cites a statement from this report that refers to "some of the possible consequences of rare events (i.e. vessel collision or entanglement) could have population level effects" (see Section 3.3, p. 23). This means that effects with a very low or rare likelihood of occurring could have a severe consequence if they were to occur. In the case of marine mammals, the extreme example of this would be a death of an endangered female, as loss of her breeding potential could have serious repercussions on the future reproductive capabilities for the population as a whole. Tangata whenua feel that the existence of these rare events is an unacceptable adverse effect. Their conclusion is that such events cannot be mitigated and instead, must be avoided.

This report specifically addressed these concerns in detail, and concluded that implementing the appropriate mitigation actions could lower the overall chances of these rare events occurring to as near to zero as possible while increasing the animal's chances of survival in the extremely unlikely event that one did occur. I discuss these report findings further below using the mitigation of vessel strikes as an example.

4.1.1. Vessel strikes

It is important to emphasise that any vessel that is on the water in areas that marine mammals reside or travel has the exact same chance of striking an animal, regardless of type (commercial or recreational). This is due to the fact that marine mammals spend the majority of their time underwater and are usually only visible as they are surfacing. Their surfacing intervals, and subsequent reaction to a nearby vessel once surfaced, are at times completely random and often unpredictable. The only difference between a small recreational boat striking a marine mammal and a container ship is the potential outcome to the animal.

Most reported incidences of vessel strikes have been with mysticete (baleen) whales (see Section 3.1.1). Whale occurrences in Bream Bay (and Whangarei Harbour) are seasonal with sightings restricted mainly to winter months, and individuals remain in the greater region for only a few days. As the proposed timeline for the capital dredging project is approximately six months, there is the possibility that the dredging will occur completely outside the whale migration period, overlap partially or occur throughout the entire migration period. However, it is important to note here that while vessel traffic will temporarily increase over the course of the capital dredging project, it will decrease over the longer term as fewer, but more heavily laden, oil tankers will be used in the future.

In order to place the likelihood of a vessel strike occurring in the context of this proposal, I have estimated a possible 'worst-case' scenario. I estimated the maximum number of whales that could occur in the larger coastal region[15] in one year at 5 individuals, based on the DOC sighting and stranding database. Out of the 112 reported sightings of baleen whales [16] in this same area, only 22 of these animals (or 19%) have passed through inshore waters between Bream Bay and Hen and Chicken Islands (to just north of Bream Head and Mangawhai Heads to the south). Based on these previous data, only 1 of 5 whales would be predicted to occur in Bream Bay waters near the proposal area.

The proposal area over which the vessel will be working is approximately 10 km^2 (including all channel areas and disposal sites; Tonkin & Taylor 2016), around 2% of the total Bream Bay area[17]. The average distance between the channel and disposal sites in which the dredge vessel must travel is between 3 and 7 km. This distance equates to around 60 to 90 mins of vessel transiting for each complete dredge cycle, or 12–13 hrs of transiting over a 24 hr period of uninterrupted dredging in perfect conditions.

Finally, I assumed that this hypothetical animal remained in this same Bream Bay area for up to three days[18]. Without any mitigation, the overall chances of this whale being struck by the dredge vessel are dependent on this one animal wandering through the specific transiting area (< 2% of Bream Bay) within a three-day period at the same time the dredge vessel is traveling to or from the disposal site (i.e. a potential collision window of 39 hrs out of an estimated 1800 hrs of transit time over a conservative five months for project completion). In other words, the likelihood of a whale being struck by the dredge vessel in this worst-case example is extremely low, but as pointed out in this report, can never be presumed to be zero.

[15] The coastal and more offshore waters between Tukukaka to the north and Omaha Bay and Great Barrier Island to the south.
[16] Note that several of these sightings will be re-sightings of the same animal on the same day and / or over different days as they travelled up the coast.
[17] Defined as ~432 km^2 from a line just north of Bream Head to the Hen and Chicken Islands to the east, to Mangawhai Head to the south and Bream Bay coastline to the west.
[18] Whales have only been resighted in the same location off this region over 1-2 days, but in other locations around NZ can occur up to a few weeks.

As discussed in this assessment, the likelihood of a vessel strike and the risk that it will result in serious injury or death increases above speeds of 10–14 knots (see references in Section 3.1.1). As demonstrated above, for approximately half of the dredging cycle, the dredge vessel will be of little concern to nearby whales as it will be relatively stationary while dredging (i.e. 1–3 knots) and disposing of dredged sediment. When travelling to the disposal site, the normal operating speed of a dredging vessel is estimated to be around 7.5 knots with a loaded hopper and up to 15 knots empty, depending on TSHD used (Tonkin & Taylor 2016). The generally slower speeds of dredge vessels likely explain why they have been involved in only one out of the 134 worldwide collisions with whales (in which the vessel type was known) reported between 1975 and 2002.

To further reduce the likelihood of a strike and avoid any risk of a mortality, we have recommended several mitigation actions (see Table 4 and Appendices 3-4). These actions include the adoption of best boating behaviour guidelines around marine mammals by the dredge vessel as part of a Marine Wildlife Management Plan, which importantly includes vessel speed limits. In addition, it is recommend that real-time / recent sighting information is obtained from DOC (or other project vessels) throughout the duration of the project, in order to anticipate and mitigate potential interactions with any whale species sighted in and near the project area. Finally, as part of the proposed informative monitoring programme, a designated marine mammal observer will also be maintaining a watch for marine mammals on the dredge vessel whenever dredging or disposal activities are underway (including transiting) over daylight hours.

Together, these mitigations actions will ensure that all available information is being used to help locate, further reduce and avoid any interactions between the dredge vessel and any visiting marine mammals (e.g. vessel collision, entanglement or otherwise) that may occur within the proposal area during the course of this project.

4.2. Issues raised by Forest & Bird

At a meeting in Wellington on 29 June 2017, Forest & Bird’s marine representative raised several points of concern in relation to the capital dredging proposal and more specifically, the resulting oil tanker traffic once the project was completed. The main issues are outlined and discussed further below.

4.2.1. Underwater noise issues

Forest & Bird’s main concern is that this report and the underwater noise assessment (Pine & Styles 2016) have used NOAA’s previously recommended behavioural noise threshold of 120 dB, developed in 1998, for assessing the spatial extent of any behavioural effects. Unlike NOAA’s recent recommendations for TTS and PTS thresholds (2016), there is currently no agreed-upon behavioural noise threshold for marine mammals in the United States or worldwide. This is due to the fact that understanding behavioural responses to varying noise levels is complex and complicated by differences in species, age groups, current behavioural state and even individual tolerances.

Forest & Bird is worried that use of 120 dB threshold for behavioural reactions, without further explanation, will set an unwarranted precedent for future resource consents of a similar nature (e.g. marine construction). As a result it was suggested, and we have agreed, that further explanation around the use of this threshold and our approach as being specific only to this application was included (see footnote 6 p.12 and further discussion in Appendix 2). We have also included spatial figures for the 120 dB threshold for behavioural reactions as single, un-weighted models in Appendix 2 (Figure A2.1), as requested by Forest & Bird to be used in combination with proposed acoustic monitoring to determine the efficacy of the 120 dB behavioural threshold in this particular case (see below for more detail).

4.2.2. Lack of proposed marine mammal surveys

Forest & Bird were curious why there was no systematic marine mammal surveys of the proposal area and nearby waters undertaken or recommended as part of the monitoring programme in this report. Given the general lack of information available on marine mammals in New Zealand and no current government initiatives to fund research, they feel that this is one of the only ways to gain more knowledge.

We discussed the lack of any resident species in the proposal area and the amount of data that could be realistically gathered over the course of this project, in particular, the 6 months while capital dredging was occurring. Through the discussion, it was pointed out that in a case such as this, several months or even years of surveys only accumulate a small sample size, too small for statistical testing to see whether there are any significant behavioural effects on marine mammals. As a result, such surveys would be collecting ‘data for data’s sake’ and not necessarily providing any useful data for mammal experts or answering any useful questions in context of the proposal. Instead, we have carefully framed the monitoring to actually get some useable data on marine mammal reactions to dredging and disposal; and the representative agreed that they were happy with that part of the monitoring programme.

Forest & Bird noted an interest in finding out more about some of the offshore species (particularly beaked whales), as Northland in general seems to be a high density region for these species. They noted that beaked whales can be extremely sensitive to underwater noise and overseas research has found that impulsive sound levels (i.e. military sonar and seismic surveys) as low as 80 dB can have behavioural effects on these species.

Our Phase 1 report (Clement & Elvines 2015) identified the presence of beaked whales as possible offshore residents of the Northland region and suggested the theory that they may move inshore during summer and autumn months as evident by increase in strandings during that time, as well as noting their increased acoustic sensitivity. At the meeting, we all agreed that there is no evidence that beaked whales would venture into waters as shallow as the proposal areas, but they still remain a potential species of interest.

It was suggested, and we agreed, that one of the passive acoustic recorders for monitoring could be placed along the 120 dB sound contour during the capital dredging work to monitor any evidence of offshore species presence and possibly their acoustic reactions to the various dredging cycles and noises levels (see Appendix 2). These results would be correlative, not causative but still useful from the perspective of trying to understanding underwater noise effects of dredging on such species and may provide some empirical evidence in terms of the 120 dB threshold for behavioural reactions. However, the actual placement of a recorder will be dependent on practicality (e.g. exposure to commercial fishing, distance offshore) and local environmental conditions (e.g. depth and currents).

4.2.3. Resulting shipping issues

Forest & Bird are concerned that the heavier oil tankers used once the capital dredging was completed would sit deeper in water and therefore, more underwater noise would be generated from the greater surface area of ship underwater. The speeds of the tankers in the channel and harbour were also queried, noting that there is a preference for 10 knots or less based on research for the avoidance of ship strike.

In response, it was noted that the current oil tankers will only be adding 10% more cargo and this will result in it sitting only 3 m deeper than currently. Jon Styles (Styles Group, acoustic and vibration consultants) noted that underwater noise comes primarily from the propeller and engine, not hull and that the extra draft would only increase the noise levels by a very small amount. Navigatus' (2016; section 4.7) risk assessment and the RHDHV (2016; section 2.2.5) report confirm that the tankers will do less than 10 knots, typically 6-8 knots in the channel, slowing as they near the berth.

4.2.4. Other issues

It was noted that it might be possible for some marine mammals to swim into the harbour while the dredge was transiting or disposing of dredge sediment, and then be 'trapped' in the harbor by the dredge noise once it started working in channel again. As discussed in Section 4.1, the THSD dredging cycle was estimated to be approximately 110–180 minutes and the transfer and disposal would be approximately half of that length (RHDHV 2016). Hence, if animals did enter the harbour and were not willing to pass by a working dredge, they would not be trapped for long. The proposed passive acoustic monitoring stations located near the Harbour entrance will be able to provide actual data into whether this issue is occurring and information on any subsequent responses.

Note, there is the possibility of both the THSD (in the channel) and BHD (at the jetty) barges working at the same time during daylight hours. In this case, the break in active dredging is likely to be shorter but still adequate for any animals to exit the Harbour within a few hours of entering.

5. CONCLUSIONS

The purpose of this report is to describe the existing environment in terms of the local and visiting marine mammals that utilise and / or are influenced by the Whangarei Harbour and associated Bream Bay ecosystem. In particular, information on the various species was reviewed for any life-history dynamics that make them more vulnerable to dredging and disposal activities or where proposal sites may overlap with any ecologically significant feeding, resting or breeding habitats (which include prey resources). This, in turn, enabled the potential effects associated with the capital and maintenance dredging and disposal components on marine mammals to be assessed.

The marine mammals most likely to be affected by the proposed project include those species that frequent the Whangarei Harbour and Bream Bay regions year-round or on a semi-regular basis. These species are bottlenose dolphins, orca, Bryde's whales, and common dolphins. Other species including NZ fur seals, pilot whales, beaked whales, southern right whales, humpback whales, sperm whales and pygmy sperm whales were considered in this assessment because of their records of occurrence in the area and their known vulnerabilities to particular anthropogenic impacts (i.e. vessel collision); species-specific sensitivities (i.e. underwater noise); and / or special concern to local iwi Tangata Whenua o Whangarei Te Rerenga Paraoa.

The coastal waters of Whangarei Harbour and Bream Bay are not considered significant habitats for any marine mammal species. Instead, these waters represent only a small fraction of similar habitats available to these marine mammals throughout the larger north-eastern region.

Based on the direct and indirect potential effects highlighted in this report, the overall effects of the capital and maintenance dredging and the disposal and pile-driving components on marine mammal species within Whangarei waters are assessed as *de minimis* when considered with the recommended avoidance / mitigation actions. This conclusion is based in part on information from other consultancy reports including the expected levels of underwater noise due to dredging (Pine & Styles 2016) and pile-driving activities, concentrations of contaminants in dredging materials and expected effects on local benthos and fish communities (Coffey 2017), and modelled and predicted turbidity plume dynamics (MSL 2016).

Informative monitoring is recommended and based around a combination of recording visual sightings of marine mammals (both opportunistic and from dedicated observers on the project vessels) with simultaneous passive underwater acoustic monitoring. Given the *low* likelihood and *de minimis* effects of the proposal, the recommended monitoring plan for capital dredging and pile driving is based on collection of information to improve understanding of how marine mammals respond to these activities, rather than testing of specific predictions of effect (Section 3.4.1,

Appendix 4). Such a programme will serve the dual purpose of collecting important data on the actual effects of dredging and pile driving on New Zealand marine mammals while assessing the effectiveness of any mitigation measures put in place. These measures can then be amended, if necessary, while operations are underway, for later maintenance dredging projects.

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7. APPENDICES

Appendix 1. Short-term passive underwater acoustic survey of Whangarei Harbour entrance and Marsden Point: preliminary investigation by Pine and Styles 2015.

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DRAFT AND CONFIDENTIAL

Prepared for: **Chancery Green on behalf of Refining New Zealand**

Date: **13th November 2015**

Title: **Short-term Passive Underwater Acoustic Survey of Whangarei Harbour Entrance and Marsden Point: Preliminary Investigation**

Prepared by:

Matt Pine, BSc. PhD. MASNZ

Jon Styles, BAS. MASNZ.

Reviewed by:

Jamie Exeter, MASNZ.

Styles Group
Acoustics & Vibration Consultants

Executive Summary

Styles Group has been engaged by Refining New Zealand (RNZ) to undertake a passive acoustic survey of the ambient underwater soundscape within and around Calliope Bay at the entrance to Whangarei Harbour as part of an investigative phase 1 study. This survey addressed three separate objectives: the first was to establish the temporal and spatial variability of background sound levels over the two week study period; the second was to determine the received sound pressure levels from several vessels, particularly a suezmax vessel, entering and departing the Marsden Point Oil Refinery; and the third was to confirm the presence of marine mammals over the study period.

Up to eight passive acoustic loggers were deployed within Calliope Bay and Bream Bay at four separate survey sites (Lort Point, Mair Bank, Busby Head and Bream Bay). Ambient sound levels varied within each survey site with spectral analyses revealing variances up to 47 dB for frequencies below 10 kHz. Measured sound levels were highest within the Lort Point survey site (average 119 ± 0.08 dB_{rms} re 1 μPa) and decreased with increasing distance from the Marsden Point industrial area (averages of 113 ± 0.07 dB_{rms} re 1 μPa, 108 ±, 0.46 dB_{rms} re 1 μPa, and 105 ± 0.10 dB_{rms} re 1 μPa from within the Mair Bank, Busby Head and Bream Bay survey sites, respectively). Between survey sites, the ambient soundscape was largely characterised by frequencies below 2 kHz. Unique within the Lort Point survey site (within the boundary of a Marine 1 (Protection) Managemen 103 - 121 dB_{rms} re 1 μPa between 0.1 and 1 kHz) of various harmonics. This low frequency signal did not demonstrate any biological characteristics and appeared typical of an already existing mechanical source. In the absence of any operating vessels, the broadband sound levels within the Whangarei Harbour entrance were comparable with many other nearshore environments around New Zealand and the soundscape within Calliope Bay was spectrally similar to other busy harbours where vessels are common (as spectral analyses reveal peaks in spectral density below 1 kHz).

Received broadband sound levels from vessels showed considerable variation depending on the type of vessel as well as being a function of speed and distance. The highest broadband (0.05 - 70 kHz) received level measured from any vessel was 150 dB_{rms} re 1 μPa (Torea, IMO 9274082); a considerable increase from the lowest measured level of 128 dB_{rms} re 1 μPa (Anatoki, IMO 8864153). There was no apparent relationship between the tonnage of a vessel and the received broadband sound levels as the largest suezmax vessel (Jag Lagshita, IMO 9208057) had a received broadband level of 135 dB_{rms} re 1 μPa; a phenomenon previously measured by Styles Group at other locations.

Dolphins (species unidentified) were detected within all survey sites, with most detections occurring outside Calliope Bay. No whales were detected during the survey period. In total, dolphins were detected on 13 separate occasions between all four survey sites and vocalisations were mostly detectable for approximately 30 minutes a time. The longest duration for which vocalisations were detected during a single occurrence was 1.5 hours. These data provide evidence that dolphins do frequent this area, however care should be taken when inferring any conclusions regarding their abundance or habitat use because the data is limited in sample size and methodology.

The data from this survey shows the ambient sound levels within and around Calliope Bay are comparable with other nearshore environments around New Zealand, however average and median levels were lower compared to very busy harbours such as the Waitemata Harbour and inner Hauraki Gulf.

Table of Contents

Introduction

Styles Group has been engaged by Refining New Zealand (RNZ) to undertake a passive acoustic survey of the ambient underwater soundscape within and around Calliope Bay at the entrance to Whangarei Harbour to accompany an application to deepen the channel at Whangarei Heads to allow suezmax vessels to operate at a higher capacity than at present, as well as ease the navigational difficulty during the channel approach. Currently, these large ships carry cargo to and from the oil refinery but are under-loaded so as to successfully navigate the channel between Whangarei Heads and Marsden Point.

The overall aim of the survey was to investigate the ambient underwater soundscape and achieve the three following objectives:

1. To establish background sound levels;
2. To determine the received levels from several vessels, particularly oil tankers, entering and departing the Marsden Point Oil Refinery;
3. To confirm any presence of marine mammals over the survey period.

This report will outline the survey methodology and results for each of the above three objectives. Potential impacts on marine life from undersea dredging or any acoustic modelling of undersea dredging noise have not been undertaken as part of this report.

Materials and Methods

Survey Sites

In order to establish background underwater sound levels within the Whangarei Harbour entrance, Styles Group was asked to design a suitable survey methodology. It was identified that potential underwater noise arising from the proposed dredging activity may propagate into four separate Marine 1 (Protected) Management Area zones in accordance with NRC Map C13 (Figure 1). Thus, eight calibrated SoundTrap (ST) acoustic loggers were deployed to assess the current background sound levels within Calliope Bay and Bream Bay; including within the Marine 1 (Protected) Management Area Lort Point and next to Mair Bank. The four survey sites (each with two individual acoustic loggers) were (1) Lort Point (S 35° 49.856' E 174° 30.223'); (2) Mair Bank (S 35° 51.091' E 174° 31.125'); (3) Busby Head (S 35° 52.449' E 174° 32.757'); and (4) Bream Bay (S 35° 53.147' E 174° 31.326'). A map showing the location of each survey site is provided in Figure 2. The location of each site was selected based on field-accessibility, depth, currents and the purpose of that particular ST logger in the scheme of the overall survey.

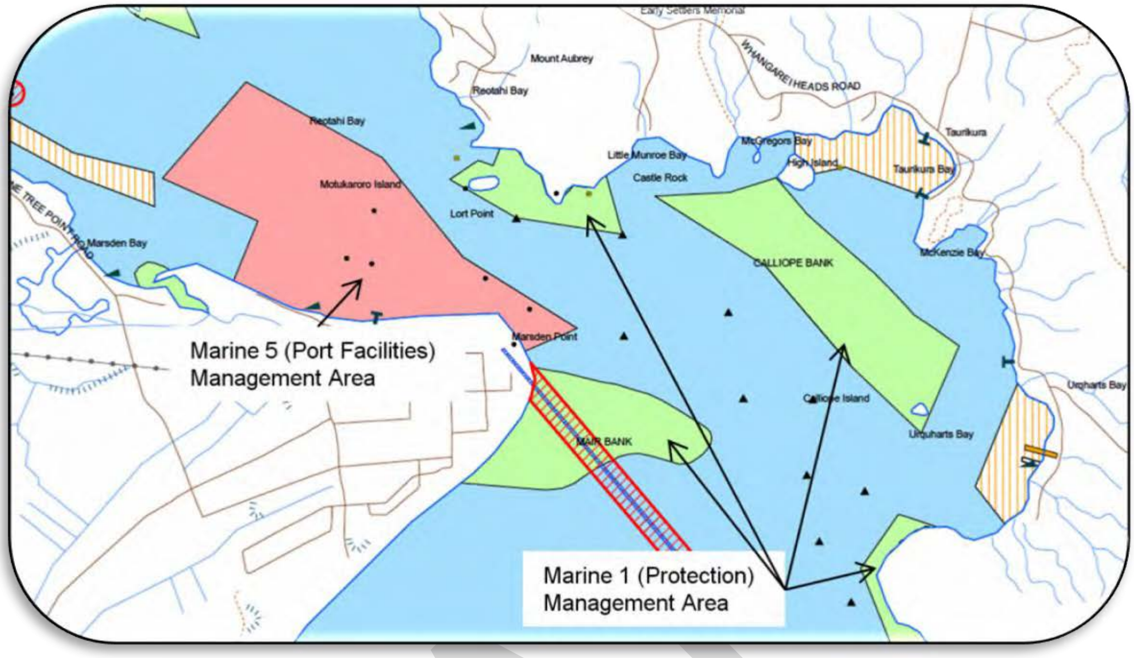

Figure 1: NRC C13 Map. Arrows show main Marine Management Areas.

Figure 2: GPS location of each survey site where SoundTrap loggers were deployed.

Underwater Recording Systems

Ambient sound recordings were made using SoundTrap (ST) 201 (288 kHz sampling rate), 202 (288 kHz sampling rate), and 202HF (576 kHz sampling rate) laboratory grade underwater acoustic loggers secured between 1 m and 2 m off the seabed and at a depth between 6 m and 20 m at MLWS. See Appendix A for a schematic diagram of the deployment apparatus. Two loggers were deployed at each survey site and set on alternating duty cycles to conserve memory and battery life during the survey. Acoustic data were obtained between the 26th March and 6th of April 2015.

Calibration

The hydrophone component of the ST acoustic logger was calibrated by the manufacturer and field-calibration checks before and after deployment were undertaken using a calibrated pistonphone (GRASS Type 42AA, SPL 114 dB re 20 µPa, nominal frequency 250 kHz), a calibrated (using a Brüel & Kjaer Type 4231 Sound Calibrator) sound level meter (Brüel & Kjaer 2250 Type 1 SLM with a Brüel & Kjaer 1/2 inch Condenser Microphone Type 4189) and specialist acoustic software. Electronic calibration of the recorder component was done at the start of each recording event by comparing a set of automated tones of known frequency and voltage amplitude to the full scale response level provided by the manufacturer and verified using the pistonphone. The calibrated range of the hydrophones was 20 Hz to 144 kHz (ST 201, 202 recorders) or up to 200 kHz (ST202HF recorders) before sensitivity begins to decrease. The distances at which an animal would need to be before being detected is highly variable and depends on the vocalisation amplitude and frequency. Consequently, we are unable to identify a scientifically defined range for which marine mammals may be detected.

Data analysis

Each sound recording was examined for extraneous noise contamination from wind, waves, or precipitation to ensure accurate calculation of ambient pressure levels, as well as received levels from commercial vessels. Recordings which did contain considerable contamination were not analysed.

A descriptive statistical analysis was undertaken on 1200 thirty-minute recordings made between the 26th March and 6th April over the four survey sites. Power spectra, third-octave band levels, the spectral probability density (SPD) and broadband sound pressure level (SPL) for each survey site over the deployment period were calculated. Note the 1200 recordings were made up of systematically selected 30min recordings which did not contain extraneous noise contamination (from weather). Selection was based on every hour or half-hour period depending on the degree of contamination, if any.

Ship arrival and departure times at the oil refinery during the survey period were provided by North Tugz Limited and were used to identify passing ships in the acoustic data. Broadband received levels of each passing ship were calculated and plotted against time, along with the corresponding power spectra.

Acoustic data were analysed to determine the presence or absence of marine mammals using automated acoustic detectors and confirmed by visual inspection of the corresponding spectrogram. Vocalisations were not characterised or specifically analysed as this type of analysis was outside the survey's scope.

Survey Results and Discussion

Due to the high tidal currents within Calliope Bay, a single ST logger at Lort Point was physically compromised by mud and contained too much extraneous noise contamination to be used. The second ST logger at Lort Point that was closer to the surface was not affected. Therefore, analysis was carried out on the remaining seven acoustic loggers.

Objective 1: Background sound levels

Broadband (50 Hz - 48 kHz) ambient SPLs measured passively over a 24 hour period (28th March 2015) are shown in Figure 3, while percentile plots of both power spectra and third-octaves over the entire survey period are given in Figure 4 and Figure 5, respectively. The 28th March 2015 was selected because the least number of ships were logged coming in or out of Marsden Point on that day and therefore provided the best opportunity to obtain a representative measure with minimal noise contamination. Simple descriptive statistics of the broadband SPLs over the survey period are provided in Table 1.

Ambient sound levels varied within each survey site with spectral analyses revealing variances up to 47 dB for frequencies below 10 kHz (due to consistent vessel activity). Consistent between survey sites was the soundscape being characterised by frequencies below 2 kHz; indicated by the power spectra (Figure 4) and third-octave (Figure 5) percentile plots. Sound levels measured from the Lort Point survey site were largely controlled by large vessels arriving and departing Marsden Point (characterised by a greater noise-floor at frequencies below 2 kHz compared to Busby Head and Bream Bay where sound levels below 200 Hz are >10 dB less). With the exception of the Lort Point survey site, in the absence of any vessels the ambient soundscape could be considered similar to other nearshore environments, such as the outer Hauraki Gulf 109 - 118 dB re 1 μPa[1]), 112 - 117 dB re 1 μPa[2]) or 114 - 118 dB re 1 μPa, respectively (Pine et al. 2015)). However, at the Lort Point survey site only, a continuous low frequency signal 103 - 121 dB_{rms} re 1 μPa between 0.1 and 1 kHz) of various harmonics was recorded below 1 kHz (Figure 6) on most days. Peak frequencies and SPLs of the signal did vary in time, although showed no consistent pattern (Figure 7). The source of this low frequency signal is not biological but appears mechanical. Notwithstanding this, average background sound levels (broadband) from all four survey sites were lower compared to the inner Hauraki Gulf where average sound levels measured from within the Waitemata Harbour, Rangitoto Channel and Waiheke Channel range between 116 and 127 dB re 1 μPa[3]. The gradual increases in sound energy residing in frequencies above 10 kHz were controlled by snapping shrimp, which are the most ubiquitous species within New Zealand's temperate habitats (Pine et al. 2015; Radford et al. 2008; Radford et al. 2010), such as those around Whangarei Heads and within Calliope Bay.

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[2] Pine, MK, Styles JR. Unpublished data from passive acoustic survey, July - October 2014. Styles Group Acoustics and Vibration Consultants.
[3] Pine MK., Styles JR. Unpublished data from passive and active surveys between May 2013 and October 2014. Styles Group Acoustics and Vibration Consultants.

Survey Site	Mean ± SE (dB_{rms} re 1 µPa)	Median (dB_{rms} re 1 µPa)	Max (dB_{rms} re 1 µPa)	Min (dB_{rms} re 1 µPa)	Range (dB_{rms} re 1 µPa)
Lort Point	119 ± 0.08	117	147	111	36
Mair Bank	113 ± 0.07	111	146	108	38
Busby Head	108 ± 0.46	107	142	98	44
Bream Bay	105 ± 0.10	104	132	96	36

Table 1: Basic statistics for ambient broadband sound (50 Hz - 48 kHz) measured at each survey site between 26th March and 6th April 2015 based on 7,043 randomly selected 60-sec samples per site.

Despite the lower broadband sound levels, the soundscape within the Whangarei Harbour entrance was spectrally similar to other harbours where vessel activity is high as the root mean squared and 5th percentile spectrum was characterised by frequencies below 1 kHz, while the outermost survey site, Bream Bay, demonstrated spectra closer resembling those of soft sediment habitats.

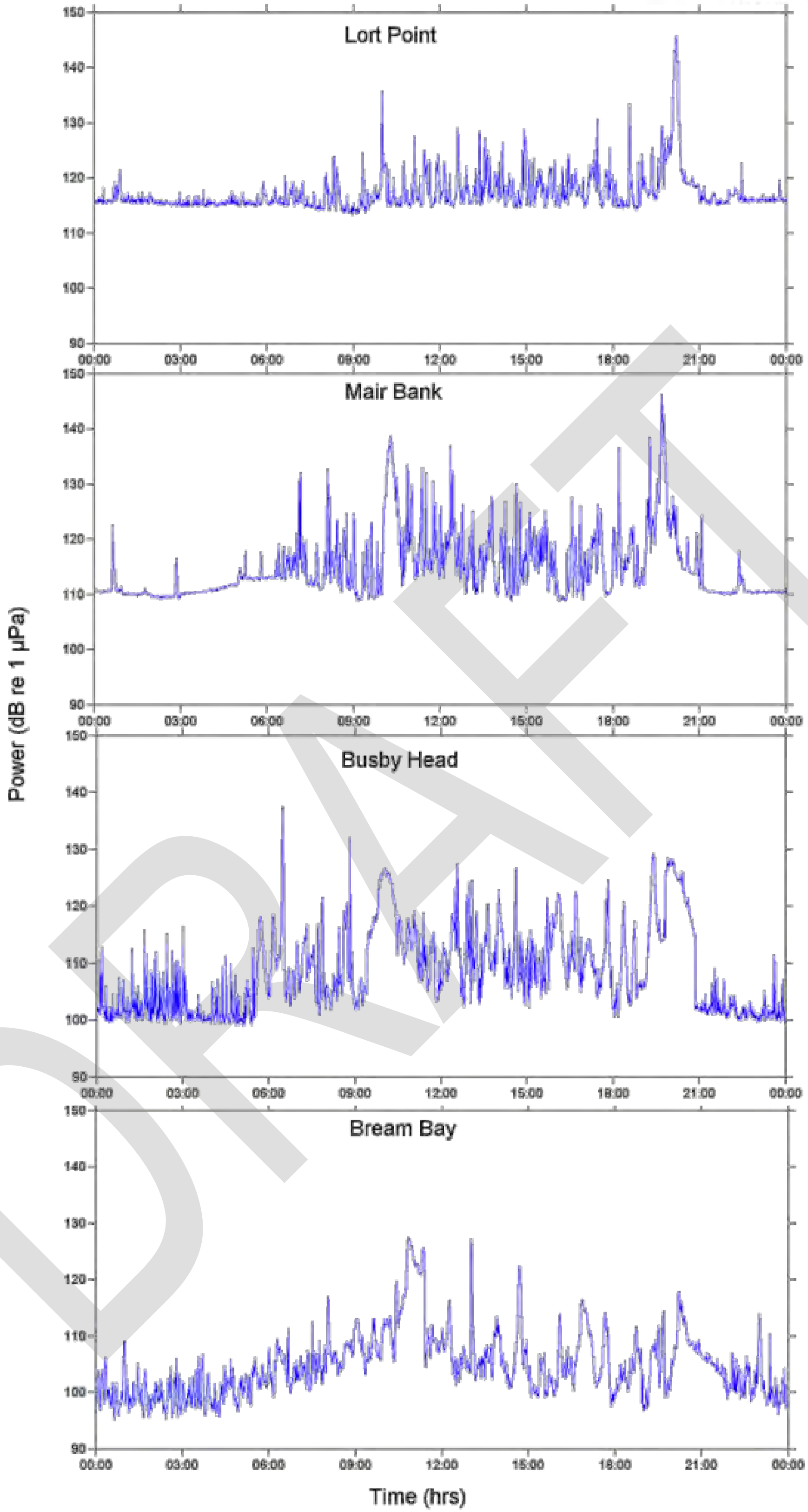

Figure 3: Broadband (50Hz - 48kHz) ambient SPLs measured over a 24 hour period (28th March 2015) at each survey site (n=2161).

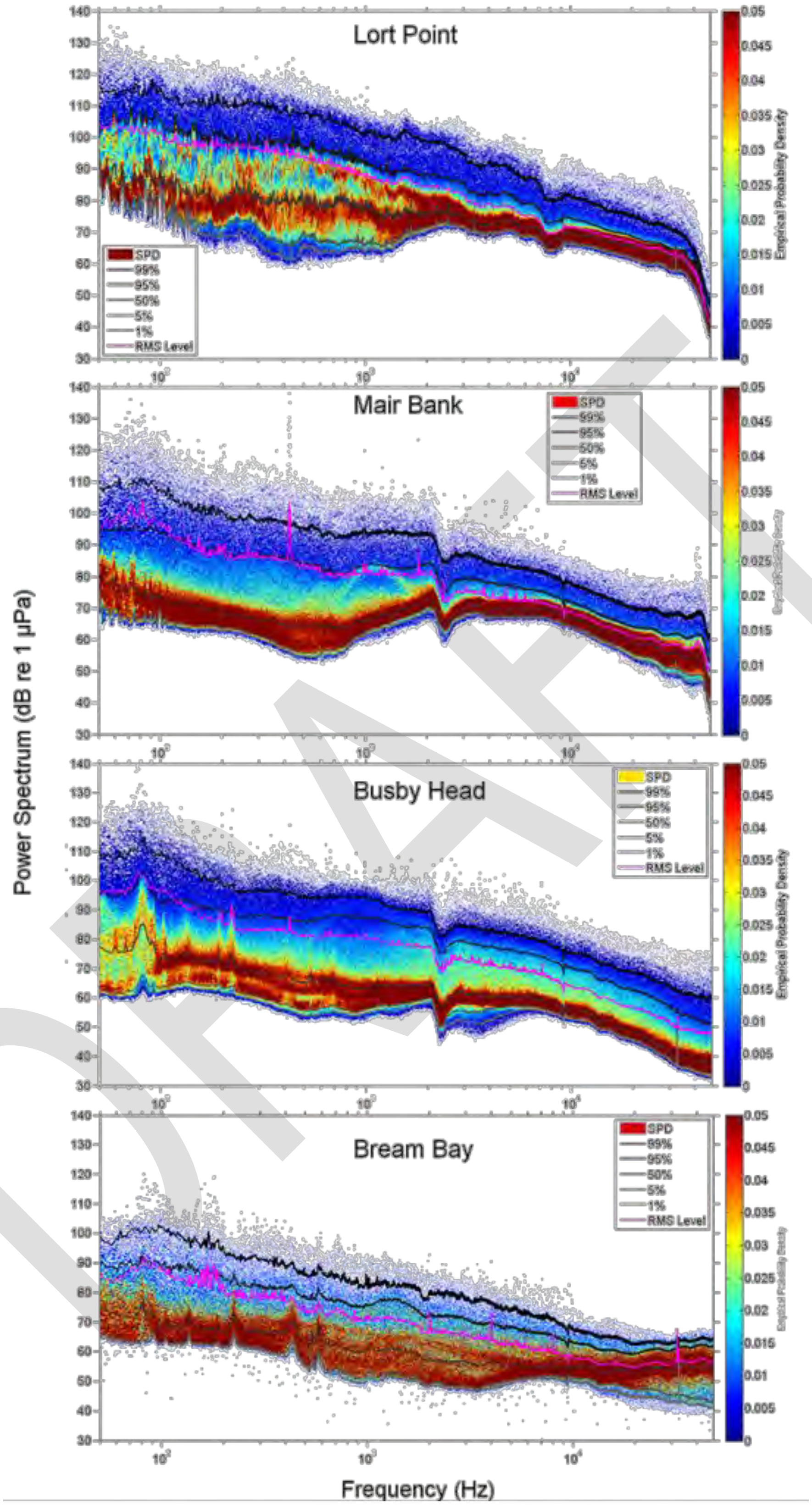

Figure 4: Power spectra plots showing RMS spectrum, percentiles and SPD measured over the survey period.

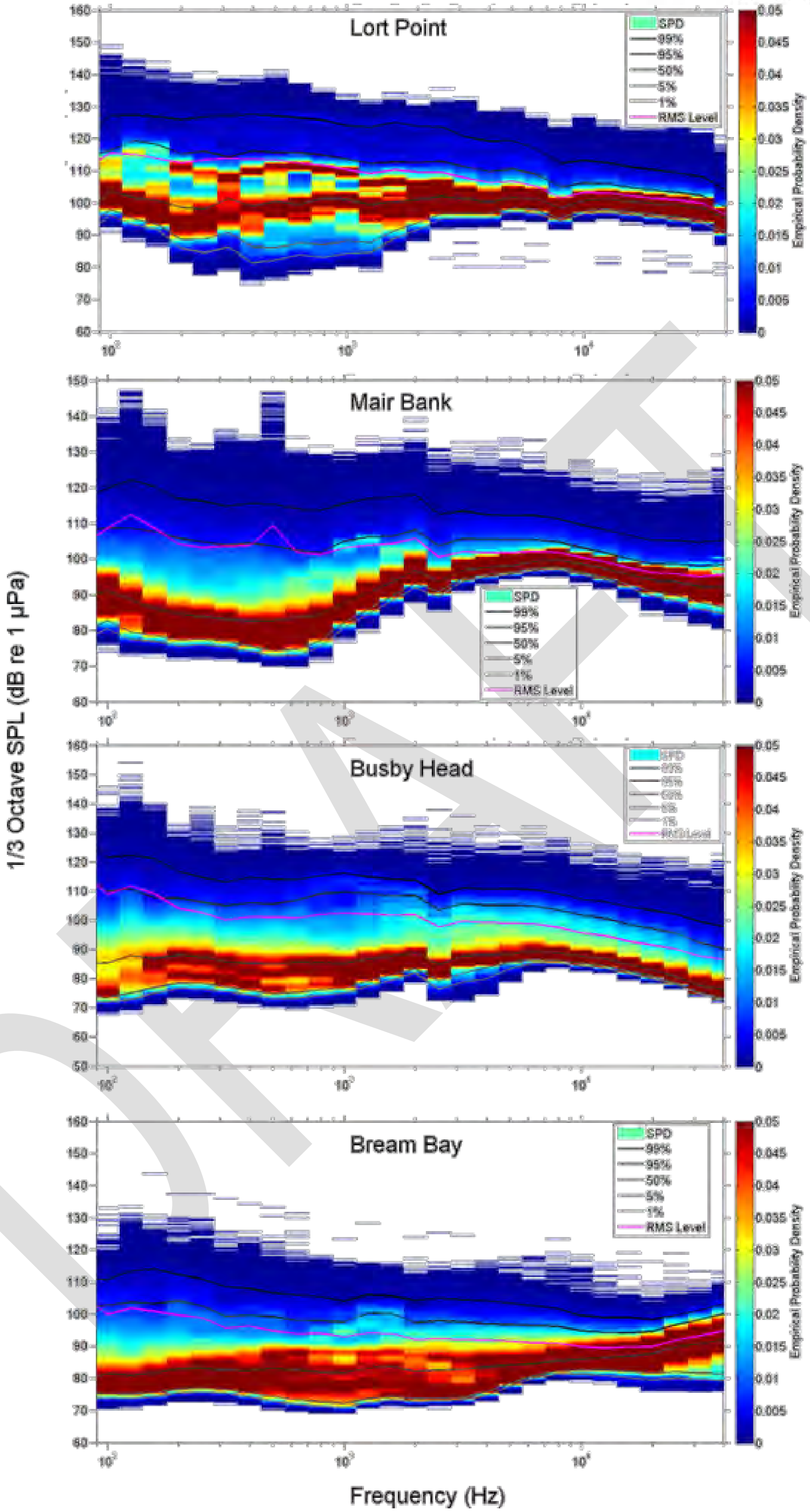

Figure 5: Third octave band plots showing RMS spectrum, percentiles and SPD measured over the survey period.

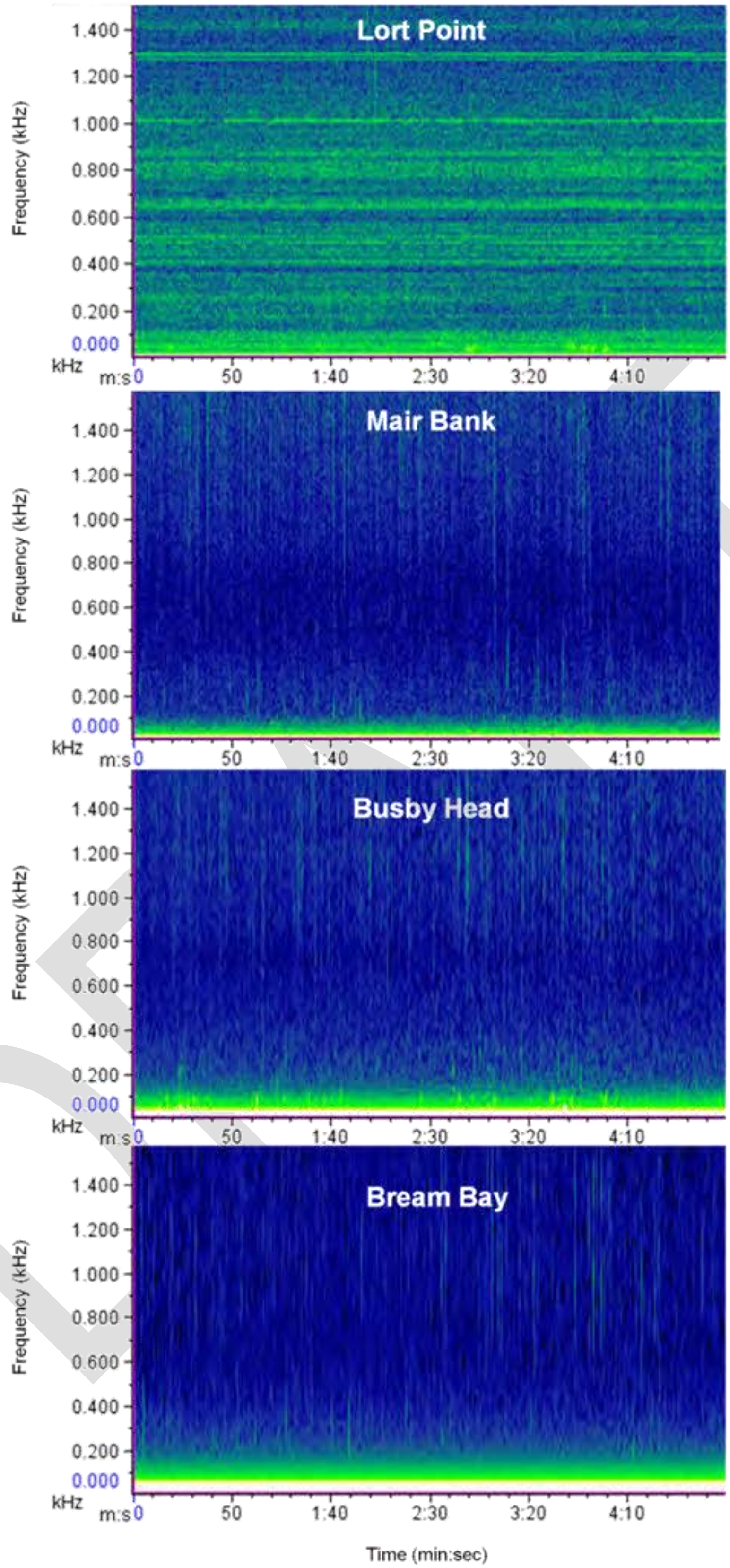

Figure 6: Acoustic spectrograms showing the low frequency signal composed of several harmonics within the Lort Point site only. Spectrograms based on five minute sample at 01:00hrs 26th March 2015.

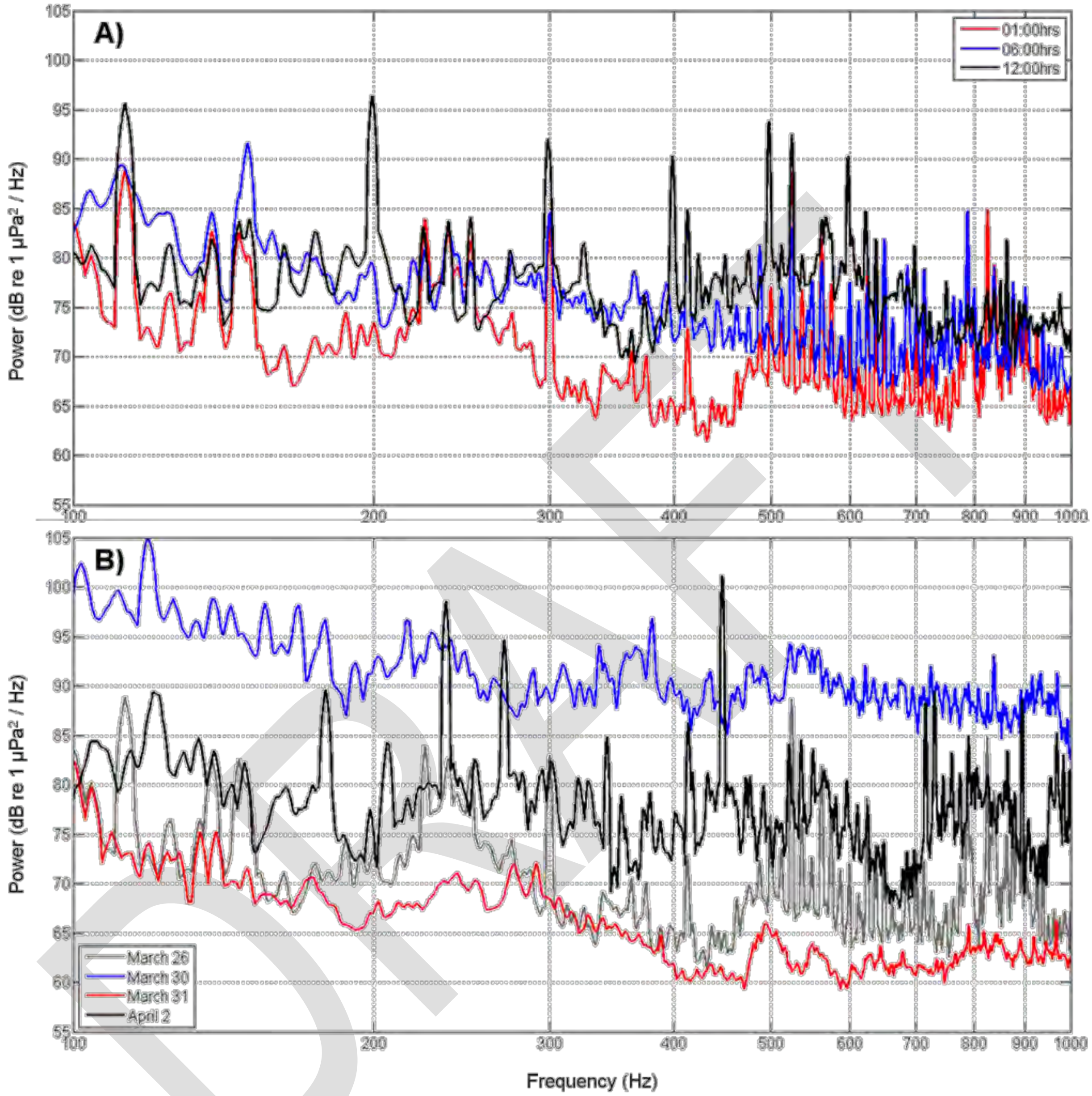

Figure 7: Power spectra plots of continuous low frequency signals within the Lort Point survey site: (A) 26th March 2015 at 01:00hrs, 06:00hrs and 12:00hrs; and (B) plots showing temporal variability in peak frequencies and SPL below 1 kHz between the 26th March and 2nd April. Samples were taken between 01:00hrs and 02:30hrs where no vessel noise (commercial and recreational) was present. Power spectra was calculated using a randomly selected 10min recording. The continuous low frequency harmonics suggest source is mechanical.

Objective 2: Vessel noise

A total of 15 identifiable vessels were recorded both arriving and departing Marsden Point. Of those 15 vessels, five were oil tankers (four out of the five were smaller coastal product vessels). Details of all 15 vessels, including the received SPLs are given in Table 2. Broadband SPL plots of each oil tanker passing through the Mair Bank or Lort Point survey site (identified in Table 2) and the corresponding spectral plots are provided in Figure 8.

Vessel Name	IMO Number	Type	Speed (km h^{-1})	Distance (m)	Received SPL (dB_{rms} re 1 μPa)	Survey Site
Awanuia	9458042	Bunker Tanker (Coastal)	17	257	143	Mair Bank
Maritime Victory	9550292	Log	17	287	141	Mair Bank
Ningpo	9134658	Veneer	NA*	NA*	136	Mair Bank
Pacific Princess	7806271	Fishing	NA*	NA*	142	Mair Bank
Amsel	9076387	Log	15	300	141	Mair Bank
Jag Lagshita	9208057	Suezmax	12	277	135	Mair Bank
Kakariki	9158305	Coastal Tanker	19	248	137	Mair Bank
Anatoki	8864153	Cement	20	314	143	Mair Bank
Yangtze Grace	9584231	Log	19	293	142	Mair Bank
Matsumae	9401336	Triboard	17	270	136	Mair Bank
Baltic Hare	9397236	Log	18	249	143	Mair Bank
Southern Trader 3	9167459	Cement	23	286	141	Mair Bank
Torea	9274082	Coastal Tanker	22	313	150	Mair Bank
High Endurance	9272929	Small Tanker	10	508	133	Lort Point
Maritime Fidelity	9528861	Log	16	284	143	Mair Bank

*Data unavailable.

Table 2: Details of each commercial vessel arriving/departing the oil refinery and the received broadband SPLs (50 Hz - 70 kHz).

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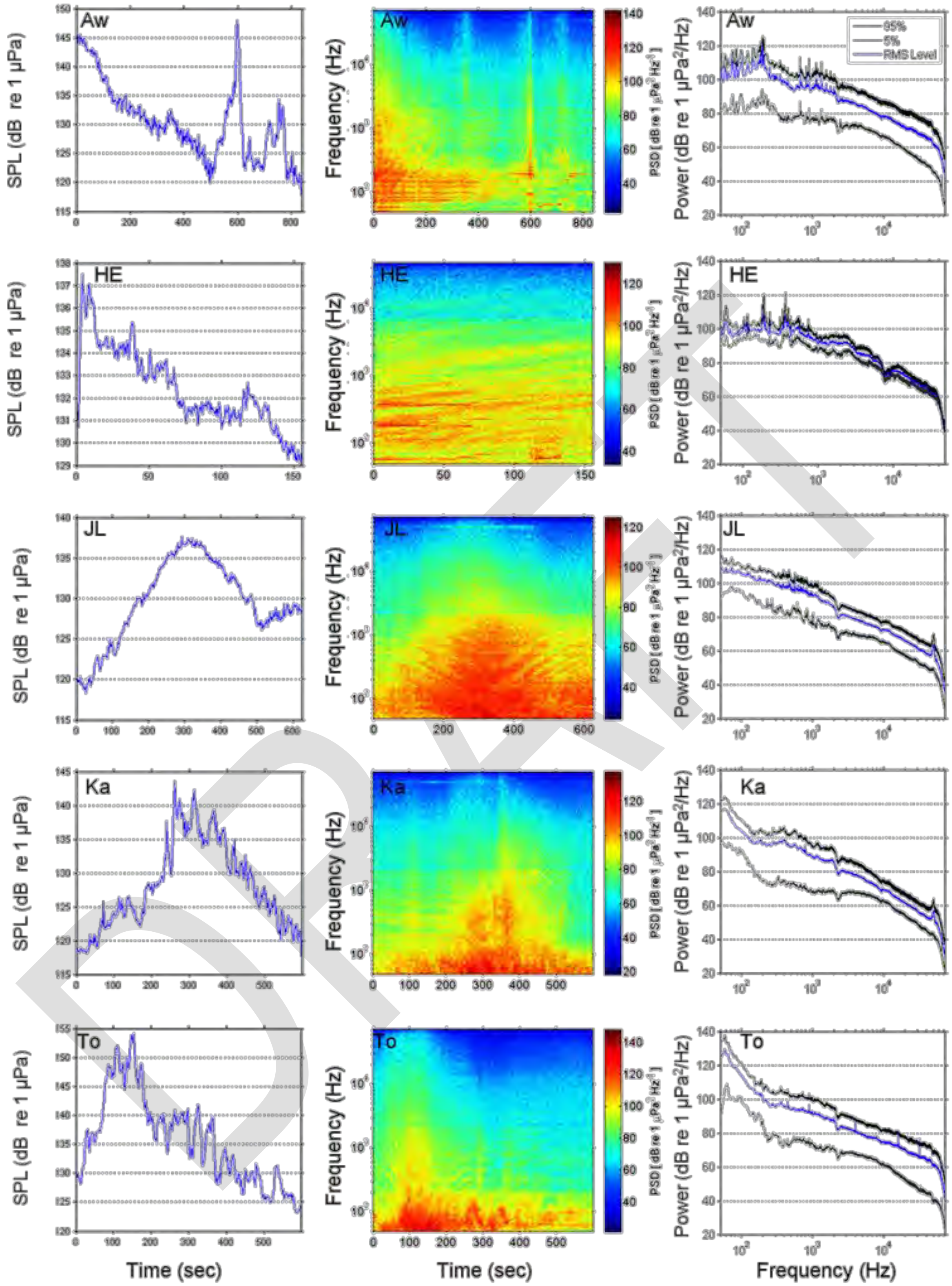

Figure 8: Broadband SPLs (left column) and corresponding acoustic spectra for five oil tankers arriving or departing the Marsden Point oil refinery (Aw=Awanuia; HE=High Endurance; JL=Jag Lagshita; Ka=Kakariki; To=Torea).

The broadband SPL of the larger suezmax tanker is not the highest, with many of the smaller coastal tankers showing greater received SPLs. It is important to note, however, that this difference may be caused from reduced speed, differing distances or engine configurations and the relationship between vessel speed and received SPLs are plotted in Figure 9.

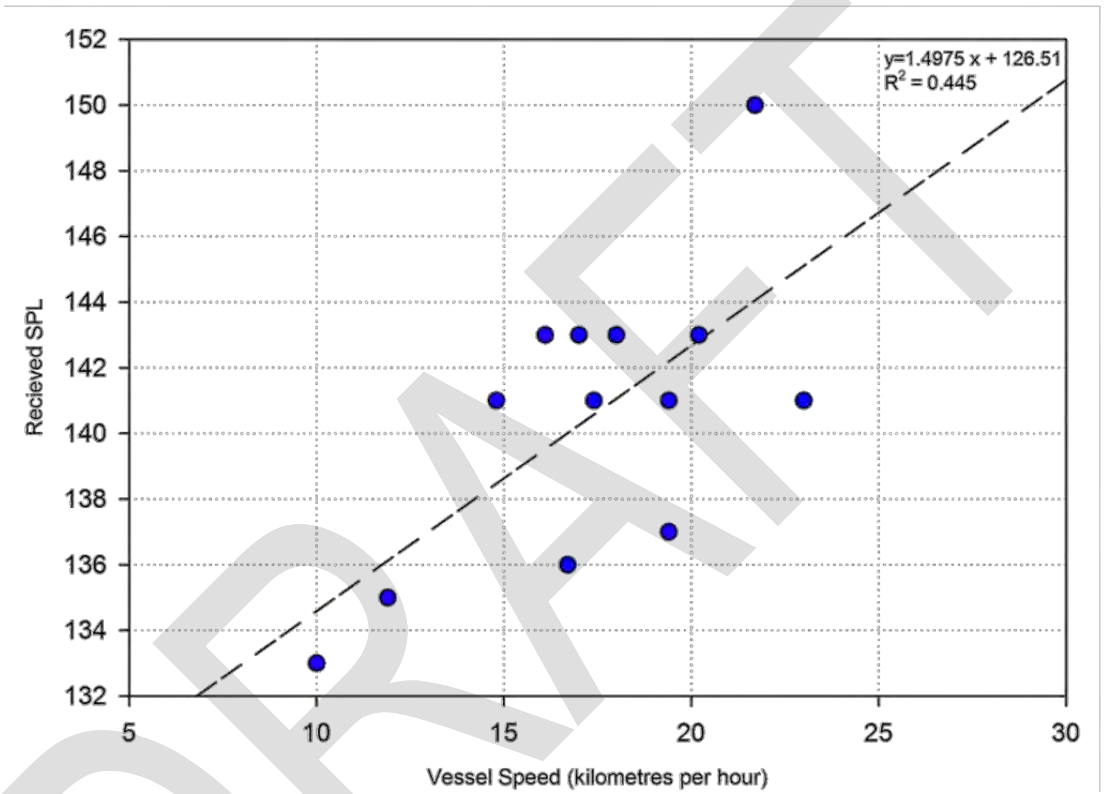

Figure 9: Relationship between received SPL (dB re 1 µPa) and vessel speed (km h^{-1}). Dotted line represents the regression line showing a statistically significant positive relationship (y = 1.4975x + 126.51; R^2 = 0.445; Regression ANOVA $F_{1,12}$ = 8.833, P = 0.013). ANOVA was performed after confirming the data met the assumptions for normality and homogeneity. Note these are based on received SPLs and have not been controlled for distances or spectral variability between vessels' acoustic outputs.

Objective 3: Marine mammal detection

Marine mammals were identified on several occasions during the survey. In total, marine mammals were detected 13 separate times between all four survey sites. Both echolocation clicks and whistles were detected and a typical example is shown in Figure 10. On most occasions, vocalisations were detectable for approximately 30 minutes at a time, with the longest occurrence lasting was approximately 1.5 hours.

Recorded whistles were consistently between 6 kHz and 20 kHz and clicks were broadband between 20 kHz and 100 kHz (characteristic of some dolphins). Due to the limited number of samples, identification of species was not possible. Whales and narrow-band high frequency cetaceans were not detected during the survey. The highest number of dolphin detections were within the Busby Head (6 separate detections) and Bream Bay (5 separate detections) survey site, followed by Mair Bank (2 separate detections) and Lort Point (1 detection). On one occasion, a group of dolphins were clearly detected during the passing of the ship Anatoki (IMO 8864153), at Mair Bank, as shown in Figure 11.

It is important to note that this survey does not serve as an accurate estimate of abundance or diversity, or the degree of affinity to a particular habitat or area. Dolphins vary their vocalisations depending on their behaviour and they are only detectable when they vocalise in proximity to the hydrophone, at sufficient levels to be detected over the background noise floor. Notwithstanding that, however, the results from this survey show that dolphins do frequent the general area. It is therefore our opinion that a noise management plan including passive acoustic monitoring may be required. This is, however, a matter that will be revisited in the future during the Phase 2 work.

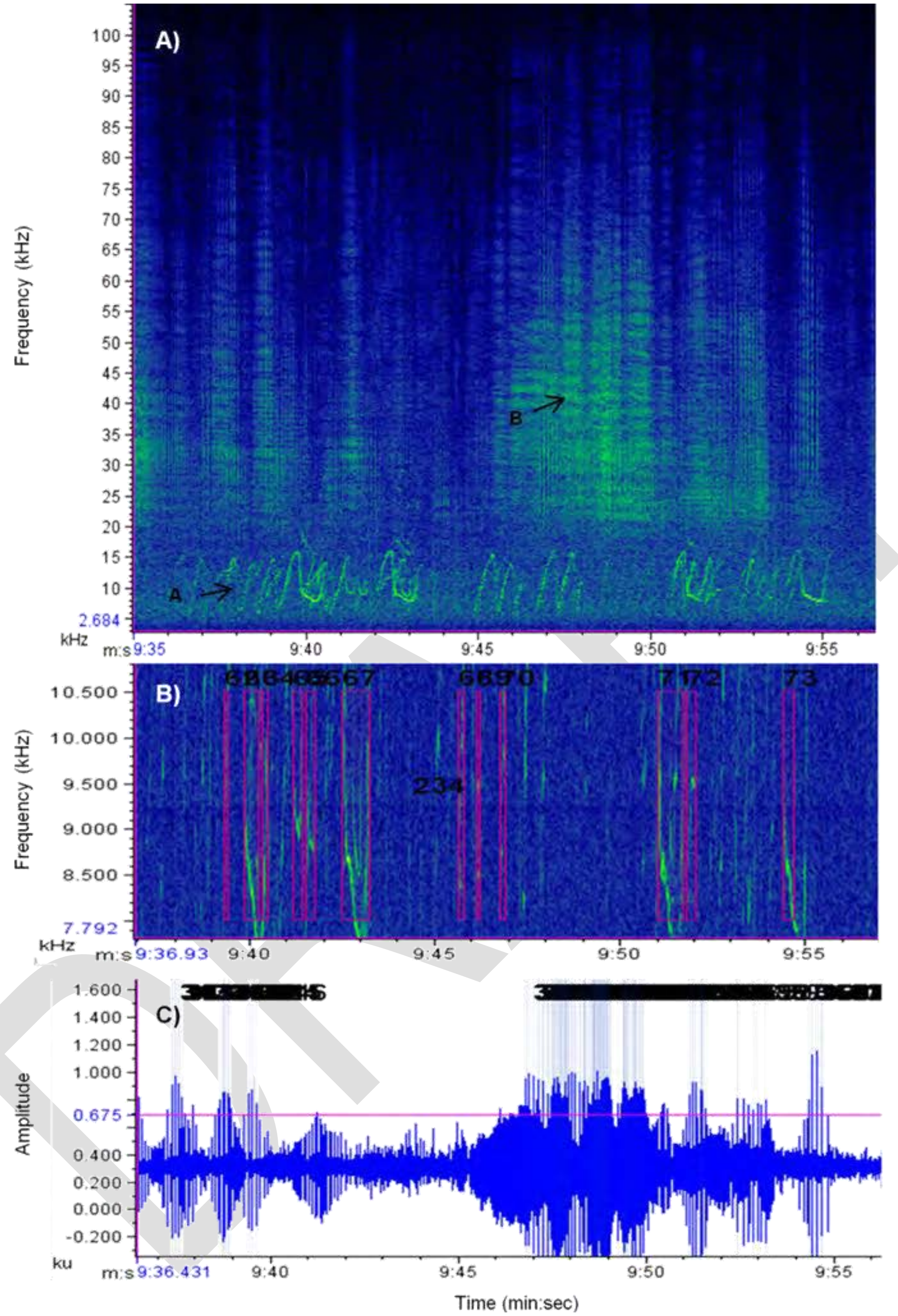

Figure 10: Acoustic spectrograms and waveform of dolphin vocalisations: (A) Echolocation clicks (shown by the arrow labelled B) and whistles (shown by arrow labelled A); (B) magnified section of whistles showing the auto-detection; and (C) waveform of vocalisations showing the amplitude auto-detection.

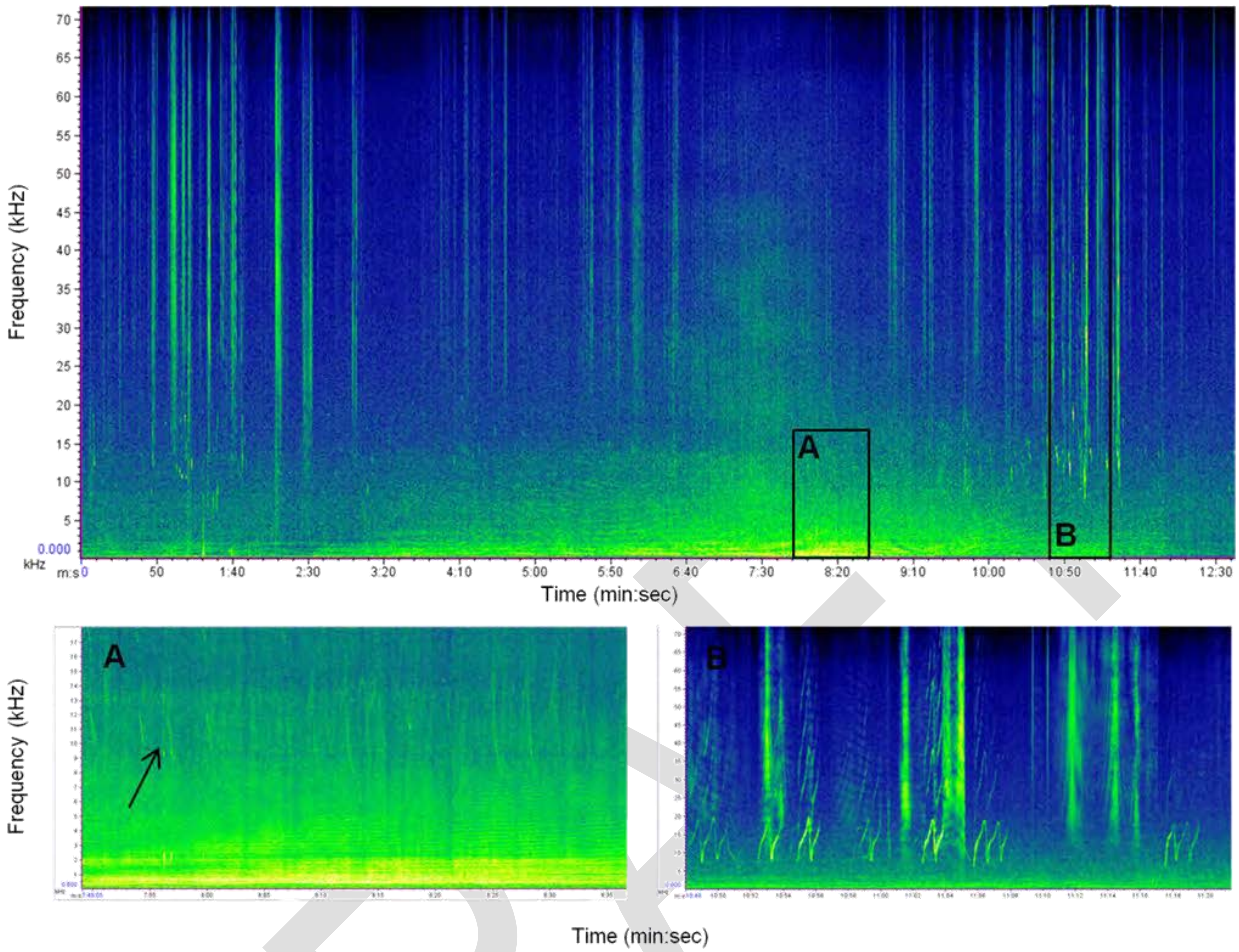

Figure 11: Acoustic spectrogram of the Anatoki (IMO 8864153) and dolphins at Mair Bank. The smaller windows labelled A and B are magnified sections corresponding to the boxes in the main spectrogram. The arrow identifies dolphin whistles over the top of the passing vessel noise.

Conclusion

Styles Group has been engaged by RNZ to undertake a passive acoustic survey of the ambient underwater soundscape within and around Calliope Bay at the entrance to Whangarei Harbour to accompany an application to deepen the channel at Whangarei Heads to allow suezmax vessels to operate at a higher capacity than at present. Currently, these large ships carry cargo to and from the oil refinery but are under-loaded so to successfully navigate the channel between Whangarei Heads and Marsden Point.

Background sound levels varied considerably between survey sites. The highest background sound levels were measured from Lort Point (average 119 ± 0.08 dB_{rms} re 1 µPa) followed by

Mair Bank (113 ± 0.07 dB_{rms} re 1 μPa), Bubsy Head (108 ± 0.46 dB_{rms} re 1 μPa) and Bream Bay (105 ± 0.10 dB_{rms} re 1 μPa). When compared to other New Zealand harbours, for example the Waitemata Harbour and around the inner Hauraki Gulf, the broadband background sound levels measured within the Whangarei Harbour entrance were lower. However, in the absence of any operating vessels, the ambient soundscape within the Whangarei Harbour entrance was comparable with many other nearshore environments around the New Zealand coastline, for example the outer Hauraki Gulf and Kaipara Harbour. Spectrally, the soundscape within the Whangarei Harbour entrance was similar to other harbours where vessel activity is high as the root mean squared and 5th percentile spectrum was characterised by frequencies below 1 kHz, while the outermost survey site, Bream Bay, demonstrated spectra closer resembling those of soft sediment habitats.

Received noise levels from vessels also varied considerably and ranged from 128 dB_{rms} re 1 μPa (Anatoki, IMO 8864153) to 150 dB_{rms} re 1 μPa (Torea, IMO 9274082). The received SPLs from the larger suezmax tanker was less than many of the smaller coastal tankers. However, the lower SPL from the suezmax may be because of her lower speed and differing distances from the receiving hydrophone.

Dolphins were detected at all survey sites, with most detections occurring outside Calliope Bay (Busby Head and Bream Bay). However, dolphins were detected within Calliope Bay on three separate occasions; once being detected as far as Lort Point. While these findings clearly show evidence that dolphins do frequent the general area, much care should taken when inferring any conclusions regarding their abundance or habitat use because the data is limited in sample size.

References

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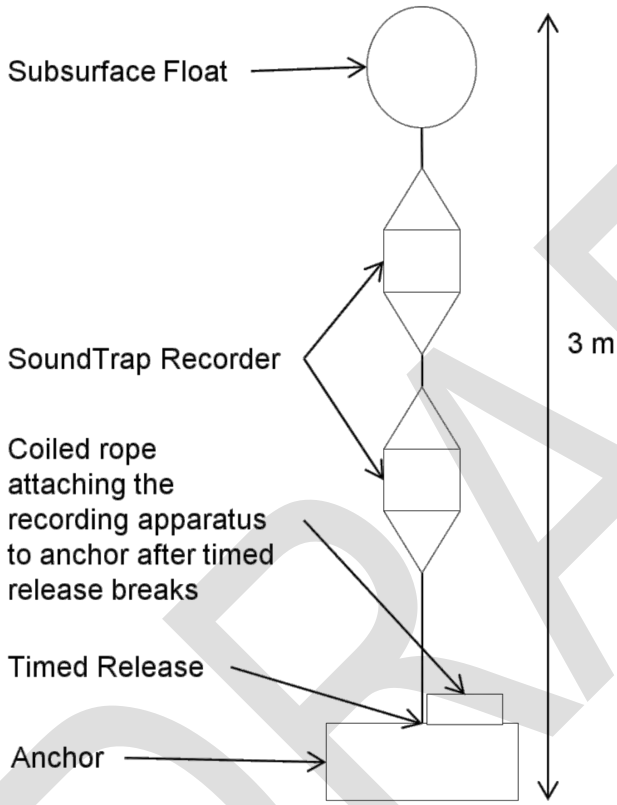
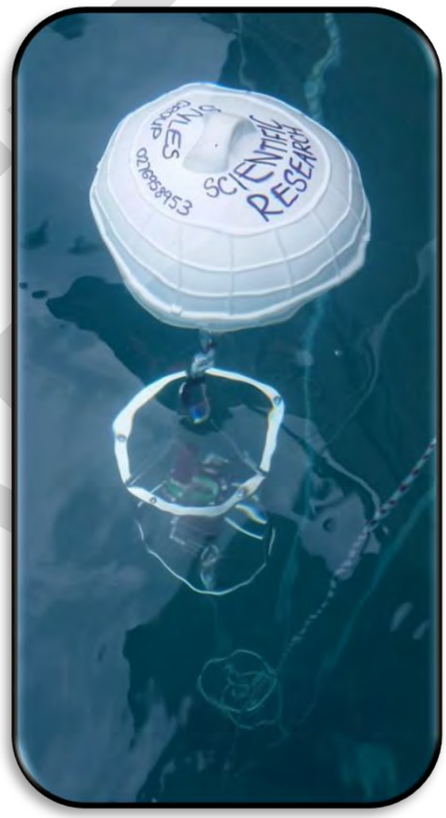
Appendix A

Schematic diagram of the SoundTrap acoustic logger apparatus and photograph of the apparatus being lowered during deployment.





Not drawn to scale

Appendix 2. Theoretical zones of auditory influence and sound threshold criteria.

Theoretical 'zones of auditory influence', originally proposed by Richardson et al. (1995), are mainly based around the distance between the source and receiver, and the idea that underwater sound intensity, and its potential impact, decreases with increasing distance. These zones include detection, behavioural responses, auditory masking and possible auditory injury (also see Pine and Styles 2016 and, in particular, figure 10).

Southall et al. (2007) used a number of studies that examined the potential onset of temporary auditory threshold shifts (TTS; in humans this is often described as the muffled effect your hearing might have after a loud concert) and more permanent threshold shifts (PTS) in captive marine mammals, and extrapolated these to set some initial thresholds for assessing potential auditory damage. More recently, the USA National Oceanic and Atmospheric Administration (NOAA) has researched, and suggested functional hearing specific sound thresholds for, the sound levels likely to cause injury (NOAA 2016), or behavioural responses (NOAA 2011). These threshold criteria are summarised in Table A2.1.

The sound levels at which significant behavioural disturbance for marine mammals can occur are still under discussion (NOAA 2016). Interim sound threshold guidelines (previously known as Level B harassment) are defined in the context of the Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA) and other United States statutes (NOAA 2011; also see Southall et al. 2007). These behavioural disturbance thresholds range between 120 and 160 dB *re*1μPa rms (including both non-pulse and pulse noise) and are defined as having …*the potential to disturb a marine mammal or marine mammal stock in the wild by causing meaningful disruption of biologically significant activities, including, but not limited to, migration, breeding, care of young, predator avoidance or defense, and feeding.* (see Table A2.1).

In the absence of any new behavioural guidelines, this report and Pine and Styles (2016) have used the 120 dB re.1μPa rms non-pulse noise threshold. We have chosen to weight this threshold in combination with the main species functional hearing group weightings proposed by NOAA (2016) to give a better estimate as to what the animals are actually receiving. We have also modelled the unweighted spatial extent of the 120 dB re.1μPa rms threshold (Figure A2.1). If practical, we will monitor this theoretical behavioural boundary for the possible presence of offshore species (i.e. beaked whales, pilot whales) to empirically test any subsequent behavioural responses to the dredging noise at the time and determine whether this noise threshold is an effective mitigation tool for protecting these species.

It is important to emphasises that Pine and Styles (2016) have used topography and oceanographic data specific to the proposal location to model the spatial extent of capital dredging noise within Whangarei Harbour and Bream Bay waters. Hence, the underwater noise approach and findings reported in Pine and Styles (2016) and this report are not applicable to other regions or similar dredging proposals.

Table A2.1. Proposed acoustic injury criteria for individual marine mammals exposed to 'discrete' noise events (multiple exposures within a 24-h period) from NOAA (2016) (and NOAA [2011] for behavioural threshold for non-pulse noise levels).

Mammal Group	Effect	Measurement	Threshold
Cetaceans (LF)*	PTS onset	Exposure Level†	199 dB re.1μPa²/s SEL_{cum} weighted
	TTS onset	Exposure Level	179 dB re.1μPa²/s SEL_{cum}
	Behavioural	Non-pulse noise	120 dB re.1μPa rms
Cetaceans (MF)**	PTS onset	Exposure Level†	198 dB re.1μPa²/s SEL_{cum} weighted
	TTS onset	Exposure Level	178 dB re.1μPa²/s SEL_{cum}
	Behavioural	Non-pulse noise	120 dB re.1μPa rms
Otariid pinnipeds (in water)	PTS onset	Exposure Level†	219 dB re 1μPa²/s SEL_{cum} weighted
	TTS onset	Exposure Level	199 dB re 1μPa²/s SEL_{cum}
	Behavioural	Non-pulse noise	120 dB re.1μPa rms

* Applies to low-frequency cetaceans – 7 Hz-35 kHz, all baleen whales;

**Applies to mid-frequency cetaceans – 150 Hz-160 kHz, all toothed cetaceans except those listed in high-frequency category (high-frequency cetaceans - 275 Hz-160 kHz, true porpoises, *Kogia*, river dolphins, cephalorhynchid (Hector's dolphin), *Lagenorhynchus cruciger, L. australis)*.

†Non-impulsive sounds only.

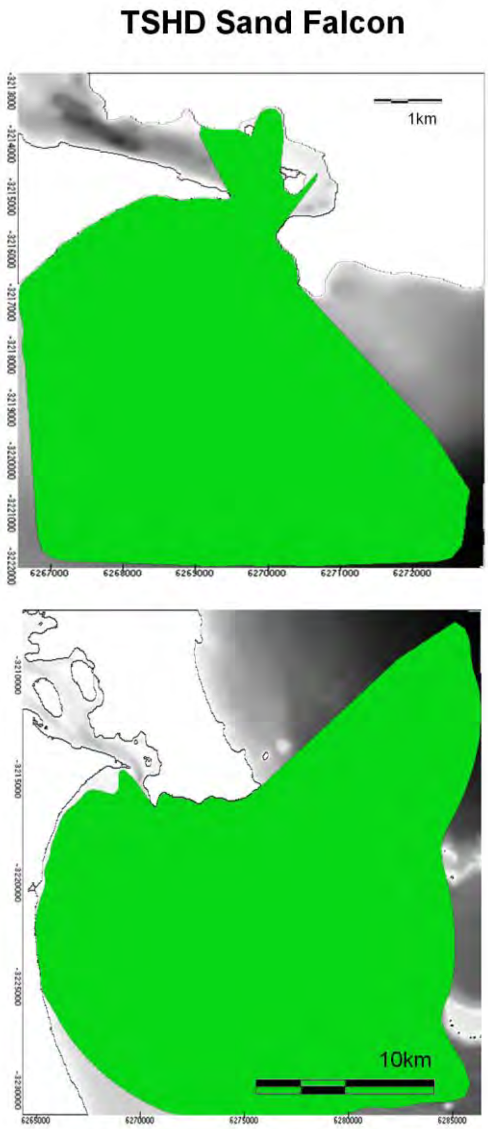


Figure A2.1. Modelled impact zone for the potential onset of behavioural responses at the 120 dB contour for unweighted noise levels for the larger TSHD Sand Falcon (left column) and smaller TSHD City of Chichester (right column) under full dredging conditions within the inner channel (top row) and outer channel (bottom row). Full dredging conditions is draghead down, pumps running and dredging vessel underway.

Appendix 3. Marine Wildlife Management Plan for the proposed capital dredging and pile driving.

1. MARINE WILDLIFE MANAGEMENT PLAN

1.1. Best boating guidelines

The overall risk of a vessel strike between dredge vessels and marine mammals is low. In the unlikely case that a vessel should encounter a marine mammal while working, implementing the following 'best practice' boating behaviours (used worldwide) around marine mammals shall reduce any chance of collision.

1.1.1. General practice

If a whale or dolphin is sighted, but not directly in the path of the vessel:

- Keep boat speed constant and / or slow down while maintaining current direction
- Avoid any abrupt or erratic changes in direction
- Maintain or resume normal operating speeds once well way from animals.

1.1.2. Large baleen whales—such as Bryde's or southern right whales

If a whale is sighted directly in the path of the vessel:

- If the whale is far enough ahead of the vessel (e.g. > 500 m) and can be avoided, slow to 'no-wake' if necessary and maintain a straight course away from the immediate sighting area (where practicable)
- If the whale is too close to the vessel and cannot be avoided, immediately place the engine in neutral and allow the boat to drift to one side of the sighting area where practicable (do not assume the whale will move out of the way)
- Avoid any abrupt or erratic changes in direction while at speed
- Once the whale has been re-sighted away from the vessel, slowly increase speed back to normal operation levels.

If a cow / calf pair is sighted within 500 m of an underway vessel:

- Gradually slow boat while maintaining a course away from the immediate sighting area (where practicable)
- Allow the pair to pass
- Once the pair has been re-sighted away from the vessel (> 500 m), slowly increase speed back to normal operation levels
- Avoid any abrupt or erratic changes in direction while at speed.

If a whale and / or cow / calf pair approaches a stationary vessel:

- Keep the engine in neutral, and allow the animal to pass
- Maintain or resume normal operating speeds once well way from animals (> 500 m).

1.1.3. Small to medium whales and dolphins —– such as bottlenose dolphin or orca

If a dolphin(s) is sighted directly in the path of the vessel:

- Keep boat speed constant and / or slow down while maintaining a course slightly to one side of the group, do not drive through the middle of a pod
- Avoid any abrupt or erratic changes in direction
- Maintain or resume normal operating speeds once well way from animals.

If a dolphin(s) approach an underway vessel to bow-ride or ride the stern wave:

- Keep boat speed constant and / or slow down while maintaining course
- Avoid any abrupt or erratic changes in direction
- Do not drive through the middle of a pod
- Maintain or resume normal operating speeds once well way from animals (> 500 m).

1.2. Debris management guidelines

To avoid the risk of entanglement to marine mammals, all dredging, support vessels and other project activities shall have waste management plans in place prior to the commencement of works. Debris and waste management shall, at a minimum, include:

- Avoiding use of continuous looping lines.
- Slack or free-floating lines should be avoided where practicable.
- Any lines to be kept under tension.
- Proper disposal, and secure storage of plastics and other wastes, especially in higher wind conditions.

1.3. Underwater noise management

Foremost, all dredging and pile-driving equipment and vessels will be regularly maintained with proper upkeep (e.g. lubrication and repair of winches, generators) to reduce the production of underwater noise.

1.3.1. Dredging noise level measurements

Acoustic monitoring shall be undertaken at the earliest possible date once the dredge vessels has arrived to confirm that the actual noise levels associated with dredging activities are as expected for dredging (Pine & Styles 2016). This monitoring shall include, as a minimum, underwater noise measurements, taken during good weather conditions and at varying distances and bearings from the vessels, during the following operational conditions/production cycles:

- During the sediment extraction phase (for all dredge types), from when the bucket/draghead/cutterhead enters the water and sediment is being loaded into the hopper/barge
- During disposal of sediment.

Noise emissions from the loaded/unloaded transit of the dredged material can be assessed and monitored from the passive acoustic moorings and AIS data from the area during dredging. Underwater recordings of each production phase identified above should be taken from the dredge vessel itself (if possible) and a range of log distances (such as, but not limited to, 50 m, 100 m, 200 m, 500 m, 1000 m, 2000 m). Recordings should be of a duration that allows for at least three representative production cycles to be sampled in good weather over the same day. RMS parameters will be measured to compare with the behavioural criteria for ground truthing the underwater noise propagation modelling in Pine and Styles (2016).

Results will be reviewed with parameters used for acoustic modelling in Pine and Styles 2016, and if necessary, spatial modelling results adjusted for use in later maintenance dredging planning. The designated ‘precautionary’ safety zone of 50 m for avoiding TTS effects (discussed in Section 1.1.2) is highly conservative and robust enough to accommodate any final adjustments based on actual dredging sound data.

1.3.2. Standard operational procedures for pile-driving activities (from DPTI 2012)

Standard operation procedures that must be undertaken by contractors during piling activities include pre-start, soft start, normal operation, stand-by operation, and shut-down procedures. The marine mammal observer (Appendix 4, Section 1.1.3) associated with the pile-driving works will be familiar with the SOP, and will document the process.

<u>Pre-start procedure</u> – The presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. Particular focus should be put on the shut-down zone but the observation zone [which can be up to 2 km radius depending on pile-driving type and noise propagation] should be inspected as well, for the full extent where visibility allows. Observations should be made from the piling rig or a better vantage point if possible [i.e. in the absence of a high vantage point, a large observation zone may require an additional vessel as sufficient observation platform].

<u>Soft start procedure</u> – If marine mammals have not been sighted within or are likely to enter the shut-down zone during the pre-start procedure, the soft start procedure may commence in which the piling impact energy is gradually increased over a 10 minute time period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the safety zones should be maintained by trained crew throughout soft starts. The soft

start procedure may alert marine mammals to the presence of the piling rig and enable animals to move away to distances where injury is unlikely.

Normal operation procedure – If marine mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew should continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity or when visual observations ceased or were hampered by poor visibility, the pre-start procedure should be used. Night-time or low visibility operations may proceed provided that no more than 3 shut-downs occurred during the preceding 24 hour period.

Stand-by operations procedure – If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig should be placed on stand-by to shut-down the piling rig. The trained crew member should continuously monitor the marine mammal in sight.

Shut-down procedure – If a marine mammal is sighted within or about to enter the shut-down zone, the piling activity should be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities should recommence using the soft start procedure. If marine mammals are detected in the shut-down zone during poor visibility, operations should stop until visibility improves.

In addition, it is recommended that a record is be kept of all sightings (as per the sighting data form in the marine mammal monitoring plan), delayed start-up or enforced shut-downs due to presence of marine mammals.

Zone sizes

The size of the safety zone and observation zone will be based on the chosen driving technique, noise exposure thresholds and subsequent safety zone distances as provided by the Australia DPTI guidelines and listed in the following table.

Species	Noise exposure threshold	Observation zone	Shutdown zone	Zone of behavioural response
Impact piling	**SEL in db(M*) re 1 μPa²s for single impact**			
All species / all functional groups	≤150 db(M_{xx}) at 100 m	1 km	100 m	≤ 150 m
	≤150 db(M_{xx}) at 300 m	1.5 km	300 m	≤ 500 m
	>150 db(M_{xx}) at 300 m	2 km	1 km	≤ 3 km
Vibro-driving	**SPL in dB re 1 μPa for single impact**			
Cetaceans	≤180 db at 10 m	500 m	10 m**	≤ 5 km
	>180 db at 10 m	1 km	100 m**	≤ 10 m
Pinnipeds	≤190 db at 10 m	500 m	10 m**	≤ 5 km
	>190 db at 10 m	1 km	100 m**	≤ 10 m

*M-weightings should be used for the species functional hearing groups for impact driving noise exposure threshold. For example, for LF cetaceans, the first noise exposure threshold would be ≤150 db(M_{lf}) at 100 m.

** when no avoidance.

1.3.3. Additional measures

Given the shallow location, soft sandy sediments and extremely short-term duration of the proposed pile-driving activity, no additional or further noise minimising options are considered necessary. The following measures are listed as additional considerations when determining the BPO for pile-driving techniques, depending on the practicality and appropriateness specific to this proposal.

Considerations for the BPO for pile driving

- Suction piling (directly from DPTI [2012]) – Suction piling uses tubular piles that are driven into the seabed, or dropped a few metres into a soft seabed, after which air and water are sucked out the top of the tubular pile thereby sinking the pile into the ground. Suction piles are often used to secure offshore floating platforms, in both shallow and deep waters. Although noise levels have not been reported, they are expected to be low as the only source of noise is the pump.
- If practicable, to reduce impact noise use a non-metallic dolly for concrete and steel piles.

1.4. Department of Conservation liaison procedures

A two-way liaison with the Department of Conservation shall be established for exchange of marine mammal sighting data throughout the capital dredging project.

The Department of Conservation shall be contacted regularly [INSERT FREQUENCY; TBC in liaison with DOC] over the project period to obtain real-time/recent sighting information. Information will be shared with officers on board all project vessels, including the designated observer on-board the dredge vessel. This will allow project vessels to anticipate and mitigate potential interactions with any whale species sighted in and near the project area.

In addition, RNZ shall collate and regularly [INSERT FREQUENCY; TBC in liaison with DOC] share any opportunistic or on-board observer sighting data (Appendix 4, Section 1.1) with DOC.

1.4.1. Contact persons and contact details

Contact person (DOC): [INSERT NAME AND CONTACT DETAILS]
Contact person (RNZ): [INSERT NAME AND CONTACT DETAILS]

1.5. Incident reporting (vessel strike and entanglement)

Incidents involving the injury or mortality of a marine mammal shall be reported to the Department of Conservation's contact person as soon as is practicable but not more than six hours. In the case of a fatality, tangata whenua's representative shall also be notified within 24 hours of the incident occurring.

Incident details shall include as much information as possible relating to incident (e.g. date, time, weather conditions [visibility, sea state, etc], vessel location, speed, activity, etc). Any details of the marine mammal (e.g. species, group size) and its behaviour before, during and after the incident shall also be recorded. If practicable, video or photos could be taken. Information will be used to inform how future incidences could be avoided.

Any incident that results in marine mammal injury or fatality will be documented using the incident reporting form (Section 1.5.2 below).

1.5.1. Contact persons and contact details

Department of Conservation: [INSERT NAME AND CONTACT DETAILS]
Tangata Whenua representative: [INSERT NAME AND CONTACT DETAILS]

1.5.2. Incident reporting form

Project vessels shall record any incidents in which a marine mammal physically contacts any project gear with this plan using the incident reporting form shown below. Incident reporting forms will be shared with DOC and Tangata Whenua within 24 hours of the incident occurring. [Final form content TBC in liaison with DOC and Tangata Whenua]

INCIDENT REPORTING FORM

Date	Time	Incident Location on Vessel (description; port, bow, propeller,..)	Vessel Position		Vessel type, activity, and speed at time of incident and any subsequent responses*	Species ¥	No. of animals involved	Animal(s) activity before incident and after #	Description of any injury or mortality	Observer/ reporter	Additional comments (e.g. weather and sea conditions)
			Latitude (northing	Longitude (easting)							

* TSHD, CSD, BHD; in transit, dredging, discharging spoil, etc

¥ Using a species guide such as IFAW and AHP (2005).

Feeding, resting, travelling, socialising, breaching, bowriding etc (e.g. see IFAW and AHP (2005]).

Appendix 4. Description of the recommended marine mammal monitoring for the proposed capital dredging.

1. MARINE MAMMAL MONITORING PLAN

1.1. Visual sighting data collection

The general public and other (non-project related) vessels working in vicinity of the project should be encouraged to report opportunistic marine mammal sightings to RNZ or DOC over the specified monitoring and project timeframes (Section 1.1.1 below). Project vessels shall record and report opportunistic sightings in accordance with this plan and sighting data shall be collected by the on-board observer when on watch (Section 1.1.2).

1.1.1. Opportunistic sighting data collection

Opportunistic sighting data shall be recorded in and around Whangarei Harbour and Bream Bay area for approximately[19]:

- One month before capital dredging.
  <u>*Aim*</u> *- The resulting data will be used (in conjunction with passive acoustic monitoring data) to verify the predicted visitation/presence of marine mammals as described in the Phase 1 and Phase 2 reports.*
- The entire ~6 month period when capital dredging is underway.
  <u>*Aim*</u> *- The resulting data will be used (in conjunction with passive acoustic monitoring data) to determine use of the project area by marine mammals during active dredging operations (e.g. are marine mammals still coming into the project area even though dredging is underway?).*
- One month following the completion of capital dredging.
  <u>*Aim*</u> *- The resulting data will be used (in conjunction with passive acoustic monitoring data) to determine the continued presence, or return, of marine mammals in the project area following the completion of capital dredging.*

1.1.2. On-board observer (dredging)

An observer will be on board the dredge vessel during daylight hours over the duration of capital dredging. The observer will be on watch whenever dredging or disposal activities are underway (including transiting). The observer has two general duties; (1) to enforce the shut-down of sediment extraction when marine mammals are within the precautionary exclusion zone (50 m; see ‘shut downs’) and (2) to record sighting data (Section 1.1.4), with an emphasis on marine mammals within 300 m of

[19] The necessity and timing of the collection of opportunistic sightings for maintenance dredge monitoring will be reviewed and revised, if necessary, based on capital dredge monitoring results.

the dredge vessel. The observer does not need to be a qualified marine mammal observer (e.g. an existing crew member can be inducted and designated to fill the role of the observer).

Shut-downs

If a marine mammal comes within 50 m of an active dredge vessel (i.e. undertaking sediment extraction), a 'shut-down' should be initiated. This is to further reduce the risk of TTS onset (see Section 3.1.2 of main report, Assessment of Actual and Potential Effects).

A 'shut-down' in this case refers to cessation of sediment extraction. This might involve lifting the draghead from seafloor and ramping down the suction pump (TSHD) or cessation of ongoing removal (BHD) or cutting (CSD) of the seabed[20]. Once the mammal has left the 50 m radius, operations can be resumed. Details of any shut-down event should be captured on an incident reporting form.

The on-board observer will communicate to the [INSERT CREW POSITION] when a marine mammal is within 50 m of the dredge vessel. The [INSERT CREW POSITION] will then cease sediment extraction. Once the marine mammals has left the 50 m radius, the observer will advise the [INSERT CREW POSITION] that operations can be resumed.

1.1.3. Onboard observer (pile driving)

The observer/s associated with pile-driving works has two general duties; (1) to detect and record the presence of marine mammals and (2) to ensure standard operating procedures are followed including documenting any enforcements (if necessary). Specifically, these are detailed in Appendix 3 (Section 1.3.2). The observer does not need to be a qualified marine mammal observer (e.g. an existing crew member can be inducted and designated to fill the role of the observer).

1.1.4. Sighting data form

All sighting data collected should be collated into a tabulated format as shown below, for ease of database input.

[20] TSHD: Trailer suction hopper dredge, BHD: Back-hoe dredge, CSD: cutter suction dredge.

SIGHTING FORM

Date	Time (of first sight)	Sighting duration	Location (description including minimum distance from vessel if applicable)	Position (at first sight)		Species*	No. of animals	Animal activity ¥	Vessel type and activity of vessel #	Observer/ reporter	Additional comments (e.g. weather and sea conditions)
				Latitude (northing	Longitude (easting)						

* Using a species guide such as IFAW and AHP (2005).
¥ Feeding, resting, travelling, socialising, breaching, bowriding etc (e.g. see IFAW and AHP 2005).
TSHD, CSD, BHD; in transit, dredging, discharging spoil, etc

1.2. Acoustic data collection

1.2.1. Passive acoustic monitoring for presence of marine mammals

Passive acoustic monitoring for the presence of marine mammals shall be undertaken for approximately:

- One month before capital dredging.

  Aim - The resulting data will be used (in conjunction with sighting data) to verify the predicted visitation/presence of marine mammals as described in the Phase 1 and Phase 2 reports.

- Two separate fortnightly monitoring periods while capital dredging is underway (~6 months). These timeframes will be sufficient to capture several dredging cycles.

  Aim - The resulting data will be used (in conjunction with sighting data) to determine use of the project area by marine mammals during active dredging operations (e.g. are marine mammals still coming into the project area even though dredging is underway?).

- One month following the completion of capital dredging.

  Aim - The resulting data will be used (in conjunction with sighting data) to determine the continued presence, or return, of marine mammals in the project area following the completion of capital dredging.

During each of these periods, passive acoustic moorings would be placed in at least four locations, including around the Harbour entrance to record any animals entering or leaving the Harbour, near the disposal area in Bream Bay and along the 120 dB contour (see Figure A4.1 for some general site locations).

Figure A4.1. Suggested site locations for passive acoustic monitoring moorings. Figure originally from Pine and Styles (2015).

Appendix 5. Reported occurrences of marine mammals in the Whangarei coastal region and Harbour since March 2015.

Date	Start time	Finish time	Location Description	longitude (easting)	latitude (northing)	Species	Number observed	Activites around animals	Observer_reporter	Comments
13/03/2015	9:00		off Whangerai Harbour			bottlenose dolphin	3 to 4 (multiple groups in area)	socializing, fast travel, chasing (prey?), bow and stern riding	Simon West	Bioresearches - Simon West while doing benthic sampling on project; photos confirm bottlenose and one animal with distinct 1 tooth rake patch on top of dorsal, left side and maybe some other good shots
26/03/2015	4:30	5:00	Bream Bay			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
26/03/2015	7:30	8:00	Bream Bay			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
28/03/2015	3:00	3:26	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
29/03/2015	14:00	14:30	Bream Bay			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
30/03/2015	4:30	5:35	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
30/03/2015	5:30	7:00	Mairs Bank			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
30/03/2015	7:30	8:00	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
30/03/2015	17:30	18:00	Bream Bay			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
30/03/2015	18:30	19:00	Bream Bay			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
31/03/2015	6:30	7:00	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
31/03/2015	9:30	10:00	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
2/04/2015	11:30	12:15	Mairs Bank			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
2/04/2015	14:00	14:30	Lort Point			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
2/04/2015	18:30	19:00	Busby Head			unknown dolphin			Styles Group data - acoustic logger	Styles Group data - acoustic logs of dolphin species in pre-assessment field work
3/08/2015	10:30	13:00	went up Whangerai Harbour (reported Tamaterau and furthest pt was Kissing Point)			bottlenose dolphin	10	fast travel swimming up harbour, maybe in response to orca outside of heads	Northern Advocate news article	Northern Advocate news article - Lindy Laird, orca also sighted in Parau Bay
3/08/2015	10:00		off Parau Bay			orca			Floppy Halliday with Whale Watch hotline	Northern Advocate news article - Lindy Laird,
15/08/2015	15:00	17:00	Smugglers Cove (Whangarei Heads near Busby Head)			Southern right whale	1	resting in shallows	Andrea Robinson and friends	Northern Advocate news article - Mike Dinsdale, watched for about 1.5 to 2 hrs in same general area, resting in shallowssame whale seen in Auckland's Mechanics Bay a few days earlier (not sure if ID confirmed or not); Ingrid Visser reported same animal in Sandy Bay (further north) on following Tuesday (18 Aug) and again off Bland Bay campground (Puriri Bay, Whangaruru Harbour) on the Friday 21 Aug 2015.
16/09/2015	14:00		entered Whangerai Harbour - Snake Bank sandbar (between McLeod's Bay and One Tree Point)			orca	3 +	feeding on eagle rays and stingrays	Northern Advocate news article	Northern Advocate news article - Lindy Laird, went on boat with Ingrid Visser; Good shot of orca in front of RNZ jetty and ship - Michael Cunningham Northern Advocate
22/11/2015	9:00		Managawhai estuary (south of Bream Bay); few hundred metres south of the Tara Creek mouth			bottlenose dolphin	6		Daren Grover-Project Jonah	Northern Advocate news article - Lindy Laird, stranded up creek with low tide, all released
9/03/2016	9:00		Ruakaka Beach	1731815	6023433.9	Gray's beaked whale	3	STRANDING	Clive Stone, Juliane Cheltham, Ingrid Visser; Marie Jordan - DOC	DOC stranding report and photos attached
21/04/2016			Bream Bay near proposed spoil grounds	35 54.954'S	174 31.740'E	bottlenose dolphin	5	5 included cow/calf pair	Alice Morrison - independent	Refining NZ benthic field work for ??
23/04/2016			Bream Bay near proposed spoil grounds	35 57.531'S	174 33.046'E	bottlenose dolphin	5	possibly same group both days	Alice Morrison - independent	Refining NZ benthic field work for ??
3/05/2016	a.m		north of RNZ jetty			bottlenose dolphin	2 to 3 (?)	chasing kahawhai and following small rubber boat	Joshua Roberts - RNZ staff	chasing and catching kahawhai on way to work in morning
19/06/2016	14:00		Prob 5 miles out off Ruakaka, middle of Bream Bay			Bryde's whale	2	traveling north to south	Steve Tyson - RNZ staff	mum with calf; sighted while sailing boat from Auckland; video at (https://youtu.be/3wplPJ9XhWI); same pair may have been seen again on 15 jUne in harbour
2/07/2016	9:00	10:00	Whangarei Harbour just west of the Port			Humpback whale	2	rolling around in shallows with lots of flippers out of water	Riaan Elliot - RNZ staff	Whale on side with fin in the air. Fin was white and serrated along one edge. Also Northern Advocate article that showed 2 whales and confirmed humpback
13/07/2016			Kerikeri- far north beach			blue whale	1	dead stranding	Northern Advocate news article	Northern Advocate news article - Mike Dinsdale, dead blue whale washed up on private kerikeri beach. No obvious causes of death
8/09/2016	7:45		Reotahi and Darch Point			Orca	3	Travelling	Steve Tyson, RNZ, via Riaan Elliot - RNZ staff	Reotahi and Darch Point. "I talked to Ingird Visser, the male with the wobbly dorsal fin is called Funky Monkey and is 18 yrs old". Caught on video at 0745am.
3/09/2016			Onerahi			Orca			Friend of Riaan Elliot - RNA	
22-24 Oct 2016			Bream Bay			Unknown dolphin	50-100	Large pod of dolphins	Staff members sailing in the coastal classic (via Riaan Elliot, RNZ)	Staff members sailing in the Coastal classic over labour weekend sighted a large pod of dolphins in Bream Bay. Pod size was somewhere between 50 and 100.

Annexure Two: Technical Reports

j) **AEE Report – Coastal Birds – Final. Bioresearches Group Limited. Graham Don. Dated 09 August 2017**

Bioresearches
A Babbage Company

REFINING NZ
CRUDE SHIPPING PROJECT

AEE REPORT
COASTAL BIRDS

FINAL

FOR: **REFINING NZ**

BY: **BIORESEARCHES GROUP LIMITED**
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CONTENTS

1. EXECUTIVE SUMMARY

A description of the coastal and pelagic birds observed utilising or recorded previously within the broad Project area is presented; that is the result of literature searches, information from a local bird watcher and specific field investigations completed in 2015 and 2016. High value bird habitats in a national context were identified at Mair Bank and Bream Bay. Northport to One Tree Point and Urquharts Bay areas were identified as being of high value in the context of the Outer Harbour.

Breeding within the Harbour was recorded or strongly inferred for variable oystercatcher, reef heron and little penguin; specific breeding sites used by threatened and at risk species are of national importance during the breeding season.

The potential risk of Project-generated effects on shorebird habitats was considered high at Mair Bank and low-moderate at Reotahi Bay as a result of their proximity to the works. The risk at the other habitats was judged to be low.

Potential issues regarding coastal and pelagic birds were identified as climate change, turbidity increases, deposition of resuspended sediment, vessel movements, vessel lighting, underwater noise and cumulative effects. There is no concern regarding permanent decrease in feeding habitat, a loss of roosting or breeding habitat, sediment contaminants, maintenance dredging, or the erection and maintenance of navigational aids. An analysis of potential effects was completed. The species most susceptible to a turbidity increase in the dredging area is considered to be little penguin; the concern is disruption of its passage between shoreline nesting areas, specifically those within the Harbour and the nearby open water. However the confined sediment plume, limited dredging area within Busby Head, temporary nature of the works, Project turbidity thresholds and ranges in ambient turbidity, indicate that adverse effects will likely be avoided and will not be contrary to NZCPS Policy 11 (a) (i) and Policy 11 (b) (ii). The probability of an adverse turbidity effect at the disposal site is considered remote and not likely to be contrary to NZCPS Policy 11 (a) (i) or 11 (b) (ii). Similarly there would be no effect on coastal or pelagic birds from the deposition of any resuspended sediments. The issue of increased vessel movements is assessed

relative to the current baseline; because the Project area is frequently used by a wide variety of vessels the effect has been judged less than minor.

Vessel lighting is a known attraction to pelagic species especially shearwaters and petrels that nest on the Hen and Chickens Islands, but especially grey-faced petrel that nests locally and is being actively encouraged within the immediately adjacent Bream Scenic Reserve. Although the objective of NZCPS Policy 11 (a) (i) would be maintained, mitigation is proposed via the provision of nesting boxes in the Reserve. The issue of noise regarding diving and swimming birds is considered negligible and to be consistent with NZCPS Policies.

Recommendations are the provision of nesting boxes for little penguin (possible turbidity effect) and grey-faced petrel (possible lighting effect), and a lighting audit of the Project's vessels to minimise the light attraction of seabirds. Monitoring of the post-dredging state-of-the-environment is proposed to cover little penguin specifically and coastal birds.

In summary the overall impact on coastal and pelagic birds is considered to be low. The Project would be consistent with NZCPS Policy 11 (a) (i) and Policy 11 (b) (ii).

2. INTRODUCTION

Assessments of the coastal bird populations in the area from a line between One Tree Point and Darch Point through to Home Point and the northern end of Bream Bay Beach were completed in February-March 2015, November 2015 and February-March 2016. The February-March 2015 and 2016 surveys aimed at documenting coastal bird abundance, diversity and habitat use while the November 2015 surveys recorded breeding activities in the context of the planned application by Refining NZ for the Crude Shipping Project.

The aim of the surveys was to gain an understanding of the characteristics and significance of bird populations in areas in the vicinity of the Project and to update information that had been reviewed in a literature review completed by Bioresearches in 2015. That literature review identified that a total of ten nationally threatened and sixteen nationally at risk coastal and pelagic species had been recorded in the outer Harbour (east of One Tree Point) and Bream Bay habitats. With non-resident native and non-threatened birds the total diversity was 34 species. Breeding in Harbour and Bream Bay edge habitat was reported for both threatened and at risk species comprising a wide range of bird groups – waders, gulls, terns, penguin, shags and shearwaters.

The two broad groups of birds present are coastal birds that utilise intertidal and nearshore habitats, and pelagic birds that generally utilise open water offshore habitats (eg shearwaters, petrels) but can occur close to shore on occasions. In this investigation the coastal birds were assessed via field surveys while information on pelagic species relied on the literature, together with observations and reports provided by Margaret Hicks, a local resident and experienced bird watcher.

While the surveys completed for this Project were completed in a two year period, a longer term benchmark is provided by the data collected at Marsden Bay by the Ornithological Society of NZ (now Birds NZ) and reported by Dickie 1984, from 1975 to 1984 inclusive; and from 2009 to 2015 inclusive by Bioresearches for the Marsden Cove Development. Those data indicate a relative stability in at least the wading bird population in this part of the Harbour over that period.

The coastal and pelagic species referred to in this report and their current (May 2017) national conservation ratings are shown in Tables 1 and 2.

The assessment of effects recognises the New Zealand Coastal Policy Statement (NZCPS) (2010), particularly Policy 11 Indigenous Biological Diversity (biodiversity) (a) which states "avoid adverse effects of activities on: (i) indigenous taxa that are listed or threatened or at risk in the New Zealand Threat Classification System lists."A total of 27 such species have been recorded in the outer Harbour survey area and Bream Bay.

Policy 11(a)(ii) is also relevant but birds listed by the International Union for Conservation of Nature and Natural Resources (IUCN) are understood to have been captured by Policy 11(a)(i). Policy 11(a)(v) is relevant to this assessment i.e. "areas containing nationally significant examples of indigenous community types" insofar as it relates to communities of coastal birds. That has been summarised in Figure 11 of this report.

Finally this evaluation recognises Policy 11(b): "avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on: (ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species". Areas of known (literature review, field investigations) habitat used for bird nesting and juvenile rearing have been identified in this assessment.

TABLE 1 - List of Coastal birds, recorded during the surveys and their current conservation status (Robertson et al, 2017*)	
COMMON NAMES	**CONSERVATION STATUS ***
black-backed gull; karoro	not threatened
caspian tern; taranui	threatened – nationally vulnerable
eastern bar-tailed godwit; kuaka	at risk - declining
eastern curlew	non-resident native
kingfisher; kotare	not threatened
lesser knot, huahou	threatened – nationally vulnerable
little shag; kawaupaka	not threatened
mallard	not threatened
NZ dotterel; tuturiwhatu	at risk - recovering
paradise shelduck; pūtangitangi	not threatened
pied shag; karuhiruhi	at risk - recovering
pied stilt; poaka	not threatened
red-billed gull; tarapunga	at risk - declining
reef heron; matuku-moana	threatened – nationally endangered
South Island pied oystercatcher; torea	at risk - declining
spur-winged plover	not threatened
variable oystercatcher; toreapango	at risk - recovering
white-faced heron	not threatened
white-fronted tern; tara	at risk - declining

* Robertson, HA; Baird K; Dowding JE; Elliott, GP; Hitchmough, RA; Miskelly CM; McArthur N; O'Donnell CFJ; Sagar, PM; Scofield RP; Taylor GA May 2017. Conservation Status of New Zealand birds, 2016. NZ Threat Classification Series 19. Dept of Conservation. 23 pp.

TABLE 2 - List of pelagic birds, recorded in the literature as utilising the wider Bream Bay area and their current conservation status (Robertson et al, 2017*)	
COMMON NAMES	**CONSERVATION STATUS ***
australasian gannet; takapu	not threatened
arctic skua	non-resident native
black-winged petrel	not threatened
Buller’s shearwater	at risk; naturally uncommon
fairy prion, titi wainui	at risk – relict
flesh-footed shearwater; toanui	threatened – nationally vulnerable
fluttering shearwater, pakaha	at risk – relict
giant petrel (northern); pangurunguru	at risk - recovering
grey-faced petrel; oi; titi	not threatened
Indian Ocean yellow-nosed mollymawk	non-resident coloniser
little penguin; korora	at risk – declining
little shearwater	at risk - recovering
northern diving petrel; kuaka	at risk - relict
Pycroft’s petrel	at risk - recovering
shy mollymawk	at risk - declining
sooty shearwater; titi; muttonbird	at risk - declining
white-faced (NZ) storm petrel; takahikare-moana	at risk – relict

3. FIELD INVESTIGATIONS

3.1 Introduction

Over the 2015-16 period there were three groups of surveys as follows:-

(i) February – March 2015: coastal bird surveys at five locations

- Bream Bay Beach (at Mair Road)
- Taurikura Bay
- McKenzie Bay
- Urquharts Bay

(ii) November 2015 – breeding activity surveys:

- Mair Road to Northport inspection
- Marsden Point to Northport habitat use
- Darch Point to Home Point habitat use

(iii) February – March 2016:- coastal bird surveys at eight locations

- Mair Bank (as 2015)
- Refinery Jetty to Northport
- Marsden Bay west to One Tree Point
- Part of Snake Bank
- Reotahi Bay
- Taurikura Bay
- McKenzie Bay
- Urquharts Bay

The above areas are shown on Figures 1 to 8.

The only 2015 survey area that was not surveyed in 2016 was Bream Bay Beach on the basis that it supported a low diversity and relatively low numbers of coastal birds and no significant high tide roosting.

For clarity a summary of the coastal bird count surveys is as follows:

Area of coast	Date	No. hourly counts
Bream Bay Beach	23.3.15	9
Mair Bank	25.2.15	9
	3.3.15	9
	9.2.16	9
Refinery Jetty to Northport	8.3.16	9
Marsden Bay West to One Tree Point	16.2.16	8
Part Snake Bank	16.2.16	8
Reotahi Bay	9.3.16	9
Taurikura Bay	18.3.15	9
	9.3.16	9
McKenzie Bay	18.3.15	9
	9.3.16	9
Urquharts Bay	18.3.15	9
	9.3.16	9

Bird use of nine sections of coastline was recorded via a total of 124 hourly counts. Mair Bank received additional emphasis regarding both the coastal bird surveys and breeding season surveys because of its proximity to the proposed works, its significance as a coastal bird habitat in a national context [NZCPS 11(a)(v)]and its current condition that includes a decrease in the pipi population (Williams JR & Hume TM 2014; Pawley, 2016) and an apparent increase in green-lipped mussels (Pawley 2016) that may change the attractiveness of Mair Bank as a feeding area for coastal birds, especially variable oystercatcher.

3.2 Methodology

The methodology for the bird surveys of the nine sections of coastline was reviewed by NIWA on behalf of Northland Regional Council. It is the same methodology that has been used to monitor the bird populations using Marsden Bay, to the west of Northport, over the 2003 to 2015 period with approval of Northland Regional Council and the Department of Conservation.

At each site hourly counts were completed to cover a range of tidal conditions and habitat use activities recorded using Leupold BX-2 Cascades 10 x 42 binoculars and a Kowa TSN-883 Prominar spotting scope (25-60 times wide zoom eye piece). Before each count the air temperature was measured (quartz digi-thermo -10 to +110°C thermometer) with wind speed, barometric pressure (Silva Alba Windwatch) and general weather conditions recorded. Field data were entered on pre-prepared, waterproof record sheets.

As well as recording bird abundance and diversity, bird habitat use was recorded using an activity code as follows:

FI	:	feeding in the intertidal area
FW	:	feeding in or over the water
REI	:	resting in the intertidal area
REW	:	resting on the water
ROI	:	roosting (waders only) in the intertidal area *
ROP	:	resting/roosting on stakes, poles, rock walls, trees

* Roosting (ROI) over the high tide period is a category applied only to wading birds in this assessment, because the presence of a high tide wading bird roost is generally considered a notable coastal feature. The ROI category applies to the period of high tide itself and one hour either side of it to provide a comparative standard. Roosting by waders can be related to "staging" i.e. birds form groups at mid to upper shore levels prior to moving up to above the high tide level to roost over the high tide period or alternatively, flying elsewhere to roost. Whether birds are resting or roosting at the time of staging can be variable and debatable, and "roosting" has therefore been standardised. In contrast, resting/roosting by non-wading birds tends to be more random in terms of both the location used and tidal stage.

For the breeding season surveys the Mair Road to Northport area was inspected on foot and using a spotting scope and binoculars. The Marsden Point to Refinery Jetty area was monitored for a total of six hours to record breeding season activities. The coastline from Darch Point to Home Point was inspected mostly on foot (Darch Point to Little Munro Bay; Urquharts Bay to Home Point) or via a combination of specific point inspections and spotting scope observations (Little Munro Bay to Urquharts Bay).

3.3 Specific Area Surveys

3.3.1 Bream Bay Beach

The section of Bream Bay Beach surveyed (Figure 1) extended from near the end of Rama Road to just south of Marsden Point proper, a distance of c.2350m.

Figure 1. Bream Bay Beach Survey Area.

Species diversity was low and comprised australasian gannet, black-backed gull, caspian tern, red-billed gull, variable oystercatcher and white-fronted tern i.e. six species (note that "pelagic species" are discussed further in Section 2.4).

The highest maximum number was only 18 red-billed gull with the other species recording less than 8 individuals.

Similar maxima per kilometre were recorded in the same habitat north of Waipu River mouth but higher numbers were recorded at the Waipu River mouth and estuary in previous surveys.

The average number of birds (rounded) was 15 with red-billed gull the dominant species (53.3%) followed by black-backed gull (20.7%) and variable oystercatcher (13.3%). In total 74% of the population was gulls and the main habitat use was resting in the intertidal area (79.3% of records).

3.3.2 Mair Bank

The Mair Bank survey area (Figure 2) included the beach between Marsden Point proper and the Refinery Jetty, the inner bank adjacent to the Refinery mooring dolphins and the outer banks.

Figure 2. Mair Bank Survey Area.

The diversity of species was moderate with ten species over the three surveys – black-backed gull, caspian tern, little shag, NZ dotterel, pied shag, pied stilt, red-billed gull, South Island pied oystercatcher, variable oystercatcher and white-faced heron; one threatened and five at risk species.

The highest maximum was of black-backed gull (196) followed by 70 red-billed gull and 66 variable oystercatcher over the three surveys. The maximum number of individuals was 288 at low tide on 25.2.15 but 67.4% were black-backed gulls. Average numbers of birds (rounded) were 119, 76 and 120 over the three surveys with the highest numbers on the two lowest tides (0.5m).

Mair Bank was utilised for feeding mainly during a four hour period from about four hours after high tide, over the low tide period and to about two hours after low tide i.e. for about one third of a 12 hour tidal cycle.

There was no significant high tide wading bird roost but the beach was used for resting by up to about 100 black-backed gulls and the occasional caspian tern, red-billed gull and variable oystercatcher.

The dominant species was clearly black-backed gull followed about equally overall by red-billed gull and variable oystercatcher.

The predominant habitat use was resting in the intertidal (80.4% 2015; 70.7% 2016) with feeding in the intertidal habitats 14.9% in 2015 and 20.9% in 2016.

The two outer banks were the more important feeding habitats; the average percentages of feeding records over the surveys were: beach – 5.7%; inner bank – 19.9% and outer banks 74.4%. That probably reflects the presence of shellfish beds in the outer banks area that remain attractive to coastal birds.

3.3.3 Refinery Jetty to Northport

This area of habitat consists of a sandy intertidal area flanked by the Refinery Jetty and Northport (Figure 3).

A total of ten species were recorded comprising black-backed gull, caspian tern, NZ dotterel, pied shag, pied stilt, red-billed gull, South Island pied oystercatcher, spur-winged plover, variable oystercatcher and white-fronted tern; one threatened species and six at risk species.

South Island pied oystercatcher had the highest number of individuals (437) followed by red-billed gull (154) and variable oystercatcher (60) noting that a maximum of 66 variable oystercatcher was also recorded using Mair Bank in February 2016. The maxima of all the remaining species were less than 5. The average number of birds (rounded) was 298 which is high but reflects specific habitat use (refer below).

The key habitat feature of this piece of coastline was its use by the three dominant species and NZ dotterel for roosting at high water; numbers of wading birds were high from high tide to half tide falling but red-billed gull, that nests within the Refinery grounds, remained throughout the survey period and was most common with white-fronted tern over the low tide period following the departure of the oystercatchers.

South Island pied oystercatcher comprised 56.6% of the records, red-billed gull 30.4% and variable oystercatcher 8.0%; white-fronted tern occurred at 3.2% while the remaining species were less than 1%.

The clearly dominant habitat use was resting rather than feeding: resting in the intertidal – 61.1%; high tide roosting – 37.2%. The value of the habitat for feeding was low.

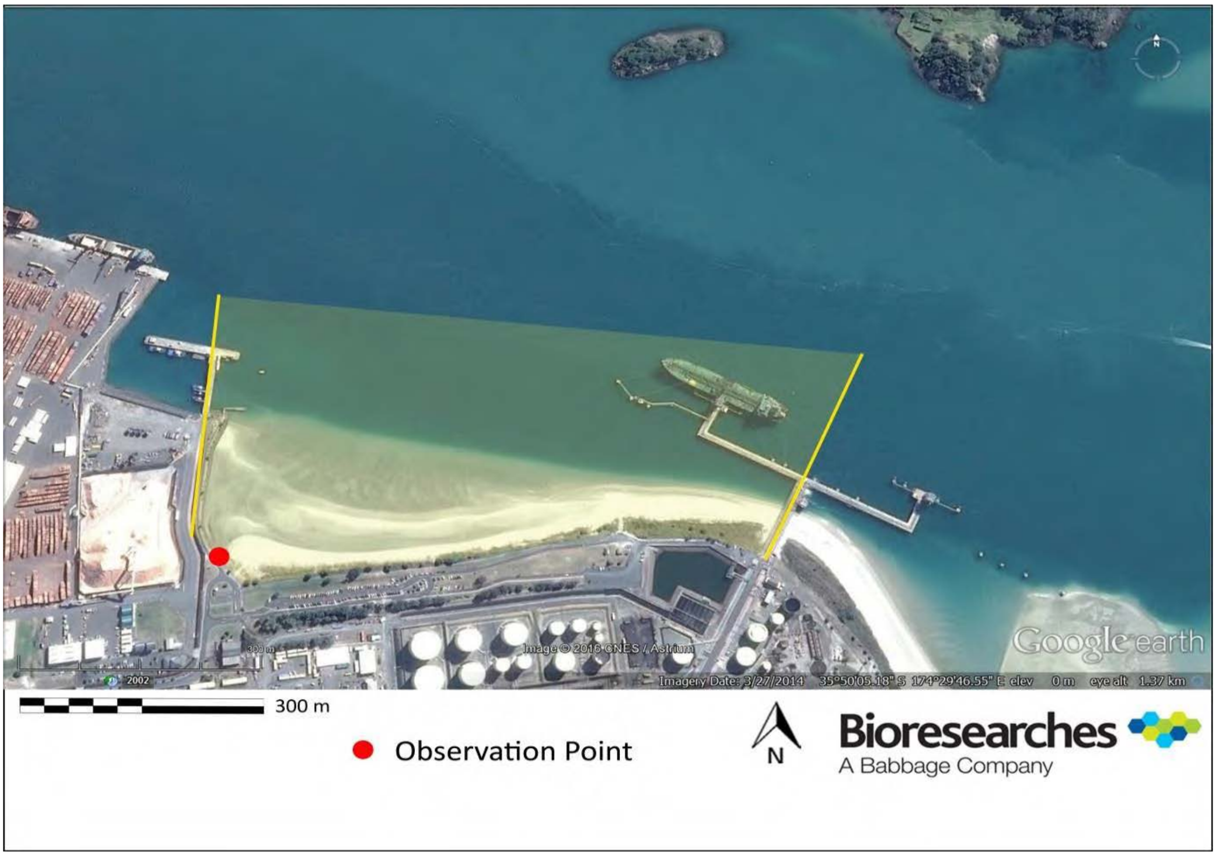

Figure 3. Refinery Jetty to Northport Survey Area.

3.3.4 One Tree Point

This area of habitat is contiguous with and similar to Marsden Bay, albeit with a narrower intertidal area and a lack of high tide roosting opportunity for wading birds (Figure 4).

Note: where there are multiple observation points, those locations were used on each hourly count to provide better coverage of the survey area (traversed by vehicle).

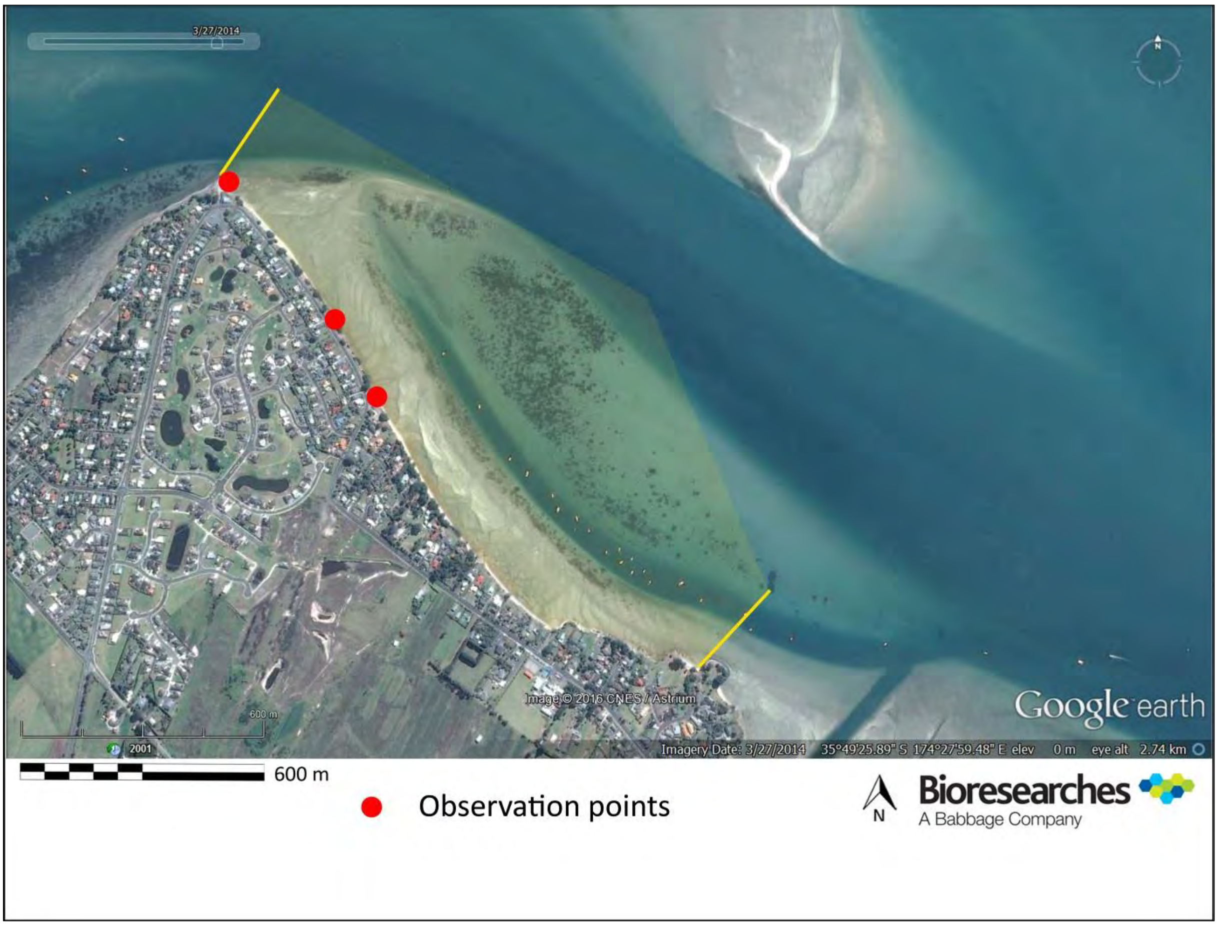

Figure 4. One Tree Point Survey Area.

A moderate – high total of 15 species was recorded – black-backed gull, caspian tern, eastern bar-tailed godwit, eastern curlew, lesser knot, little shag, mallard, NZ dotterel, paradise shelduck, pied stilt, red-billed gull, South Island pied oystercatcher, variable oystercatcher, white-faced heron and white-fronted tern.

The notable species were bar-tailed godwit, eastern curlew and lesser knot, all overseas migrants. A total of two threatened species and six at risk species was recorded; bar-tailed godwit is at risk nationally but threatened overseas while lesser knot is threatened both nationally and overseas.

The highest maxima were black-backed gull (114), white-fronted tern (71), bar-tailed godwit (60), red-billed gull (58), variable oystercatcher (54) and lesser knot (37). In contrast to the maxima at Marsden Bay, (i.e. between Northpoint and the One Tree Point survey area) the maxima at One Tree Point that were lower were for bar-tailed godwit, lesser knot, NZ dotterel, South Island pied oystercatcher and variable oystercatcher noting that Marsden Bay is also utilised for high tide roosting. The only higher maxima at One Tree Point were for black-backed gull and white-fronted tern.

The average number of individuals was 168 (rounded) with the highest number over the low tide period to half tide rising after which only white-fronted tern was common, resting on an intertidal fence.

Over the entire survey period the dominant species were black-backed gull (25.2%), white-fronted tern (20.5%), red-billed gull (17.5%), bar-tailed godwit (13.9%) and variable oystercatcher (9.2%) while the remaining species occurred at less than 5%.

In contrast to the Refinery Jetty to Northport area and Marsden Bay (c.24% feeding, c.76% resting/roosting), the split at One Tree Point was 47.6% feeding and 52.4% resting with no high tide wading bird roost but a high proportion of resting by gulls and tern.

The predominant features were a lower diversity than Marsden Bay and a population containing relatively large numbers of black-backed gull and white-fronted tern.

3.3.5 Snake Bank

The southern end of Snake Bank was surveyed i.e. south of a line from about One Tree Point to Darch Point. The wider area of Snake Bank, and McDonald Bank to the east, where considered beyond the survey area for the purposes of this assessment

The diversity of species recorded (8) was relatively low but included one threatened and four at risk species. Birds recorded were black-backed gull, eastern bar-tailed godwit, little shag, red-billed gull, South Island pied oystercatcher, variable oystercatcher, white-faced heron and white-fronted tern.

The highest maximum was for South Island pied oystercatcher (63) but maxima for the remaining species were all less than 12.

Figure 5. *Snake Bank Survey Area. Observation points as shown in Figure 4.*

The average number of individuals (rounded) was relatively low at c.39 but birds were only common over the low tide period, as recorded at Mair Bank, and no high tide roost is present.

Clearly dominant was South Island pied oystercatcher (75.8%) followed by black-backed gull (9.7%) and variable oystercatcher (6.5%) with the remainder incidental only. Feeding, mainly by South Island pied oystercatcher, was the predominant activity (63.5%). The Snake Bank population differed from that at Mair Bank in that black-backed and red-billed gull were not as prominent and South Island pied, rather than variable, was the more common oystercatcher species. Snake Bank is a relatively short commute for birds roosting at Marsden Bay over the high tide period and contains a notable population of cockles as a food source.

3.3.6 Reotahi Bay

Reotahi Bay (Figure 6) presents a small area of soft intertidal habitat amongst a rocky shoreline.

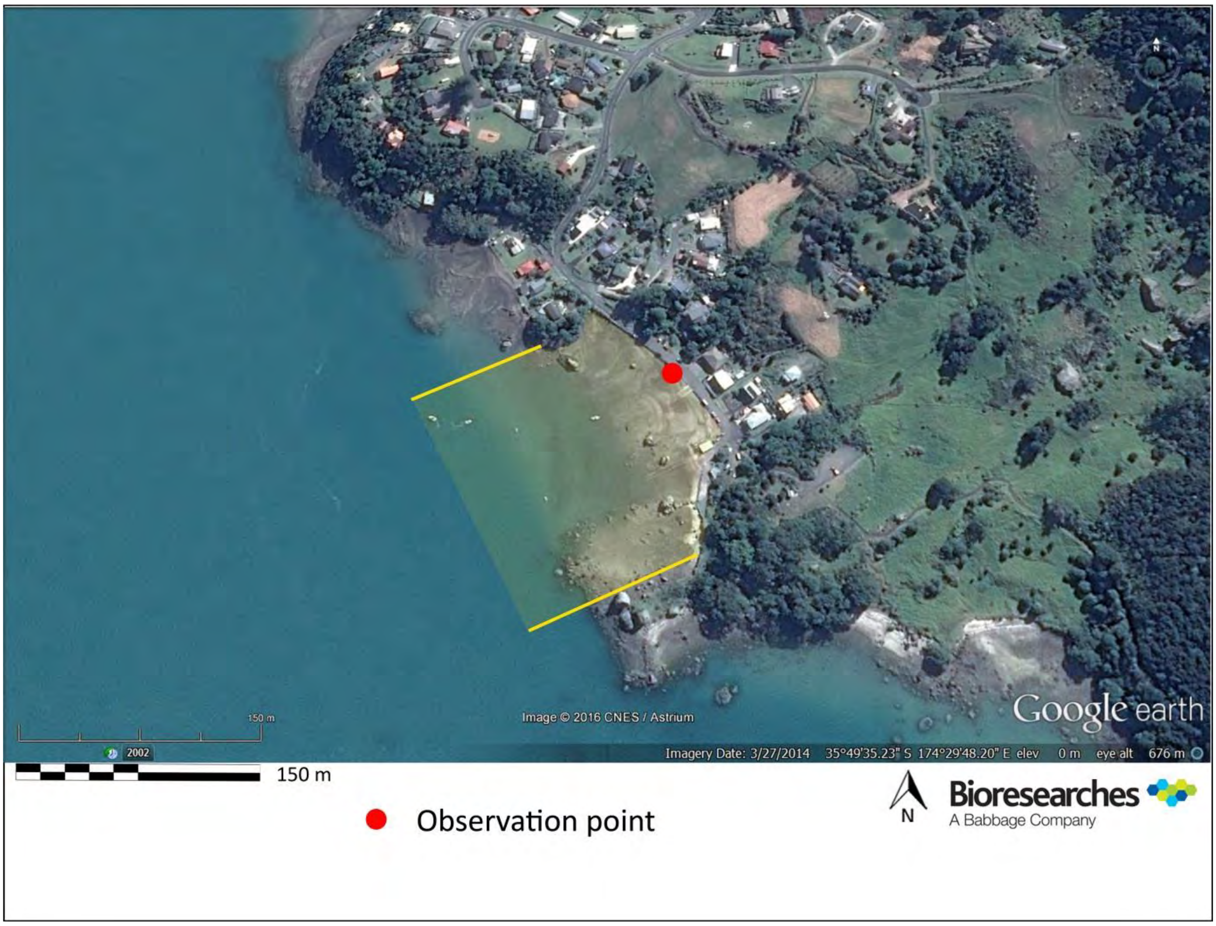

Figure 6. Survey Area at Reotahi Bay.

A total of six species were recorded – black-backed gull, caspian tern, red-billed gull, variable oystercatcher, white-faced heron and white-fronted tern. Of those species, one is threatened and three at risk.

Overall the maxima were low with the highest being of red-billed gull (26) followed by white-fronted tern (10) and the rest less than six. The overall average (rounded) was 24 individuals dominated by red-billed gull (77.6%) and white-fronted tern (10.0%) with the remaining species less than 7%.

The Bay was used almost exclusively for resting (in the intertidal area) or roosting on poles, boulders and trees, a combined total of 98.2%.

3.3.7 Taurikura Bay

The Bay (Figure 7) contains a combination of rocky and soft intertidal habitat.

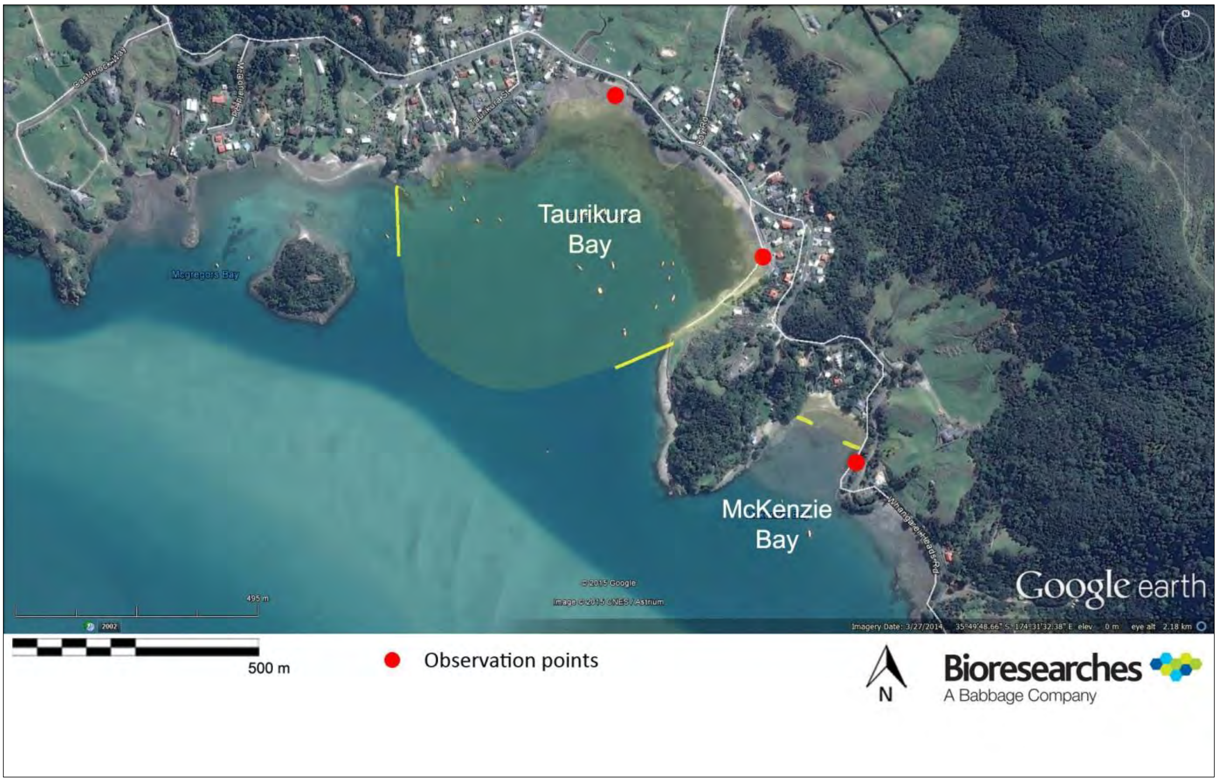

Figure 7. Taurikura Bay and McKenzie Bay Survey Areas.

Over the two (2015 and 2016) surveys a total of 11 species was recorded that included two threatened species and three at risk species. The species recorded were australasian gannet, black-backed gull, caspian tern, kingfisher, little shag, pied shag, red-billed gull, reef heron, spur-winged plover, variable oystercatcher and white-faced heron.

The maxima were low with the highest being for red-billed gull - 24 in 2015 and 29 in 2016; other species were less than 10 and 6 respectively.

The average numbers were 23 (2015) and 30 (2016) and dominated by red-billed gull at 71.9% and 80.3% of records respectively. The second most dominant species was variable oystercatcher with 8.1 and 7.7 respectively i.e. 8 individuals in each survey.

Habitat use was biased toward resting in both 2015 and 2016 with 75.9% and 82.4% resting respectively.

Overall the 2015 and 2016 results were similar inferring a consistency to bird use of Taurikura Bay in the March period.

3.3.8 McKenzie Bay

McKenzie Bay is a small, enclosed area of habitat that was utilised by low numbers and a low diversity of species.

Birds recorded were black-backed gull, caspian tern, red-billed gull, variable oystercatcher and white-faced heron that included one threatened and two at risk species.

The rounded average number of birds was 2 in 2015 and 3 in 2016; the dominant (consistent) species overall was variable oystercatcher and resting and roosting were the dominant habitat use activities at 96.9%.

3.3.9 Urquharts Bay

The Bay is relatively large and comprises both rocky and soft intertidal substrate dominated by the latter.

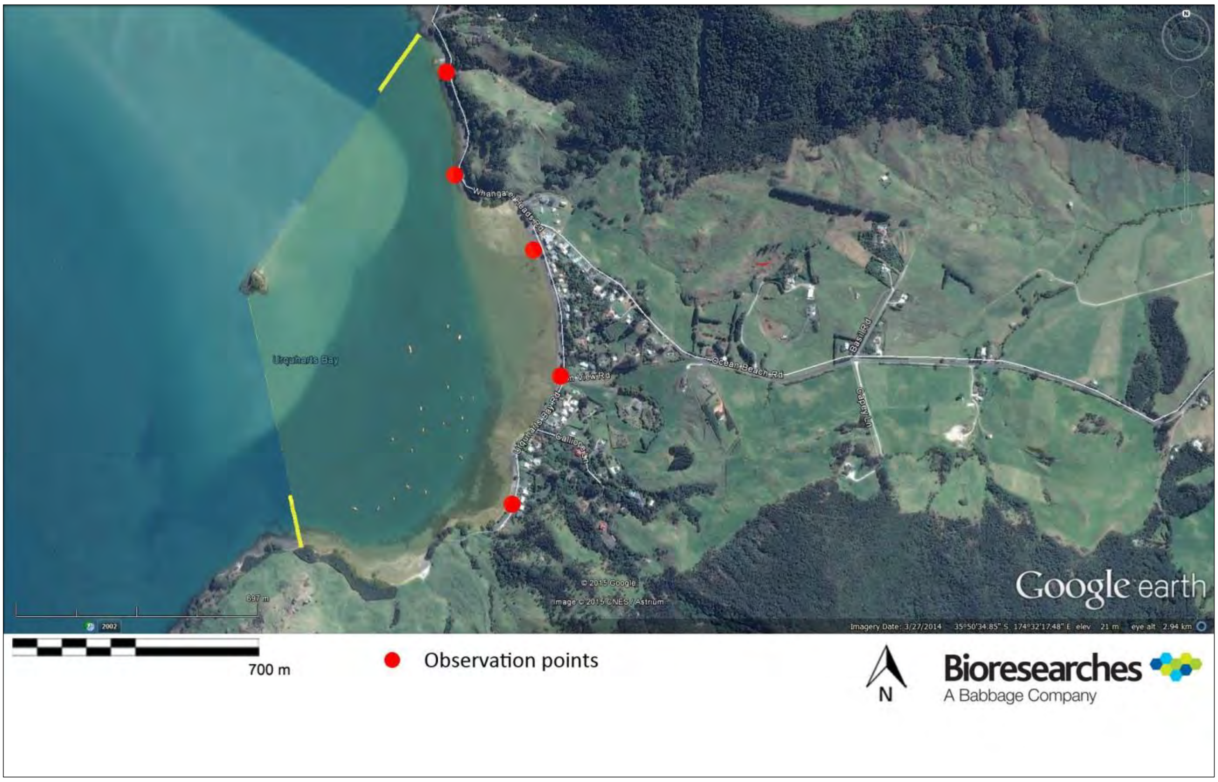

Figure 8. Urquharts Bay Survey Area.

A relatively high total of 12 species was recorded, considering the limited habitat, over the 2015 and 2016 surveys including two threatened and five at risk species.

The population recorded consisted of australasian gannet, black-backed gull, caspian tern, little shag, pied shag, red-billed gull, reef heron, South Island pied oystercatcher, spur-winged plover, variable oystercatcher, white-faced heron and white-fronted tern.

As at both Reotahi and Taurikura Bays, the highest maxima at Urquharts Bay were for red-billed gull (51 : 2015; 37 : 2016) with about equal maxima for black-backed gull and variable oystercatcher. Little shag was notably common overall.

The average number of individuals was 77 in 2015 and 50 in 2016. The dominant species were consistent in terms of percentage occurrence. Notably, 8.9% of records in 2016 were for little shag but only 2.4% in 2015; little shag commonly roosts on vessels in Urquharts Bay.

The total percentage occurrence of gulls illustrates the typical population in the Bay with 66.6% in 2015 and 69.7% in 2016 (red-billed plus black-backed gull). That is largely reflected in the habitat use data with resting and roosting the main activity – 70.1% : 2015; 74.4% : 2016. However the proportion of feeding (29.9% : 2015 and 25.6% : 2016) was relatively high. Marsden Bay, which contains both feeding and high tide roosting habitat, has c.24% feeding and c.76% resting and roosting activity.

3.3.10 Comparative Population Composition and Habitat Use

The following summarises the percentages of wading birds versus gulls in the survey area and the percentages of feeding versus resting/roosting. McKenzie Bay is excluded because of low numbers.

TABLE 1 – COMPARATIVE POPULATION COMPOSITION AND HABITAT USE

	Bream Bay Beach	Mair Bank	Refinery Jetty to Northport	One Tree Point	Snake Bank	Reotahi Bay	Taurikura Bay	Urquharts Bay
% feeding	11.8	18.0	1.5	47.6	63.5	1.8	20.9	23.3
% resting/ roosting	88.2	83.5	98.5	52.4	36.5	98.2	79.1	76.7
% wading birds	13.3	16.1	65.1	34.4	84.2	4.2	12.1	23.9
% gulls	74.0	82.9	31.0	42.3	12.9	84.4	81.1	68.2

Where several surveys have been completed, an overall percentage is presented. Table 1 presents an overall reference that is useful in the effects analysis below by identifying the areas where feeding was predominant with that activity likely to be the more susceptible to any habitat changes. The activity can be matched with the overall population composition. For example One Tree Point and Snake Bank stand out as key feeding habitats for reasonably high proportions of wading birds whereas the Refinery Jetty to Northport and Reotahi Bay are not notable feeding areas. Areas clearly dominated by gulls are Bream Bay Beach, Mair Bank, Reotahi Bay, Taurikura Bay and Urquharts Bay.

3.4 Pelagic Birds

Pelagic species recorded in the outer Harbour and Bream Bay are also addressed in the Bioresearches literature review (2015). A total of 17 species had been recorded in the literature; of those species one is considered threatened (flesh-footed shearwater) and eleven at risk – little penguin, sooty shearwater, little shearwater, Pycroft's petrel, fairy prion, fluttering shearwater, northern diving petrel, white-faced storm petrel, Buller's shearwater, giant petrel and shy mollymawk.

Other, non-threatened species recorded are – australasian gannet, arctic skua, black-winged petrel, grey-faced petrel and eastern yellow-nosed mollymawk.

The literature indicates that Bream Bay is utilised for feeding by the above species either regularly or on a seasonal basis.

Observations of three pelagic species have been provided by Margaret Hicks as follows:

(i) From September onwards, large numbers of Australasian gannets feed in the vicinity of the Ruakaka Estuary mouth and an extensive area to the north of the mouth. Ms Hicks reports that advice from the Department of Conservation is that the gannets are from the Poor Knights Islands colony.

(ii) Little penguins, possibly mainly juveniles, are common in the northern part of Bream Bay especially in spring and summer; dead individuals are commonly found washed up on Bream Bay Beach. On 9 November 2015, between Mair Road and Northport, four dead little penguins and one dead fluttering shearwater were recorded. The observations are also endorsed by the results of regular surveys of beach wrecked birds undertaken by the Northland Region of the Ornithological Society of New Zealand and published in their newsletter Amokura. For example in February 2007 a notable beach wreck of 258 little penguin was recorded between Mair Road and Mangawhai (Amokura, 2007). Other commonly beach wrecked birds are flesh-footed shearwater, Buller's shearwater, sooty shearwater, fluttering shearwater, common diving petrel and australasian gannet, however numbers and species are both highly variable.

(iii) In April hundreds of fluttering shearwaters are typically observed in Bream Bay in the area off Bream Bay Beach between Sime Rd and Mair Rd and they also enter the Mair Bank and outer Harbour open water areas.

There is a high diversity of species that utilises Bream Bay's open water habitat; several of those species have been observed to occur in high numbers close to shore at various times.

3.5 Breeding Season Surveys

The “breeding season” for shorebirds was considered to be from August/September to December/January acknowledging that some species exhibit breeding outside that period. The surveys described below were undertaken in November 2015 and results are shown on Figures 9 & 10.

3.5.1 Mair Road to Northport

The section of foreshore was inspected on foot on 9 November 2015. No nesting birds were present along the foreshore.

3.5.2 Marsden Point to Refinery Jetty

The use of this area by breeding birds was documented on 9 and 24 November 2015. The decision to survey this area was based on known breeding of NZ dotterel in particular within the RNZ grounds and the possibility that early nesting in the area may have occurred prior to 9 November.

This section of coastline was used by a pair of NZ dotterel for juvenile rearing with three juveniles present on 9 and 24 November. Secondly a maximum of four adults were recorded feeding along the intertidal habitat and returning to within the Refinery grounds.

The area was also utilised by variable oystercatcher for juvenile rearing and adult feeding with a total of four adults and two juveniles recorded.

3.5.3 Refinery Jetty to Northport

No juveniles of either NZ dotterel or variable oystercatcher were recorded and the feeding frequency of adults of both species was low. In comparison the adjacent Marsden Point to Refinery Jetty area had the greater “intensity of use” during the breeding season period surveyed.

3.5.4 Darch Point to Home Point

This area contained a high diversity of potential breeding habits – rocky outcrops, overhanging trees (especially pohutukawas), caves, rock platforms, Harbour edge scrub and sandy beach.

The following nesting was recorded:

Western end Reotahi Bay	• variable oystercatcher on rocky outcrop (1 pair)
Motukaroro Island	• little shag (dominant) and pied shag in pohutukawas (10-15 pairs) • variable oystercatcher on rock platform (1 pair) • reef heron probable outside a small cave
McKenzie Bay east	• variable oystercatcher in high tidal boulders (1 pair)
Calliope Island	• black-backed gull and variable oystercatcher on rock platform (1 pair of each)
Urquharts Bay South	• pair variable oystercatcher + 2 juveniles
Home Point	• little shag and pied shag in pohutukawas (10-15 pairs)

3.6 HARBOUR PENGUIN SURVEYS

Preliminary surveys in the November-December 2016 nesting period concluded that a population of little penguin is utilising the area between Busby Head and McLeods Bay. Nesting is considered highly probable on the mainland between McLeods Bay and Reotahi Bay, and on High, Callliope and Motukaroro Islands. A minimum population of 12 nesting pairs is estimated from the initial surveys (Bioresearches, December 2016).

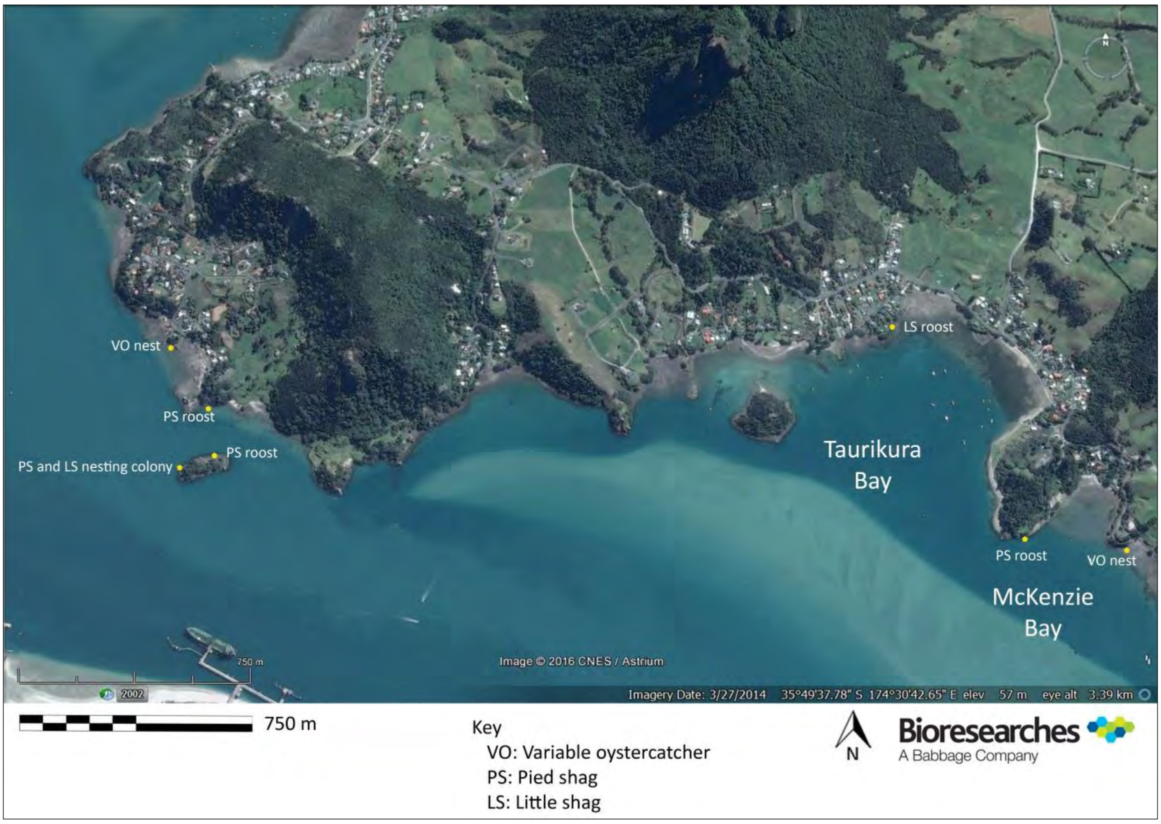

Figure 9. *Breeding activity recorded from Reotahi Bay to McKenzie Bay*

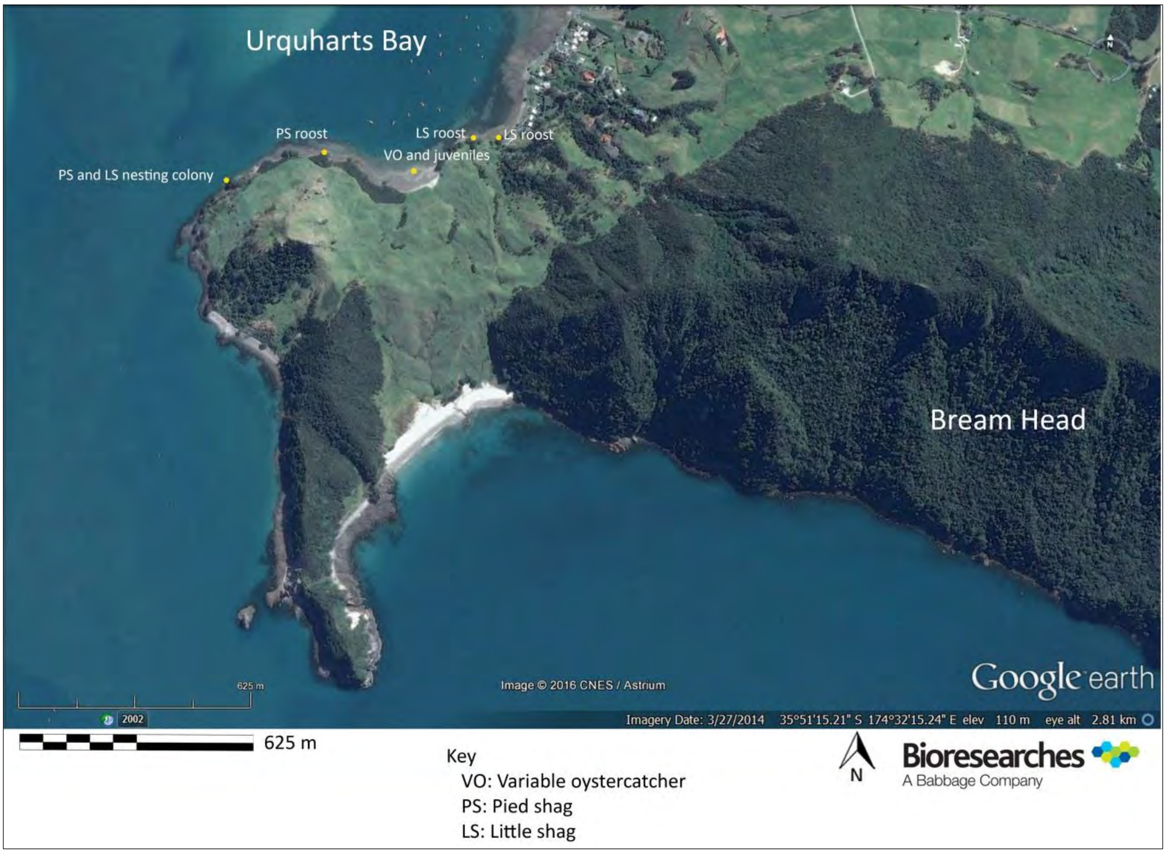

Figure 10. *Breeding activity recorded from Urquharts Bay to Home Point.*

4. AVIFAUNAL VALUES AND HABITAT SIGNIFICANCE

4.1 INTRODUCTION

The operative Regional Coastal Plan (RCP) for Northland refers at Section 9.2 to Habitats of Indigenous Fauna i.e. “all fauna associated with estuarine or marine habitats other than those known to be introduced by man. This includes resident and migratory birds, fish and marine mammals”.

Relevant to coastal birds, intertidal habitants include:

- sand flats and banks
- beaches
- rocky shores

Subtidal habitats also involve the full range of types (i.e. soft bottom open coasts to shallow and deep rocky reefs and flats) that are relevant to open water pelagic species.

A significant threat to habitats of indigenous fauna noted in the RCP is “dredging and dredge spoil disposal.”

A Policy (9.2.4.1) relevant to this assessment is “to identify habitats or habitat areas of indigenous fauna that have moderate, moderate high, high or outstanding value within Northland’s coastal marine area and protect these from adverse effects of subdivision, use and development.”

Method 9.25.2 of the RCP states that “assessments of significance should include the criteria listed within the appendices.” Appendix 9 – Criteria used to determine areas of important conservation value – lists 9 criteria including (3) Protected areas (4) Wetlands, Estuaries and Coastal Lagoons, (5) Marine Mammals and Birds and (6) Ecosystems, flora and fauna habitats. Specifically, Criterion 5(b) concerns “habitats of endangered, vulnerable, rare or threatened bird species” and Criterion 5(c) refers to “important roost sites, or feeding areas of wading birds”. The assessment of avifaunal values and habitat significance has considered the criteria and policies of both the RCP and NZCPS; in combination, both documents capture the features that need to be considered.

The draft Northland Regional Plan identifies significant bird areas in the Whangarei Harbour. Those within the survey area for this project are Snake Bank, Marsden Bay to One Tree Point; the Northern Coastline – Darch Point to Busby Head, Mair Bank – Marsden Point and the nearshore area of Bream Bay Beach and Mair Bank across to Busby Head and thence to Bream Head. (Note: the Plan's provisions are currently draft and have no legal effect).

Two habitats within the area of interest for this project that are not annotated as significant bird areas are (i) the wider Bream Bay pelagic habitat and (ii) the intertidal area between the Refinery Jetty and Northport.

The most recent Harbour – wide assessment of its avifauna is that of Pierce, 2005 for Northland Regional Council in the context of a proposed reclassification of a substantial part of the harbour as a Marine 1 (MM1) Area.

Key locations identified in Pierce 2015 were as follows:

(i) Tidal flats of Marsden Bay (including mangroves) and One Tree Point.

(ii) Mair Bank and Snake Bank

(iii) Northeastern Harbour beaches and headlands i.e. Darch Point to Home Point in this assessment.

(iv) Islands used for breeding: Motukaroro, High and Calliope.

In addition the area from Home Point to Busby Head, including Frenchman Island, was identified as a key location. Pierce, 2005 concluded that regarding the key areas, "habitat and avifaunal values are particularly high at these sites and they require ongoing protection via the RMA and other statutory means."

On the basis of the recent literature reviews, surveys specific to this project and surveys completed in Marsden Bay almost annually in the 2002-2015 period, the following values are assigned to the key locations identified in Pierce 2005.

(a) Tidal flats – Marsden Bay to One Tree Point: of regional significance and of high value in an outer Harbour context.

(b) Mair Bank : national significance and part of Snake Bank: regional significance and of high value in an outer Harbour context.

(c) Northeastern Harbour beaches and headlands: national significance in parts in the breeding season because of nesting by threatened and at risk species. Of local significance outside the breeding seasons and vary between low and high value in the context of the outer Harbour.

(d) Islands – Motukaroro; High and Calliope: significance as for (c) above. Frenchman Island, adjacent to Busby Head, would also be of national significance in the breeding season (as indicated on Figure 11).

The additional areas of significance identified in this survey are Bream Bay pelagic habitat and the upper intertidal habitat adjacent to Northport. The Bream Bay area is of national significance for seabirds being in close proximity to breeding habitats at the Bream Head Scenic Reserve and the Hen and Chicken Islands. The area of the Refinery Jetty to Northport shoreline that is used for high tide roosting is considered to be of regional significance during high tide periods only, but is otherwise of low coastal bird value based on the field investigations completed for this project.

The following assessment of values addresses each survey area and integrates the information from the Regional Coastal Plan, draft Northland Regional Plan, Pierce 2005 and the specific surveys undertaken for this project.

Sections 3.2 to 3.10 inclusive address the avifaunal values of the various surveyed areas that apply during most of the year i.e. their general values based on feeding, resting and roosting. Section 3.11 considers pelagic species including the close proximity of nationally important seabird breeding colonies. Section 3.12 addresses breeding activities as a separate consideration because, rather than any area supporting exceptionally large colonies, the breeding recorded occurred in discrete, relatively small areas and at isolated nesting sites. Those activities increase the values for the duration of the breeding season only eg scattered individual variable oystercatcher nests. A summary of avifaunal habitat values is shown as Figure 11.

4.2 BREAM BAY BEACH

The c.2450m section of Beach in the vicinity of Mair Road is open coastline habitat that was utilised by a low diversity and relatively low numbers of coastal birds. It did not contain a high tide roost for wading birds and was not used by significant numbers of birds for feeding either in its intertidal habitat or nearshore open water habitat. It is accepted however that pelagic species use the nearshore areas for feeding at times (refer 4.11 below).

The intertidal habitat is similar to that along about 30km of Bream Bay from Marsden Point to Bream Tail, has relatively low coastal bird values and is considered of local significance only. However, that assessment excludes both Ruakaka and Waipu River mouths and estuaries that have very high coastal bird values in a national context. The River mouth habitats were not surveyed because they were considered too remote from potential works areas. Based on the project description and proposed disposal areas (i.e. disposal areas 1, 2 and 3.2) the probability of the river mouths and estuaries being adversely affected is remote.

4.3 MAIR BANK

The three surveys indicated that Mair Bank complex was a notable high tide resting area for black-backed gull and a key low tide feeding habitat for variable oystercatcher as a result of its pipi beds. The surveys showed that the two outer banks (Figure 2) are the most utilised feeding habitats and are therefore the highest value areas within the context of the entire Bank. Mair Bank presents a habitat that is different from habitats of both Bream Bay Beach and inside the Harbour entrance. Mair Bank is a sand and shell ebb-tidal delta swept by strong currents and contains shellfish beds whereas Bream Bay Beach is an open, sandy surf beach. The Taurikura to Home Point area is relatively sheltered and contains a diversity of soft sediment and rocky habitats. Overall Mair Bank is considered a nationally significant coastal bird habitat. A key feature of Whangarei Harbour is that it is the third ranked wintering site in New Zealand for variable oystercatcher (Dowding and Moore 2006). The present surveys showed that Mair Bank is a key feeding area for variable oystercatcher and that raises the significance of the Bank. The potential risk of an adverse effect on Mair Bank is high because of its proximity to the works and its use for feeding.

4.4 REFINERY JETTY TO NORTHPORT

This area of coastline presents poor quality feeding habitat but is a notable high tidal roosting area and supports a significant portion of the outer Harbour's variable oystercatcher population at high tide. Other roosting and resting birds were South Island pied oystercatcher, red billed gull and white-fronted tern. The area is of significance in the context of the outer Harbour and functions as an alternative to the Marsden Bay high tide roosting areas. It is of regional significance during high tide periods as a roosting site for threatened and at risk species but is otherwise of local significance only. The potential risk is considered low-moderate because the area is used mainly for roosting and resting.

4.5 ONE TREE POINT

The coastline from the western side of Marsden Bay to One Tree Point contrasts with the above (4.4) area in that it is a significant outer Harbour feeding and resting habitat in the context of the Harbour, but does not contain a high tide roosting area, the closest of which is in the contiguous Marsden Bay. Notable numbers of black-backed gull and white-fronted tern were recorded but the maxima of five typical wading species were lower than recorded in Marsden Bay. Both the Bay and the One Tree Point area are "stepping stone" habitats to Snake Bank in particular. The Marsden Bay – One Tree Point – Snake Bay complex is considered a regionally significant coastal bird habitat. The overall risk is considered low because it is removed from the works area.

4.6 SNAKE BANK

The southern part of Snake Bank supported a low species diversity but a high number of feeding South Island pied oystercatcher. The southern part of the Bank is a significant outer Harbour feeding area in the context of Whangarei Harbour especially in tandem with the Marsden Bay to One Tree Point habitats and in this survey, particularly for South Island pied oystercatcher. The Marsden Bay – One Tree Point – Snake Bank complex is considered a regionally significant coastal bird habitat – separating out individual areas is arbitrary and not appropriate in the context of a functioning habitat. The overall risk is considered low because it is removed from the works area.

4.7 Reotahi Bay

Reotahi Bay supported a low number and low diversity of birds dominated by red-billed gull and is used mainly for resting and roosting. It is not a notable local feeding habitat and is not a significant coastal bird habitat in general relative to the NZCPS (i.e. for feeding, resting and roosting) outside of the breeding season the details of which are provided in Section 4.12 below. The risk is considered low-moderate because it is close to the works but is mainly used for resting.

4.8 Taurikura Bay

The results of Taurikura Bay (also dominated by red-billed gull) recorded in 2015 and 2016 were consistent and indicated that the Bay does not contain significant intertidal feeding habitats or a notable high tide roost. In the context of the northern shoreline and the NZCPS it is a low value coastal bird habitat. All the remaining northern Bays (McKenzie, Taurikura and Urquharts) are considered low risk areas because they are removed from the works area.

4.9 McKenzie Bay

The McKenzie Bay results were consistent in 2015 and 2016; it provides limited habitat that supports a low diversity and very small number of coastal birds. It is not a significant coastal bird habitat in the context of the northern shoreline and the NZCPS in general outside the breeding season, the details of which are provided in Section 4.12 below.

4.10 Urquharts Bay

The results for Urquharts Bay were also consistent in 2015 and 2016 and indicate that the Bay supports a relatively diverse avifauna although dominated by red-billed gull. It provides feeding habitat for variable oystercatcher and resting habitat for red-billed gull and is a favoured local area by little shag. It is in close proximity to Mair Bank feeding habitats and overall is a notable habitat for coastal birds but only in the context of the outer Harbour and the NZCPS outside the breeding season, the details of which are provided in Section 4.12 below.

4.11 Pelagic Birds

Bream Bay supports a relatively high diversity of pelagic birds including threatened and at risk species, some of which can be present in high numbers eg little penguin, australasian gannet, fluttering shearwater. It is in close proximity to known seabird breeding colonies within Bream Bay Scenic Reserve and the Hen and Chickens Islands in particular, together with slightly more distant habitats at the Poor Knights and Mokohinau Islands. Whangarei Harbour and Bream Bay are within a wider area proposed as a New Zealand Pelagic Important Bird Area (IBA) (Gaskin, 2014). Overall Bream Bay is considered a significant habitat for pelagic birds in a national context i.e. it is of national significance relative to the NZCPS (Figure 11).

4.12 Breeding

“Breeding” is broadly considered to include the period from nest construction and establishment to the fledging of juveniles. The notable breeding activities identified in the survey area (One Tree Point to Darch Point and thence to Home Point) were as follows:

- juvenile NZ dotterel (at risk species) rearing and variable oystercatcher (at risk species) rearing: Marsden Point to Refinery Jetty.
- variable oystercatcher nesting along the northern shoreline – Reotahi Bay, McKenzie Bay East, Urquharts Bay South, Motukaroro and Calliope Islands
- significant shag (little and pied shag – the latter an at risk species) colonies at Motukaroro Island and Home Point.
- inferred nesting by reef heron (threatened species) – Motukaroro Island.

In addition there is a very high probability of the survey areas being used for nesting by little penguin (at risk species) based on the literature review completed by Bioresearches in 2015 and the November –December 2016 surveys. Potential breeding habitat for little penguin is not shown on Figure 11 but would potentially involve all areas of shoreline.

On the basis of known and probable nesting and juvenile rearing in the survey area of one threatened and four at risk species, together with reported additional breeding from Home Point to Bream Head, the area as a whole is considered to contain significant breeding habitats in a national context i.e. relative to the NZCPS. [(Policy 11(a) (i) and Policy 11 (b) (ii)]. That value differs from the general value of the areas as coastal bird habitat because it refers to the duration of the breeding season for each species only, but could not be necessarily applied to the habitat outside the breeding season. As a result of recorded breeding by species that are "at risk" or "threatened" on a national basis in the 2016 surveys, the following areas are of national importance, at least in part, during the breeding season of the species concerned – Marsden Point to Refinery Jetty, Reotahi Bay, Motukaroro Island, McKenzie Bay East, Calliope Island, Urquharts Bay South and Home Point.

Tree nesting pied shags (Motukaroro Island; Home Point) can lay clutches all through the year. New Zealand dotterel (Marsden Point to Refinery Jetty) that is "ground-nesting" has a breeding season extending from about August to December. The similarly ground-nesting variable oystercatcher (Reotahi Bay, Motukaroro Island, McKenzie Bay East, Calliope Island, Urquharts Bay South and Marsden Point to Refinery Jetty) has an approximate September to March inclusive breeding season.

Little penguin can be present at nesting burrows in all months except April and May.

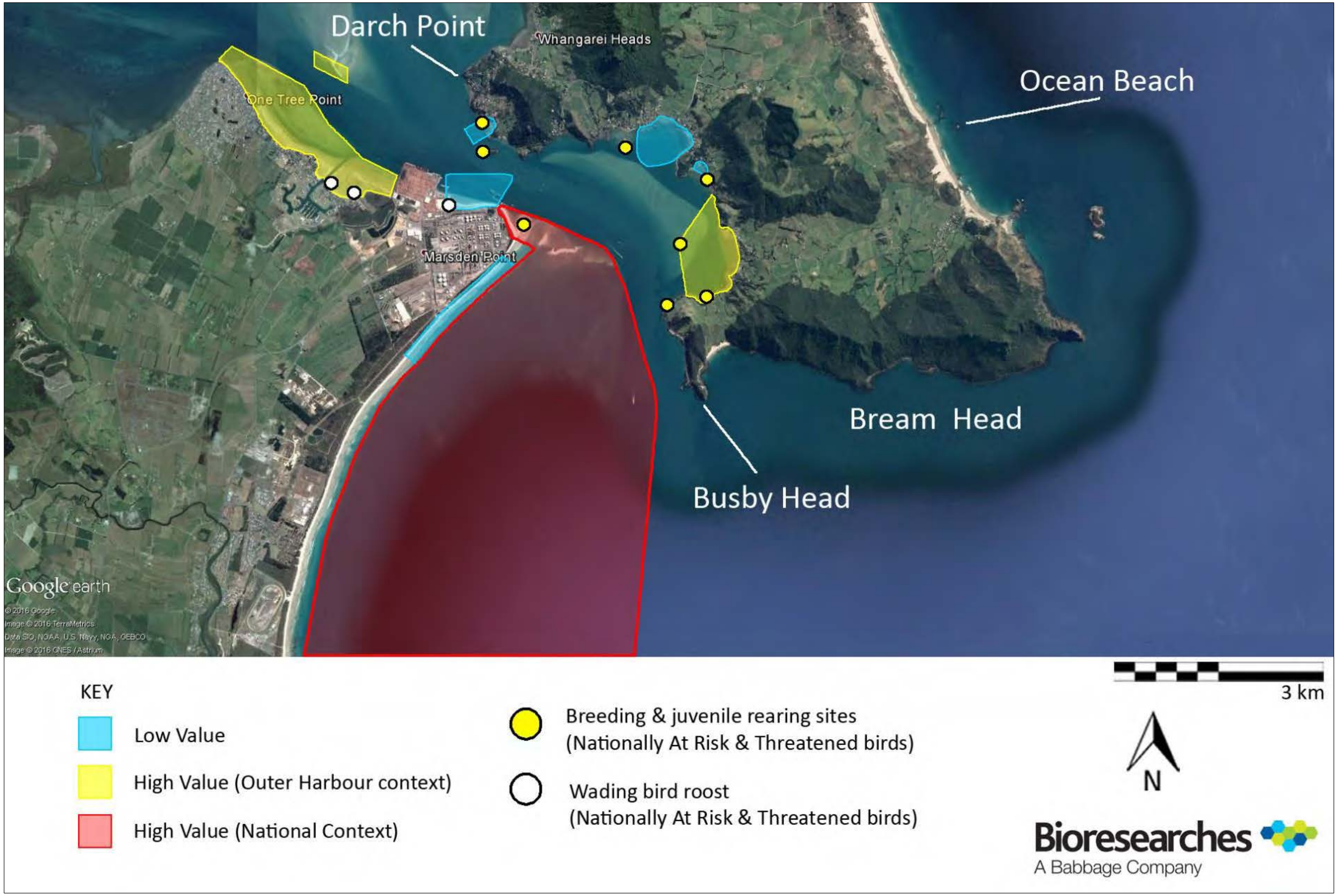

Figure 11. Overview of coastal bird values.

5. AVIFAUNAL EFFECTS

There may be effects during the consent period (limited to a maximum of 35 years by section 123 RMA) as a result of climate change. For shorebirds that could include direct effects (changes to rainfall, temperature, wind conditions, solar radiation) and indirect effects – habitat changes eg loss of intertidal flats, saltmarsh and rocky shorelines; alteration to invertebrate prey distribution and abundance; changes to predator populations; changes to both South Island breeding and feeding areas and North Island feeding areas (eg South Island pied oystercatcher). For eastern bar-tailed godwit that breeds in Western Alaska, climate change is likely to affect birds at all stages of their annual cycle ie in New Zealand, along the East Asian-Australasian Flyway and in Alaska – tundra vegetation encroachment on nesting habitat, asynchronous food production at breeding sites, loss of intertidal foraging areas and changes to synoptic weather patterns adversely affecting migratory flights.

Pelagic species will also be subject to changing climatic conditions, air temperature, sea temperature and freshwater inputs for example, all of which could affect marine productivity and food availability. Overall, the aspects listed as (i) to (iii) inclusive below could be affected by climatic change (East Asian-Australasian Flyway Partnership e-Newsletter, No.42, May 2017, Barbraud et al, 2012; Mustin et al 2007; Piersma & Lindstrom, 2004; Rehfisch & Crick, 2003; www.nzbirdsonline.org.nz).

Although effects as a result of climate change are probable, those effects are unlikely to be exacerbated by this Project.

5.1 Discounted Effects

The Project will not result in the following issues that are relevant to coastal and pelagic birds

(i) there will be no permanent loss of feeding habitat

(ii) no intertidal roosting site for shorebirds will be removed or adversely affected to the degree that it is no longer used.

(iii) no nesting habitat will be adversely affected

(iv) there is no concern regarding sediment contamination or any contaminant release that could affect marine habitats and organisms relied on for food. This includes the potential for avifauna to be impacted by bioaccumulation of contaminants.

(v) there is no concern regarding the avifaunal effects of intermittent maintenance dredging

(vi) there will be no adverse effect as a result of the erection and maintenance of navigational aids.

5.2 Potential Issues

The potential issues regarding the avifauna arising from the Project are as follows:

(i) turbidity increases in the dredging and disposal areas

(ii) deposition of resuspended sediment on soft substrate and hard substrate intertidal habitats

(iii) increase in vessel movements

(iv) vessel lighting

(v) underwater noise

(vi) cumulative effects

These potential issues are discussed below.

5.2.1 Turbidity Increase

5.2.1.1 Capital dredging

The dredging area totals 1.95 km2 of seabed that will be excavated on a continuous (24 hours, 7 days per week) basis for about six months. The uncontaminated sediments contain less than 6% silt (Coffey 2016). Modelling has indicated that the Trailing Suction Hopper Dredger (TSHD) sediment plumes will not disperse to adjacent beaches, sand banks or marine management areas (MetOcean, 2016).

The risk of intertidal deposition of sediment will increase in the smaller berth pocket area that would be excavated with backhoe and barge equipment (BHD). That risk may result in the operation being restricted to slack water or ebb tide periods (Tonkin and Taylor, 2016).

It is clear, however, that there will be a continual increase in the turbidity in the immediate vicinity of the dredger for the duration of the dredging which is unavoidable, in contrast to the short term, temporary increase in turbidity at the disposal sites during each spoil release.

The 2000 – 2010 average range of turbidity from One Tree Point, Marsden Point, Mair Bank and Snake Bank is 0.5 to 7.5 NTU with a grand median for those sites of 1.3 NTU (Coffey, 2016; Table 2).

The comparable secchi disk values are 1.5 to 7.5m with a grand median of 3.9m i.e. water clarify is generally excellent in these areas.

In contrast, turbidity may decrease significantly in inner Bream Bay following heavy rainfall where a level of 23.7 NTU has been recorded (Coffey 2016).

For this Project the trigger level threshold for the turbidity entering the Marine 1 Management Areas is 15-20 NTU and 15-20 g/m^3 suspended solids [i.e. Motukaroro Island, Mair Bank, Calliope Bank (northern bays) and the Home Point to Busby Head coastline].

At the Port of Melbourne a similar water quality threshold was set for a channel dredging project at 25 g/m^3 suspended solids and 17 NTU. Those thresholds were aimed at protection of feeding areas of crested tern (*Sterna cristata*) and australasian gannet (*Morus serrator*) (Sagar, 2011).

The birds that will be affected by an increase in turbidity are visual fish feeders (eg little penguin, australasian gannet, white-fronted tern, caspian tern, red-billed gull and the shag species).

Firstly an increase in turbidity may impair their ability to see and capture fish and fish may avoid areas of higher turbidity reducing the available area of feeding habitat. In general the effects of increased turbidity and suspended solids on foraging seabirds are not well known (Michel et al 2013).

The use of vision by birds to locate food aggregations and capture prey is well known however (eg Wells et al, 2016; Thiebault et al, 2014; Stempniewicz et al, 2013) and the occurrence of a continual plume of elevated turbidity is considered to present a potential adverse effect, but only to a limited number of species and only while the dredge is operating.

A vulnerability assessment was undertaken by Cook & Burton, 2010 in the context of marine aggregate extraction. Some of the affected species are analogous with birds that occur in the Project's dredging area. The conclusions were as follows:

Northern gannet (*Morus bassanus*; compared with australasian gannet *Morus serrator*) were considered relatively insensitive to the dredging operation and associated shipping. "Their wide foraging means that despite being moderately sensitive to increased sedimentation and impacts to the benthos or associated fish communities, the vulnerability of Gannets to these issues has been assessed as being very low. Despite using vision whilst foraging their vulnerability to increased turbidity has also been assessed as being low." This conclusion is considered to have a high level of application to australasian gannet.

Similarly the effects on overseas shag species have application to shags in the Project area. European or common shag [(*Phalacrocorax aristotelis*) cf pied shag and little shag in particular; *Phalacrocorax varius* and *Phalacrocorax melanoleucos* – nesting colonies present] "Despite being highly sensitive to some aspects of marine aggregate dredging, notably disturbance and the issues related to shipping, the exposure of the European Shag to dredging operations is low. Consequently European shags have been assessed as being of low vulnerability to all of the issues associated with marine aggregate extraction."

This conclusion is considered to have a low to moderate level of application because of the recorded degree of use of the Darch Point to Busby Head area by shags and the presence of nesting colonies of pied and little shag at Motukaroro Island and Home Point. There is the potential for an adverse effect on an at risk species (pied shag) through a decreased level of feeding efficiency. The reduced efficiency to capture prey (small fish) could result from a combination of impaired underwater vision and avoidance of feeding areas close to the nesting sites by small fish. Those factors in isolation or combination would lead to a decrease in feeding efficiency and therefore the ability to sustain juvenile shags.

The potential effect would apply to the nesting periods that can be variable and extended but generally peak in the spring-summer. "Some little shags begin nesting in July or August, while others join the colony later and breeding can extend to April or May. Peak activity occurs in October-December." Regarding pied shag – "Clutches are laid in all months, with peaks during February-April and August-October" (nzbirdsonline.org.nz).

In general, gulls are likely to be of low sensitivity to the effects of dredging activities as they have a broad diet and are able to use a wide variety of habitats (Cook & Burton 2010). Although this conclusion has a high level of application to red-billed gull, an effect is most likely during the breeding period ("They have an extremely long egg-laying period that can extend from mid-September to January" – nzbirdsonline.org.nz). A nationally significant nesting colony is present within the RNZ grounds.

There are two species of terns that are common in the dredging area, white-fronted and caspian, both of which dive for small fish. Cook and Burton 2010 comment on terns as follows "As they are constrained by a short foraging range, they are highly vulnerable to reduced food availability". "Thus any changes in food availability at a local level could have a dramatic impact on populations. As they require clear water for foraging (Essink, 1999) terns may thus be particularly sensitive to the turbidity caused by dredging operations and the re-suspension of sediment." An increase in turbidity has been suggested as resulting in the reduced breeding success of sandwich tern (*Sterna sandvicensis*) in the Dutch Wadden sea as a result of adults having to fly a greater distance from the breeding colony to obtain food for their young (Essink, 1999).

In the case of the dredging area effects of this Project, the level of application is considered relatively low because both white-fronted and caspian terns will range both up the Harbour and out into Bream Bay to feed. Both species use the intertidal area, especially Refinery Jetty to Northport, for resting, while white-fronted tern commonly uses the Refinery Jetty for roosting.

In general, however, terns can be considered as being moderately to highly vulnerable to the effects of impacts on the benthos and associated fish communities, and highly vulnerable to increases in turbidity (Cook and Burton, 2010).

The species and groups of birds discussed above are all able to fly and therefore move rapidly away from visually unsuitable feeding conditions. There will be sufficient areas of habitat containing typically high clarity water close to the dredging area to prevent a significant adverse effect in general, however, a caveat applies to nesting shags, gulls and terns during the main breeding period when feeding efficiency and energy conservation obtaining food can be critical to breeding success and juvenile survival.

Specific instances may arise where greater effort may be required to secure food (eg longer feeding flights; additional feeding time in Bream Bay and beyond). These instances, if any, cannot be defined precisely but are unlikely to be any greater than the effects caused by natural, seasonal prey variation or poor weather conditions and are unlikely to reduce either breeding success or juvenile survival during the six month period of dredging.

The flightless species using the dredging area footprint is little penguin that hunts prey visually in daylight (squid, small fish) and is likely to nest around the coastline of the islands and northern shoreline. Their behaviour that informs consideration of potential effects in the dredging area is as follows from nzbirdsonline.org.nz.

Eggs are laid from July to mid-November, with additional clutches beginning as late as December. Incubation takes up to 36 days. Chicks are brooded for 18 – 38 days, and fledge after 7-8 weeks.

Little penguins are nocturnal on land. They return to nesting areas at dusk, congregating in small groups, or “rafts” offshore. Rafts usually come ashore together and are comprised of the same individuals each night. They feed at sea as solidary individuals or small groups, rarely more than 6 individuals. They must stay ashore continuously for about 2 weeks during the annual moult (mainly between January and March), when all feathers are replaced simultaneously.

During the breeding season little penguins forage within 20 km of the colony, pursuit diving for prey generally in waters less than 50m deep. Their diet is composed of varying proportions of small shoaling fish, squid and crustacean species. Important prey items include arrow squid (*Nototodarus sloanii*), slender sprat (*Sprattus antipodum*), Graham's gudgeon (*Grahamichthys radiata*), red cod (*Pseudophycis bachus*), ahuru (*Auchenoceros punctatus*) and stomatopod larvae. (nzbirdsonline.org.nz).

The concern with the dredging footprint is primarily the disruption to breeding penguins commuting between inner Harbour nesting habitats and feeding areas (i.e. probably, Bream Bay).

Although little penguins are typically seen on the water surface, the deepest dive recorded in New Zealand waters is 35m with an average dive of 5.2 – 6.4m (Doc 2015). The deepest dive recorded was at Phillip Island, Australia at 66.7m (Ropert-Coudert et al 2006), however most dives did not exceed 50m. NZ little penguins spend about 60% of their time below 1m depth while at sea.

There are two main phases of little penguin breeding of concern and during those phases behaviour can be quite different. The two phases are egg incubation and the chick-guard stage both of which are shared. In the incubation phase the foraging trips away from the nest averaged 8 days, however, the majority are about 2 – 3 days (Cannell, 2016). During the guard phase the penguins foraged closer to the nesting location and that is driven by the need for penguins to return each evening to feed their chicks (Cannell, 2016). In the guard phase satellite tracking has shown that most penguins undertake one day trips up to 22km from the colony but of a mean maximum distance of 14.2km (Preston, 2007).

The overarching behaviour that could be affected is mid-water to demersal foraging for food (Preston 2007, Preston et al 2007) – they require light penetration through the total water column to forage efficiently since they hunt by sight. Therefore areas affected by a turbidity plume could be rendered unsuitable for foraging by little penguin resulting in temporary displacement from that feeding area and a lower foraging efficiency. That would have potentially adverse effects at a local population level but not at a national level where the national population is estimated at 50,000 – 100,000 with a world breeding population of c.350,000 – 600,000 individuals (www.penguins.cl/little-penguins.htm). In context any area of disruption is almost certainly likely to be minor relative to the wide feeding area available in Bream Bay out to the Hen and Chickens Islands.

In summary the main concern regarding little penguin is disruption of their passage between shoreline nesting areas and the nearby open water and specifically between the inner Harbour and its entrance.

The recent information on little penguin use of the Harbour is sparse. Pierce 2005 refers to past breeding (i.e. pre 1985) on Calliope Island, High Island, some northern headlands and One Tree Point and notes observations of little penguin at potential nesting areas including Little Munro Bay and McGregors Bay. Pierce, 2005 concludes that the current relative scarcity of little penguin in Whangarei Harbour probably reflects their vulnerability to predators over a long period. No little penguins were observed either singly or rafting in groups during any of the 2015 – 2016 coastal bird surveys. In addition the modification and renovation of residential dwellings on the northern shoreline may have reduced the availability of suitable nesting sites under houses.

However targeted surveys in November-December 2016 at dusk identified a population that could represent at least twelve pairs using the Harbour habitat for nesting and chick rearing. That is a notable result in the context of the Harbour but numbers recorded suggest a relatively low breeding density.

Therefore although a continual but confined plume has the potential to disrupt foraging trips during the breeding season, the risk on a population level is considered low-moderate inside Busby Head on the basis of current information and relative to the adverse effects of storm events as evidenced by beach wreck data.

Recent advice on nesting little penguin beyond the Harbour has been provided by the Ranger, Bream Head Conservation Trust (Riaan Elliot pers comm; email of 3.10.16). Little penguin is known to be currently using the shoreline from Busby Head to Bream Head and around to Ocean Beach (Bream Islands) for breeding although there are no data on the numbers. The probability of an adverse effect in this area on a local population basis is also considered low because much of the nesting habitat is remote from the works area, it is an open water situation with high dilution and dispersion rates and the probability of a "turbidity barrier" to foraging trips being created is remote; the effects on little penguin nesting beyond the Harbour (ie along the Bream Head coastline) would be less than minor.

Nevertheless there remains a possibility of a short term change to the local little penguin population with respect to effects both inside and outside Busby Head in combination, especially the former.

The characteristics of the sediment plumes associated with the dredging would be as follows (Metocean Solutions 2016): the plumes associated with the drag head are "constrained within the lower water column, with negligible expression in the mid-water and surface levels. In contrast the sediment plumes associated with the overflow phase are spread across the entire water column". Of note was that the maximum excursion of any plume did not exceed 1200m and was constrained to the channel.

There would be a discrete inner Harbour dredging area to the southeast of Motukaroro Island and more minor works towards Home Point, with the major dredging area being predominantly outside Busby Head.

Therefore the main area of dredging disturbance, albeit temporary, will be beyond the Heads and would not affect the passage of little penguin to and from the Harbour. The turbidity effect of dredging within the Harbour will be temporary and confined to the existing channel i.e. a turbidity "barrier" across the channel at right angles would not be created allowing little penguin to traverse the channel's edges, especially along the northern side where nesting habitat is more likely. That would avoid a disruptive barrier being created between inner Harbour nesting habitats and open water (Bream Bay) feeding areas. In addition, as noted above, there will be Project-specific turbidity threshold levels that are similar to those aimed at protecting the foraging of terns and gannets at the Port of Melbourne. Finally, although the specific turbidity levels are not known, little penguins have adapted to intermittent, temporary turbidity increases that would be accommodated during storm events, rainfall events and river discharges.

On balance the Project would be consistent with NZCPS Policy 11 (a) (i) and Policy 11 (b) (ii) and Objective 3.4 and Policy 4.4.1 of the partially Operative Northland Regional Policy Statement ('NRPS') as applied to little penguin and, indeed, to the other bird species that nest within or frequent the outer Harbour and Bream Bay.

It is acknowledged, however, that the behaviour of birds is difficult to predict and it is equally difficult to discount all effects. For that reason, recommendations are presented below for predator control and the installation of little penguin nesting boxes inside the Harbour to mitigate any short term changes that might adversely affect the local breeding population. In the longer term the maintenance of nesting boxes, especially in a predator – controlled area, would be a positive benefit to the Harbour's population, and also to any nesting variable oystercatcher, reef heron and shags.

In summary, without any mitigation the effects on the local little penguin population are concluded to be less than minor; with the initiatives outlined in Section 7.1 the nett result is viewed as ecological enhancement.

5.2.1.2 Disposal Areas

Disposal area 3.2 is 5.75 km2 and 45m deep and would be the repository for most of the dredged material. Area 1.2 is 2.5 km2 and 7-15m deep.

At Area 3.2 the average mound height would be a maximum of c.4m whereas that at Area 1.2 would average 0.6m and no shoreward migration of sediment that could adversely affect the intertidal habitat would occur.

There is no concern regarding potential contaminant release at the disposal sites and the proportion of silt is low.

The main disposal area is utilised as part of the wider Bream Bay by a relatively high diversity of pelagic birds at times as identified and described in the Bioresearches literature review (2015) and Section 3.4 of this report.

The dredge vessel's slow passage into the release site will disperse any surface resting birds as would the passage of tankers, freighters and other vessels at present. The released sediment will rapidly fall to the seafloor at 45m depth and, because of the low silt content, any adverse effect on water quality is likely to be very localised. At least in daylight there would be nothing to attract birds to the vessel in contrast, for example, with a fishing vessel and the behaviour and presence of birds can be highly variable.

Species such as grey-faced petrel are nocturnally active at breeding sites (April/May and August) but rapidly fly out to the continental shelf to feed. Birds have been recorded flying to the east coast of Australia while their partner is sitting on an egg (nzbirdsonline.org.nz). In contrast, fluttering shearwaters can form large feeding flocks in inshore and harbour waters during the summer (Gaskin & Rayner, 2013) and are typically present off Bream Bay Beach (Sime Road to Mair Road) in April (M. Hicks pers comm).

Similarly large numbers of gannets can be present from Ruakaka Estuary mouth north from September onwards and would extend into Area 1.2.

Therefore while there would be disruption to any feeding pelagic birds by the dredge vessel's passage, the effect would be less than minor on a population level. Similarly the probability of pelagic birds being attracted to the stationary vessel and diving to depths with localised elevated turbidity resulting in an adverse effect, is remote, and any effect would be very low and would not trigger NZCPS Policy 11 (a) (i) or 11 (b) (ii) and cut across Objective 3.4 and Policy 4.4.1 of the NRPS.

5.2.2 Resuspended Sediment Deposition

Based on the modelling results for the dredging area and the disposal areas there is no concern regarding an adverse ecological effect of sediment deposition on adjacent intertidal and subtidal areas that could impact on the feeding areas of coastal birds. There would be no adverse effect.

5.2.3 Vessel Movements

The vessels involved with the Project will not be very different from the range using inner Bream Bay and the Home Point to Busby Point area at present in terms of sizes and speeds. Large ships utilise the Busby Head to Northport area on a regular basis at present. Similarly, freighters and cement carriers pass through the area en route to the Port of Whangarei and Portland, together with numerous smaller commercial and private vessels. On balance the risk of additional vessel movements resulting in an adverse effect on the avifauna is very low.

Arguably the species most at risk is little penguin but injuries and mortality from fast moving craft are more likely than from the vessels used for this Project. (Canwell 2016). Little penguins can reach speeds of up to 6 kph (3.2 knots) underwater (www.doc.govt.nz/native - animals/birds/birds-a-z/penguins/little-penguin-korora/) and have the ability to deep dive.

On balance any effect would be less than minor, and would, therefore, be in accordance with the direction set by the NZCPS and the NRPS.

5.2.4 Vessel Lighting

Light is well known to attract a variety of marine birds (Montevecchi, 2016). The adverse attraction to vessel lights by seabirds is considered to be more likely in Bream Bay beyond Busby Head. That is because the degree of ambient night lighting within Busby Head is relatively high and contributed by the Refinery, Northport, Marsden Cove, berthed vessels, residential areas and navigational aids.

Beyond Busby Head, however, the potential attraction of seabirds to a vessel dredging, in transit to and from disposal area 3.2 in particular, and stationary over that area, is considered high. Considering the operation is continuous, the potential for an adverse effect is also considered moderate-high but tempered by the fact that large vessels are moored in Bream Bay on a continual basis, 12 months a year in all weather conditions. It is not known whether these vessels are impacted by seabirds however it would be surprising if that were not the case. Nevertheless the dredger will be a large, "resident" vessel and a constant light source. Fishing vessels can also be an attractant to seabirds that impact with their decks at night. The most sensitive seabirds to light attractions are gadfly petrels (*Pterodroma genus*), storm petrels, diving petrels, prions and some smaller shearwater species (Taylor, 2014).

Petrels and shearwaters in particular are described as being very sensitive to artificial light (Le Corre et al, 2002) especially fledglings on their first flight to sea. It is thought that occurs because these species feed on bioluminescent squid and mistake the lights for potential prey. (Le Corre et al 2002). One of the species known to exhibit this behaviour is grey-faced petrel (*Pterodroma macroptera gouldi*) that nests within the adjacent Bream Head Scenic Reserve (Montevecchi, 2006).

The susceptibility of light-attracted seabirds to collision and injury or death is higher on moonless nights or during the hours of darkness when the moon is below the horizon. A critical period is a week either side of the new moon each month, whereas clear starlit nights are less risky because the birds are able to navigate and orientate normally. Similarly heavy fog and rain at night can increase the collision risk (Black, 2005; Thompson, 2013; Taylor, 2014).

Therefore it is concluded that collisions between seabirds and the dredging vessel especially in the areas between Busby Head and disposal Area 3.2 are likely.

From the advice of Taylor 2014 above the more susceptible seabirds are the gadfly petrels, grey-faced petrel (*Pterodroma macroptera gouldi*) that nests within Bream Scenic Reserve, and Pycrofts petrel (*Pterodroma pycrofti*) that nests on the Hen and Chicken Islands.

Shearwaters and diving petrels nesting on the Hens and Chickens Islands and therefore susceptible to collision are as follows -

- flesh-footed shearwater (*Puffinus carneipes*)
- sooty shearwater (*Puffinus griseus*)
- fluttering shearwater (*Puffinus gavia*)
- little shearwater (*Puffinus assimilis haurakiensis*)
- northern diving petrel (*Pelecanoides urinatrix urinatrix*)

Additional susceptible species that nest on the Poor Knights Islands are –

- fairy prion (*Pachyptila turtur*)

- Buller's shearwater (*Puffinus bulleri*)
- white-faced storm petrel (*Pelagodroma marina maoriana*

The literature review undertaken by Bioresearches (2015) identified one nationally threatened pelagic species (flesh-footed shearwater) and twelve nationally at risk species that are potentially susceptible.

Clearly, but with the caveats on the existing use of the area by large vessels, the risk of an effect on species that are considered nationally threatened or at risk is notable and heightened by the proximity of breeding colonies at Bream Bay Scenic Reserve, the Hen and Chickens Islands and the Poor Knights Islands, and the use of Bream Bay by young, inexperienced birds.

It is understood that there has been no breeding activity by grey-faced petrel on Matakohe-Limestone Island in the inner Harbour in 2016 so that potential risk would not appear to be an issue. Any birds utilising the Island would anyway have acclimated to the ambient light levels of the Harbour environment.

On balance the general risk of light attraction and collision would be similar to that of any other large vessel and would not be significant on a population level but would increase during the post-fledging period. While NZCPS Policy 11 (a) (i) would not be triggered, some management may be appropriate, particularly to achieve the direction set in Objective 3.4 and Policy 4.4.1 of the NRPS.

There are management measures to reduce the attraction of seabirds to a vessel as summarised by Taylor, 2014 in the case of mining on the Chatham Rise and quoted in full. Such measures should be considered as part of a lighting audit (refer section 7.2 below) to address concerns, including for locally breeding grey-faced petrel in the Bream Head Reserve.

“(a) reduce all unnecessary deck and cabin lighting, cover accommodation windows at night with blinds and curtains;

(b) where possible, orientate all deck lights so they shine only downwards and shield them to prevent upwards or horizontal light projection.

(c) use light dimmers and timers to minimise lighting in areas where people are not constantly active;

(d) trial different light colour options such as green coloured lights in operational areas to reduce overall light intensity levels on the vessel;

(e) investigate the use of LED floodlights with computer controlled light levels, colours and timers;"

5.2.5 Noise

The noise generation of potential concern would be underwater noise. This is of relevance mainly to species that hunt prey underwater for longer periods than the short dives of birds such as white-fronted tern and australasian gannet. In the project area that will apply to shags and little penguin.

Roger HaskoningDHV advise that the noise generated by a TSHD will be similar to that of a large vessel. Clearly large vessels are common in the Project area at present, the difference being that the noise will be continuous rather than intermittent.

Woehler, 2002 investigated the literature during a study on the underwater hearing abilities of six species of penguin in Antarctica. Only one study was located; Cooper 1982 found that underwater acoustics (killer whale vocalisations or electronic noise) had no effect on cape cormorants (*Phalacrocorax capensis*) or jackass penguins (*Spheniscus demersus*), and concluded that underwater acoustics does not seem to be an efficient scaring technique.

However the present positon appears to be that there are no published studies on the effects of underwater noise on birds (McCauley & Kent, 2008) that provide an assurance; however Bream Bay and the Harbour support a diverse and abundant avifauna despite the passage of large ships and numerous smaller vessels. The probability of a noise-induced adverse effect on swimming and diving birds is considered negligible. Noise effects would not cut across the requirements set by either NZCPS Policy or by the NRPS.

5.2.6 Cumulative Effects

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

None of the effects arising from dredging and disposal is particularly novel; large vessels traverse the Whangarei Heads and Harbour area at present on a 24 hour basis and in a wide range of sea states, weather conditions, tidal stages and turbidity levels. There is some information that little penguin nationally is subject to external pressures, including development in the coastal strip. This is evidenced by its 'at-risk' ranking. However, there is no information that the current proposal will have effects – including cumulative effects - on little penguin beyond intermittent, temporary turbidity increases confined to the existing channel. When considered together with the provision of nesting boxes and predator eradication and control proposed by way of environmental enhancement, the effect on little penguin is considered negligible.

6. CONSULTATION AND REVIEW

This assessment has benefitted from discussion (and subsequent provision of information) with Margaret Hicks at an Open Day at NZ Refining on 9 March 2015, and a review by Dr David Thompson, NIWA on behalf of Northland Regional Council.

Comment was also received from tangata whenua regarding coastal birds. While views expressed by tangata whenua regarding the nature and scale of potential effects on birds, and in particular variable oystercatcher, have been carefully considered, they are not consistent with the findings of this assessment. As described above, and following careful assessment and field investigations, the effects on birds is overall held to be less than minor, especially in the context of existing conditions and activities, and the proposed mitigation (refer Section 5.2.6).

With respect to variable oystercatcher, feeding on Mair Bank only occurs when the Bank is exposed. While there may be additional noise from the dredger, acclimation will be rapid and feeding will not be disrupted. The current environment includes movements of ships and other vessels, and a variety of noises. The key variable oystercatcher roost is within 50-100m of the Northport facility (refer Figure 3) and is subject to regular industrial noise, discharges and movement of vehicles, cranes and heavy industry. Indeed there are some variable oystercatcher nests within the RNZ property, which is a heavy industrial site. On balance the likely effects of the Crude Shipping Project on variable oystercatcher will be no more than minor and do not warrant further mitigation.

7. RECOMMENDATIONS AND MITIGATION

7.1 LITTLE PENGUIN

There is sufficient information to indicate that little penguin would be susceptible to a sustained increase in turbidity. The effect is a potential decrease in the foraging efficiency of the penguins which in turn has the potential to impact on juvenile survival and the viability of the local population. Secondly there is a concern, but only at a precautionary level, over the effect of continuous underwater noise during the breeding season. Countering that, the available information indicates that the key breeding area is possibly the shoreline from Busby Head to Ocean Beach rather than inside the Harbour and that on balance, the effect at a population level would be low. However there is clearly a local nesting population within the Harbour and beyond Busby Head, and there remains a possibility that an adverse effect on the breeding success of those populations could occur.

It is further recommended that in consultation with the Department of Conservation the breeding opportunity and potential success of little penguin should be enhanced via predator control and the provision of nesting boxes on Motukaroro Island

Focus should be on Motukaroro Island because it is in a Marine Reserve and is habitat that is readily pest controlled. Motukaroro Island is part of the DoC estate and is not currently pest controlled. Pest eradication is recommended on the Island and along its facing mainland foreshore to minimise pest incursions, commencing 6 months prior to the start of any capital dredging. That should provide a sufficient period in which to eradicate pests and assemble and deploy nesting boxes. The eradication should be paralleled by the establishment of tracking tunnels on the Island to monitor pest presence. The most efficient means for both eradication and subsequent control, especially on the Island, would be via self-setting traps for stoats/rats and possums, with about 5 stations on the Island and 10 on the mainland edge.

Pest eradication should ideally be completed prior to June when little penguins start to utilise their burrows (April – May is the only period when little penguins are unlikely to be present on land.) The pest control should be continued for a minimum of 5 years to accommodate acclimation to the boxes and allow a positive impact on the local population in pest controlled conditions.

The Island has a total area of about 11321m^2 (ie 1.13ha). From the literature accessed, a typical maximum density of a mixture of natural burrows and nest boxes is about 0.5 per 100m^2 or 1.0 per 200 m^2 (eg Braidwood et al 2011). On that basis there is potential area available on the Island for c.57 nests/breeding pairs. On the assumptions that (a) the twelve pairs observed in the November-December 2016 surveys are typical and (b) for management purposes, all pairs nest on Motukaroro Island, then a theoretical surplus of nesting area for a further 45 pairs would be available.

Motukaroro Island is likely to consist of a relatively rough, rocky surface and the aim of 45 nest boxes may not be practicable. It is recommended that the target is 24 boxes based on an assumed current nesting population of 12 pairs that were observed during the surveys. An increase of 24 pairs would be a significant conservation gain and, in combination with pest eradication and control, would ensure any adverse effect on the local population was negligible.

7.2 Vessel Lighting

In recognition of the high diversity of pelagic species, a relatively high proportion of which have national conservation ratings, the nearby presence of significant seabird breeding colonies and the reported aggregations of pelagic species, a lighting audit of the Project's vessels should be undertaken relative to the potential measures in mitigation listed in Section 5.2.4 above. Where there are deficiencies, those should be rectified where practicable in consultation with the vessel operators.

7.3 Grey-faced Petrel

The concern with grey-faced petrel is mortality of fledged young as a result of attraction to lights and subsequent collision with the dredger in particular, especially when it is operating beyond Busby Heads at night.

As with little penguin, any potential adverse effect could be offset by the provision of nesting boxes. It is understood that the Bream Head Conservation Trust already operates a comprehensive predator control program at present and that Refining NZ is a supporter of the Trust. The grey-faced petrel nest box initiative would be specific and targeted, with the nest boxes enhancing existing earth burrows. In consultation with the Trust and Department of Conservation, the final details could be outlined in a specific management plan or agreement. It is understood, however, that there are at least ten active burrows. It is recommended, as with little penguin, that the aim should be a significant increase of available nest sites and therefore 20 boxes should be provided contingent upon confirmation from the Trust.

8. MONITORING

The recommendations below assume that the Recommendations and Mitigation outlined in Section 7 above can be achieved.

There is no regular monitoring recommended for coastal birds because the major elements of the Project are essentially fixed and there are unlikely to be any opportunities to modify those elements in the event of an adverse effect being recorded, which based on the modelling results and analysis, is considered to be in the low risk category.

It would be more effective to focus on potential offset measures and monitoring following completion of the Project.

8.1 MONITORING

The proposal is to document the state of the coastal bird populations in specific areas following the completion of the Project so that both before and after data were on the record.

The following exercises are proposed, with the coastal bird surveys being repeats of the November 2015 – March 2016 surveys in terms of methodology and timing.

8.1.1 Coastal Birds

The following once-off state-of-environment surveys are proposed.

(a) Marsden Point to Northport breeding season (November) habitat use.

(b) Darch Point to Home Point breeding season (November) habitat use.

(c) Mair Bank coastal bird surveys (2) in the February – March period.

(d) Refinery Jetty to Northport coastal bird survey (1) in the February – March period.

(e) Urquharts Bay coastal bird survey (1) in the February - March period.

(a) and (b) would document the degree of post-dredging nesting activity by coastal birds as previously, especially variable oystercatcher, reef heron, pied shag and little shag.

Mair Bank is considered to be of national importance, is immediately adjacent to the TSHD and berth pocket dredging and is the key feeding habitat for variable oystercatcher in the outer Harbour.

The Refinery Jetty to Northport habitat is also adjacent to the TSHD and berth pocket dredging and is a key high tide wading bird roost and general resting area.

Urquharts Bay is a locally significant habitat for coastal birds, is the most notable habitat on the northern shoreline and the data would reflect the general state of the northern shoreline.

Overall, the above surveys would substantiate the state-of-environment and baseline condition of the avifauna post-dredging that is likely to be of interest to stakeholders and provide useful assurance for Refining NZ.

8.1.2 Little Penguin

Daylight counts and dusk arrival counts should be completed in the November to January period as a once-off exercise when both parents are likely to be feeding at sea and therefore more visible. In the chick-guard period (about September to October) only one adult would be feeding at sea and encounters would be lower. The survey area should cover the northern bays area from Reotahi Bay to Urquharts Bay inclusive.

In addition a regular, ongoing monitoring program to record nesting box success will be developed in consultation with the Department of Conservation. To parallel the pest control that should continue for a minimum of 5 years.

9. CONCLUSION

Overall the impact of the Project including cumulative effects on coastal and pelagic birds is considered to be low especially at a national population level; the NZCPS Policy 11 (a) (i), regarding adverse effects on threatened or at risk taxa, and Policy 11 (b) (ii), regarding adverse effects on vulnerable life stages would not be triggered at a population or regional level and, if triggered at a local level, can be mitigated. Furthermore, the other applicable (avifauna) policy from the NRPS will also be achieved if the Proposal is advanced in the manner that we have recommended.

The key initiative recommended is the provision of little penguin nesting boxes within the Harbour to offset any local effect on breeding success as a result of dredging and a turbidity increase.

In addition the provision of nest boxes for grey-faced petrel in Bream Head Scenic Reserve is recommended to offset any local effect of the dredger's lighting on fledged juveniles.

Post-capital dredging monitoring is recommended to provide before and after state-of-the-environment information on coastal birds and little penguin.

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Annexure Two: Technical Reports

k) **Assessment of Marine Ecological Effects excluding Seabirds and Marine Mammals. Brian T Coffey and Associates. Brian Coffey. Dated 10 August 2017**

Brian T. Coffey and Associates Limited
Environmental Consultants

Water Resource Management

Crude Shipping Project

Proposal to Deepen and Partially Realign the Approaches to Marsden Point

Assessment of Marine Ecological Effects Excluding Seabirds and Marine Mammals

Prepared for:

ChanceryGreen

Prepared on behalf of:

Refining NZ

Prepared by:

Brian Coffey

Inquiries and reference: please quote:
Brian T. Coffey and Associates Limited:
AEE: RNZ Marine Ecology, 15 August 2017.

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Preamble

The New Zealand Refining Company Limited (trading as 'Refining NZ' or 'RNZ') operates a crude oil refinery at Marsden Point on the southern side of the Whangarei Harbour mouth (see Figure 1). Deep water access to Marsden Point from Bream Bay is via a natural tidal inlet that varies in depth from 15 to 32 metres (see LINZ, 2010, LINZ, 2004 and Figure 2).

Figure 1: Locality Diagram for Marsden Point Oil Refinery.

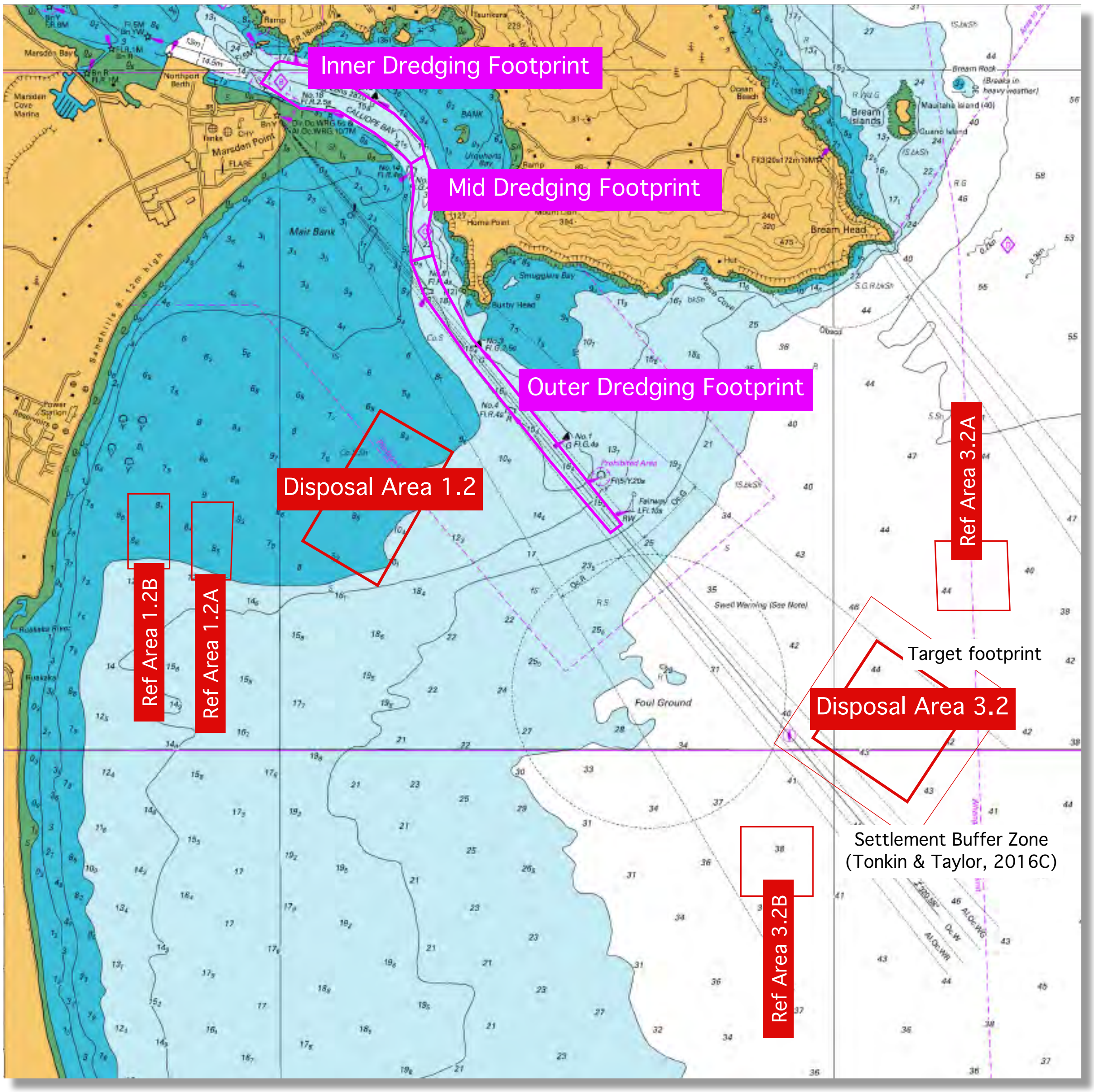
Crude oil supply to the refinery is currently delivered by smaller fully-loaded "Aframax" ships and larger partially-loaded "Suezmax" ships. "Suezmax" ships can only be partially loaded due to existing port draft requirements.

There would be financial and efficiency returns for RNZ if fully-loaded "Suezmax" ships could access the Marsden Point berthing terminal from Bream Bay (Tonkin & Taylor, 201A).

To this end, RNZ is applying for resource consents required:

- to partially realign the access channel to provide safe navigational access for fully-loaded "Suezmax" ships,
- to remove / replace / relocate / add to navigational aids along the new channel alignment (see Figure 3 and Royal HaskoningDHV, 2016C),
- for targeted capital and maintenance dredging to achieve and maintain a minimum depth to support 16.6m ship draught in the access channel, and
- to dispose of dredged materials.

Figure 2: Study Area Showing Footprints for Proposed Dredging and Disposal of Dredged Material (Chart courtesy of LINZ, 2010).



With reference to Figure 2, a range of access channel alignments have been evaluated[1] but only the preferred access footprint (Option 4.2) is considered and described in this Assessment of Ecological Effects (see Figures 3 and 4).

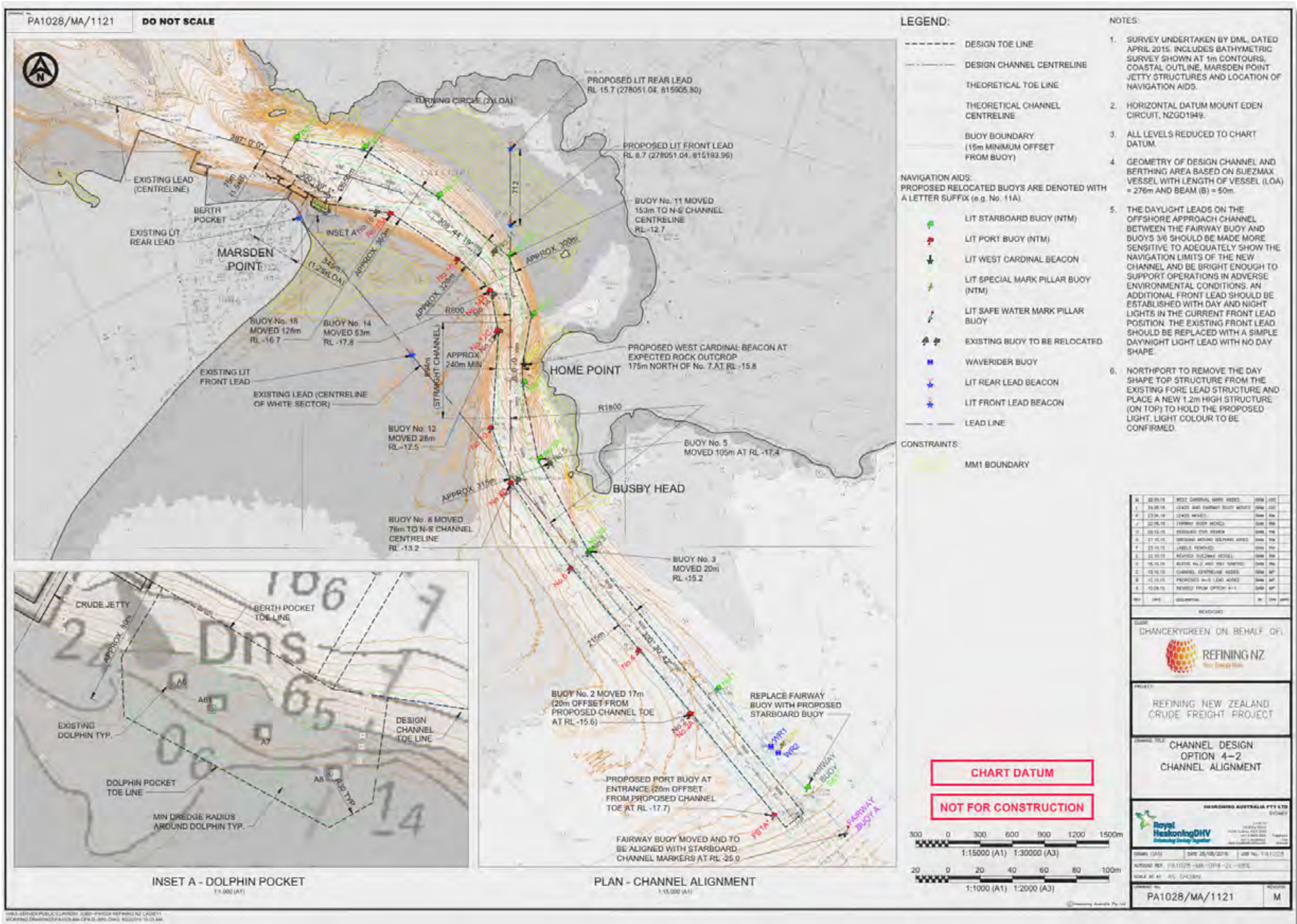
Similarly, a range of preferred options for offshore disposal sites have been evaluated[2] but only the preferred options (Areas 1.2 and 3.2) are considered and described in this Assessment of Ecological Effects (AEE).

These choices were the subject of a mid-point multi-criteria alternatives assessment by Tonkin & Taylor (2017C)

[1] MetOcean Solutions (2016B), Royal HaskoningDHV (2016A), Tonkin & Taylor (2017A).

[2] MetOcean Solutions (2016B), Tonkin & Taylor (2017A), West and Don (2016B), Kerr and Grace (2016E).

Figure 3: Proposed changes to Navigational Aids for Channel Alignment Option 4.2.



1.0 Executive Summary

The ecological context for these resource consent applications is that both the proposed dredging footprint and the footprint of proposed disposal areas 1.2 and 3.2 (see Figure 2) are occupied by soft-bottom benthic communities that colonise seabed materials (silts, sands, shell and gravel) that are actively sorted / moved by tidal and wave-induced disturbance effects.

Benthic communities within these soft-bottom areas of seabed are typical of the coastal environment off the north-east coast of the North Island and are included within the Marine 2 (Conservation) Management Area as recognised and defined in the Regional Coastal Plan for Northland (Northland Regional Council, 2004). They are generally dominated by sand dollars, starfish, polychaete worms, hermit crabs, flatfish, shellfish and crabs.

Proposed dredging activities would physically remove existing benthic communities from a substantial proportion of the footprint shown in Figure 2 and the placement of dredged material within Disposal Areas 1.2 and 3.2 (see Figure 2) would bury and effectively eliminate existing benthic communities within part or all of these areas.

This would result in a short-term displacement (c. 6 to 24 months – Coffey, 2017A) of benthic communities (that include shellfish resources and fish food reserves) within disturbed areas until they are expected to be recolonised by a similar assemblage of taxa that occur at a similar depth on the surrounding soft-bottom seabed.

Invasive taxa (marine pests) are also potential re-colonisers of the vacant niche that would be created by proposed disturbance activities, but are considered to be a low risk as they have not proved problematic at other comparable dredging programmes at the Ports of Auckland, Tauranga or Otago.

Benthic communities such as kelp beds and sponge gardens that occur on hard-bottom areas of Northland's Coastal Marine Area (rock and stable boulders) are of high ecological value[3] and whilst they would not be directly affected by proposed disturbance activities, submerged reefs and rocky shorelines adjacent to disturbance activities are potentially vulnerable to sediment plumes and sedimentation effects that can be associated with dredging activities and the disposal of dredged material within the Coastal Marine Area.

In this regard, there are two soft-bottom Marine 1 Management Areas (Mair Bank and Calliope Bank) and two hard-bottom Marine 1 Management Areas (Motukaroro Island Whangarei Marine Reserve and Home Point) immediately adjacent to the proposed dredging footprint (see Figure 4) where existing values are to be protected.

These management areas are from Map A3 of the Northland Regional Coastal Plan (Northland Regional Council, 2004) and it is important that their conservation values are protected from potentially adverse turbidity, sedimentation and potential fuel spill effects, for example, that can be associated with dredging activities and the disposal of dredged material.

Three Mile reef is a fishing area west of Disposal Area 3.1 (see foul ground in Figure 2 and Greenaway, 2015). Whilst not afforded any particular recognition in the Operative Regional Coastal Plan, it is recognised that Three Mile reef has local recreational and ecological value within the study area.

Table 1 provides a summary of the actual and potential ecological effects of the proposed dredging programme, the associated avoidance, remediation and compensation measures, and the magnitude of the effects post the application of the avoidance, remediation and compensation measures.

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[3] e.g. Golder (2010), Hay and Grant (2004), Kamo High School (2002), Kerr and Moretti (2012), Kerr and Grace (2006A), Kerr and Grace (2006B), Morrison (2003) and Morrison (2005).

Figure 4: Marine 1 (Protection) Management Areas adjacent to the proposed dredging footprint in the approaches to Marsden Point.

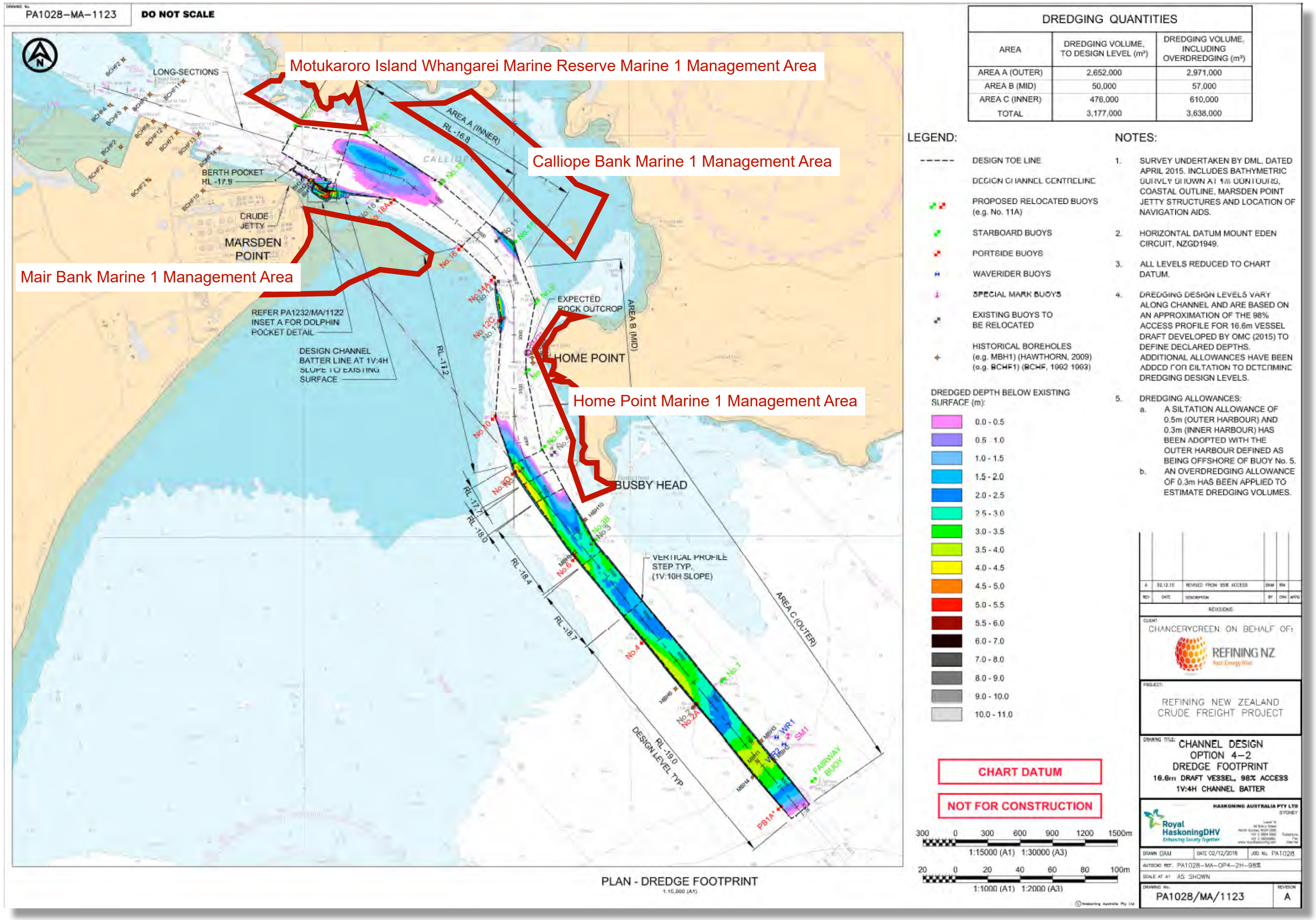

Table 1: Summary of Ecological Effects of Proposed Dredging Activities (excluding Marine Birds and Marine Mammals)).

				Actual Effects	Potential Effects	Avoidance Factors	Remediation / Compensation	Final Significance
Dredging Activities (see Figure 2)								
	Disturbance and removal of bed material							
		Seabed Effects						
			Bathymetry	Increased water depth	Changed currents / sediment transport / wave climate	Not required (MetOcean Solutions, 2016B)	Not required (MetOcean Solutions, 2016B)	Less than minor (MetOcea Solutions, 2016B)
			Exposure of new surficial sediments	Removal of benthic communities and some biological armouring	Change sediment type / texture / transport	Not required as vibrocores show similar sediment will be exposed	Contribution to enhancement of local harbour water quality / seagrass habitat for example	Minor to moderate, localise short term loss of benthos within dredging footprint
		Water Column Effects						
			Sediment Plumes	Increased sedimentation and turbidity within dredging footprint	Dissolved Oxygen sags / toxicity / sedimentation issues outside of dredge footprint	Dredged material is not contaminated and has a low silt content	Manage turbidity thresholds at boundary of adjacent habitats	Avoid effects on adjacent reef habitats, avoid / mitiga effects on others
			Suspended Solids	Increased concentration within dredging footprint	Increased concentration outside dredging footprint	Monitor and respond to turbidity limits in adjacent communities	Not applicable for adjacent reef habitats.	Avoid effects on adjacent reef communities, avoid / mitigate for effects on othe
			Turbidity	Increased value within dredging footprint	Increased value outside dredging footprint	Monitor and respond to turbidity limits in adjacent communities	Not applicable for adjacent reef habitats.	Avoid effects on adjacent reef communities, avoid / mitigate for effects on othe
			Light penetration	Decreased value within dredging footprint (but no attached macrophytes present)	Decreased value outside dredging footprint	Managed via response to turbidity limits in adjacent habitats	Not applicable for adjacent reef habitats.	Avoid effects on adjacent reef communities, less tha minor effects on others.
		Effects on Communities						
			Plankton	Less than minor due to high replenishment rates	Less than minor due to high replenishment rates	Not required	Not required	Less than minor
			Benthos	Removal & death of resident benthos from dredging footprint	Adventive pests may colonise vacant niche	Not applicable	Contribution to local enhancement of harbour water quality / seagrass habitat for example	Minor to moderate, localise short term loss of benthos within dredging footprint
			Fish and Wildlife	Minor, localised, disturbance and avoidance during dredging activities	Minor, localised, and short-term reduction in available food supplies	Not applicable	Not required	Less than minor outside c dredging footprint

Table 1 continued.

			Actual Effects	Potential Effects	Avoidance Factors	Remediation / Compensation	Final Significance
Dredge in transit between dredging / disposal sites							
		Water Column Effects	None if zero discharge from dredge	None if zero discharge from dredge	Not applicable	Not Applicable	none
		Effects on Communities	None if zero discharge from dredge	None if zero discharge from dredge	Not applicable	Not Applicable	none

Table 1 continued.

				Actual Effects	Potential Effects	Avoidance Factors	Remediation / Compensation	Final Significance
Disposal Sites for Dredged Material (see Figure 2)								
	Disturbance and Deposition of bed material							
		Water Column Effects						
			Sediment Plumes	Increased sedimentation increased turbidity within disposal footprint	Dissolved Oxygen sags / toxicity / sedimentation issues outside of disposal area	Not required. Material not contaminated and with low silt content.	Not required if placement confined to disposal area	Less than minor outside c disposal footprint
			Suspended Solids	Increased concentration within disposal footprint	Increased concentration outside disposal footprint	Monitor and respond to turbidity limits in adjacent habitats	Not required if placement confined to disposal area	Less than minor outside c disposal footprint
			Turbidity	Increased value within disposal footprint	Increased value outside dredging footprint	Monitor and respond to turbidity limits in adjacent habitats	Not required if placement confined to disposal area	Less than minor outside c disposal footprint
			Light penetration	Decreased value within disposal areas (but attached macrophytes not present)	Reduced value outside disposal footprint	Managed via response to turbidity levels in adjacent habitats	Not required due to lack of attached macrophytes within disposal areas	Less than minor outside c disposal footprint
		Effects on Communities						
			Plankton	Less than minor due to high replenishment rates	Less than minor due to high replenishment rates	Not required	Not required	Less than minor
			Benthos	Burial & death within disposal footprint	adventive pests may colonise vacant niche	Not applicable	Contribution to local enhancement of harbour water quality / seagrass habitat for example	Minor to moderate, localise short term loss of benthos within disposal areas
			Fish and Wildlife	Minor, localised, disturbance and avoidance during disposal activities	Minor, localised, and short-term reduction in available food supplies	Not applicable	Not required	Less than minor outside c disposal footprint

Table 1 continued.

			Actual Effects	Potential Effects	Avoidance Factors	Remediation / Compensation	Final Significance
Changes to Navigation Aids (see Figure 3)							
		Water Column Effects	Less than minor because of limited footprint	Less than minor because of limited footprint	Not applicable	Adoption of Best Industry Practices	Less than minor
		Effects on Communities	Less than minor because of limited footprint	Less than minor because of limited footprint	Not applicable	Adoption of Best Industry Practices	Less than minor

Table 1 considers the:

- disturbance and removal of bed material from the proposed dredging footprint,
- transport of seabed material between the dredging and disposal areas,
- disposal of dredged material at offshore disposal sites, and
- effects of changes to navigation aids for Alignment Option 4.2.

It is considered that bathymetric changes at dredging and disposal sites will have less than minor effects on current wave climate and water currents (Tonkin & Taylor, 2017B; MetOcean Solutions, 2016B).

Survey and analytical results presented in this AEE provide reassurance that the concentration of metals and potentially toxic organic materials associated with seabed materials that are to be relocated from the access channel to the two nominated disposal sites are not likely to be associated with toxicity issues (Maritime Safety Authority of New Zealand, 1999).

Similarly, a low proportion of silt and organic matter in seabed materials that will be dredged and disposed of is expected to avoid water quality issues in plumes (such as excessive turbidity and dissolved oxygen sags) beyond a reasonable mixing zone down-current of disturbance activities.

Stewart (2017) established a 1:1 correlation between the concentration of suspended solids ($g.m^{-3}$) and turbidity (Nephelometric Turbidity Units [NTU]) when these particular seabed sediments are temporarily suspended in the water column. This permits real time monitoring of potential sedimentation effects (suspended solids concentrations) during proposed disturbance activities using field turbidity meters.

Provided there is no discharge from the Trailing Suction Hopper Dredger when it is in transit between dredging and disposal sites, no ecological effects are expected to be associated with the transport of material between dredging and disposal areas.

Due to the limited footprint and construction methodology involved, the ecological effects of modifying navigation aids for Alignment Option 4.2 are expected to be less than minor.

Therefore, provided adverse sedimentation effects can be confined to the nominated footprint of both dredging and disposal footprints,

- water column effects,
- effects on plankton, fish and wildlife, and
- effects on adjacent coastal habitats (particularly the more sensitive rocky intertidal areas, submerged reefs and ecologically significant banks),

are expected to be localised and minor or less than minor.

Potential sedimentation effects down-current of dredge activities are to be managed by responding to real time turbidity recorders on the boundaries of adjacent habitats.

Provisional turbidity limits / thresholds have been derived / are being developed that require the following responses in terms of concurrent operational controls on dredging / dredged spoil disposal activities.

- Level 1: the reason for elevated suspended solids concentrations down-current of the operational dredge need to be investigated,
- Level 2: operational changes are required by the dredge to reduce down-current suspended solids concentrations, and
- Level 3: suspended solids concentrations down-current of the operational dredge result in dredge activities being stopped.

Best management practices are also proposed to avoid, to the greatest extent practicable, the potential for issues such as hydrocarbon spillages within, and adjacent to disturbed areas. Navigational and environmental risk have been separately assessed (Bilderbeck and Oldham, 2016: Oldham and Bilderbeck, 2017) and it has been concluded there would be benefits of improved navigational safety resulting from the RNZ dredging proposal.

The capital dredging programme would result in the short term (6 to 24 months) displacement / reduction of benthic productivity within a 4.37 km^2 (437 ha) area of seabed (see Figure 2 and Coffey, 2017A). While these soft-bottomed areas include indigenous taxa, they are not of national or regional significance and no benthic taxa within these predominantly sandy sites are considered to be endangered or at risk.

Nevertheless, due to the local and short-term effect of proposed dredging activities on benthic productivity, some form of compensation is considered to be appropriate. Compensation in the form of a contribution to the enhancement of the overall health of the Whangarei seagrass communities within and adjacent to the study area is recommended for consideration (Coffey and Stewart, 2017).

A monitoring programme is recommended to describe the effects of the dredging programme separately from other temporal ecological changes that are occurring within the study area.

The baseline description of pre-impact community structure by Bioresearches, Kerr and Associates and the Cawthron Institute (within and adjacent to areas that would be disturbed by the proposed dredging programme) is considered to be robust in terms of providing a comparison with post impact surveys of the same areas. However, a benchmark description of seagrass and shellfish communities (that are in a current state of flux) requires to be undertaken immediately prior to capital dredging activities.

2.0 General Introduction to the Existing Environment and Existing Values within the Study Area (see Figure 2)

The character of an area of marine coastline is largely determined by latitude and the water currents that flood it.

Notwithstanding direct developers such as marine gastrods and lecithotrophic larvae (e.g. some fish and some benthic invertebrates such as tunicates) most benthic invertebrates have a planktotrophic larval development where larvae join the plankton and are dispersed by water currents. If adequate quality habitat is available downstream of where planktotrophic marine organisms spawn and form offspring, sessile organisms will settle out of the plankton to colonise benthic habitats and pelagic / demersal taxa will form part of the downstream water column community.

Along the north-east coast of New Zealand (from North Cape down to East Cape), the most influential current is the East Auckland Current that introduces a tropical / subtropical element into the marine flora and fauna from the Kermadec and Three Kings Islands.

Commercial fisheries such as crayfish, paua, cockles, pipi, scallops, fin fish and edible seaweeds rely on recruitment from resident populations upstream of a particular locality. This explains much of the resilience of marine communities to overfishing and disturbance events in that once such disturbance factors cease, there is the potential for recruitment via planktonic larvae to recolonise previously compromised habitats.

In contrast to waters south of the subtropical convergence, the East Auckland Current is warmer, more transparent and more saline than subantarctic waters and supports kelp forests to a depth of 30 m on rocky reefs along the eastern coast of Northland.

The setting of the East Auckland Current during summer is associated with a world renowned big game fishery off the Northland coast down to White Island in the Bay of Plenty. The most prized catches include billfish such as marlin.

The East Auckland Current occasionally delivers a range of novel taxa such as sun fish, sea turtles, sea snakes, manta and devil-spined rays to Northland's east coast (Morrison, 2005).

The most informative articles describing the extraordinary marine biodiversity that occurs on the open coast and offshore islands of Northland are arguably that of Morrison (2005) and Andrew and Francis (2003).

2.1 Climate and Exposure

Northland, with its low elevation and close proximity to the sea is characterised by a mild, humid, and rather windy climate. Summers are warm and tend to be humid, while winters are mild, with many parts of the region having only a few light frosts each year. Rainfall is typically plentiful, all-year round, with sporadic very heavy falls. However dry spells do occur, especially during summer and autumn.

Most parts of Northland receive about 2000 hours of sunshine per year. It can be very windy in exposed areas and occasionally Northland experiences gales, sometimes in association with the passage of depressions of tropical origin (Chappell, 2013).

In enclosed waters, such as Whangarei, Kaipara, and Hokianga Harbours, wind generated waves are unlikely to exceed two metres. This is because winds required to generate such waves would need to be either a steady 70 $km.hr^{-1}$ or more (a very rare event in Northland), or would require a longer fetch than the enclosed harbours provide (Chappell, 2013).

On the east coast of Northland, swells from an easterly or north-easterly direction tend to predominate. These can originate from tropical cyclones well to the north of New Zealand or from anticyclones far to the east. Of all swells observed on the eastern coast the frequency of those less than one metre is about 40 percent, while for those greater than two metres is eight percent (Gorman et al., 2003).

Whilst Bream Head and the Hen and Chicken Islands offer some protection to Bream Bay in terms of the wave climate (see Figure 1), the entrance to Whangarei Harbour can be very exposed in occasional south-easterly storms.

In Bream Bay, seawater temperatures vary from 24-25°C in summer and 13-14.5°C in winter (Golder (2010).

2.2 Bathymetry, Water Currents and Seabed / Shoreline Types

Whangarei Harbour is a drowned river valley system that covers some 10,000 ha and includes 5,400 ha of intertidal flats, 1,400 ha of mangroves and 200 ha of saltmarsh (Morrison 2003).

The harbour is connected to Bream Bay via a 2.4 km wide inlet between Marsden Point and Home Point. The main channel extends inland some 24 km in a north-westerly direction and then divides into two arms, the Hātea River in the north and the Mangapai River in the south.

The harbour drains a catchment of 29,507 ha that has been heavily modified, with a large amount of native vegetation cleared for urban use in the north-west and agricultural land use in the east and south.

Water currents within Bream Bay and at the mouth of the harbour have been measured and modelled by MetOcean Solutions (2016B). Relatively low wind speeds, low to moderate wave heights and moderate tidal currents are associated with the confines of the entrance channel. Calm conditions (winds less than 2 $m.s^{-1}$) occur more than 90% of the time and moderate to low wave climate (sea and swell wave heights less than 1 m) occur for more than 90% of the time at the entrance to the channel. Within the mid and inner parts of the channel, wave heights are less than 0.6 m 99% of the time. Peak tidal velocities reach 2.0 to 2.5 knots over the length of the channel (MetOcean Solutions, 2016B).

Bream Bay and Whangarei Harbour tides have a period of 12 hours and 25 minutes, and a mean tidal range of 1.36 m for neap tides to 2.25 m for spring tides (LINZ, 2004, 2010).

Bream Bay is a sand-dominated environment, forming a key part of offshore sand resources present on this coastline that extend southward to Pakiri Beach. Soft shorelines also dominate the southern (right bank shores of the lower harbour and entrance channel (see Figure 4). Calliope and Mair Banks fringe the deep sandy-shell channel in the lower harbour.

The 18 km stretch of coastline along Bream Bay from Marsden Point to the Waipu River Mouth (see Figure 1) is largely comprised of clean exposed beach with up to 5 m high fore dunes accreting and eroding in response to storm events. Bream Bay has a wide (80 m) mid to low tide platform seaward of a relatively narrow (9 m) mid to high tide rise to an upper beach platform at the seaward base of the fore dune (Coffey, 2004).

However, the northern shoreline of Bream Bay (Busby Point to Bream Head) is a predominantly rocky headland that bottoms out onto sand in approximately 10 m water depth, with small sandy beaches in the western sector of the northern shoreline and in Smugglers Bay.

Similarly, the downstream section of Whangarei Harbour and northern (left bank) shoreline of the entrance includes hard shore communities between Busby Head and Home Point, at High and Motukararoro Islands, and on headlands between Darch Point and Home Point.

Moreover, there is an area of foul ground shown on Marine Chart NZ 5219 (Approaches to Marsden Point, LINZ, 2010) inshore of Disposal Area 3.2 (see Figure 2) that is known locally as three-mile reef.

Kerr and Grace (2016D) have logged reference photoquadrats for this area that show it includes a rocky–boulder lined seabed that supports a low-profile reef community that is partially / intermittently covered by sand and shell movement along the seabed.

2.3 Soft Seabed Sediment Quality and Sediment Transport

Basement rock for Whangarei Harbour and catchment area consists of greywacke from the Waipapa Group, which is overlain by sedimentary rocks, andesitic volcanic facies and quaternary sand and mud deposits (Northland Harbour Board 1989). The landform behind Bream Bay is dominated by Quaternary dune sands (Edbrooke and Brook, 2009).

The sand in Bream Bay consists of feldspar (65-70%), quartz (25%), rock fragments (1 -4%), heavy minerals (1-4%), shell (1-2%), and a variable amount of organic material (Christie & Barker 2007) and is generally low in organic carbon (Golder, 2010).

West and Don (2016B) and Tonkin & Taylor (2017B) have described the chemical characteristics and particle size composition of soft seabed sediments within the proposed dredging footprint which were relatively “clean” predominantly medium and fine sands with low silt contents (less than 6%).

Kerr and Grace (2016C) have described soft sediment quality within Disposal Area 1.2. Kerr and Grace (2016B) and the Cawthron Institute (Appendix B) have described soft sediment quality within Disposal Area 3.2.

Black (1983) reported sediment transport occurs in a northerly direction in Bream Bay towards Mair Bank then out of Whangarei Harbour via the main channel.

2.4 Occurrence and Quality of Reef Structures and Hard Shorelines

Within the study area, reef structures and hard shorelines occur along the northern shoreline of Bream Bay (Busby Point to Bream Head). In the downstream section of Whangarei Harbour, hard shore communities also occur between Busby Head and Home Point, at High and

Motukararoro Islands (including the marine reserve), and on headlands between Darch Point and Home Point.

Kerr and Associates (2016A) have described reef structures and hard shoreline communities adjacent to the dredging footprint in the downstream section of Whangarei Harbour.

The high quality of these habitats has been confirmed by Golder (2010), Hay and Grant (2004), Kamo High School (2002), Kerr and Moretti (2012), Kerr and Grace (2006A), Kerr and Grace (2006B), Morrison (2003) and Morrison (2005).

2.5 Water Quality

2.5.1 Introduction and Background

Water quality in Bream Bay and in the Lower Whangarei Harbour (see Figure 5) is generally good, as a result of regular tidal flushing with ocean water (Andries, C., 2010; Beca Planning, 2002; Cornelisen, et. al., 2011; Golder, 2010; Griffiths, R., 2013; MWH, 2009; Northland Regional Council, 2004; Northland Regional Council and Whangarei District Council, 2012; Northland Regional Council, 2012) and supports high habitat quality in the four Marine 1 Management Areas shown in Figure 4.

Figure 5: Water Quality Sampling Sites Monitored by Northland Regional Council (2011).

Tweddle et. al. (2011) have summarised 10 years of monitoring data for 16 sites in Whangarei Harbour (see Figure 5) and MWH (2009) have reported on baseline water quality monitoring sites in the lower Whangarei Harbour and in Bream Bay between 2008 and 2009 (Figure 6).

The MWH (2009) water quality data were sourced from field sampling that was undertaken by Northland Regional Council staff for Whangarei District Council at nine sites in Bream Bay, Whangarei Harbour entrance and Ruakaka River over the period June 2008 to May 2009. Surface water samples were collected on seven occasions, including ebb and flood tides, and dry and wet weather.

Figure 6: Water Quality Sites Monitored by MWH (2009).

Northland's Regional Coastal Plan (Northland Regional Council, 2004) has adopted water quality standards for coastal waters (see Table 2). These standards specify acceptable changes to ambient water quality as a result of a discharge for example and in the lower Whangarei Harbour, a general quality standard CA applies.

In the case of Bream Bay which is a Marine 2 (Conservation) Management Area, general performance standards as listed in section 31.4.13 of the Regional Coastal Plan apply (Northland Regional Council, 2004).

Section 31.4.13 of the Regional Coastal Plan states that discharges to water shall, after reasonable mixing, comply with the relevant receiving water quality standards and shall not contain any contaminants which could cause:

(i) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials.

(ii) any conspicuous change in the colour or visual clarity of the receiving waters.

(iii) any emission of objectionable odour.

(iv) accumulation of debris on the foreshore or seabed underlying or adjacent to the discharge point.

(v) any significant adverse effects on aquatic life or public health.

The requirements of section 31.4.13(c) of the Regional Coastal Plan closely reflect section 107(1) of the RMA and Policy 4.4.1 of the Northland Regional Policy Statement (Northland Regional Council, 2016B).

Neither the Regional Coastal Plan nor the RMA define an appropriate mixing zone. Instead, this is to be determined having regard to the attributes of a particular location (for instance, currents, tides, bathymetry, and roughness coefficient of the seabed).

Table 2: Coastal water quality standards (Northland Regional Council, 2004).

	Standards for Coastal Waters
Standard	General Quality Standard CA (for lower Whangarei Harbour)
Purpose	Provides for virtually all uses and protection of marine ecosystems
Natural temperature	Not changed by more than 3°C
Natural pH	Not changed by more than 0.2 units
Concentration of dissolved oxygen	Not reduced below 80% saturation
Natural visual clarity	Not reduced more than 20%
Natural hue	Not changed more than 10 Maunsell units
Natural euphotic depth	Water deeper than $0.5.z_{eu}$ not changed more than 10% Water shallower than $0.5.z_{eu}$ maximum reduction in light at sediment bed not more than 20%
Oil/grease film, scum, foam, odour	No conspicuous oil or grease film, scums or foams, floatable or suspended materials, or emissions of objectionable odour
Toxic Metals	
Total Arsenic	50 mg/m^3
Total Cadmium	2 mg/m^3
Total Chromium	50 mg/m^3
Total Copper	5 mg/m^3
Total Lead	5 mg/m^3
Total Zinc	50 mg/m^3
Faecal Coliforms	Based on not fewer than 10 samples for any 30-day period median < 14/100 ml 90%ile < 43/100 ml
Nutrients (Default standards in the absence of specific site investigations)	DRP 1-10 mg/m^3 NO3-N 10-60 mg/m^3 NH4-N <5 mg/m^3
Other toxicants and parameters	As per Table 2.1 of ANZECC Water Quality Guidelines 1992

Here, a reasonable mixing zone within Bream Bay is considered to be in the order of 300m (20 x average water depth), however in proximity to some hard-shore communities (e.g. Home Point) only 100m is available for a mixing zone (Tonkin & Taylor, 2016C).

The same performance standards as Section 31.4.13 of the Regional Coastal Plan for Marine 2 (Conservation) Management Areas, apply to Section 31.7.12 for Marine 5 (Port Facilities) Management Areas in which dredging activities will occur in the lower Harbour.

In terms of the Section 31.4.13(v) of the Regional Coastal Plan and Chapter 19 of the Regional Coastal Plan (Northland Regional Council, 2004), humans are not expected to come into contact with sediment plumes that might be generated by proposed disturbance activities and survey and analytical results presented in this AEE, provide reassurance that seabed materials that are to be relocated from the access channel to the two nominated disposal sites are not contaminated with toxic metals or potentially toxic organic materials (Maritime Safety Authority of New Zealand, 1999).

2.5.1a Harbour Sites

Tweddle et. al. (2011) reported that sites within Whangarei Harbour with the best water quality ("judged according to Coastal Water Quality Standards, Table 2) are located close to the harbour entrance and sites with the worst water quality are located in the Hātea River and the Mangapai River.

Sites near the entrance of the harbour are more heavily influenced by coastal water, while sites in the Hātea and Mangapai Rivers, are more influenced by freshwater input from rivers and streams. By ranking sites based on results from seven parameters, the site with the best water quality was located at Marsden Point and the site with the worst water quality was located in the Waiharohia Canal.

Of the parameters where default trigger values have been developed by ANZECC, the median value was within the recommended guideline for turbidity, dissolved oxygen (%) and enterococci at all sites.

Four sites had a median value that fell outside of the guideline value for faecal coliforms; all 16 sites had a median value outside of the guideline value for dissolved reactive phosphorus; 10 sites had a median that fell outside of the guideline value for total phosphorus; 13 sites had a median value that fell outside of the guideline value for nitrate-nitrite nitrogen; and nine sites had a median value that fell outside of the guideline value for ammonium.

Water temperatures were lower in Blacksmith Creek than One Tree Point, Snake Bank, Marsden Point or Mair Bank. Dissolved Oxygen concentrations were highest and the enterococci numbers were lowest in the harbour entrance.

Nutrients were present at the lowest concentrations at the Harbour entrance but some such as Dissolved Reactive Phosphorus exceeded Table 2 guideline values at all harbour sites.

2.5.1b Bream Bay Sites

MWH (2009) found nutrient levels are higher in winter and become depleted over summer. The principal cause of nutrient depletion is uptake by microalgae (phytoplankton and microphytobenthos), which reach their highest concentration in late winter and spring. Three sources of nutrient replenishment are identified, these being recycling from the seafloor, inputs from deep oceanic upwelling and inputs from terrestrial sources following freshes or floods in the Ruakaka River and other watercourses.

The results of this monitoring programme confirm that the Ruakaka River has a significant influence on the water quality of a large portion of Bream Bay at times of fresh or flood. Other watercourses discharging to upper Whangarei Harbour and Bream Bay will also contribute to changes in Bream Bay water quality in wet conditions.

2.5.2 Suspended Solids, Turbidity and Light Penetration

Water quality data that are of particular interest to this assessment are those relating to water clarity and suspended solids, as these can be potentially affected by dredging activities and the disposal of dredged materials. However, in some instances nutrient release from sedimentary pore waters related to the disturbance of benthic sediments may also be of concern during dredging activities.

Table 3 summarises the turbidity data generated by Tweddle et. al. (2011) for the Whangarei Harbour monitoring sites shown in Figure 5.

Harbour sites (from Tweddle et. al., 2011) that were of particular interest to this study were Marsden Point and Mair Bank which are in the Lower Harbour (see Figure 5).

The ANZECC (2000) default trigger values for turbidity in estuarine and marine environments are 0.5-10 NTU (note this is for south eastern Australia as there are no trigger values established for NZ). None of the sites had median values for turbidity that exceeded 10 NTU (see Table 2). The highest median values for turbidity (lowest water clarity) were found at sites close to freshwater inputs in the Mangapai River and the Hātea River.

Sites with the lowest median turbidity (highest water clarity) were located near the harbour entrance at One Tree Point, Blacksmith's Creek, Marsden Point and Mair Bank, where freshwater inflows are likely to have less influence on water quality. However, it is of interest that turbidity at Snake Bank ranged from 1.0 to 15.3 NTU.

Both turbidity and Secchi depth visibility are measures of water clarity. Table 4 summarises Secchi depth visibility at a number of Whangarei Harbour sites (Tweddle et. al. (2011).

Table 3: Turbidity (NTU) at 16 sites in Whāngārei Harbour, 2000-2010.

Site Name	No. of Samples	Range (NTU)	Median (NTU)	% of samples within guideline value (<10 NTU)
One Tree Point	25	0.5 – 5.7	1.0	100
Blacksmith's Creek	18	1.0 – 3.4	1.0	100
Marsden Point	38	0.4 – 6.6	1.0	100
Mair Bank	39	0.2 – 2.4	1.0	100
Snake Bank	18	1.0 – 15.3	2.1	94
Tamaterau	39	1.0 – 37.0	2.9	92
Town Basin	25	3.4 – 63.0	5.0	92
Onerahi	18	2.5 – 12.4	5.1	89
Lower Port Road	18	3.6 – 11.9	5.4	89
Kaiwaka Point	22	3.4 – 11.7	5.4	91
Kissing Point	50	2.8 – 92.0	5.4	94
Riverside Drive	18	3.4 – 11.1	5.7	94
Waiharohia Canal	18	3.4 – 13.2	6.6	83
Portland	18	4.0 – 18.1	7.4	78
Limeburners Creek	25	4.1 – 67.0	7.9	88
Mangapai	18	4.6 – 15.2	9.3	67

There are currently no ANZECC default trigger values for Secchi depth. A similar spatial trend to turbidity was observed, with the lowest median Secchi depths (lowest water clarity) found in the Hātea River and Mangapai River, and the highest median Secchi depths (highest water clarity) found near the harbour entrance.

Table 4: Secchi depth visibility in Whāngārei Harbour, 2000-2010.

Site Name	No. of Samples	Range (m)	Median (m)	% of samples within guideline value
Marsden Point	37	0.9 – 9.0	4.5	N/A
Blacksmith's Creek	15	1.6 – 6.0	4.0	N/A
Mair Bank	34	1.8 – 7.5	3.85	N/A
One Tree Point	24	2.0 – 6.3	3.8	N/A
Snake Bank	14	1.3 – 7.0	3.65	N/A
Tamaterau	33	0.3 – 4.7	2.4	N/A
Onerahi	17	0.9 – 2.2	1.5	N/A
Kaiwaka Point	18	0.47 – 1.8	1.4	N/A
Lower Port Road	17	0.8 – 1.7	1.3	N/A
Portland	17	0.6 – 2.1	1.3	N/A
Town Basin	18	0.5 – 1.9	1.23	N/A
Kissing Point	47	0.15 – 2.1	1.2	N/A
Waiharohia Canal	17	0.7 – 2.0	1.1	N/A
Riverside Drive	17	0.7 – 1.8	1.0	N/A
Limeburners Creek	21	0.3 – 2.2	1.0	N/A
Mangapai	17	0.2 – 1.5	0.9	N/A

Median Secchi disc values of 3.65 to 4.5 m for One Tree Point, Snake Bank, Blacksmith Creek, Marsden Point and Mair Bank represent good water clarity (>2.0 metres).

Water clarity can be reduced by the growth of phytoplankton and human activities that increase levels of suspended solids entering the coastal environment. High levels of material in the water column can restrict light transmission which affects the amount of photosynthesis (primary production) of aquatic plants and consequently other species that are dependent on them such as fish, zooplankton and shellfish.

Seaweeds and seagrass typically require more light for photosynthesis than phytoplankton and are particularly susceptible to reduced light levels resulting from suspended sediments by nature of being attached to the seabed (Thrush *et al.*, 2004). High concentrations of suspended sediments can also clog fish gills and reduce the ability of fish to see prey and detect predators (ANZECC, 2000).

MWH (2009) reported turbidity and suspended solids data for the lower Whangarei Harbour and Bream Bay between June 2008 and May 2009. Suspended solids and turbidity levels were elevated in the Ruakaka River (Site 9) but generally low at the harbour entrance and in offshore sites, although some variability was evident at most locations. During the heavy rainfall event of 16 June 2009, high suspended solids concentrations were recorded in the Ruakaka River and in the Bay, offshore and south of the river mouth. On that occasion, on the ebb tide, a clearly visible coloured and turbid plume extended from the river mouth out into the Bay and to the south. That plume would be expected to migrate to the north on the flood tide (MWH, 2009).

There was a poor correlation between turbidity and suspended solids concentrations for this data base (MWH, 2009). However, on the basis of turbidity reaching 23.7 NTU at Site 3 in December 2008, it appears that background levels of turbidity may occasionally exceed the ANZECC guideline of 10 NTU.

Stewart (2017) has analysed back up vibrocore samples from the dredging foortprint (see Section 4.1.1b) and has established there is a 1:1 relationship for Total Suspended Solids ($g.m^{-3}$) and Turbidity (NTU) when these bed materials are suspended in the water column.

This relationship is important for relating plume modelling data (based on suspended solids data) to the ANZECC (2000) default trigger values for turbidity in estuarine and marine environments.

2.5.3 Water Quality at Marsden Point and Mair Bank

Water quality at Marsden Point and Mair Bank between 2000 and 2010 in relation to Northland Coastal Water Quality Standards is summarised in Table 5 (Tweddle et. al., 2011).

Table 5: Water quality at Marsden Point and Mair Bank (Tweddle et. al. (2011) in relation to coastal water quality standards CA (Northland Regional Council, 2004).

Parameter and standard	Marsden Point: Median (range)	Mair Bank: Median (range)
Turbidity <10 NTU	1.0 (0.4 – 6.6)	1.0 (0.2 – 2.45)
Dissolved oxygen >80% saturation	96.8 (80.9 – 137.2)	98.1 (81.2 – 135.5)
Enterococci <140/100mL	5 (1 – 31)	5 (1 – 42)
Faecal Coliforms <14/100ml	1 (1 – 20)	1 (1 – 68)
Total Phosphorus <0.03 mg/L	0.015 (0.005 – 0.03)	0.014 (0.005 – 0.032)
Dissolved Reactive P 0.01 mg/L	0.008 (0.005 – 0.015)	0.007 (0.005 – 0.028)
Nitrate nitrogen <0.015 mg/L	0.015 (0.001 – 0.057)	0.017 (0.001 – 0.050)
Ammonium (<0.015 mg/l)	0.005 (0.005 – 0.36)	0.005 (0.005 – 0.37)

Turbidity records at both Marsden Point and Mair Bank were fully compliant with < 10 Nephelometric Turbidity Units during this sampling period.

Dissolved oxygen saturation was also fully compliant with CA water quality standard of > 80% saturation.

Enterococci counts were all <140 cfu per 100ml, with 98% and 97% compliance with the Faecal Coliform standard of <14 cfu per 100ml for CA water quality.

Marsden Point samples were 100% compliant with the Total Phosphorus threshold of 0.03 milligrams per litre. Mair Bank samples were 87% compliant with the Total Phosphorus threshold of 0.03 milligrams per litre. Dissolved Reactive Phosphorus concentrations at Marsden Point were 65% compliant with a CA water quality standard of 0.01 mg/l compared to 73% of samples at Mair Bank.

Compliance with a CA water quality standard of 0.015 mg/l for Nitrate Nitrogen was 50% for Marsden Point samples and 46% for Mair Bank samples.

Compliance with a CA water quality standard of 0.015 mg/l for Ammonium Nitrogen was 89% for Marsden Point samples and 87% for Mair Bank samples.

2.5.4 Water Quality within Bream Bay

Specific water quality data for Bream Bay was provided by MWH (2009) to support the resource consent application by Whangarei District Council to discharge wastewater from the Ruakaka wastewater treatment plant via an offshore diffuser in Bream Bay. That data showed that freshwater inputs from the Ruakaka River can adversely impact water quality in Bream Bay during wet weather events, but generally the Bay is flushed with highly transparent oceanic water that may during winter and spring, support phytoplankton blooms.

2.6 Marine Community Structure

Golder (2010), Hay and Grant (2004), Kamo High School (2002), Kerr (2016A and 2016B), Kerr and Moretti (2012), Kerr and Grace (2006A, 2006B, 2016C, 2016D and 2016E), Morrison (2003) and West and Don (2015, 2016A and 2016B) have all described the high biodiversity of marine communities in Bream Bay and the Lower Whangarei Harbour.

2.6.1 Plankton

Plankton is a combination of phytoplankton, zooplankton, bacteria and dispersing larvae. Marine phytoplankton around the New Zealand shoreline includes some 620 species of diatom and 230 marine species dinoflagellates.

Phytoplankton provide nearly half of the earth’s atmospheric oxygen, they regulate carbon dioxide levels in the water and atmosphere and they are the founding organisms of aquatic food webs.

The distribution and quantity of phytoplankton depends on light penetration, the stability of water layers and the availability of nutrients. Around New Zealand there is usually a spring-time bloom of phytoplankton algae in surface waters. At this time, surface temperatures rise, sunlight hour’s increase and nutrients become abundant following winter cooling and the stirring action of storms. Phytoplankton grow and reproduce rapidly, doubling their population each day and sometimes reaching nuisance proportions. Increased growth may raise toxicity levels and deplete the water of oxygen. However, phytoplankton usually exhaust their nutrient supply before this happens. Phytoplankton numbers are generally kept in check by grazing zooplankton.

Zooplankton around the New Zealand shoreline include about 1,000 species of foraminifera and 150 species of radiolarian, but it is the copepods that form the most important link from phytoplankton to other animals in the food chain. Bacteria digest copepod faeces, and by doing so, release nutrients back into the water that help sustain the phytoplankton.

Within Bream Bay coastal waters nutrient levels are higher in winter and become depleted over summer. The principal cause of nutrient depletion is uptake by phytoplankton, which reach their highest concentration in late winter and spring. Three sources of nutrient replenishment are recycling from the seafloor, inputs from deep oceanic upwelling and inputs from terrestrial sources following freshes or floods in the Ruakaka River and other watercourses (MWH, 2009).

There is also ample evidence that extensive algae blooms within the study area might be directly related to oceanic upwelling driven by north-westerly wind stress MWH (2009).

A few phytoplankton species produce powerful toxins. In suitable conditions, they can grow and reproduce in great abundance, creating what is called a toxic bloom. They produce poisons that accumulate in the bodies of filter-feeding shellfish such as oysters, mussels, pipi and cockles. Usually the shellfish remain unaffected, but the fish, shore birds and marine mammals which eat them can be poisoned and die. In humans, they can cause paralysis, respiratory difficulty, memory loss or diarrhoea.

New Zealand has recorded four types of toxin, with at least 34 different species responsible. An extensive toxic algal bloom affected the north-east coast of the North Island during the summer of 1992-1993 and caused food poisoning to a large number of people (>100) who ate shellfish contaminated with the toxins (MacKenzie et al. 1995). The effects of the bloom extended from the Firth of Thames/Coromandel area to at least as far north as Bream Bay and Whangarei Harbour. Following this outbreak, shellfish toxins have been regularly monitored. It is becoming increasingly common for areas of the North Island coast and the Marlborough Sounds to close shellfish gathering during spring and summer.

Whangarei Harbour has a history of such issues which resulted in the Northland Regional Council imposing restrictions on dredging in Whangarei Harbour outside of winter months. The rationale for imposing dredging restriction in the harbour was that dredging during the summer “high risk period”, might lead to the generation of new blooms by re-suspending the resting cysts of the micro-algae that caused the problem in the water column.

Mackenzie (2009) undertook a risk evaluation of dredging and the potential for harmful algal bloom initiation in Whangarei Harbour, and recommended the seasonal restriction on dredging in Whangarei Harbour could be relaxed. The species that caused the 1992 – 1993 event has no known benthic resting cyst in its life cycle and there is nothing to suggest that toxic shellfish blooms will reoccur in the harbour as a result of earlier incidents.

In terms of monitoring marine plankton around the New Zealand coast, the traditional approach of using plankton nets or settling plankton from water samples for counting under an inverted microscope has now largely been replaced by Ocean colour data from the NASA Seaviewing Wide Field-of-view Sensor (SeaWiFS) being used to estimate chlorophyll a concentrations in sea water.

New Zealand northern subtropical and Tasman Sea waters have a classical cycle of spring and autumn chlorophyll blooms consistent with production being co-limited by nitrate and light. Subantarctic waters have a low-magnitude annual cycle of chlorophyll abundance that peaks in early autumn, consistent with production being predominantly limited by a combination of iron and light (Murphy et. al., 2001).

2.6.2 Benthos

These are the bottom-dwelling communities that will be adversely impacted by the dredging, disposal and navigation aid modification / construction activities described in Section 3. Fish, marine mammals and marine birds have the ability to avoid disturbance areas.

In addition to literature surveys (West and Don, 2015A; Coffey 2016B), the source of the novel benthic database generated on behalf of RNZ for this AEE is summarised in Table 6.

West and Don (2016A) described benthos, sediment particle size and sediment chemistry in three candidate disposal areas that have not progressed to the identification of the preferred disposal sites. That information is still useful in terms of describing adjacent soft bottom sites.

West and Don (2016B) have provided a detailed description of the existing marine ecology in the dredging footprint (benthos, sediment particle size and chemistry for surficial sediments). The sampling footprint used by West and Don (2016B) extended beyond the final Option 4.2 dredging footprint, particularly in the outer channel (see Figure 7).

Table 6: Source of ecological data (excluding marine mammals and birds) generated on behalf of RNZ that has been used for this Assessment of Environmental Effects.

		Work Undertaken / reported by:			
		Field Sampling	Benthic ID and Counts	Contaminant Testing	Particle Size Analysis
Dredging Footprint					
	Photoquadrats	West & Don 2016B			
	Grab & Dredge Samples	West & Don 2016B*	West & Don 2016B*	Hill Labs*	WU*
	Vibrocore Samples	Tonkin & Taylor 2016C		Hill Labs (App C)	WU (App C)
Disposal Area 1.2					
	Photoquadrats	Kerr & Grace 2016E			
	Diver Core Samples	Kerr & Grace 2016E**	Cawthron (App A1)	Hill Labs **	WU **
Reference Areas 1.2A and 1.2B					
	Photoquadrats	Kerr & Grace 201CE			
	Diver Core Samples	Kerr & Grace 2016C**	Cawthron (App A1)	Hill Labs**	WU **
Disposal Area 3.2					
	Photoquadrats	Kerr and Grace 2016D			
	Grab Samples	Cawthron	Cawthron (App A2)	Hill Labs (App B)	WU (App B)
Reference Areas 3.2A and 3.2B					
	Photoquadrats	Kerr and Grace 2016C			
	Grab Samples	Cawthron	Cawthron (App A2)	Hill Labs (App B)	WU (App B)
Adjacent Habitats: Soft Bottomed					
	Photoquadrats	Kerr & Ass. 2016A			
		Kerr & Ass. 2016B			
	Photoquadrats	West & Don 2016A			
	Grab & Dredge Samples	Kerr & Ass. 2016A***	Kerr & Ass. 2016A***		WU ***
		Kerr & Ass. 2016B^	Kerr & Ass. 2016B		WU ^
	Grab & Dredge Samples	West & Don 2016A^^	West & Don 2016A	Hill Labs^^	WU ^^
Adjacent Habitats: Hard-Bottomed					
	Photoquadrats	Kerr & Ass. 2016B	Kerr & Ass. 2016B		
		Kerr and Grace 2016D			
	Photoquadrats & Video	West & Don 2016B			

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The habitats adjacent to the dredging footprint were described in two phases. The first phase involved a preliminary qualitative description of 18 transects as shown in Figure 8 (Kerr and Grace 2016A). On the basis of that survey and a consideration of the sensitivity of adjacent habits to potential turbidity / sedimentation effects that could arise from proposed dredging activities, the specific sites shown in Figure 9 were quantitatively surveyed by Kerr and Associates (2016A).

The baseline description of hard bottom sampling sites was done by Kerr and Associates; sediment particle size was carried out by Waikato University and benthos in soft bottom core samples were identified and counted by the Cawthron Institute.

Figure 7: Overlay of Figures 2.2 and 2.3 of West and Don 2016B in relation to the final Dredging Footprint Option 4.2.

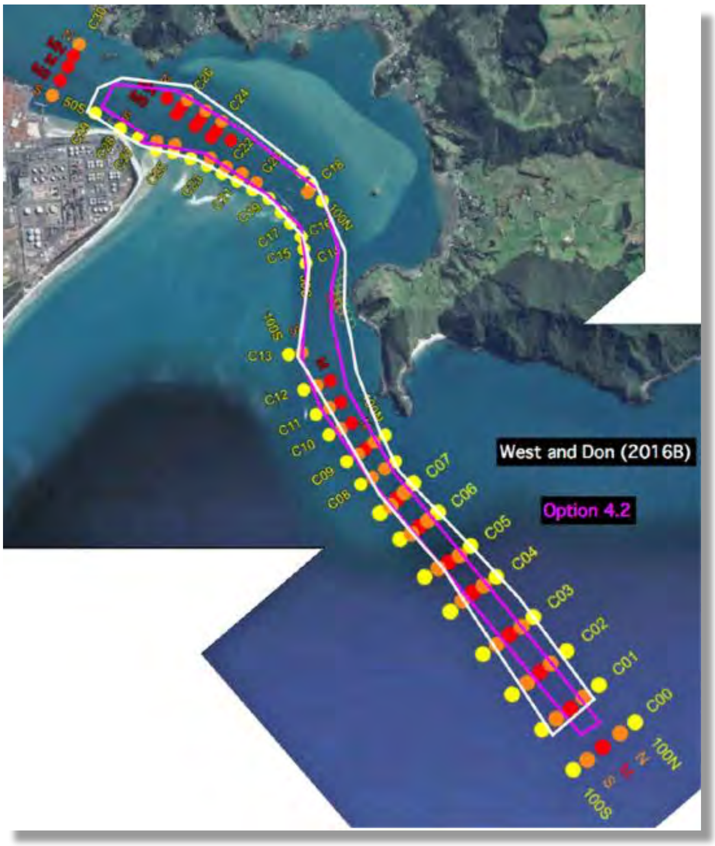
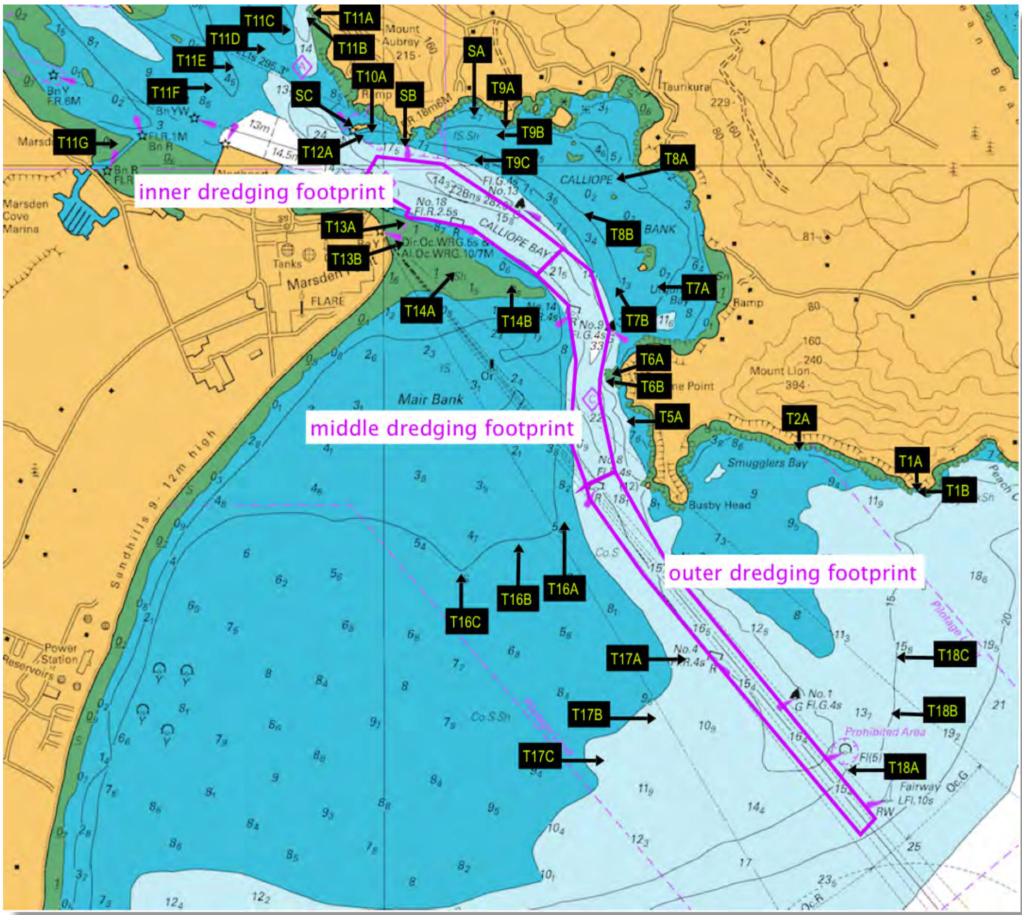


Figure 8: Locality of the 18 transects qualitatively described by Kerr and Grace (2016A) to select specific sampling sites for a baseline description of communities potentially affected by proposed dredging activities.

Figure 9: Sampling Localities for a Baseline Description of Habitats Adjacent to the Dredging Footprint that was undertaken by Kerr and Associates 2016A).



West and Don (2016B) also described 15 sites close to Home Point that are outside the dredging footprint.

The description of these foul ground sites now provides a baseline description of hard-bottom sites adjacent to the dredging footprint to complement those hard-bottom sites described by Kerr and Associates (2016A).

Kerr and Associates (2016D) have also provided reference photographs from the foul ground at 3-mile reef as shown in Figure 2.

Hard-bottom sites were non-destructively described with fixed photoquadrats.

Soft bottom communities have been described by a combination of photoquadrats within a particular sampling site (that have recorded surficial sediment texture and epibenthos) and five random sediment samples from which infauna has been sieved, identified and counted.

Where appropriate, additional soft bottom samples have been collected and analysed for sediment particle size and contamination status (see Table 6).

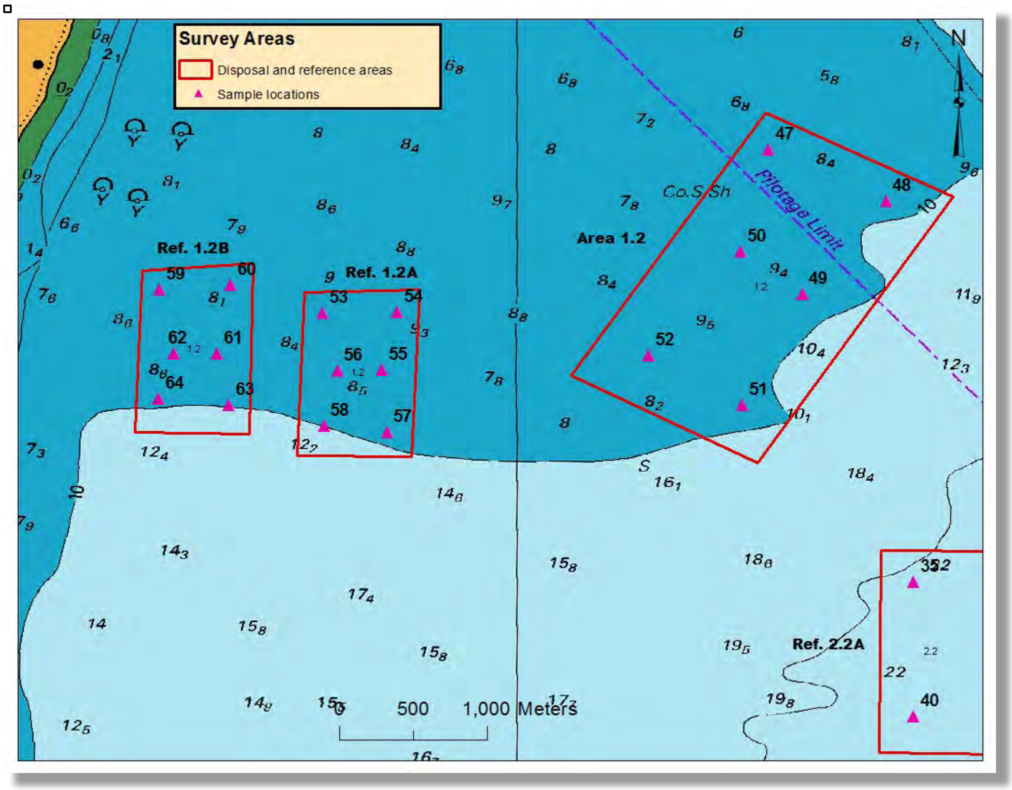
There is a great deal of supporting information, particularly photoquadrat and video records that has been obtained to benchmark baseline community structure and habitat types within the study area. This information is available to interested parties on request from Refining New Zealand.

A soft copy of the videos and photographs will be provided to the Northland Regional Council once the resource consent application for the project is lodged.

The underwater photography that had been produced by Bioresearches and Kerr and Associates is of a very high standard and will be used to monitor the effects of the dredging operation and the disposal of dredged material on hard shorelines where the same specific quadrats can be relocated and re-photographed in a time sequence.

In terms of offshore Disposal Area 1.2 for dredged material, Kerr and Grace (2016E) undertook the sampling for a baseline ecological survey and have reported on sediment particle size analysis and the contamination status of samples submitted to the Cawthron Institute for analysis (see Figure 10).

Figure 10: Sampling Sites 47 to 64 used by Kerr and Grace (2016C) to describe disposal site 1.2 and reference sites 1.2A and 1.2B within Bream Bay (see Figure 2). From Figure 2 of Kerr and Associates (2016C).



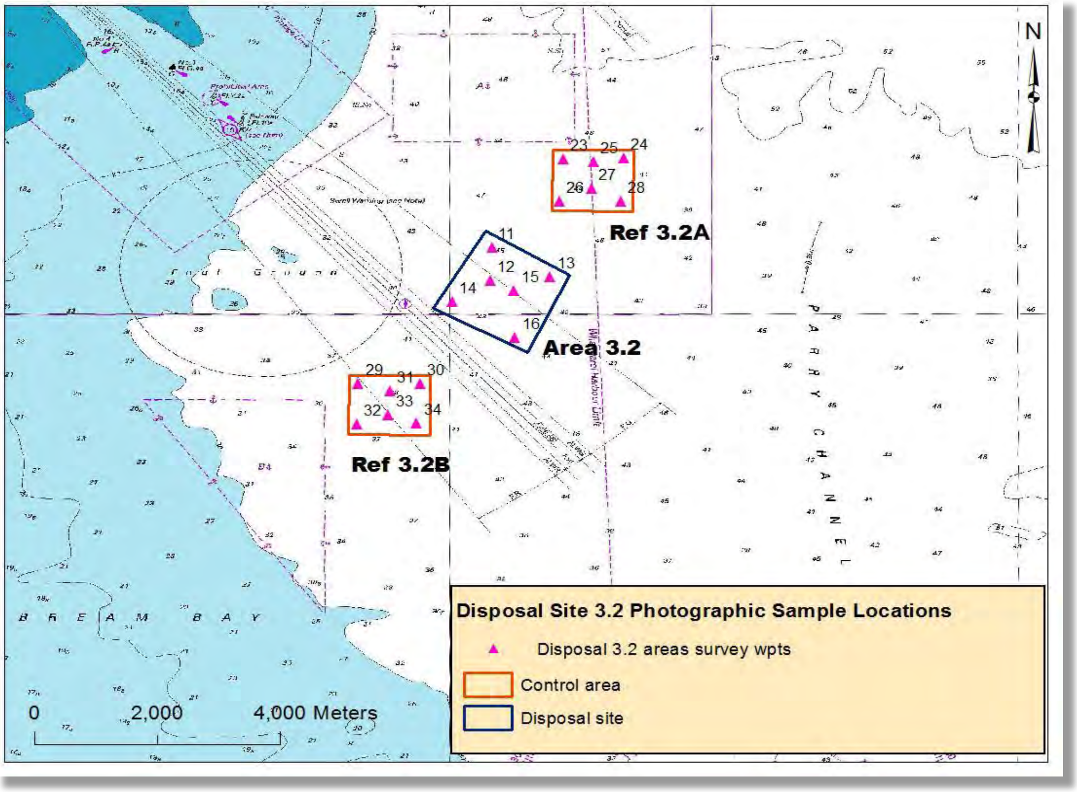
These results of benthic sample analyses (five replicates for each of samples 47 to 64) are attached as Appendix A1.

In terms of Disposal Area 3.2, Kerr and Grace (2016A) undertook a preliminary ecological assessment (sediment particle size and soft-bottom benthos) of the site in January 2016.

The Cawthron Institute then undertook a quantitative survey of Disposal Area 3.2 and Reference Sites 3.2A and 3.2B in early May 2016 (see Figure 11). Data they have provided on sediment particle size and the contamination status of sediments are summarised in Appendix B. Identification and counts of soft bottom benthos at the 18 sites shown in Figure 11 (five replicates per site) are summarised in Appendix A2. A comparison of the two disposal sites and reference sites is provided by Kerr and Associates (2016C).

Both the proposed dredging footprint and the footprint of Disposal Areas 2.1 and 3.2 are soft bottom areas of seabed that support a benthic community that is considered typical of the coastal environment off the north-east coast of the North Island.

Figure 11: Sites 11 to 16 (Area 3.2), 23 to 28 (Ref Area 3.2A) and 29 to 34 (Ref Area 3.2B) sampled by the Cawthron Institute within Bream Bay (see Figure 2). From Figure 2 of Kerr and Associates (2016D).



2.6.2a Open Sandy Beaches in Bream Bay

Crustacea of the open sandy beaches in Bream Bay include the sea-slater (*Scyphax ornatus*), common sandhopper (*Talorchestia quoyana*), isopods of the families Sphaeromidae and Eurydicidae, paddle crab (*Ovalipes catharus*), ghost shrimp (*Callianiassa filholi*) and mantis shrimp (*Squilla sp*.). The tuatua (*Paphies subtriangulata*) is the most common bivalve on this and other east coast beaches. (Kerr 2005).

2.6.2b Sub-Tidal Sand Flats in Bream Bay

Benthic communities through the subtidal sand flats in Bream Bay are generally dominated by sand dollars *(Fellaster zelandica),* the starfish *(Patiriella regularis)*, polychaete worms, hermit crabs *(Pagurus sp.)* flatfish, the morning star shell *(Tawera spissa),* the gastropod *Amalda depressa* and crabs *(Ovalipes catharus and Petrolisthes sp.),* together with *Circomphalus yatei, Dossinia subrosea, Pahies australis, Ostea sp., Sigapatella sp., Austrominius sp. and mysids* (Golder, 2010).

2.6.2c Disposal Area 1.2

Benthos within the shallower Disposal Area 1.2 (see Appendix A1) was dominated by nematodes, urchins (echiniodea), polychaetes (members of the Paraonidae, Syllidae), amphipods (including members of the Haustoridae and Phoxocephalidae), the isopod *Exosphaeroma sp*. and cumacea.

2.6.2d Disposal Area 3.2

Benthos within deeper Disposal Area 3.2 and its reference sites was dominated by nematodes, oligochaetes, polychaetes (the spionid *Spiophanes modestus*, the nereid *Nereididae sp. A*, the onuphid *Onuphis aucklandensis* and members of the Maldanidae, Paraonidae, Syllidae [including *Sphaerosyllis sp.*), amphipods (particularly members of the Phoxocephalidae), bryozoans and ostracods (see Appendix A2).

2.6.2e The Dredging Footprint

The fine sand habitat that was most common within the dredging footprint supported the most diverse benthos that was dominated by smaller biota such as polychaete worms and amphipods (West and Don, 2016B).

A coarse sand habitat that was present both seawards and inshore of Busby Head differed slightly in composition inshore compared to seawards. Seawards of Busby Head the biota was dominated by the bivalve *Tawera spissa* and the primitive chordate, *Epigonichthys hectori*. Inside the harbour mouth the coarse sand habitat was dominated by the community defining bivalve *Venerupis largillierti* and juvenile gastropods (West and Don, 2016B).

The shell gravel habitat had a higher proportion of larger species than the sandy habitats. The species composition was different from the sandy habitats with 36 taxa only found in the shell gravel habitat. The community defining bivalve *Tucetona laticostata* and the primitive chordate, *Epigonichthys hectori* were abundant in the shell gravel seaward of Home Point, but almost absent inside the harbour mouth. Inside the harbour mouth the shell gravel had greater numbers of the bivalves *Corbula zelandica* and *Venerupis largillierti* and juvenile gastropods. (West and Don, 2016A).

West and Don (2016A) concluded that no species of marine invertebrates or marine fish reported as present in the dredge area are listed as “Threatened” or “At Risk” and that the habitats within the proposed dredge area were not considered to be of national significance.

2.6.2f Soft-bottom communities in the lower Whangarei Harbour

Beds of pipi (*Paphies australis*), and cockle (*Austrovenus stutchburyi*) are present on intertidal and adjacent subtidal sandy substrates within the lower harbour and scallops (*Pecten novezealandiae*) are locally common in subtidal channels and in Bream Bay.

However, it is of some concern that benthic communities on Mair Bank have undergone significant recent changes, without a satisfactory explanation of cause and effect (Williams and Hume 2014).

The most recent study commissioned by RNZ is by Pawley (2016) who reported that:

- the bathymetry of Mair Bank appears to have changed since the 2010 and 2014 surveys. Mair Bank is no longer separated from neighbouring Marsden Bank by a channel, and the northern edge now extends further (compared to 2014). This view is supported by Williams and Hume (2014),
- both the total abundance and biomass of pipis have reduced significantly since his 2010 survey. The total population has declined from around 460 million (2010) to around 4.95 million individuals, and the 2016 estimate of absolute biomass, 44.7 t, is around only 1% of the 2010 estimate (4,450 t) and less than 1% of the 2005 estimate (10,542 t).

Between 1986 and 2010, the average commercial landings of pipi from Whangarei Harbour was 176.6 tonnes per annum (Report from the Fisheries Assessment Plenary, May 2014). It is now non-existent (Pawley, 2016). This report did not consider cockle populations.

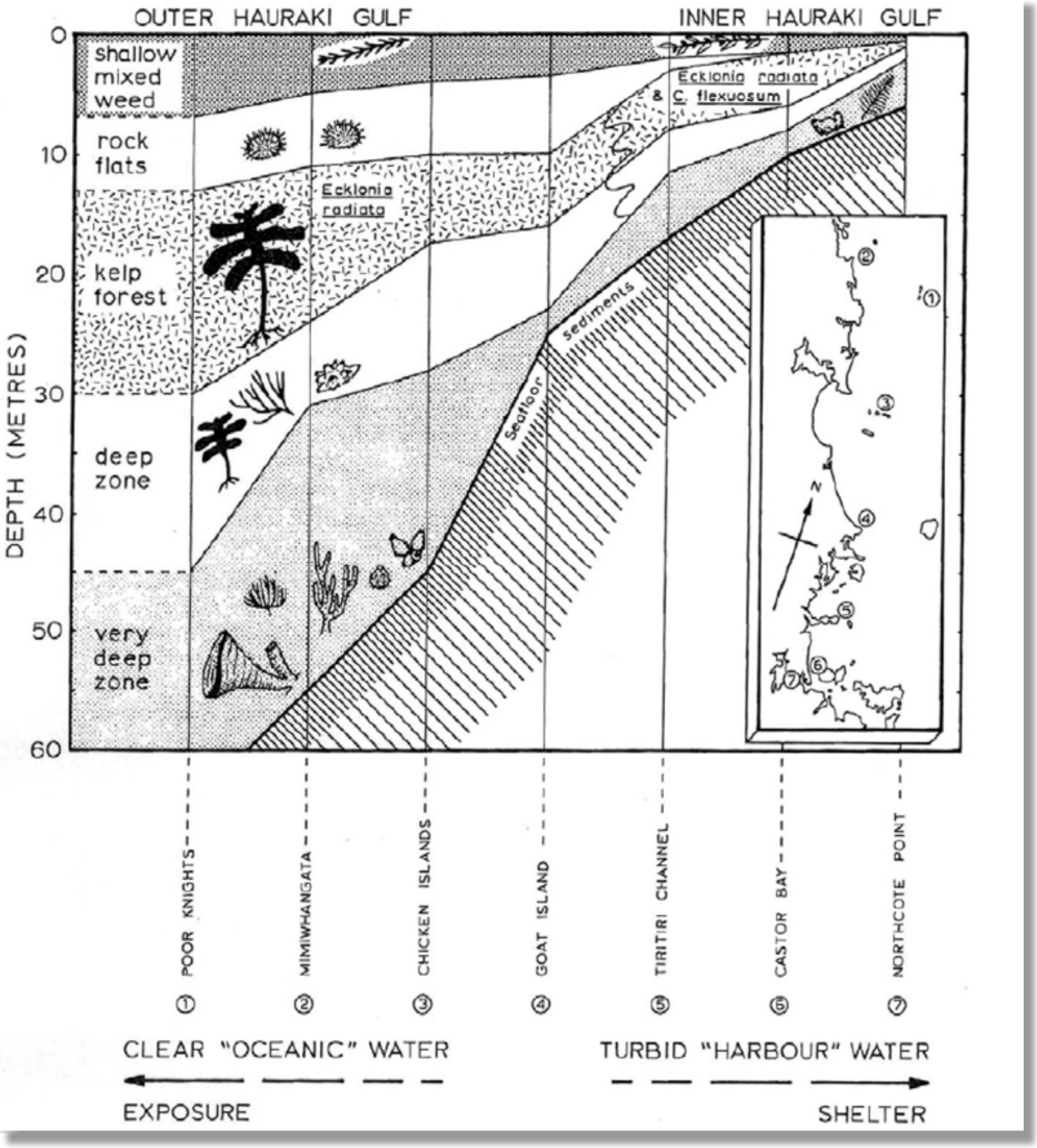
In recent years, an expanding bed of green-lipped mussels (*Perna canaliculus*) has established on Mair Bank (Pawley, 2016 and pers. comm. Riaan Elliot, Refining NZ).

Moreover, seagrass beds at One Tree Point are currently recovering from a former dieback event (NIWA, 2004, 2005), so it is important to benchmark these changes that are not associated with the proposed dredging programme.

2.6.2g Hard-shore habitat and submerged reefs within the study area

The zonation of hard shore communities between Darch Point and Bream Head (see Figure 8) have been characterised by Kerr (2005) and are consistent with generalised zonation of hard shores in the Hauraki Gulf (see Figure 12).

Figure 12: Generalised zonation on hard shores in the Hauraki Gulf (Kerr, 2005).



The sheltered rocky intertidal shore is characterised by zones of barnacles (*Chamaesipho columna*), rock oysters, *Pomatoceros* tubeworms, red algae (*Corallina* sp.) and brown algae Neptune's necklace (*Hormosira banksii*).

A range of mobile and attached invertebrates with adaptations to avoid desiccation (e.g. chitons, crabs and shellfish), remain in the intertidal zone as it is dewatered between high tides, whilst other mobile animals such as fish return to the intertidal zone on a rising tide.

The sublittoral fringe (at and immediately below low tide) consists of large brown algae (notably species of *Carpophyllum* and *Cystophora*) that are typically separated from submerged forests of tall-growing kelp by rock or kina flats.

The kelp forests are dominated by the attached brown alga *Ecklonia radiata*, whose canopy provides shelter for a wide range of fish and mobile / attached invertebrates.

Rock overhangs and caves are common throughout the rocky shore profile and the taxa that colonise these shaded habitats add to the diversity of the zones depicted in Figure 4.

Below the *Ecklonia* forest there are deep and very deep zones dominated by sponge gardens. Throughout the rocky profile a diverse range of fish and mobile and attached invertebrates can be found on and under the cover of seaweeds and within the deep sponge gardens.

Within more turbid harbour waters, kelp forests may only penetrate to a depth of 10 m, whereas on clearer, open coast, they can extend to a depth of 30 metres (see Figure 12).

MacDiarmid et. al., (2013) have nominated sensitive marine benthic habitats in New Zealand that include the kelp beds and sponge gardens featuring in Figure 12.

2.6.3 Fish

(Kerr and Moretti, 2012) report that the six most common fish in the Motukaroro Island, Whangarei Marine Reserve are goatfish (*Upeneichthys lineatus*), jack mackerel (*Trachurus novaezelandiae*), parore (*Girella tricuspidata*), spotty (*Notolabrus celidotus*), sweep (*Scorpis lineolatus*) and snapper (*Pagrus auratus*). This is also likely to be the case for other reefs within the study area.

Others include (Kerr and Moretti, 2012) banded wrasse (*Notolabrus fucicola*), blue maomao (*Scorpis violaceus*), butterfish (*Odax pullus)*, butterfly perch (*Caesioperca lepidoptera*), conger eel (*Conger wilsoni*), demoiselle (*Chromis dispilus*), eagle ray (*Myliobatis tenuicaudatus*), John dory (*Zeus faber*), kahawai (*Arripis trutta*), kelpfish (*Chironemus marmoratus*), kingfish *(Seriola grandis)*, koheru (*Decapterus koheru*), leatherjacket (*Parika scaber*), black pipefish (*Stigmatopora nigra)*, parore (*Girella tricuspidata*), piper (*Hyporhamphus ihi*), red moki (*Cheilodactylus spectabilis*), scarlet wrasse (*Pseudolabrus miles*), short-tail stingray (*Dasyatis brevicaudata*) and silver drummer (*Kyphosus sydneyanus*).

Blue mackerel *(Scomber australasicus)*, yellow-eyed mullet *(Aldrichetta forstefl),* grey mullet *(Mugil cephalus), (Pseudocaranx dentex)*, butterfly perch (*Caesioperca lepidoptera*) and marblefish (*Aplodactylus arctidens*) are also caught along the coast and within the Whangarei Harbour (Fisher & Bradford 1998, Mason & Ritchie 1979).

A number of subtropical species present at the Hen and Chickens Islands also occur around Bream Head (the nearest mainland point), such as half-banded perch (*Hypoplectodes* sp.), single-spot demoiselle (*Chromis hypsilepis*), red pigfish (*Bodianus unimaculatus*) and *Coris sandageri*, the Sandager's wrasse (per. obs).

Flounder are known to be in Whangarei Harbour (pers. obs.) and eels and whitebait migrate through the harbour to freshwater streams.

Northland Regional Council has recently sponsored a "fish ladder"' in a culvert under Whangarei's Western Hills bypass to enable native fish access to the Kirikiri Stream from Whangarei Harbour for example (Scoop Regional Independent News, 25 August, 2015).

It is expected that pelagic fish in general (but not shellfish) have the ability to avoid potential disturbance activities that are described in Section 3. However, epibenthic taxa such as flounder and goatfish maybe more likely to be smothered by dredged material being placed at the nominated disposal sites.

2.6.4 Marine Birds

Marine Birds have been described by Don (2015 and 2016) and a separate avifauna report is to accompany the resource consent application that is lodged by Refining NZ. As a consequence, marine birds are not addressed further in this report.

2.6.5 Marine Mammals

The impacts of marine dredging activities on marine mammals have recently been reviewed by Todd et. al. (2014) and are the subject of a stand-alone report by Clement and Elvines (2016).

Therefore, marine mammals will not be considered further in this report.

2.6.6 Noise

Pine and Styles (2015) and Styles (2017) have provided a separate airborne and underwater acoustic assessment for the Whangarei Harbour Entrance and Marsden Point.

Therefore, noise and the effects of noise on wildlife will not be considered in this report.

2.7 Recreational and Commercial Harvesting of Marine Resources

The Bream Bay coastline (Northland Regional Council, 2004) is an important commercial and recreational fishing / diving area, with the main target species including kahawai (*Arripis trutta*), kingfish (*Seriola grandis*), snapper (*Pagrus auratus),* lobsters (*Jasus edwardsii* and *J. verreauxi*) and scallops (*Pecten novaezelandiae*).

Other shellfish are also harvested along the Bream Bay coastline (MWH, 2009), in estuaries and within Whangarei Harbour. These populations include cockles, pipis, tuatua, paua and various oyster species. However, as noted in in Section 2.6.2.f, in terms of commercial shellfish harvesting, the pipi resource at Mair bank has been depleted in recent years and was effectively non-existent as of 2016 (Pawley, 2016).

Reference to Greenaway (2015 – Section 4.2) shows the access channel and the major disposal area for dredged spoil are within an area of high recreational boat usage area in Bream Bay and Whangarei Harbour.

Recreational matters are being addressed by Rob Greenaway and will not be considered further in this report.

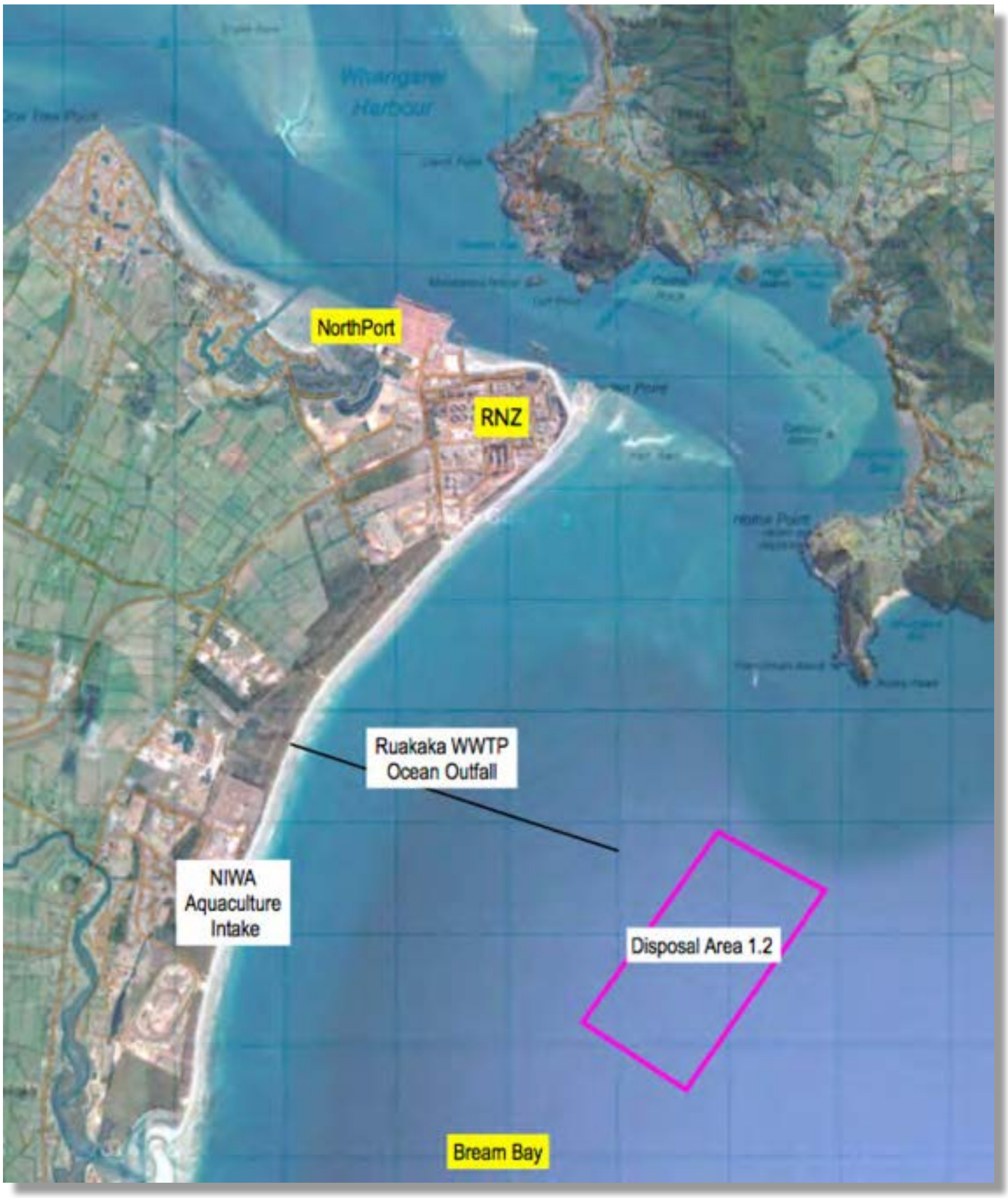
Commercial fishing is to be addressed by Rick Boyd and will also not be considered further in this report.

2.8 Other Uses, Discharges and Disturbance Activities

There are a number of other uses, discharges and disturbance activities within the Study Area that are not associated with the proposed RNZ dredging activities.

It is important that the effects of the RNZ dredging programme are described separately from the effects of the following existing and / or proposed uses of the area (see Figure 13).

Figure 13: Locality Diagram for other uses, discharges/disturbance activities in the Study Area.



In addition, the potential for cumulative effects to arise as a result of activities by any of these third parties occurring in conjunction with the proposed RNZ dredging have been considered.

2.8.1: Northport Limited

The adjacent deep-water cargo port facility at Northport (see Figure 13) is also associated with large vessel movements, stormwater discharges and consent provisions for maintenance dredging activities.

The principal cargos that are handled at Northport are *Pinus radiata* logs, wood chips, phosphate rock, cement clinker and packaged cargos.

Sweeny (2015) reported that, with the exception of two out of seven occasions during 2014 and 2015 when total suspended solids exceeded 50 $g.m^{-3}$, and an unexpected spike in aluminium concentrations in the stormwater discharge from Northport to the lower Whangarei Harbour, all conditions of consent were currently being met. This was supported by a

Stormwater Discharge Review for Northport Ltd by Poynter and Kane (2015) that was attached as Appendix V to the Northport stormwater monitoring report for 2014 / 2015.

There are also maintenance dredging provisions for the Northport deep water cargo port to maintain a working depth of 14.5 m for the facility (Coastal Permit No. 2).

During pre-lodgement consultation undertaken by RNZ, concerns were raised regarding potential tannin and resin acid discharges to the harbour from the Northport Stormwater treatment system (sourced from open storage areas for logs and wood chips). It was suggested that if these materials had accumulated in the seabed that would be disturbed by the proposed RNZ dredging programme, there was the potential for them to be remobilised in the water column as a result of dredging activities.

Resin acids and tannins are compounds which occur naturally in wood. These materials, on release to aquatic environments, have been reported to cause toxicity in some biota. Most toxicity has been reported in relation to freshwater fish and resin acids, and is best documented for salmonid species (e.g. *Salmo gairdneri* and *Oncorhynchus mykiss*) in lakes and rivers.

Poynter and Kane (2015) have provided a review on this matter for the 2014 / 2015 stormwater monitoring report for Northport Limited (Sweeny, 2015). Poynter and Kane (2015) report resin acids have not been measured in the port stormwater discharge. However, pond influent total resin acids have been measured and concentrations are low. For example, 0.19 $g.m^{-3}$ Total Resin Acids were present in a pond influent sample collected on 15/12/2014.

There is no ANZECC 2000 threshold for resin acids and no "*Action Value*" for total resin acids, therefore the pond influent sampling was undertaken only for trend analysis purposes.

Poynter and Kane (2015) considered concentrations of resin acids would be reduced to trace levels very quickly in close proximity to the Northport stormwater discharge and that resin acid toxicity is not considered to pose environmental concern for the Northport stormwater discharge. Poynter and Kane (2015) included a summary of a literature review they had undertaken on resin acid toxicity as Appendix E to their report to support their views.

Given these findings, resin acids and tannins were not analysed for in sediments to be disturbed by the proposed dredging programme and are not discussed further within this report.

Northport hold resource consents enabling the future extension of their facilities to include a new Berth 4 [NRC, 2004]. Whilst there is no indication as to when these extant consents may be implemented, the potential cumulative effects of further wharf extensions in conjunction with the Refining NZ dredging programme have been considered. From an ecological perspective, the key effect would be turbidity and sedimentation, particularly with regard to those more sensitive receiving environments, being the rocky reef habitats. Discharge limits conditions placed on the Northport resource consents, together with the proposed real-time monitoring, and response mechanisms, applying to the Refining NZ dredging proposal, are considered to be adequate to avoid, remedy or mitigate potentially adverse cumulative effects that could occur.

2.8.2: The Ruakaka Wastewater Treatment Plant (WWTP) Ocean Outfall.

An ocean outfall has been consented for the Ruakaka WWTP but it has yet to be constructed / commissioned (see Figure 13, and MWH, 2009). It was prudent therefore, to locate Disposal Area 1.2 at a non-interactive (0.5 km) distance from the planned diffuser for this outfall. This was done during revised phases of the project (Tonkin & Taylor, 2016B).

Accordingly, due to this separation distance, cumulative effects are unlikely to occur. Further, the Ruakaka WWTP is expected to result in different contaminants to the Refining NZ disposal operations, the latter expected to have only short-term effect on sedimentation.

2.8.3: NIWA Aquaculture Facility

A seawater supply and discharge is required at the NIWA Aquaculture Centre at the former Marsden B Power Station Site.

This facility is located to the south west of the Ruakaka WWTP and so is considered to be at a non-interactive distance (c. 3 km) from the proposed RNZ dredging and disposal site 1.2 for dredged material and is not considered further in this report.

2.9 Marine Sites of Special Scientific or Conservation Value

The Northland Regional Coastal Plan recognises four marine sites of special scientific or conservation value within and / adjacent to the Study Area (see Figure 3).

The first is the Motukaroro Island Whangarei Marine Reserve (established under the Marine Reserves Act 1971). This area is also zoned as the Reotahi[4] Marine 1 Management Area in the Regional Coastal Plan. The area was established as the Whangarei Marine Reserve for the purpose of preserving it in its natural state as the habitat of marine life for scientific study. The Reotahi Marine 1 Management Area zoning recognises the following values: protected areas, birds, ecosystems, habitat values. Marine reserve habitat features include high species diversity including subtropical species.

Two other areas (Calliope and Mair Bank Marine 1 Management Areas) are zoned in the Regional Coastal Plan on the basis of the following values: protected areas, ecosystems, birds, habitats, coastal landforms. The Plan records that inter-tidal areas provide internationally significant habitat for international migratory and NZ endemic wading and wetland birds, including threatened species.

The fourth area, (Busby Head) Marine 1 Management Area is zoned under the Regional Coastal Plan on the basis of the following values: protected areas, ecosystems, habitats. The Plan specifically records that rocky shore internationally significant habitat for NZ endemic wading and coastal birds, including threatened species.

The Marine 1 (Protection) Management Area is applied to those areas within Northland's coastal marine area identified as being Areas of Important Conservation Value. The priority in these areas is the protection of those significant described values specifically identified as occurring within each particular area.

The Calliope Bank, Mair Bank and Busby Head Marine 1 Management Areas are considered to be of regional significance. The Motukaroro Island Whangarei Marine Reserve is considered to be of national significance because it forms part of a national network of marine protected areas that have been created for scientific study.

Northland Regional Council has recently released its draft Northland Regional Plan (Northland Regional Council, 2016A). While the rules in the draft plan do not currently have legal effect, the three Marine 1 Management Areas of the northern side of the access channel would no longer be separate but would be part of a continuous “Significant Ecological Area” on the northern side of the harbour entrance and the Mair Bank Marine 1 Management Area on the south side of the heads would be enlarged (see Figure 14).

It is agreed that Castle Rock, High Island and other rocky points between Reotahi Bay and Busby Point should appropriately be included as significant ecological areas and that the northern shoreline of Bream Bay from Busby Point to Bream Head would quality for a similar status.

[4] Boundaries coincide with the Motukaroro Island Marine Reserve, as indicated in the Regional Coastal Plan Maps, map sheets A3, B25, C13.

Figure 14. Significant Ecological Area overlay proposed in the draft Northland Regional Plan at the entrance to Whangarei Harbour (compare and contrast with Figure 4).

"Significant Bird Areas" are part of a more extensive overlay area than Significant Marine Ecological Areas and include the sandy shoreline of Bream Bay (see Don, undated).

However, given the current ecological condition of Mair Bank where there has been a significant, recent population decrease for pipi and a recent proliferation of green-lipped mussels (Pawley, 2014; Pawley, 2016) without a satisfactory explanation of why such changes are occurring (Williams and Hume 2014), it is more difficult to justify an expansion of the Mair Bank site in terms of current ecological values.

These areas of elevated ecological significance can be grouped into two headings for the purposes of the NZ Coastal Policy Statement (Department of Conservation, 2010) ('NZCPS').

- First, are those areas falling within Policy 11(a) of the NZCPS, being: the marine reserve, kelp beds, and sponge gardens associated with the rocky reef habitats extending roughly from Motukaroro Island to Busby Point. These areas contain nationally significant examples of indigenous community types.
- Second are the remaining coastal areas which fall within Policy 11(b) of the NZCPS, including the channel, disposal areas, Calliope and Mair Banks, and Three Mile Reef.

In accordance with the NZCPS, within the areas covered by Policy 11(a) it is necessary to avoid all adverse effects of activities.

Within the areas covered by Policy 11(b) of the NZCPS, the requirement is to avoid significant effects, and to avoid, remedy or mitigate other effects of activities.

3.0 Description of Proposed Disturbance Activities

3.1 Introduction and Background

The Marsden Point Oil Refinery is located at Marsden Point and is the only oil refinery in New Zealand, making the refinery one of New Zealand's nationally strategic infrastructural assets. The oil refinery's location was chosen due to the deep water at Marsden Point, low risk of earthquakes, flat topography of the site and close proximity to large residential populations in the North Island (MWH, 2009).

Construction started in 1962, and the refinery was opened in 1964. An expansion between 1979 and 1981 included the installation of a hydrocracker and a 170-km long pipeline to Wiri in South Auckland. In 2005, the refinery undertook another expansion to allow for the de-sulphurising of diesel and removing of benzene from petrol to occur on site.

Another expansion of the refinery in 2009 increased the refinery's capacity by 15%, which equates to approximately 135,000 barrels per day or some 80% of all fuel products in New Zealand (MWH, 2009). A \$365 $x10^6$ CCR project to produce petrol at the plant has also been completed recently (McNeill, 2016).

Current deep-water access to Marsden Point from Bream Bay is via a natural tidal inlet that varies in depth from 15 to 32 metres (see Figure 2). This is adequate for vessels visiting the Northport log berth that requires 14.5 m clearance, and for smaller "Aframax" vessels visiting the refinery, but not for fully loaded "Suezmax" oil tankers that require a 16.6 m clearance.

Therefore, crude oil supply to the refinery is currently delivered by smaller fully-loaded "Aframax" ships and larger partially-loaded "Suezmax" ships.

Royal HaskoningDHV (2016C) and Tonkin & Taylor (2017A) have evaluated alternatives to dredging (primarily ship-to-ship transfer, and a single buoy mooring system), and a range of access channel alignments but only the preferred access footprint (Option 4.2) is considered and described in this report. The preferred dredging footprint (Option 4.2) avoids rock / boulder outcrops on the western side of Home Point that were evaluated by West and Don (2016A), so dredging activities would be restricted to soft-bottom communities that have been described by West and Don (2016A). Similarly, a range of disposal location options have been considered and evaluated (MetOcean Solutions, 2016B; Tonkin & Taylor, 2017A; West and Don, 2016B and Kerr and Grace, 2016E). Following refinement through the process of scoping the proposal, only the preferred options (Disposal Areas 1.2 and 3.2) are considered and described in this report (see Figure 2).

The anticipated capital dredge volume is a total of 3,638,000 m^3 (Royal HaskoningDHV, 2016C). This can be broken down into 610,000 m^3 (from the inner channel alignment), 57,000 m^3 (from the mid channel alignment) and 2,971,000 m^3 (from the outer channel alignment). The area or footprint of direct disturbance within the entrance channel (see Figures 2 and 4) involves a total area of 1.62 square kilometres. Up to 97.5% of capital dredgings would be disposed of in disposal area 3.2 (see Figure 2 and Tonkin % Taylor 2017A).

The average annual rate of sedimentation in the dredged footprint is assessed to be between 56,000 to 122,000 m^3 per annum (i.e. up to 4% of the capital dredge volume) with the main areas of focus expected to be the berth pocket and the outer section (Tonkin & Taylor, 2017A). Maintenance dredging may need to occur every 2 to 5 years in the berth pocket area and in targeted areas of the inner and mid channel to maintain navigable draft around the jetty dolphins. Assuming uniform distribution of sedimentation within the outer section, the 0.5 m sedimentation allowance could be reached within 5 to 20 years requiring a maintenance dredging campaign in this area (Tonkin & Taylor, 2017A).

Maintenance dredgings may be disposed of on land or in either of disposal areas 1.2 and / or 3.2 (Tonkin & Taylor 2017B). Tonkin and Taylor (2017A) consider the capital dredging programme is likely to last up to six months with maintenance dredging involving smaller vessels and a shorter time frame.

3.2 Dredge Type and Management

The dredge methodology is described in detail in the reports prepared by Tonkin & Taylor (2017C) and Royal HaskoningDHV (2016B) as part of this application. A brief summary is provided here.

Dredgers are generally hydraulic or mechanical. A hydraulic dredger delivers dredged material to the discharge site or to temporary storage (e.g. a hopper) in the form of a slurry (e.g. Trailing Suction Hopper Dredgers [TSHD] and Cutter Suction Dredgers [CSD]).

Trailing suction hopper dredgers are self-propelled ships with hoppers (dredged material storage internal to the hull). They have articulated dredging pipes, or “drag-arms”, that extend to the sea bottom. They dredge at low speeds while underway. The drag-head can be either passive or active. No additional power is applied to a passive head and material to be excavated is scoured by hydraulic flow induced by the suction at the drag-head. An active drag-head uses power to drive cutting teeth or high-pressure water jets to excavate the material and to aid in forming a solid/water slurry.

Cutter Suction Dredgers are stationary hydraulic dredgers that use centrifugal pumps to produce the flow required to mobilise and transport dredged material.

A mechanical dredger collects dredged material in a bucket or grab and then places it directly into the discharge site or into a temporary storage device for transport to a discharge site. Alternatively, the temporary storage device can remain on site and the dredged material is re-handled (e.g. pumped through a pipeline or transported away using a truck or a barge). An example of a mechanical dredger is a Backhoe Dredger (BHD).

A Backhoe Dredger is generally an excavator mounted on a dredging pontoon and is suitable for dredging soils made of an unconsolidated, heterogeneous mixture of clay, sand, pebbles, cobble and boulders. They can also handle fragmented or soft rock. To ensure stability and counter the large digging forces of the BHD, the pontoon is anchored and its position maintained by spud poles.

A dredging operation involves four phases: excavation, lifting, transportation and placement.

- Excavation is the physical removal of sediment from the seabed and can be done using hydraulic forces and/or mechanical forces.
- Lifting is the vertical transport of the dredged material from the seabed to the water surface and can be achieved using hydraulic or mechanical means.
- Transportation is the process of transferring the dredged material from the excavation site to the placement site.
- Placement of the dredged material at a designated site involves disposal of dredged material at an underwater or onshore location.

There are also a range of ancillary vessels that are required to support a dredging operation. These include:

- survey vessels to complete hydrographic survey of the dredged areas. These are typically small craft (around 9 to 11 m in length) and will be present within the vicinity of the project area (channel and disposal areas) for the project duration,
- a crew boat for the transfer of project staff between the dredger and shore. This typically is a small launch 8 to 15 m in length averaging 4 trips per day, and
- a tug for towing the bottom dump barge to the disposal location that could make two trips per day.

All support vessels will generally sail within the shipping channel, but due to the shallower draft of these vessels they can go outside the channel if shipping traffic is present.

Royal HaskoningDHV (2016B) conclude preferred dredging methodology is to use a TSHD for mid and outer dredging footprint and a BHD for the berth pocket (inner dredging footprint).

With regard to the capital dredging programme, Tonkin and Taylor (2017A) advise as follows:

- The TSHD dredging operation would be up to 24 hours per day, seven days per week whereas the BHD dredging operation within the berthing area would only occur during daylight hours, seven days per week, subject to any noise restrictions.
- The majority of capital dredging (up to 97.5%) could be placed within Disposal Area 3-2. The area of placement is 2.5 km^2 with a maximum area of 5.75 km^2 defining the outer boundary of where placed sediment may settle. This area is situated around 45 m below Chart Datum to the south east of the channel. Disposal Area 3.2 has been sized to enable all capital and maintenance dredging to be placed within the area for the maximum duration of the consent period allowed (35 years). The average height of the placement mound after the capital dredging campaign would be 1.5 m with a maximum height of less than 2.5 m. The average height after 35 years assuming the majority of maintenance dredging is placed in this area would be less than 4 metres.
- Some sediment (2.5 to 5%) will be placed in the nearshore Area 1-2, a 2.5 km^2 area of seabed situated on the southern end of the ebb tidal delta in water depth of between 7 and 15 m Chart Datum. Disposal Area 1.2 is designed to enable placed sediment to be slowly transported landward during higher energy wave events to maintain sediment volumes on the ebb delta. It is also sufficiently large to enable different locations to be targeted for the placement of maintenance dredging. If the dredged sediment is placed uniformly in this area the average depth would be around 0.06 m. However, it is more likely that there would be a smaller area targeted within this larger area during each campaign, with average placement depths of around 0.6 m (i.e. covering an area of around or 10% of the total placement area).
- Both marine disposal areas comprise sand of a similar composition to the channel area to be dredged.
- Land based locations may also be used to dispose of some of the capital dredging although this will only be undertaken where there is a demand by others, and they have the necessary environmental authorisations (including resource consents) in place to enable the use. Given that any land-based options will be authorised via other processes, they are not considered further in this report.
- When the TSHD reaches the marine disposal area it reduces speed and manoeuvres itself via GPS to the allocated area where the load can be discharged. When the vessel is at the correct location the dredge-master opens the bottom doors and the sediment drops out of the hopper.
- The BHD is likely to be required for dredging around the berthing area and is not expected to be used for the main dredging activity. The dredged material would either be placed in a barge for marine disposal or transported for land based disposal.

4.0 Assessment of Environmental Effects of Proposed Disturbance Activities

4.1 Area affected by capital dredging and disposal

The capital dredging programme proposed would displace benthos from 1.62 km^2 of seabed within the entrance channel and the disposal of dredged spoil would bury benthos in 2.5 km^2 of Disposal Area 3.2. (Tonkin & Taylor, 2017A). In terms of disposal area 1.2, only 10% of the area (0.25 km^2) is expected to be used for capital dredging, hence benthos will be displaced from a total area of 4.37 km^2 of seabed as a result of the capital dredging programme.

4.1.1 Prediction of Seabed Effects

4.1.1a Bathymetry and Topography

Tonkin and Taylor (2017A) illustrate the change in bathymetry for the dredging footprint as a result of capital dredging in their Figure 2-1 (Channel design depths for Option 4-2, 98% access channel - Source: RHDHV, 2016B).

Tonkin and Taylor (2016D) expect the peak depth within Disposal Area 3.2 to reduce by up to 4 m (10% of existing) as a result of the disposal of dredged material at that site. On average, the expected mound height (and therefore depth reduction) in Area 3.2 would be 1.5 metres.

MetOcean Solutions (2016B) expect a less than minor difference in tides, currents or wave heights as a result of this change and in the medium to long term the mound will be expected to reduce (depending on the volume and frequency at which additional maintenance dredgings are added to the site).

The specific detail of the size and shape of mounds of dredged material is currently intended to be left to detailed design and tendering. In any event, post placement effects of the sorting of dredged materials placed within Disposal Areas 1.2 and 3.2 (due to water currents generated by wind and wave action) are not expected to interfere with the rate or succession of benthic taxa that recolonise these disturbed areas.

As a consequence, the changes to the bathymetry and topography are not expected to cause any adverse effects on the marine ecology adjacent to the disturbed areas.

4.1.1b Sediment Texture and Contaminants

Surficial sediment texture and heavy metal content were sampled and described in all three proposed disturbance areas and four reference sites (West and Don, 2016B; Appendix B, Kerr and Grace 2016B, Kerr and Grace, 2016C – see Figure 2).

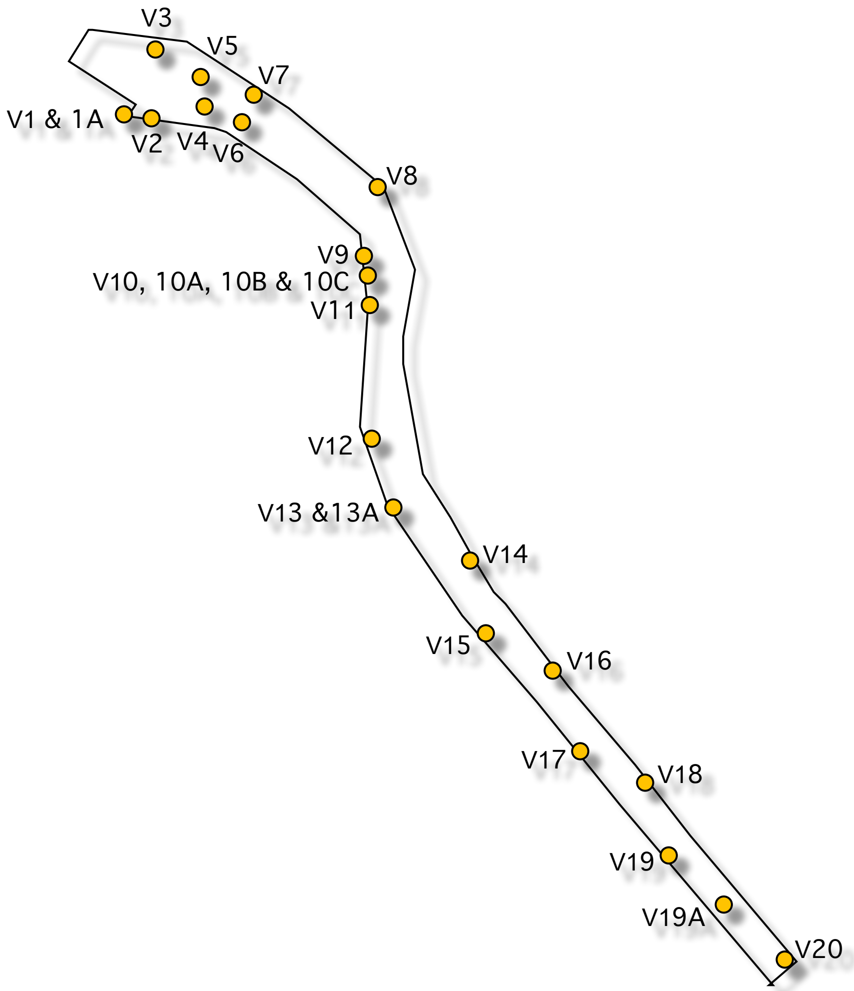
West and Don, 2016B also analysed surficial sediment samples from the dredging footprint for a comprehensive suite of organic materials (antifouling cobiocides, haloethers in SVOC, nitrogen containing compounds in SVOC, organochlorine pesticides in SVOC, other compounds in SVOC, other halogenated compounds in SVOC, phenols in SVOC, plasticisers in SVOC, polycyclic aromatic hydrocarbons in SVOC and total hydrocarbons).

Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc were used as proxys or "indicators" for potential contamination of soft-bottom seabed sediments that would be disturbed by the disposal of dredged materials at disposal sites 1.2 and 3.2.

In a separate sampling exercise, Tonkin and Taylor (2017A) collected and analysed 26 depth-integrated vibrocores from the dredging footprint to describe sediment texture and contamination status through the profile of materials that would be dredged (see Figure 15).

Tonkin and Taylor (2017A) have considered sediment particle size distribution at the three disturbance areas and concluded "*Both marine disposal areas comprise sand sediments of a similar composition to the area to be dredged*" and hence the traditional objective of placing "like on like" would be achieved with the proposed dredging and relocation of dredged material.

Figure 15: Location of Vibrocore samples in relation to Dredging Footprint Option 4.2 (see Figure 3).



West and Don (2016B) concluded "*sediment chemistry and particle size were assessed at all sites to ascertain the risk associated with the disturbance of this material during dredging. The chemistry results were compared against the ANZECC interim sediment quality guidelines (where available). None of the surface sediment samples exceeded the ANZECC ISQG Low values with the exception of Fluoranthene, Phenanthrene and Pyrene at site C26S. This minor exceedance at one site suggests that no adverse effects are expected to occur from the redistribution of sediments during dredging or from the disposal of the dredge spoil at a nearby marine disposal site*".

Sampling site C26S is immediately south of the Option 4.2 dredging footprint (see Figure 7) but it is reasonable to assume that whilst Fluoranthene, Phenanthrene and Pyrene may be present in the inner basin sediments, they are not considered to be present at ecologically significant concentrations.

No potentially contaminated sediment was sampled within the surficial footprints of Disposal Areas 1.2, 1.2A or 1.2B (Kerr and Grace, 2016C) or within the surficial footprints of Disposal Areas 3.2, 3.2A or 3.2B (see Appendix B).

The sediment guidelines listed in Table 7 were approached for Nickel (20 v 21 mg/kg dry weight) in Vibrocore Sample V19A 0 – 0.5 m depth (see Appendix C1) and in the case of Vibrocore Sample V20 0 – 0.5 m depth (see Appendix C1) the Effects Range-Low was exceeded for Chromium (210 mg/kg dry weight) and Effects Range-High was exceeded for Nickel (123 mg/kg/dry weight).

Table 7: Thresholds of potential concern for heavy metals (ANZECC, 2000).

		Sediment Guideline Effects Range-Low	Sediment Guideline Effects Range-High
Total Recoverable Arsenic	mg/kg dry wt.	20	70
Total Recoverable Cadmium	mg/kg dry wt.	1.5	10
Total Recoverable Chromium	mg/kg dry wt.	80	370
Total Recoverable Copper	mg/kg dry wt.	65	270
Total Recoverable Lead	mg/kg dry wt.	50	220
Total Recoverable Mercury	mg/kg dry wt.	0.15	1
Total Recoverable Nickel	mg/kg dry wt.	21	52
Total Recoverable Zinc	mg/kg dry wt.	200	410

On this basis, back up samples for both V19A (0-0.5 m depth) and V20 (0-0.5 m depth) were submitted for elutriate testing (using seawater collected from Bream Bay) and a full range of organic analyses. Elutriate testing provides a better indication of what contaminants are biologically –available than standard chemical tests.

Reference to Appendix C2 (for V19A) and C3 (for V20) show all organic materials tested for were not detectable in either sample.

Chromium and Nickel were not detectable in the elutriate for Sample V19 and for Sample V20, total Chromium was < 0.0011 g.m^{-3} in the elutriate sample and total Nickel was 0.014 g.m^{-3} in the elutriate sample.

Given the results of the follow up elutriate testing that was conducted on samples from Vibrocore Sites V19A and V20, it was concluded that there are no issues with the potential contamination status of material to be disposed of from the proposed dredging footprint.

Overall therefore, no adverse contamination effects are anticipated, and the sediment sizes of the dredged material and that existing at the disposal sites are compatible.

As noted in Section 2.5.1, in terms of the Section 31.4.13(v) of the Regional Coastal Plan and Chapter 19 of the Regional Coastal Plan (Northland Regional Council, 2004), humans are not expected to come into contact with sediment plumes that might be generated by proposed disturbance activities and survey and analytical results presented in this AEE, provide reassurance that seabed materials that are to be relocated from the access channel to the two nominated disposal sites are not contaminated with toxic metals or potentially toxic organic materials (Maritime Safety Authority of New Zealand, 1999).

4.1.1c Sediment Transport

Black (1983) reported sediment transport occurs in a northerly direction in Bream Bay towards Mair Bank then out of Whangarei Harbour via the main channel.

Tonkin & Taylor (2017B) have recognised the benefit of placing dredged material within Disposal Area 1.2 as sediment transport to the north would nourish sediment supply to Mair Bank that is currently undergoing morphological changes (Pawley, 2016).

There are no adverse ecological effects associated with sediment transport that occurs as a consequence of sediment being placed in Disposal Area 1.2. Such transport is a naturally occurring process that existing communities are adapted to.

4.1.2 Prediction of Water Column Effects

4.1.2a Sediment Plumes

MetOcean Solutions (2016B) have gathered data on tides, waves and currents within the study area and have modelled expected sediment plumes under a range of conditions for both the winning and disposal of dredged material.

Potential sediment plume effects within the dredging footprint between Home Point and the Motukaroro Island Whangarei Marine Reserve are of greater concern than in the outer dredging footprint and at the two disposal areas. This is because the dredging footprint is immediately adjacent to hard-bottom habitat between Home Point and the Motukaroro Island Whangarei Marine Reserve, but the outer dredging footprint is surrounded by a less sensitive (soft-bottomed) receiving environment.

MetOcean Solutions (2016B) found that currents in the dredging footprint between Home Point and the Motukaroro Island Marine Reserve, are such that plumes will largely be confined to the deepest part of the channel with limited lateral dispersion into adjacent areas.

Tonkin & Taylor (2017A) consider the presence of predominantly medium and fine sands with low silt contents (less than 6%) that are to be dredged, significantly reduces the extent of turbid plumes during dredging and placement of sediment in the disposal areas. On that basis, they predict sediment plumes and overspill from the TSHD whilst winning dredged spoil will be manageable. This opinion has been supported by plume testing conducted by Brian Stewart of Ryder Consulting Limited and video monitoring of dredging around the dolphins at the Marsden Point Wharf.

In order to understand the potential ecological effects, there is a need to focus on overspill (return of decant water from the hopper) from a Trailing Suction Hopper Dredge adjacent to Marine 1 Management Areas (see Figure 4).

A conservative standard that the turbidity of plumes that enter the Marine 1 Management Areas should not exceed a level 2 threshold of 20 $g.m^{-3}$ / NTUs (or revisions thereof), see Table 8) is proposed to safeguard their nominated values (see Section 5.2). The achievement of these guideline values should ensure that the habitats and species with the areas adjacent to the dredging do not experience adverse effects.

Given the low organic matter content of the sands to be relocated (Appendix C), no water quality issues such as dissolved oxygen sags are expected to be associated with sediment plumes that are associated with winning and disposing of dredged material.

In this regard, West and Don (2016B) commented:

> "*higher percentages of very fine sands and silts will likely result in greater plumes of sediment discoloured water at the point of dredging and at the disposal site. In addition, there would be greater spread of fine sediments which could potentially smother some habitats, resulting in loss of or changes in biota. The proportion of very fine sand and silt is generally very low in the surface sediments in the proposed dredge area. The proportion of very fine sand is highest at the furthest extent offshore of the proposed dredge area (C01) and beyond (C00). Silt was only detected in abundance at two sites; C11M, mid channel adjacent to Frenchman Island. Both samples up and downstream from this site were considerably coarser, suggesting the sample was anomalous or the result or some peculiarity in the currents in this area. Similarly, silt was detected at site HP01 in the small bay between Home Point and Busby Head. Current flow data provided by Ocean Currents Ltd. (2015) showed that a counter current (eddy) is formed in this area on both the rising and falling tides; thus the deposition of silts is natura*l".

The soft-bottom taxa within and adjacent to the Disposal Sites for dredged material are less sensitive to sedimentation effects than the hard-bottom communities surrounding the dredging footprint (Coffey, 2016A) and the special communities such as *Sabella* fan worm monitoring site described by Kerr and Associates (2016A).

Nevertheless, it is intended to restrict sedimentation effects to the nominated footprint at each of the disposal areas.

Following the initial placement of dredged material within either of the disposal areas, there will be subsequent movement / transport of that material on the seabed, albeit on a lesser scale than during the initial placement phase (as modelled by MetOcean Solutions, 2016B). This is particularly the case at Disposal Area 1.2 where longshore drift is expected to nourish Mair Bank with a supply of sand.

Clearly, these processes are occurring at present and resident benthic communities that have been described on and in the seabed, can cope with this low-level disturbance (i.e. sediment transport in response to waves and water currents). Consequently, no further adverse ecological effects are anticipated following the initial placement of dredged material within disposal areas.

4.1.2b Suspended solids, Turbidity and Light Penetration

Table 2 lists the guidelines for coastal water within the study area and refers to changes in the euphotic depth and light reduction at the sediment bed rather than suspended solids, turbidity and light penetration that are usually easier to model (MetOcean Solutions, 2016B).

In the present instance, it is the settlement of suspended solids onto sensitive taxa and community types that is of most concern, hence the use of suspended solids rather than turbidity as a reference standard. However, it is only turbidity that can be measured in real time on site during disturbance activities and therefore a robust correlation between these two parameters is required to manage proposed works.

A 1:1 relationship has been established between turbidity and suspended solids (see Section 2.5) that will allow suspended solids concentrations that arise from disturbance activities to be managed on the basis of real time turbidity monitoring.

Existing water quality is discussed in Sections 2.5.3 and 2.5.4. As a result of the proposed Crude Shipping Project, effects on water quality are likely to be limited to a reasonable mixing zone in the water column. These actual and potential effects are detailed below.

Within the lower Whangarei Harbour, dredging activities outside of a reasonable mixing zone, are not expected to compromise current water quality limits for Class CA waters.

Disposal of dredged material within Disposal Areas 1.2 and 3.2 is expected to comply with Clauses (i) and (iii) of Section 31.4.13(c) of the Regional Coastal Plan (see Section 2.5.1).

In terms of sediment plumes compromising water clarity, clause [ii] of Section 31.4.13(c) of the Regional Coastal Plan is expected to be met beyond a reasonable mixing zone of 300 m in Bream Bay.

4.1.2c Return of decant water to sensitive environments

The use of “overflow” or the discharge of decant water from the hopper of the dredge to increase the payload of dredged material moved by the barge on each movement from the dredging site to a disposal site increases the potential for TSHDs to generate turbidity (Royal HaskoningDHV, 2016A).

On moderate to larger dredges, overflow from the hopper back to the sea is likely to be via an outlet at the bottom of the hull (the keel) where a “green valve” or equivalent could be used to reduce air bubbles within the discharge both to reduce the potential for turbidity and to increase the speed of settlement of the plume discharged from the keel of the dredger. This would be an appropriate means to minimise the effects on sedimentation and turbidity.

Sediment plume dispersion modelling has been undertaken by MetOcean Solutions (2016B) to determine potential sedimentation impacts at the dredging site. That modelling concludes that the plumes can be largely confined to the dredged channel.

4.1.2d Analysis against Regional Coastal Plan Performance Standards

Discharges to water are required to be assessed against the General Performance Standards in the Northland Regional Coastal Plan (Northland Regional Council, 2004). Relevant standards include, for disposal of dredged material within Disposal Areas 1.2 and 3.2, those standards listed in Section 31.4.13. In relation to dredging activities, including return of decant water, the standards in both Section 31.4.13 and Section 31.7.12 apply, given the area to be dredged includes areas zoned Marine 2 (Conservation) Management Area and Marine 5 (Port Facilities) Management Area. Within Sections 31.4.13 and 31.7.12, performance standard (c) is identical, and is the only relevant general performance standard concerning discharges to water. It reads:

(c) Discharges to water shall, after reasonable mixing, comply with the relevant receiving water quality standards and shall not contain any contaminants which could cause:

(i) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials.

(ii) any conspicuous change in the colour or visual clarity of the receiving waters.

(iii) any emission of objectionable colour.

(iv) accumulation of debris on the foreshore or seabed underlying or adjacent to the discharge point.

(v) any significant adverse effects on aquatic life or public health.

The proposed dredging and disposal activities are expected to meet these performance standards. Outside a reasonable mixing zone (300m, or 100m in proximity to sensitive hard-shore communities) it is not expected that the proposed activities will result in any of the matters listed in (c) (i)-(iii). This is reflected in the modelling undertaken (MetOcean Solutions, 2016B). Further, video footage of a smaller, distinct, dredging operation undertaken by Refining NZ in December 2016 - February 2017 to undertake urgent emergency works around its berthing ‘dolphins’ did not reveal any oil or grease films, scums or foams, and no floatable materials. Moreover, video of the plume generated by the dredge indicated the plume was not associated with a conspicuous change in the colour or visual clarity after reasonable mixing.

In terms of standard (c)(iv), which refers to an accumulation of “debris” on the foreshore or seabed, a reasonable interpretation of this standard is that it seeks to avoid any accumulation of harmful contaminants from point source discharges (for example, litter/waste products associated with a wastewater outfall). It is of course a necessary aspect of a dredging and disposal project that there will be an accumulation of dredged material on the seabed. It is acknowledged that, construed narrowly, this particular performance standard could be interpreted as including disposal of any / all dredged material - although it could be expected the terminology used would reflect this, rather than the specific use of the term “debris”. However, it is not considered to be a reasonable (nor intended) application of the standard. Accordingly, the proposed disposal activity can be considered to be compliant with the standard.

In terms of clause (v), which relates to significant adverse effects on aquatic life, it has been concluded that that adverse effects on benthos within the dredge and disposal areas should be minor to moderate, which is consistent with that performance standard (refer Section 2.5.1).

Overall, it is not expected there will be a compliance issue with any of the clauses of performance standards 31.4.13(c) or 31.7.12(c).

In terms of Regional Coastal Policy 21.4, there will be an effective net zero take of coastal water as a result of proposed dredging activities.

4.1.2e Summary and Recommendations

Given the:

(i) modelling of sediment plume dispersal,

(ii) reasonable / available mixing zone around the dredge and disposal footprints, and

(iii) real time turbidity monitoring at the boundary of sensitive rocky reef habitats,

water column effects are expected to be less than minor.

Coastal water quality standards discussed in Section 2.5.1 are expected to be met after reasonable mixing of sediment plumes generated by proposed dredging activities and the disposal of dredged material at disposal sites 1.2 and 3.2.

Derived turbidity limits / thresholds are proposed in Table 8 to manage suspended solids concentrations within adjacent sensitive communities.

These require the following responses in terms of concurrent operational controls on dredging / dredged spoil disposal activities.

- Level 1: the reason for elevated suspended solids concentrations down-current of the operational dredge need to be investigated,
- Level 2: operational changes are required by the dredge to reduce down-current suspended solids concentrations, and
- Level 3: suspended solids concentrations down-current of the operational dredge result in dredge activities being stopped.

Accordingly, it is recommended:

(1) real time turbidity recorders are installed and monitored on the boundaries of adjacent sensitive rocky reef communities during dredging activities (refer A and D in Table 8 and Section 7.2), and

(2) hand-held turbidity meter measurements are used to ensure compliance with thresholds where dredging and disposal activities are undertaken in proximity to other receiving environments (see B, C and E in Table 8 and Section 7.2).

The turbidity thresholds proposed in Table 8 (from Coffey, 2016D, Elliot 2017 and Tonkin & Taylor, 2017C) are also based on comparative studies conducted by the Ports of Tauranga and the Ports of Otago (Bryan et. al., 2014; Fenwick and Stenton-Dozey, 2015; Port of Tauranga, 2014; Warren et. al., 2015: Warren, 2016, Stewart, 2011, Stewart 2013 and 2015).

MetOcean Solutions (2017) calculated suspended sediment concentrations in the water column within disposal area 1.2 in relation to wave height using historical weather records. They found (see Table 3-4 of Tonkin & Taylor, 2017A) that average suspended solids concentrations in the water column exceeded 100 $g.m^{-3}$ for 10% of the year when wave heights exceed 1.5 m and hence it could be assumed resident benthos within that area were tolerant of at least 100 $g.m^{-3}$ of suspended solids for short periods of time.

On this basis, the Level 3 turbidity threshold of 40 proposed for Bream Bay by Coffey (2016D) has been increased from 40 to 100 for disposal area 1 because natural events involving high winds and extreme wave events, may on occasions, result in higher turbidity events than have been described in Section 2.5.2 (MetOcean Solutions 2017).

Similarly, Refining NZ (pers. comm. Riaan Elliot) have been trialling the deployment of continuous recording, data transmitting, turbidity meters on the Motukaroro Island Whangarei Marine Reserve Marine 1 Management Area boundary since May 2017 (see Section 7.2 and Figure 16) and have reported background turbidity records greater than 10 grams per cubic metre (see Table 8).

Table 8: Recommended turbidity thresholds (NTU) for the dredging programme. A and D relate to a six-hour average of one-minute interval records from fixed turbidity metres. B, C and E relate to hand-held turbidity meter readings as per Figure 17.

Location	Concern	Level 1 Threshold	Level 2 Threshold	Level 3 Threshold
A - Motukaroro Island Whangarei Marine Reserve Marine 1 Management Area	Rocky Reef Taxa	**15***	**20***	**25***
B - Calliope Bank Marine 1 Management Area	Shellfish benthic invertebrates	**15**	**20**	**35**
C - Mair Bank Marine 1 Management Area	Shellfish benthic invertebrates	**15**	**20**	**35**
D - Home Point Marine 1 Management Area	Rocky Reef Taxa	**15***	**20***	**25***
E - Bream Bay including Three Mile Reef	Shellfish benthic invertebrates	**20**	**25**	**40** (**100**** for Disposal Area 1.2

* provisionally based on RNZ data base (Elliot, 2017) for Location A between May and July, 2017.
** based on Table 3-4 of Tonkin & Taylor (2017B).

Therefore, the suspended solids standards / thresholds adopted in Table 8 can be considered to be conservative, precautionary and subject to revision on the basis of further monitoring data.

Neither the Regional Coastal Plan nor the RMA define an appropriate reasonable mixing zone. Instead, this is to be determined having regard to the attributes of a particular location (for instance, currents, tides, bathymetry, and roughness coefficient of the seabed). Here, a reasonable mixing zone within Bream Bay would be 300m, however in proximity to some hard-shore communities (e.g. Home Point) only 100m is available for a mixing zone (Tonkin & Taylor, 2016C).

4.1.3 Prediction of Effects on Marine Community Structure

4.1.3a Plankton

As described in Section 2.6.1, plankton is abundant along the north-east coast of the North Island and can on occasions bloom to nuisance proportions. The study area (including the mouth of Whangarei Harbour) is well flushed with open oceanic water with its associated plankton community.

It is considered very unlikely that the large-scale drivers for plankton productivity and potential toxicity within Bream Bay or the lower Whangarei Harbour would be affected by the dredging and disposal activities proposed.

Localised and transient effects of reduced light levels and fine particles clogging the filter feeding mechanisms of zooplankton could occur within sediment plumes generated by disturbance activities, but it is not considered that these short-term potential impacts warrant the imposition of a monitoring regime that specifically describes plankton.

Overall, any adverse effects on plankton associated with the proposed disturbance activities are predicted to be negligible, and are not expected to adversely impact on significant ecological areas.

4.1.3b Benthos

Soft-bottomed benthic communities are routinely subject to high turbidity / suspended solids concentrations during high energy wave events (MetOcean Solutions, 2017) and are considered tolerant of sediment plumes that will be generated when winning and disposing of dredged material.

However, soft-bottomed benthic communities within the area to be dredged (see Figure 4) will be removed with dredged material and very few are expected to survive excavation, transport and disposal at an alternative site.

Similarly, those benthic animals and occasional plants at disposal sites 1.2 and 3.2 on which dredged sediment is placed are expected to be buried and not survive.

The bulk of moribund benthic organisms that are buried at disposal sites would be decomposed by bacteria and fungi.

On the basis of a marine habitat map for Northland (Kerr, 2009), the conservation status of New Zealand marine invertebrates (Freeman et. al., 2013) and nominated sensitive marine benthic habitats in New Zealand (MacDiarmid et. al., 2013), it is concluded the indigenous fauna that would be removed from the dredging footprint and buried by the placement of dredged material in proposed disposal areas 1.2 and 3.2 (see Figure 2) is not of national or regional significance. No benthic taxa in these predominantly sandy sites are considered to be endangered or at risk.

However, surrounding some of these soft bottom areas (particularly those dredging locations within the Whangarei Harbour) that will be disturbed by proposed dredging activities are hard-bottom reef communities of high intrinsic, conservation and recreational value.

Capital dredging would impact on (displace) benthic communities from an area of 1.62 km^2, and disposal of that dredged material will disturb an area of 2.75 km^2 for a period of up to 12 months.

Shallow (<20m), high-energy, coastal environments tend to become recolonised more rapidly than deeper offshore environs environments following dredging activities and there are a wide range of variables that determine the rate of recolonisation (Coffey, 2017A).

However, on the basis of monitoring other dredging sites in New Zealand (Port of Auckland[5] Tauranga[6] and Otago[7]), it is expected that an ecologically constructive benthic community would have re-established within a period of 6 - 24 months (albeit of a smaller size class than perennial taxa that were displaced by the dredging event).

This is considered to be a localised, minor to moderate impact on benthic productivity (and available food for fish in the local area) and hence compensation is proposed (see Section 5 and Coffey and Stewart, 2017). There will be a progressive reduction in the level of these effects over time, and it is expected that the dredge and disposal areas will support an ecologically constructive community 6 - 24 months after proposed disturbance events (Coffey, 2017A).

It is recognised that whilst re-colonisation sequences that have occurred following dredging activities to maintain access to other NZ ports (see footnotes 5, 6 and 7) have generally

5 http://www.poal.co.nz/sustainability/environmental-management/dredging

6 http://www.environmentguide.org.nz/issues/marine/major-marine-development/im:2115/

7 www.portotago.co.nz/our-harbour/overview/

involved endemic benthic community types that were disturbed by dredging activities, adventive pests have the potential to become pests in areas that have been disturbed within dredging footprints or disposal grounds for dredged material (Inglis and Seaward, 2016; Ministry for the Environment and Statistics New Zealand, 2016).

Such adventive pests include *Arcuatula senhousia*, the Asian bag (or date) mussel, *Charybdis japonica* the Asian paddle crab, *Eudistoma elongatum* the Australian droplet tunicate, *Sabella spallanzanii* the Mediterranean fanworm, *Styela clava* the Clubbed tunicate, and *Theora lubrica* the Fragile clam.

Monitoring is required to check this does not happen.

The post-impact monitoring regime recommended in Section 7 includes drop-camera and physical sampling within the disturbed areas. In the event that adventive pests are found to have dominated the re-colonisation process within these areas, Refining NZ would notify the Ministry of Primary Industries ('MPI') and RNZ would co-operate / collaborate with any response plan MPI consider appropriate.

4.1.3c Fish

Local finfish stocks are expected to avoid planned disturbance activities and disturbed sites until their feeding grounds have recovered (Desprez, 2000; Sutton & Boyd, 2009; Slabbekoorn et al., 2010).

The proposed dredging and disposal activities are likely to result in in an initial reduction of the population of species such as snapper, kahawai and kingfish using the disturbance footprints, but a progressive recovery of these populations would be expected to be complete within the subsequent 6 to 24-month period (Coffey, 2017A).

Parties at consultation meetings conducted by RNZ have also raised the question of how the proposed dredging programme and disposal activities might impact on sharks and fish migrations to and from freshwater.

In response, Sharks are also expected to avoid areas that are subject to active disturbance due to reduced benthic production following a dredging or disposal event and are less likely to feed in disturbed areas until benthic production is re-established.

Eels have a strong sense of purpose in terms of migrating from fresh water to their breeding grounds in the tropical Pacific, and in returning home to fresh water as glass eels and elvers. Like most native fish (including whitebait) returning to fresh water from the sea, they have the ability to avoid obstacles, or to wait until conditions are suitable to continue with their migration. Consequently, the activities proposed by Refining NZ are not expected to adversely affect eels, either as individuals commencing or completing their migrations or as a population.

In terms of whitebait (primarily the young of: inanga (*Galaxias maculatus*), koaro (*G. brevipinnis*) and banded kokopu (*G. fasciatus*); inanga is by far the most commonly caught taxa. Giant kokopu (*G. argenteus*), short-jawed kokopu (*G. postvectis*) and smelt (*Retropinna retropinna*) are also occasionally present along with the young of many other fish such as eels, bullies and brown trout.

All whitebait species spend part of their life cycle in fresh water and part in the sea. Fish hatch in late autumn and are carried along rivers out to sea where they live and grow over the winter. In late winter and early spring whitebait migrate back up rivers and streams, finally settling and growing in bush covered streams and swamps. The start of the migration is thought to be influenced by river flows (i.e. shortly after floods) and phases of the moon. Mature inanga adults migrate downstream to lower river sections and estuaries to spawn in grasses covered by water during spring tides. The eggs remain in the grass until the next spring tide covers them again when the young hatch and are carried out to sea.

The effect of the proposed disturbance activities on fish feeding and fish migration is expected to be relatively minor with the most important effect being a temporary reduction in food availability for those taxa that feed on benthos in the entrance channel and disposal grounds for dredged material. In this regard, the fish species that feed in the disturbed areas are likely to avoid them in the short term, but will return as re-colonisation occurs. As such, the disturbance activities proposed are not considered likely to contravene Policy 11(b) of the Coastal Policy Statement (Department of Conservation, 2010) or provisions of the Northland Regional Policy Statement relating to Indigenous Ecosystems and Biodiversity (Northland Regional Council, 2016).

4.2 Maintenance Dredging and Disposal of Maintenance Dredgings

Maintenance Dredgings (up to 150,000 m^3 over 35 years) may be placed in any or all of disposal area 1.2, disposal area 3.2, or possibly on land (assuming any relevant consents or authorisations are separately obtained).

Disposal area 3.2 has been sized to enable all capital and maintenance dredging to be placed within the area for the duration of the maximum consent period allowed (35 years) and disposal area 1.2 is sufficiently large to enable different locations to be targeted for the placement of maintenance dredging as required to retain sand within the littoral system.

As discussed in Section 3, maintenance dredging may need to occur every 2 to 5 years in the berth pocket area and in targeted areas of the inner and mid channel to maintain navigable draft around the jetty dolphins. Assuming uniform distribution of sedimentation within the outer section, the 0.5 m sedimentation allowance could be reached within 5 to 20 years requiring a maintenance dredging campaign in this area (Tonkin & Taylor, 2016C).

All issues and comments in 4.1 above apply equally to maintenance dredging activities. The difference would be the reduced scale and the reduced duration of these effects. Tonkin and Taylor (2016C) report maintenance dredging will involve smaller vessels and a time frame of less than 6 months.

In terms of the recovery of benthos within disturbance areas, each successive disturbance event (which could occur as frequently as once every two years) will again remove the benthic community and re-colonisation will restart.

However, the difference is that if only 10% rather than 60% of a dredging / disposal footprint is involved with maintenance versus capital dredging activities for example;

- the area of reduced benthic productivity is reduced in a linear fashion, and
- the likelihood of recolonising taxa being recruited from adjacent seabed communities at a similar depth rather than from adventive organisms at adjacent wharf / berthing structures / areas is improved.

4.3 Ecological effects associated with potential Hydrocarbon Spillages

In terms of proposed capital dredging activities, the operation of dredge(s) for a six-month period within the study area would increase the risk of spills of oil and fuel and exhaust emissions (Royal HaskoningDHV (2016B).

Royal HaskoningDHV (2016B) advise that dredging operations have now improved with respect to environmental awareness and that the risk of an oil or fuel spill is unlikely with modern professional dredging operations. Furthermore, oil spill contingencies are available at RNZ (Marsden Point).

In terms of the changed pattern of oil deliveries that would occur as a result of the capital dredging programme, Bilderbeck and Oldham (2016), who assessed the risk of an oil spill as a result of the Option 4.2 channel access improvements, concluded that the benefits of improved navigational safety and fewer tanker visits would significantly outweigh the countervailing effects of the proposed larger crude oil cargo sizes on the volume of oil released and subsequent environmental consequences in the unlikely event of a spill.

This is because tankers would clear Home Point with a greater safety margin after the channel realignment and that there would be a reduction of tanker movements to the RNZ oil terminal per annum.

4.4 Relocation of, Additions to, Navigation Aids adjacent to the Realigned Access Channel

The proposed aids to navigation (AtoN) are shown on Royal HaskoningDHV, 2016C Drawing PA1028-MA-1121 Revision M (see Figure 3).

The existing channel demarcation is provided by a safe water mark (also referred to as the fairway buoy) and eighteen (18) channel markers consisting of nine (9) starboard buoys and nine (9) port buoys.

Eight of the existing buoys will need to be relocated to accommodate the reconfigured channel alignment. These are buoys 2, 3, 5, 8, 11, 12, 14 and 18.

Two additional channel marker buoys (being one starboard buoy and one port buoy) will be installed at -17.7m depth and the existing fairway buoy will be moved to be aligned with the starboard channel markers and installed at -25.0 m depth to accommodate a lengthened entrance channel.

Other AtoN improvements proposed (Royal HaskoningDHV, 2016C) involve an improved Port Entry Light, modification of the (rear) lead light marking the offshore approach channel and installation of a set of lead lights in Taurikura Bay to assist with the night time navigation of arriving Suezmax Tankers and other vessels.

The construction of these navigational aids includes both the initial effects of installing the aid (e.g. anchors, blocks, poles or rock / boulder pins) and routine maintenance visits to service the structures (e.g. lights, marks). The expected effects associated with the removal, installation and maintenance of navigational aids will be localised and temporary.

Further, the navigation aids are expected to have positive effects in that they will reduce the likelihood of ships stranding or colliding with the shoreline, they will reduce the likelihood of accidents and potential hydrocarbon spillages. Accordingly, in my view, the ecological effects associated with the installation, modification and removal of navigational aids will be less than minor.

In addition, it is noted that approval to install, alter or remove aids to navigation aids in the Coastal Marine Area is required from the Director of Maritime New Zealand and there are industry best management practices for such activities.

Due to the rock outcrop, and therefore potential navigational hazard in the vicinity of Home Point, it is proposed that a West Cardinal Beacon or buoy be installed 175 m north of Buoy No. 7 at a relative depth of 15.8 metres. This is the only AtoN that will be constructed within habitats covered by Policy 11a of the NZCPS (Department of Conservation, 2010) and it is noted that the construction methodology for the beacon would involves a tripod base utilising two MT blocks on each leg to hold in position to avoid a requirement to fix too or drill into the reef. Alternatively, the buoy would involve three separate mooring blocks and chain. It is considered that these construction strategies and the limited footprint of reef involved would avoid adverse effects on reef habitat at that site.

4.5 Summary of Environmental Effects of Proposed Disturbance Activities

An adverse effect of the capital dredging proposal would be a localised and temporary reduced food supply for animals such as finfish and rays that feed in the entrance channel and the nominated sites that are used for the disposal of dredged material.

Seafloor sediments within the proposed dredging footprint are not contaminated and their relocation to the nominated offshore disposal areas is not expected to be associated with water column issues such as toxicity.

Given the low organic matter content of the sands to be relocated, no water quality issues such as dissolved oxygen sags are expected to be associated with sediment plumes that are associated with winning and disposing of dredged material.

The deepening of the access channel and the placement of dredged material at nominated disposal sites is expected to have a minor or less than minor effect on tides, currents, and/or wave heights within the study area (Met Ocean Solutions, 2016). No adverse marine ecology effects are expected as a result of such changes.

Existing soft-bottomed communities are adapted to naturally occurring sediment transport and there are no ecological issues associated with proposed disturbance activities at these sites. However, when these soft-bottom communities are instantaneously buried by a layer of sediment that is too deep for them to migrate up through to reach the new seabed surface, they are smothered and a conservative approach is to assume complete mortality of pre-exiting benthos. It is expected that such areas will be recolonised by like communities within a relatively short time-frame (i.e. 6 - 24 months after disposal is compete, Coffey, 2017A).

The habitat of indigenous fauna that would be disturbed by proposed dredging activities and buried by the placement of dredged material in proposed Disposal Area 1.2 and 3.2 is not of national or regional significance. No benthic taxa in these predominantly sandy sites are considered to be endangered or at risk (West and Don, 2016A).

However, surrounding some of these soft-bottom areas that will be disturbed are hard-bottom reef communities of high intrinsic, conservation and recreational value. These communities are of regional and national significance and it is proposed that potential adverse effects on these areas are to be avoided by monitoring and responding to real time telemetering of turbidity meters on the boundary between disturbance activities and these sensitive habitats (Bryan et. al., 2014).

The effect of the proposed disturbance activities on fish migration is expected to be minor with the most notable effect being a temporary proportional reduction in food availability for those taxa that feed on benthos in the entrance channel and disposal grounds for dredged material.

The proposed new alignment for the entrance channel and a reduced number of tanker visits per year will reduce the likelihood of significant oil spill from oil tankers within the study area (Bilderbeck and Oldham, 2016).

The ecological effects associated with the relocation and / or modification of existing, and / or the establishment of new navigation aids adjacent to the realigned channel entrance are expected to be less than minor.

While the winning and placement of the dredged material will result in the loss of benthic biomass at disturbed sites, the expected re-colonisation of disturbed areas should ensure that such effects are short-term, and overall, the effects are expected to be minor to moderate. There will be a progressive reduction in the level of these effects over time, and it is expected that the dredge and disposal areas will support an ecologically constructive area 6 - 24 months following disturbance.

In terms of the dredging footprint at Marsden Point, the fine sand habitat was the most common, most diverse, and dominated by smaller biota such as polychaete worms and amphipods (see Figure 3.14 of West and Don 2016). Benthic recovery in this habitat type is expected to be relatively rapid (c. six months).

It is anticipated that the fine sand habitat will also dominate the dredging footprint following capital dredging works.

The coarse sand habitat (see Figure 3.14 of West and Don 2016) was dominated by the bivalve Tawera spissa and the primitive chordate, Epigonichthys hectori. Inside the harbour mouth the coarse sand habitat was dominated by the community defining bivalve Venerupis largillierti and juvenile gastropods. These communities would be expected to take two years to recover (in terms of longer lived bivalves) but ecologically constructive benthic communities (in terms of providing feeding grounds for fish) would be expected to recover within 12 months.

The shell gravel habitat (see Figure 3.14 of West and Don 2016) had a higher proportion of larger species than the sandy habitats. The species composition was different from the sandy habitats with 36 taxa only found in the shell gravel habitat. The community defining bivalve Tucetona laticostata and the primitive chordate, *Epigonichthys hectori* were abundant in the shell gravel seaward of Home Point, but almost absent inside the harbour mouth. Inside the harbour mouth the shell gravel had greater numbers of bivalves *Corbula zelandica* and *Venerupis largillierti* and juvenile gastropods.

Maldanid polychaetes that are indicative of stable rather than disturbed benthic communities were more common in the outer section of the proposed dredging footprint.

In terms of proposed disposal grounds for dredged material, Disposal Area 1.2 was a more disturbed site than Disposal Area 3.2 (in terms of Maldanid polychaetes and longer-lived bivalves) and recolonisation would be expected to be more rapid (c. 6 months) within Disposal Area 1.2 than within Disposal Areas 3.2 (c. 1 – 2 years). Again however, ecologically constructive benthic communities (in terms of providing feeding grounds for fish) would be expected to recover within 12 months within Disposal Area 3.2.

5.0 Avoidance, Remediation or Compensation Measures for Disturbance Activities

5.1 Short term loss of soft-bottom benthic productivity in the northern sector of Bream Bay

There will be a short-term loss of benthic productivity within the dredge and disposal areas. This area totals 4.37 km^2 or 437 hectares.

As an offset / compensation measure for this effect, it is recommended that RNZ consider supporting / collaborating with / making a financial contribution to, a Regional Council or Department of Conservation catchment management initiative that would improve the overall health of the Whangarei Harbour (Coffey and Stewart, 2017). Failing that, the recommended approach would be for RNZ to collaborate with the Regional Council, the Department of Conservation and Tangata Whenua to establish and support a Stream Care Group for Blacksmith's Creek and Estuary, or initiate / contribute to a planting programme to enhance the current recovery of seagrass beds in the downstream reaches of Whangarei Harbour.

NIWA and the Regional Council (Cummings and Hatton, 2003; Cummings, 2006; Lundquist and Broekhuizen, 2012; Reed et. al, 2004, NIWA, 2005) have already pioneered initiatives in Whangarei Harbour to understand and to re-dress the demise of pipi populations and seagrass beds in Whangarei Harbour.

5.2 Avoiding adverse sedimentation effects within sensitive hard bottom communities adjacent to the dredging footprint.

Given the regional and national significance of kelp beds and sponge gardens that are on the boundary of (but not within) the proposed dredging footprint and the Motukaroro Island marine reserve and Home Point, then to be consistent with Policy 11(a) of the NZCPS (Department of Conservation, 2010), adverse sedimentation effects within these areas need to be avoided.

In addition, there are other specified receiving environments which also require significant adverse sedimentation effects to be avoided, and other effects to be avoided, remedied of mitigated. These include Calliope Bank, Mair Bank, and Bream Bay including Three Mile Reef.

Whilst there is less concern with potential sedimentation effects in soft-bottom communities that are on the boundary of the proposed dredging footprint (as they are less sensitive to sedimentation effects) the intention is to confine adverse ecological effects to the specific footprint of proposed disturbance activities wherever possible.

The usual approach is to establish background sedimentation rates to which surrounding communities are subject and to assume they are tolerant of these background conditions. Provided these worst-case concentrations of suspended solids are not exceeded as a result of proposed disturbance activities (and it has been established the sediment suspended by the dredging activities is not contaminated), it can be concluded the surrounding communities are not expected to be adversely affected if these thresholds are not exceeded.

Monitoring of turbidity levels at the boundary of each of the above sensitive receiving environments is proposed in Section 7 below.

Based on this monitoring, responses in terms of concurrent operational controls on dredging / dredged spoil disposal activities are summarised in Table 8 and Section 4.1.2d above and are expected to be effective in protecting adjacent community to adverse sedimentation effects arising from proposed disturbance activities.

5.3 Summary

With proposed avoidance, remediation and compensation measures in place, any adverse ecological effects within the footprints of the dredging and disposal activities are expected to be localised and short term (6 - 24 months) and further compensated for by proposed contributions to projects such as enhancing the overall health of the harbour / seagrass habitats (Coffey and Stewart, 2017).

Similarly, given the very conservative approach that is proposed in close proximity of ecologically significant areas (Motukaroro Island Whangarei Marine Reserve and kelp beds and sponge communities at Home Point), any adverse effects on the adjacent communities and environs is expected to be avoided.

In terms of Policy 11 of the New Zealand Coastal Policy Statement, the proposed activities would be conducted in accordance with the direction it sets. Adverse effects on matters listed in 11(a) will be avoided; and significant effects on matters listed in 11(b) will be avoided, and other effects avoided, remedied or mitigated.

6.0 Planning Matters (Resource Management Act 1991[8])

Some relevant matters that are set out in the Resource Management Act (1991) are now addressed.

6.1 Section 6(c)

The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance under section 6(c) of the Resource Management Act 1991 (the Act) and are expected to be achieved if more than minor sedimentation effects can be avoided in sponge garden and kelp bed habitats adjacent to proposed disturbance activities.

The proposed monitoring regime details a threshold limit for turbidity, and establishes real time monitoring at the boundary of the sensitive Motukaroro Island Whangarei Marine Reserve and Home Point, with hand-held monitoring at the boundary of other receiving environments as set out in Table 8. That regime specifically considers the potential effect on significant vegetation and habitats, to ensure that adverse sedimentation effects will be avoided in these sensitive habitats adjacent to proposed disturbance activities. Therefore, in my view the proposal is consistent with section 6(c) of the Act.

6.2 Section 7

The area of soft-bottom seabed that would be directly affected by the proposed disturbance activities is the most abundant and widespread habitat type within the coastal marine area of Northland. On this basis, the intrinsic value of that ecosystem will be maintained due to the localised footprint of the ecosystem that would be affected and because full recovery of the disturbed area is expected in the short term.

Kaitiakitanga and the ethic of stewardship for ecological values within the study area is demonstrated by Patuharakeke Te Iwi Trust Board Inc. (2014).

Maintenance and enhancement of the quality of the environment (as set out in Section s7 (f) of the Act) would be satisfied in terms of proposed works reducing the likelihood of a significant crude oil spill within the study area, and as a consequence of the considerable efforts that have been made to avoid the areas of significance, and to develop and advance robust, conservatively cast, measures to protect those areas. Minimising the adverse effects on all other marine species and environments also will ensure that quality of the marine environment will be at least maintained in the medium to long term.

The sea run salmon fishery is confined to the South Island and these applications will have no effect on that fishery (which is a relevant matter for consideration under Section 7[h] of the Act).

In terms of trout, brown trout do migrate in the sea from river mouth to river mouth around the New Zealand coastline but they are not generally present north of the Coromandel Peninsula because of warmer water temperatures (McDowall, 1990). Rainbow trout are not common in Northland and do not venture into salt water.

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[8] Under the Resource Management (Marine Pollution) Regulations 1998 (reprint as of 28 August 2014) the dumping of dredge material in the Coastal Marine Area is included as a discretionary activity in any regional coastal plan or proposed regional coastal plan and an application for such an activity must identify the sources of contamination and waste prevention strategies that may be used to control that contamination. However, it is considered that these matters have been adequately dealt with under the following sections of the Resource Management Act (1991) and elsewhere in this Assessment of Effects.

As a consequence, the activities proposed by Refining NZ are not expected to impact on that aspect of Section 7(h).

In terms of Section 7(i), based on the latest climate projections for New Zealand (mfe.govt.nz), by the end of this century we are likely to experience:

- higher temperatures – greater increases in the North Island than the South, with the greatest warming in the northeast (although the amount of warming in New Zealand is likely to be lower than the global average),
- rising sea levels,
- more frequent extreme weather events – such as droughts (especially in the east of New Zealand) and floods,
- a change in rainfall patterns – with increased summer rainfall in the north and east of the North Island and increased winter rainfall in many parts of the South Island.

No measureable effects of global warming are expected during the capital dredging programme as it would involve a 6-period within an 80-year projected impact time frame mfe.govt.nz).

However, the term of consent sought for maintenance dredging is 35 years and some subtle changes in terms of rising temperatures, rising sea level, drought / flood frequency and increased summer rainfall might be expected within this time frame. However, any such subtle changes are not expected to have a measureable effect on the effects of the maintenance dredging activities proposed by Refining New Zealand.

6.3 Section 8

It is recognised that the Act requires development of the type proposed to account for the Principles of the Treaty of Waitangi and in this case taonga species such as pipi and flounder.

6.4 Section 15B

Section 15B relates to the discharge of harmful substances (or contaminants) from ships and offshore installations. In terms of ecological matters, sediment plumes created by proposed dredging activities are not expected to contravene matters set out in 15B1(b) (i), (ii) and (iii) of the Act after reasonable mixing.

However, in the case of Section 15B (1) (b) (iv) of the Act, there will be an adverse effect on aquatic life in that surface dwelling benthos and infauna within the dredging footprint will be sacrificed for the project and surface dwelling benthos and infauna at the nominated disposal grounds (1.2 and 3.2) will be buried.

However, the effect is expected to be localised, short term and re-colonisation of disturbed areas is expected to be relatively rapid (6 – 24 months) and compensation measures are proposed to offset these effects (also see Section 2.5.1).

Therefore, this is not expected to constitute a significant adverse effect.

Accordingly, it is considered that the requirements of Section 15B will be met and that this section should not prohibit the grant of resource consents for the project.

6.5 Section 105

(a) The nature of the discharge and the sensitivity of the receiving environment to adverse effects.

These applications involve the placement of clean (uncontaminated) sand and shell with < 6% silt onto similar sediment that occurs within Disposal Areas 1.2 and 3.2 (Tonkin & Taylor 2016C). Benthic communities that are present within the nominated disposal sites can tolerate sediment transport and sediment resuspension that occurs naturally in these habitats in relation to water currents and wave action.

However, they cannot tolerate burial by a significant depth of sediment (> 20 cm) as is proposed during the disposal of dredged sediment in this instance. Re-colonisation of dredged sediment placed in disposal areas is expected to occur relatively quickly so that the effect of displacing benthic communities within these areas will be short term (6 – 24 months, see Coffey 2017A).

Each maintenance dredging event will again displace benthic communities from the footprint of the disposal areas where dredged sediment is placed and the re-colonisation sequence will need to begin again.

(b) The applicant's reasons for the proposed choice.

A combination of project efficiency (addressed by other experts) and sediment supply to nourish Mair Bank that has been described by Tonkin & Taylor (2016D).

(c) Any possible alternative methods of discharge, including discharge into any other receiving environment.

Whilst the stated preference in the RCP is "*to promote land-based disposal of dredging spoil from both capital and maintenance dredging of the coastal marine area, where this better meets the purpose of the Act*" (Policy 22.4 No. 7), benthic communities are expected to re-establish in and on dredged material placed in these areas within a reasonable time frame (6 to 24 months).

Refining N.Z. have sought to identify land-based disposal options where there is a market for dredged material and parties wishing to receive dredged material have the necessary authorisations (Tonkin and Taylor, 2016C).

6.6 Section 107

Section 107 is addressed within the Assessment of Environmental Effects report that is being lodged in support of the Refining NZ's proposal. In summary, however, Section 107 requires that consent for discharges to the CMA shall only be granted where certain water quality and ecology outcomes (as set out in subsections 107(1)(c) to (g) of the Act) are met. The water quality and ecology outcomes (that apply after reasonable mixing in receiving waters) are discussed briefly in the following comments.

Management measures will be required to meet Section 107 (c) requirements in terms of suspended materials and the risk of oil or grease contamination from machinery used to win and dispose of dredged materials. These can be managed by conditions of consent.

In terms of Section 107 (d) a conspicuous change in colour and visual clarity should be confined to a reasonable mixing zone and again can be managed by conditions of consent.

Section 107 (e) is not expected to be an issue due to the low organic matters content of dredged material to be won and disposed of and Section 107 (f) is not applicable in this instance.

There will be an adverse effect on aquatic life (Section 107[g]) in that surface dwelling benthos and infauna within the dredging footprint will be sacrificed for the project and surface dwelling benthos and infauna at the nominated disposal grounds (1.2 and 3.2) will be buried. However, the effect is expected to be, localised, short-term and re-colonisation of disturbed areas is expected to be relatively rapid (6 – 24 months) and compensation measures are proposed to offset these effects. Therefore, this is not expected to constitute a significant adverse effect.

Accordingly, it is considered that the requirements of S107 will be met and that this section should not prohibit the grant of resource consents for the project.

7.0 Recommended Monitoring

The baseline description of pre-impact community structure by Bioresearches, Kerr and Associates and the Cawthron Institute, within and adjacent to areas that would be disturbed by the proposed dredging programme is considered to be robust. Post-dredging monitoring is required to document any actual changes and effects of the proposed activities.

The situation in terms of potential impacts is less complicated now it has been established that seabed sediments that would be disturbed by proposed works are not contaminated and have a low organic matter content.

The remaining matters that warrant on-going monitoring are:

- a localised, short-term loss of benthic productivity,
- measures to ensure that sediment plumes and associated sedimentation effects from dredging operations do not extend into sensitive communities adjacent to the proposed dredging footprint,
- a benchmark description of seagrass and shellfish communities that are in a current state of flux and need to be described separately from the effects of the proposed RNZ dredging programme, and
- monitoring to identify possible re-colonisation by adventive marine pest species.

7.1 Immediately Prior to Dredging and Disposal

Monitoring would involve a benchmark description of seagrass beds (footprint description and photoquadrats for % cover, health and vigour) and shellfish communities on Mair Bank (as per Pawley (2016). It is appropriate to undertake this immediately prior to commencement of dredging operations because they are known to be in a state of flux and subject to short term change in the absence of proposed disturbance activities.

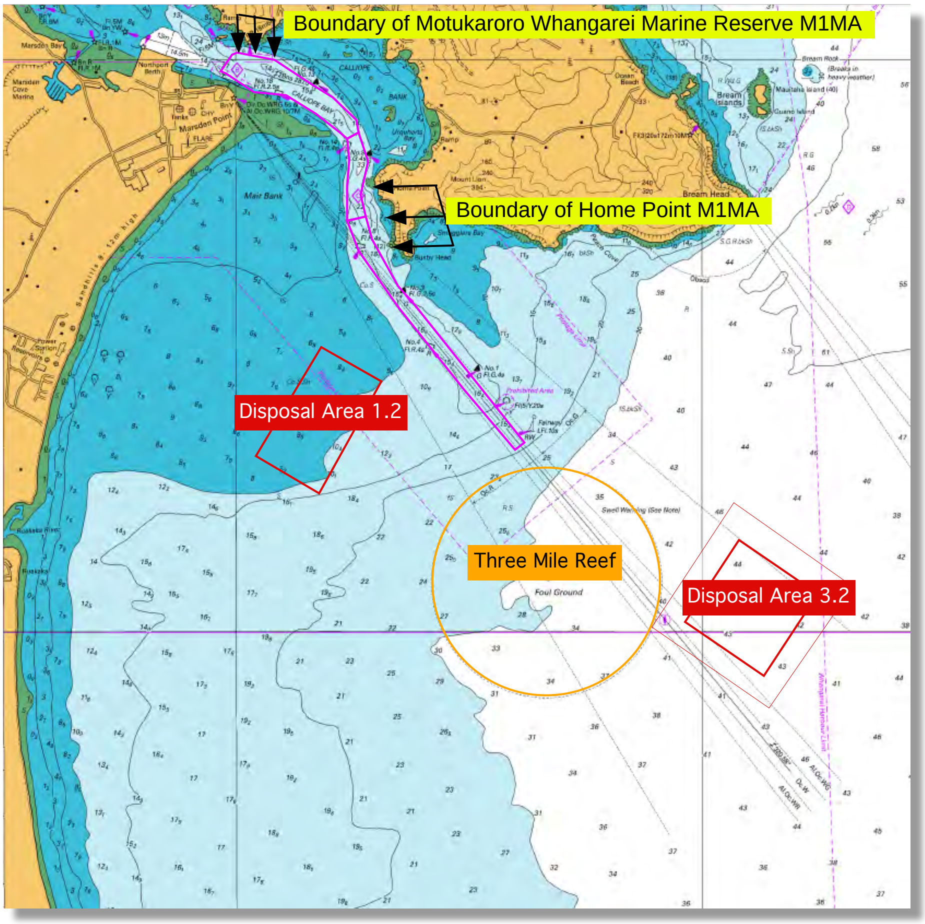
7.2 During Dredging and Disposal

Monitoring would involve the deployment of continuous recording, data transmitting, turbidity meters on the boundary of adjacent reef habitats abeam of where the dredge(s) would be winning dredged material (see Figure 16).

Three would be deployed on the southern boundary of the Motukaroro Marine Reserve and three would be deployed on the western boundary of the Home Point Marine 1 Management Area).

Real time data would be sent to the dredging vessel and a running 6-hour average NTU value (or revisions thereof – see Table 8) would be used to modify (if necessary) engineering and operational measures to meet NTU guidelines for those receiving environments.

Figure 16: Proposed deployment of six fixed, real time, transmitting turbidity metres adjacent to sensitive hard-short receiving environments. Other adjacent receiving environments are to be monitored with hand-held turbidity metres outside a 100m mixing zone at high tide on a daily basis when the dredger is operational.



Turbidity limits / thresholds have been derived that require the following responses in terms of concurrent operational controls on dredging / dredged spoil disposal activities.

- Level 1: the reason for elevated suspended solids concentrations down-current of the operational dredge need to be investigated,
- Level 2: operational changes are required by the dredge to reduce down-current suspended solids concentrations, and
- Level 3: suspended solids concentrations down-current of the operational dredge result in dredge activities being stopped.

In this instance, it is proposed that if a six-hour average turbidity of 20 NTU (average of 360, one-minute real-time records) is exceeded on the boundary of the Motukaroro Island Whangarei Marine Reserve or Home Point due to dredging activities, then dredging activities shall to be modified to ensure the a six-hour average turbidity is reduced to less than 20 NTU (or revisions thereof – see Table 8).

If the one-hour average turbidity of 25 NTU is exceeded on the boundary of the Motukaroro Island Whangarei Marine Reserve or Home Point due to dredging activities, then dredging activities shall stop.

These limits (see Table 8) apply to the boundary of the Motukaroro Island Whangarei Marine Reserve and Home Point. This strategy requires that real time data from turbidity meters on the boundary of the Motukaroro Island Whangarei Marine Reserve or Home Point are transmitted to the operational dredge and that there are agreed protocols to follow to reduce sediment plumes generated by the dredge if required (for example stop the discharge of decant water, or move away from the boundary of the Motukaroro Island Whangarei Marine Reserve or Home Point).

With regard to other soft-bottomed adjacent communities (see Figure 16), compliance with turbidity thresholds listed in Table 8 (or revisions thereof) would be established with hand-held turbidity meter readings.

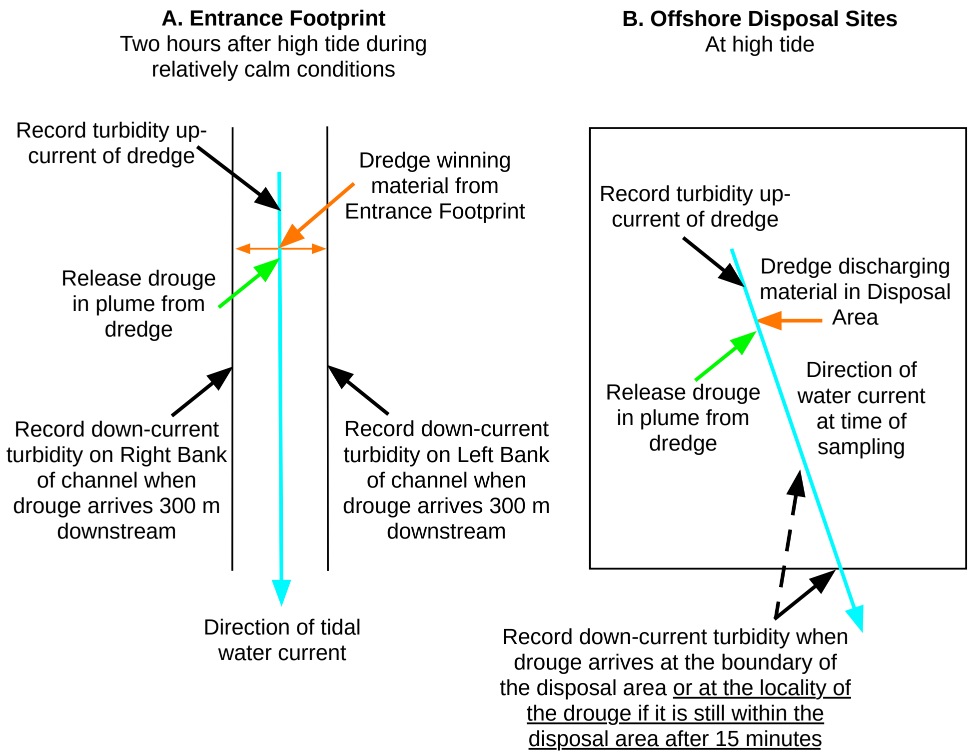
There would two strategies employed with the hand-held turbidity meters.

The first would apply to dredging activities in the entrance channel (see Figure 17A). The second would apply to the disposal areas 1.2 and 3.2 in Bream Bay (see Figure 17B). A drogue (e.g. Dan Bouy) would be used to track the downstream movement of the plume and down-current readings would be taken at the position of the drogue as per Figure 17.

The up-current readings will be used to determine natural background levels of turbidity and the down-current readings will be used to described turbidity increases due to the operation of the dredge (as per Byran et. al., 2014). Turbidity records would be made at a depth of one metre.

It is recommended the readings within the entrance channel are standardised (2 hours into ebb tide during relatively calm conditions) and a mixing zone of 300 m is used to describe turbidity on either bank of the entrance channel as shown in Figure 17A. In the event the drogue enters the boundaries of either of Mair Bank or Calliope Bank, a hand-held turbidity reading would be taken on that boundary (plus records of time and GPS co-ordinates).

Figure 17: Use of hand-held turbidity metre to measure up-current / down-current turbidity when dredge is operating adjacent to soft bottomed habitats (see Figure 16).



In the case of the disposal areas (see Figure 17B), it is recommended sampling is undertaken at high tide and that the down-current reading is taken when the plume (as indicated by the drogue) crosses the boundary of the disposal area (together with records of time and GPS co-ordinates). In the event that the drogue is still within the boundary of the disposal area after

15 minutes, a turbidity reading would be at the position of the drogue (together with records of time and GPS co-ordinates).

Values in Table 8 (or revisions thereof) would be used to assess compliance of dredging activities with turbidity thresholds in soft-bottomed receiving environments and it is envisaged 4 days of data would be used to established compliance / non-compliance on a monthly basis.

The highest turbidity (equivalent to Total Suspended Solids concentration) adopted in Table 8 is 100 NTU for disposal area 1.2 in Bream Bay. This is because Tonkin & Taylor (2016D) have calculated that this depth average concentration of Total Suspended Solids is experienced within disposal area 1.2 for some 10% of the year when waves are 1.5 m high. Clearly therefore, resident benthos present in disposal area 1.2 can tolerate short to medium term exposure to Total Suspended Solids concentration of 100 grams per cubic metre. Similarly, data currently being generated by Elliot (2107), whilst subject to on-going review, has used to inform other changes in Table 8 relative to thresholds originally proposed by Coffey (2016D).

7.3 Post Dredging and Disposal

Benthic ecological surveys post dredging and disposal would involve a repeat of the following.

- The benchmark description of seagrass beds (footprint description and photoquadrats for % cover, health and vigour) and shellfish communities on Mair Bank (as per Pawley (2016) immediately prior to dredging and disposal activities.
- Aspects of the baseline surveys conducted for the AEE immediately after the disturbance events.

These annual repeat (post-dredging and disposal) surveys will be designed to provide ecological information on:

- the recovery of disturbed benthic communities within the dredging footprint,
- the recovery of any affected communities in the immediate surrounds of the dredging footprint (if any adverse effects are described outside of the dredging footprint in the immediate post dredging and disposal monitoring survey),
- the recovery of disturbed benthic communities within the disposal areas,
- the recovery of any affected communities in the immediate surrounds of the spoil disposal footprints (if any adverse effects are described outside of disposal footprints in the immediate post dredging and disposal monitoring survey),

If it is determined that disturbance effects have successfully been limited to the footprint of disturbance activities (on the basis of the immediate post dredging and disposal monitoring survey), then subsequent benthic ecological surveys can be limited to same season follow up surveys for up to three years, or until it has been determined that the affected habitats have recovered. Any longer monitoring period beyond three years will be influenced by anticipated maintenance dredging and disposal disturbances.

However, if the results of the post-dredging and disposal survey find ecological areas adjacent to the dredging footprint have changed as a result of the dredging programme and / or the disposal of dredged material, then a contingency post capital dredging monitoring programme would involve a more detailed control-impact design with both seasonal and temporal components.

In this regard, reference sites have been described for the disposal areas 1.2 and 3.2 (i.e. reference areas 1.2A and 1.2B, and reference areas 3.2A and 3.2B -see Figures 10 and 11) relative to which recovery of soft-bottomed disturbed areas can be gauged. The reef / hard-bottomed areas have necessarily been sampled non-destructively with photoquadrats as they include a marine reserve and there are ample hard-bottomed photoquadrats logged by Kerr and Associates (2016A) and Kerr and Grace (2016A) relative to which recovery of hard-bottomed disturbed areas can be gauged.

It would also involve a review of ongoing maintenance dredging activities to ensure subsequent dredging activities are confined to disturbance footprints.

8.0 Overall Conclusion

It is confidently expected that dredging activities proposed by Refining NZ can be managed to ensure they have only minor to moderate, localised and short-term effects on benthic communities and water quality at the entrance to Whangarei Harbour.

The material to be removed from the dredging footprint is not contaminated relative to guidelines provided by the Maritime Safety Authority of New Zealand (1999) and contains a low proportion of fines and organic matter (Tonkin & Taylor, 2016D).

Soft-bottomed benthic communities that will be directly disturbed by the proposed dredging programme, will be removed from the proposed dredging footprint and will be effectively buried at offshore disposal sites for dredged materials. There will therefore be a short-term loss of benthic productivity within the dredging and disposal footprints shown in Figure 2.

Soft-bottomed benthic communities adjacent to the dredging and disposal footprints are routinely subject to high turbidity / suspended solids concentrations during high energy wave events (MetOcean Solutions, 2017) and are considered relatively tolerant to sediment plumes that will be generated when winning and disposing of dredged material.

Conversely, there are hard-bottomed reef / rock / boulder communities immediately adjacent to the dredging footprint at the Motukaroro Island Whangarei Marine Reserve and Home Point that are of regional and national significance and that are afforded protection under Policy 11a of the New Zealand Coastal Policy Statement. Adverse sedimentation effects on kelp beds and sponge gardens within these habitats must be avoided rather than remedied or mitigated.

To this end, turbidity limits / thresholds have been derived / are being reviewed (see Table 8) for the boundaries of receiving environments that require the following responses in terms of concurrent operational controls on dredging / dredged spoil disposal activities.

- Level 1: the reason for elevated suspended solids concentrations down-current of the operational dredge need to be investigated,
- Level 2: operational changes are required by the dredge to reduce down-current suspended solids concentrations, and
- Level 3: suspended solids concentrations down-current of the operational dredge result in dredge activities being stopped.

These turbidity thresholds are to be monitored by fixed turbidity meters that telemeter results to the operational barge so it can respond to real time data in the case of sensitive hard-bottomed communities adjacent to the dredging footprint (the Motukaroro Island Whangarei Marine Reserve and at Home Point) in particular.

In the case of the turbidity limits / thresholds that have been derived for the boundaries of the less sensitive soft-bottomed receiving environments adjacent to the dredging and disposal footprints, compliance will be assessed with hand held turbidity meters down-current of the barge on an outgoing (ebb) tide.

Given there is expected to be a localised and short-term loss of benthic productivity within the dredge and disposal areas that amounts to some 4.37 km^2 or 437 hectares, some compensation measures are considered appropriate.

As a compensation measure for this effect, it is recommended that RNZ consider supporting / collaborating with / making a financial contribution to, projects that would enhance the overall health of the harbour or seagrass habitats for example (Coffey and Stewart, 2017).

A monitoring programme is recommended to describe the effects of the dredging programme separately from other temporal ecological changes that are occurring within the study area. The baseline description of pre-impact community structure by Bioresearches, Kerr and Associates and the Cawthron Institute (within and adjacent to areas that would be disturbed by the proposed dredging programme) is considered to be robust in terms of providing a comparison with post impact surveys of the same areas. However, a benchmark description of seagrass and shellfish communities (that are in a current state of flux) needs to be undertaken immediately prior to capital dredging activities.

In summary, it is considered that adverse sedimentation effects can be avoided in sponge garden and kelp bed habitats adjacent to proposed disturbance activities, and should be appropriately avoided, remedied or mitigated in all other adjacent habitats.

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Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B.

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institute in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B.

Appendix B: Particle Size and Chemistry for Disposal Area 3.2 (11, 12, 13, 14, 15, 16) Reference Areas 3.2A (23, 24, 24, 25, 26, 27, 28) and 3.2B (29, 30, 31, 32, 33, 34).

Appendix C1: Summary Chemical database for sectioned vibrocore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories.

Appendix C2 Amended Laboratory Report, including elutriate testing for Vibrocore sample V19.

Appendix C3 Amended Laboratory Report, including elutriate testing for Vibrocore sample V20.

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

1.2

Taxa	KER2016INF-47-1	KER2016INF-47-2	KER2016INF-47-3	KER2016INF-47-4	KER2016INF-47-5	KER2016INF-48-1	KER2016INF-48-2	KER2016INF-48-3	KER2016INF-48-4	KER2016INF-48-5	KER2016INF-49-1	KER2016INF-49-2	KER2016INF-49-3	KER2016INF-49-4	KER2016INF-49-5	KER2016INF-50-1	KER2016INF-50-2	KER2016INF-50-3	KER2016INF-50-4	KER2016INF-50-5	KER2016INF-51-1	KER2016INF-51-2	KER2016INF-51-3	KER2016INF-51-4	KER2016INF-51-5	KER2016INF-52-1	KER2016INF-52-2	KER2016INF-52-3	KER2016INF-52-4	KER2016INF-52-5
Aglaophamus sp.					1	1	2			1												1					2	1		
Alpheus socialis			1	2																										
Amalda australis	1				1										1															
Amphipoda			2				5		1				1	1			3								1	5	5	7	1	6
Anthozoa																														
Anthuridea							1			3						1														
Anthuridea																														
Armandia maculata									1																					
Asteroidea																														
Barantolla lepte																														
Bivalvia Unid. (juv)				1																										
Bryozoa (encrusting)				1		1	1	2	2	1																				
Caecum digitulum																														
Chaetognatha																								1						
Cirratulidae	1		2				6	1	1	3											5	6	4	14	6	1		2		
Cominella adspersa		1					1																							
Cominella adspersa																														
Cominella glandiformis																														
Copepoda			1			1		2	2		1			2		1	1	1	1		4	5		4	1			1		
Corophiidae																1		1												
Cumacea		1	3	2	1		1	1	1	3		4	2	4				1	2		2	5	3		1					
Cylichna thetidis																														
Decapoda (larvae unid.)																														
Decapoda ident.																	1													
Diasterope grisea																														
Diplodonta zelandica																									1					

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Divalucina cumingi											1		1																	1
Divariscintilla maoria				2		3		1						9								3								
Dorvilleidae																														
Dosinia sp.																	1	1												
Dosinia sp. (Juvenile)			2																											
Dosinia subrosea	1		1				2	3	3	1		2	1								1		1				1	1	1	
Echinocardium cordatum																							1							
Echinoidea	2	1	4	2	1	4	4	19	3	7	13	16	8	2	51	3		1	2	1	21	16	11	3	12	4	6	13	3	2
Edwardsia sp.						1											1													
Epigonichthys hectori																		2	2	1										
Euchone sp.						1			1									2											2	
Eurydice sp.	3	1	1	2		1	5	5			1			2							1		1		1	3	2			
Eurydice sp.																														
Euterebra tristis																				1										
Exosphaeroma chilensis																1														
Exosphaeroma chilensis																														
Exosphaeroma sp.	2	2	4		1	3	1	11	2		3	1	1	8	4						6	6	5	10	4	11	4	11	4	
Exosphaeroma sp.																														
Exosphaeroma sp.																														
Fellaster zelandiae															1			1												
Gastropoda (micro snails)																		1												
Gastropoda Unid. Juv.																														
Goniadidae			2					1	3									3												
Goniadidae																														
Haustoriidae	12	9	6	10	6	14	17	11	15	7	1	1	2					1				2	1							
Hesionidae									1												1									
Hydroides norvegicus																														
Hydrozoa		1	1				1										1					3								
Limnichthys polyactis																														
Lumbrineridae																														
Lysianassidae	3		3	1		1	1	2		1					1	1														
Magelona sp.	1		1		2	5	1	2	2	10			1		1															

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Maldanidae																														
Munna neozelanica																													1	
Munna neozelanica																														
Myadora antipodum																														
Myllitella vivens vivens						6	1		1	1																				
Mysidacea											1										1	1		1				1		
Natatolana sp.		1					1	1	1		2	2		1				1			1	11	4	4	1	4	3	3	3	2
Nematoda		3	1				1	1	3	3						30		7	3	1	1	1	2	1	7			8	1	
Nemertea	1					1				2							2				2		1		3					
Neoguraleus sp.										1																				
Nereididae sp. A																														
Nucula nitidula																														
Oenonidae																														
Oligochaeta								2										1	1											
Ophiuroidea																														
Ostracoda	1		3	2	1	2	3	1	3	6			1					1			1	2	1	1				1		
Oweniidae																														
Paguridae													6								1									
Paraonidae	2				2	1	1	1	1	1	2	1	1	1	1		1				30	79	56	54	41	5		7	1	3
Phoronida										2																				
Phoxocephalidae	1	1					1	1	1	1											2	3	3	4	3	7	4	7	4	11
Phyllodocidae																1				1										
Polynoidae									1																					
Prionospio sp.	2						1				1																			
Propeamussiidae																														
Pycnogonida																	1													
Sabellidae																1				1										
Serpula sp.																														
Serpulidae																														
Sigalionidae		1			1					1		1										1	1		1					
Sigapatella tenuis																	3	1												
Soletellina nitida																														

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

	KER2016INF-47-1	KER2016INF-47-2	KER2016INF-47-3	KER2016INF-47-4	KER2016INF-47-5	KER2016INF-48-1	KER2016INF-48-2	KER2016INF-48-3	KER2016INF-48-4	KER2016INF-48-5	KER2016INF-49-1	KER2016INF-49-2	KER2016INF-49-3	KER2016INF-49-4	KER2016INF-49-5	KER2016INF-50-1	KER2016INF-50-2	KER2016INF-50-3	KER2016INF-50-4	KER2016INF-50-5	KER2016INF-51-1	KER2016INF-51-2	KER2016INF-51-3	KER2016INF-51-4	KER2016INF-51-5	KER2016INF-52-1	KER2016INF-52-2	KER2016INF-52-3	KER2016INF-52-4	KER2016INF-52-5
Sphaeromatidae												2	1				1													
Sphaeromatidae																														
Sphaerosyllis sp.																6			5	5										
Syllidae	2						4	2	1					1		3	3	4	1	1	3	10	4	11	20	2		1		
Tanaidacea								1																						
Tawera spissa						1							1					1		1										1
Travisia sp.			2	2	1		1				2	2									1		2	1						
Waitangi brevirostris											1					1	1	1	4								2	1		
# taxa	15	11	18	11	11	17	24	21	22	19	11	11	12	11	7	12	13	19	9	9	18	17	17	13	15	9	9	15	10	7
# individuals	35	22	40	27	18	47	63	71	50	55	28	33	26	32	60	50	20	32	21	13	84	155	101	109	103	42	29	65	21	26

average per site	47	48	49	50	51	52
# taxa	13	21	10	12	16	10
# individuals	28	57	36	27	110	37

average per area	Disposal Area 1.2
# taxa	14
# individuals	49

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

	1.2A																													
Taxa	**KER2016INF-53-1**	**KER2016INF-53-2**	**KER2016INF-53-3**	**KER2016INF-53-4**	**KER2016INF-53-5**	**KER2016INF-54-1**	**KER2016INF-54-2**	**KER2016INF-54-3**	**KER2016INF-54-4**	**KER2016INF-54-5**	**KER2016INF-55-1**	**KER2016INF-55-2**	**KER2016INF-55-3**	**KER2016INF-55-4**	**KER2016INF-55-5**	**KER2016INF-56-1**	**KER2016INF-56-2**	**KER2016INF-56-3**	**KER2016INF-56-4**	**KER2016INF-56-5**	**KER2016INF-57-1**	**KER2016INF-57-2**	**KER2016INF-57-3**	**KER2016INF-57-4**	**KER2016INF-57-5**	**KER2016INF-58-1**	**KER2016INF-58-2**	**KER2016INF-58-3**	**KER2016INF-58-4**	**KER2016INF-58-5**
Aglaophamus sp.												1			1	1		1												
Alpheus socialis																														
Amalda australis										1																		1		
Amphipoda	1	2	10	13		3	22	1		20		4	4	10			2				1						1	1		
Anthozoa																		1												
Anthuridea																														
Anthuridea																														
Armandia maculata																									1		1			
Asteroidea					2													1												
Barantolla lepte																														
Bivalvia Unid. (juv)																														
Bryozoa (encrusting)				1																										
Caecum digitulum																														
Chaetognatha																						1								
Cirratulidae	3	3	3	1		2	1			1	3	7	2	2	5		1			1	1		2	2		6	5		5	1
Cominella adspersa																														
Cominella adspersa																	2													
Cominella glandiformis																1														
Copepoda										1																				
Corophiidae																														
Cumacea							1					1							1		1	6			1		4	2		2
Cylichna thetidis																												1		
Decapoda (larvae unid.)					1																									
Decapoda ident.																														
Diasterope grisea																											3	6		1
Diplodonta zelandica																														

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Divalucina cumingi																														
Divariscintilla maoria																						2								
Dorvilleidae																	1													
Dosinia sp.																														
Dosinia sp. (Juvenile)																														
Dosinia subrosea	2				1	1			3	1				1		1						1		1		1		4	2	
Echinocardium cordatum																												1		
Echinoidea	5	10	14	3	14	17	2	1	3	4	11	3	4	2	5	3	4	6		4		6	1				11	9	4	1
Edwardsia sp.									1		2						3													
Epigonichthys hectori	1														1	3	4	4	2	1										
Euchone sp.	2	17	10	1	29	5		3	4	7	2	12	5	1	64	36	85	10	34	12										
Eurydice sp.			1		1						2						1					2			6	1	2	6	1	3
Eurydice sp.																														
Euterebra tristis																														
Exosphaeroma chilensis							1											1		2							2			
Exosphaeroma chilensis																														
Exosphaeroma sp.																														
Exosphaeroma sp.				1							1			1								2	1	5	3	3	3	2	3	7
Exosphaeroma sp.																														
Fellaster zelandiae																														
Gastropoda (micro snails)															2		2													
Gastropoda Unid. Juv.					2																									
Goniadidae																														
Goniadidae	1					1											3		2	1				1						
Haustoriidae																					2	3		2		3	4	4	8	9
Hesionidae																														
Hydroides norvegicus																														
Hydrozoa																														
Limnichthys polyactis								1		1										1										
Lumbrineridae			1														2			3										
Lysianassidae	2																				3	1	2				1			
Magelona sp.													1								1						1			

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Maldanidae															2		1													
Munna neozelanica																														
Munna neozelanica																														
Myadora antipodum																							1							
Myllitella vivens vivens																														
Mysidacea							2								1															
Natatolana sp.	1							1	1	1	1		2	2									2	3			1	1	2	1
Nematoda	5	8	2	2	15	3	3	2	2	1	12	5	26	6	14	3	19	11	14	18				6	4	1			3	
Nemertea	2	1							1							1	1	1	1	1									1	
Neoguraleus sp.																														
Nereididae sp. A																2	8	4	12	2										
Nucula nitidula																														
Oenonidae																	2	1												
Oligochaeta																	1	1												
Ophiuroidea																														
Ostracoda		1	1				1				1			1	1	1	1		2		1	2	1		3	5	1	1	5	7
Oweniidae																														
Paguridae						2						1	1	1				1												
Paraonidae	3	3	3	4	7		1				3	6	5	7	6	8	2	1		4	3	12	5	16	8	3	6	14	1	
Phoronida																														
Phoxocephalidae	9	5	10	4	5	2	2		5	4	6	4	4	12	4	2		2	2	3	3	1	3	2	6	2	8	3	14	7
Phyllodocidae															1			1	1											
Polynoidae																														
Prionospio sp.																						1				1			1	
Propeamussiidae																														
Pycnogonida																														
Sabellidae								2			1		2		9	2	3			1										
Serpula sp.								1									1													
Serpulidae													1																	
Sigalionidae	1												1	1												1		1		
Sigapatella tenuis								1				1							1											
Soletellina nitida																						1				1				

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

	KER2016INF-53-1	KER2016INF-53-2	KER2016INF-53-3	KER2016INF-53-4	KER2016INF-53-5	KER2016INF-54-1	KER2016INF-54-2	KER2016INF-54-3	KER2016INF-54-4	KER2016INF-54-5	KER2016INF-55-1	KER2016INF-55-2	KER2016INF-55-3	KER2016INF-55-4	KER2016INF-55-5	KER2016INF-56-1	KER2016INF-56-2	KER2016INF-56-3	KER2016INF-56-4	KER2016INF-56-5	KER2016INF-57-1	KER2016INF-57-2	KER2016INF-57-3	KER2016INF-57-4	KER2016INF-57-5	KER2016INF-58-1	KER2016INF-58-2	KER2016INF-58-3	KER2016INF-58-4	KER2016INF-58-5
Sphaeromatidae																														
Sphaeromatidae																														
Sphaerosyllis sp.					4		6	3			1	1	1	12	4	1	4	1	2	1										
Syllidae	13		6	6	1	9	2	6	2	8	14	5	29	10	4	14	13	15	14	10	1	1	3	2	4		2	2		
Tanaidacea																														
Tawera spissa							1											1												
Travisia sp.															1												1			
Waitangi brevirostris			1			1							2						2	1						4				
# taxa	15	9	12	10	12	11	13	11	9	12	14	13	16	15	17	15	24	19	14	17	10	15	10	10	9	13	18	17	13	10
# individuals	51	50	62	36	82	46	45	22	22	50	60	51	90	69	125	79	166	64	90	66	17	42	21	40	36	32	57	59	50	39

average per site	53	54	55	56	57	58
# taxa	12	11	15	18	11	14
# individuals	56	37	79	93	31	47

average per area	Reference Area 1.2A
# taxa	13
# individuals	57

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

1.2B

Taxa	KER2016INF-59-1	KER2016INF-59-2	KER2016INF-59-3	KER2016INF-59-4	KER2016INF-59-5	KER2016INF-60-1	KER2016INF-60-2	KER2016INF-60-3	KER2016INF-60-4	KER2016INF-60-5	KER2016INF-61-1	KER2016INF-61-2	KER2016INF-61-3	KER2016INF-61-4	KER2016INF-61-5	KER2016INF-62-1	KER2016INF-62-2	KER2016INF-62-3	KER2016INF-62-4	KER2016INF-62-5	KER2016INF-63-1	KER2016INF-63-2	KER2016INF-63-3	KER2016INF-63-4	KER2016INF-63-5	KER2016INF-64-1	KER2016INF-64-2	KER2016INF-64-3	KER2016INF-64-4	KER2016INF-64-5
Aglaophamus sp.				1									1			1				1					1	1				
Alpheus socialis																				1										
Amalda australis																													1	
Amphipoda		2	1			4	4	2	5	3	1		1	1		1		4	1	2		8	1	2	2	2			1	
Anthozoa																					1									
Anthuridea																														
Anthuridea																														
Armandia maculata																														
Asteroidea						1			1				1																	
Barantolla lepte		2																												
Bivalvia Unid. (juv)																					4									
Bryozoa (encrusting)																														
Caecum digitulum					1																									
Chaetognatha																														1
Cirratulidae		1			6			1			6	7	3	1	6	1		1			2	1	2	6	5	7	6	2	1	3
Cominella adspersa																														
Cominella adspersa																														
Cominella glandiformis																														
Copepoda																						1	2					1		2
Corophiidae																														
Cumacea	1					9	2	2	3	9	2	6	2	1	1		2				2	9	2	2	3	4	4	7	3	8
Cylichna thetidis																														
Decapoda (larvae unid.)																														
Decapoda ident.																														
Diasterope grisea												3	1																1	
Diplodonta zelandica																														

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Divalucina cumingi																31	1		11	1										
Divariscintilla maoria														3		1	2									4				
Dorvilleidae				1																										
Dosinia sp.																														
Dosinia sp. (Juvenile)																														
Dosinia subrosea		1					1			1					1	1	1	1	1	1	4	5	2			3	2	2	4	2
Echinocardium cordatum																									1		1			
Echinoidea	2	6	6		1	8	1	9	3	10	5	42	12	15	3	13	8	3	6	2	3	25	52	1	19	38	20	39	12	35
Edwardsia sp.																						2								
Epigonichthys hectori				1						1																				
Euchone sp.	10	4	1	7	6	2			3		1	2	2		1	2			1											
Eurydice sp.				1						1		1	2	3	3	1					3	14	2	2	1	2	1	4	5	8
Eurydice sp.																														
Euterebra tristis																														
Exosphaeroma chilensis	1	1		3	1				2							31	2		1											
Exosphaeroma chilensis																														
Exosphaeroma sp.																														
Exosphaeroma sp.						2	6	3	3	10	11	19	8	4	3						5	14	11	3	11	10	2	7	2	10
Exosphaeroma sp.																														
Fellaster zelandiae																		1												
Gastropoda (micro snails)												1				1	1													
Gastropoda Unid. Juv.																														
Goniadidae																														
Goniadidae				1												3	3	2	2					2	1	1	1	1	2	
Haustoriidae												1									1		4		1		2		9	1
Hesionidae																														
Hydroides norvegicus													1	1																
Hydrozoa																														
Limnichthys polyactis	1	1																												
Lumbrineridae		1		1													3			1										
Lysianassidae											1										5	4	14	3	2	4	4	2	5	3
Magelona sp.																								2	2	1	1			

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

Maldanidae				8	1											3	1								1					
Munna neozelanica																														
Munna neozelanica																														
Myadora antipodum																														
Myllitella vivens vivens																					1									
Mysidacea												1	2	1													2			
Natatolana sp.							3	1	2	1	3		2	2	1					1						5		1		
Nematoda	4	3	3	10	10	19	1	8	4	1	1	3	1	4	2	18	9		1	1	2	2	5	2	3	2	5	2	2	5
Nemertea											1										2				2					
Neoguraleus sp.																														
Nereididae sp. A				1												2														
Nucula nitidula																2												1		
Oenonidae			1																											
Oligochaeta																		1												
Ophiuroidea																						1	1			1		1		
Ostracoda												1									1	5	1	1	8	1	3		1	4
Oweniidae				1																										
Paguridae																														
Paraonidae			4		4	6	3	11	3	9	6	11	8	5	10						1	3	1	1	5	2	1	2		
Phoronida																														
Phoxocephalidae	5	2	2	1	3	1		2	3	3	1	2	1	4	4			4		1	2	2	3	6	4	2	5	4	2	1
Phyllodocidae																1		1	2											
Polynoidae																														
Prionospio sp.																								1				1	1	
Propeamussiidae				1																										
Pycnogonida																														
Sabellidae	4	7		4	4		5	3	1		1	1	2	1			2			1										
Serpula sp.																														
Serpulidae																														
Sigalionidae								1			1		1						1							1				1
Sigapatella tenuis				2												2														
Soletellina nitida																														

Appendix A1: Synthesised Data for Cawthron Institute ID and Counts for diver cores collected by Kerr and Associates in Disposal Area 1.2 and Reference Areas 1.2A and 1.2B

	KER2016INF-59-1	KER2016INF-59-2	KER2016INF-59-3	KER2016INF-59-4	KER2016INF-59-5	KER2016INF-60-1	KER2016INF-60-2	KER2016INF-60-3	KER2016INF-60-4	KER2016INF-60-5	KER2016INF-61-1	KER2016INF-61-2	KER2016INF-61-3	KER2016INF-61-4	KER2016INF-61-5	KER2016INF-62-1	KER2016INF-62-2	KER2016INF-62-3	KER2016INF-62-4	KER2016INF-62-5	KER2016INF-63-1	KER2016INF-63-2	KER2016INF-63-3	KER2016INF-63-4	KER2016INF-63-5	KER2016INF-64-1	KER2016INF-64-2	KER2016INF-64-3	KER2016INF-64-4	KER2016INF-64-5
Sphaeromatidae																														
Sphaeromatidae																														
Sphaerosyllis sp.	12	11	2	16	5	3	4	1	1								2													
Syllidae	7	5	6	8	3	3		2		5	3	2	5	6	2	23	10	8	7	3		1	1	1						1
Tanaidacea																														
Tawera spissa																														
Travisia sp.											1				1														1	1
Waitangi brevirostris	3	3			1			1						1			1		1											
# taxa	11	15	9	18	13	11	10	14	13	12	16	16	19	16	13	19	15	10	12	12	16	16	16	15	18	19	16	16	17	16
# individuals	50	50	26	68	46	58	30	47	34	54	45	103	56	53	38	138	48	26	35	16	39	97	104	35	72	91	60	77	53	86

average per site	59	60	61	62	63	64
# taxa	13	12	16	14	16	17
# individuals	48	45	59	53	69	73

average per area	Reference Area 1.2B
# taxa	15
# individuals	58

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

	3.2																													
Taxa	11_3_2_ RNZ2016INF001	11_3_2_ RNZ2016INF002	11_3_2_ RNZ2016INF003	11_3_2_ RNZ2016INF004	11_3_2_ RNZ2016INF005	12_3_2_ RNZ2016INF006	12_3_2_ RNZ2016INF007	12_3_2_ RNZ2016INF008	12_3_2_ RNZ2016INF009	12_3_2_ RNZ2016INF010	13_3_2_ RNZ2016INF011	13_3_2_ RNZ2016INF012	13_3_2_ RNZ2016INF013	13_3_2_ RNZ2016INF014	13_3_2_ RNZ2016INF015	14_3_2_ RNZ2016INF016	14_3_2_ RNZ2016INF017	14_3_2_ RNZ2016INF018	14_3_2_ RNZ2016INF019	14_3_2_ RNZ2016INF020	15_3_2_ RNZ2016INF021	15_3_2_ RNZ2016INF022	15_3_2_ RNZ2016INF023	15_3_2_ RNZ2016INF024	15_3_2_ RNZ2016INF025	16_3_2_ RNZ2016INF026	16_3_2_ RNZ2016INF027	16_3_2_ RNZ2016INF028	16_3_2_ RNZ2016INF029	16_3_2_ RNZ2016INF030
Acarina																														
Aglaophamus sp.		1	5	2		1	2	3	1	3	1																			1
Alpheus sp.																														
Amalda northlandica																														
Ampelisca sp.									1																					
Ampharetidae		3		3	1	1					1			1				1			1									
Amphinomidae																														
Amphipoda	5	4	3	2	7	2	1	1	2	2	1	1		2	4	5	5	2		2	1		3	3				2		
Annelida indet.																														
Anthozoa	1																													
Anthuridea	5	2	4	1	2	1			1			1				3	4	3	2	2			1	1						
Aonides trifida																														
Arachnanthus sp.																				1										
Aricidea sp.			2																											
Armandia maculata																														
Ascidiacea																														
Ascidian (orange colonial)																														
Asellota	1		2			1	3												1											
Asteroidea																														
Austrofusus glans					1																									
Austrovenus stutchburyi					1	1																								
Barantolla lepte																														
Bathytoma murdochi																														
Bivalvia Unid.															2															

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Bivalvia Unid. (juv)		1	1	1		3				1																				
Brachyura (juv.)																														
Bryozoa (bushy)																														
Bryozoa (Conical Discoidal)																		1	2	1										
Bryozoa (encrusting)												1	1	1					1			1	1				1			
Callianassidae																														
Capitella sp.											1																			
Capitellidae			1																											
Caprellidae										1							2													
Chaetognatha		1																												
Chrysopetalidae			1																											
Cirolanidae														1																
Cirratulidae	1	3	4	4	2	2	1			2	1				1	1				2	1	1	2	4	2	3		1	1	
Cominella quoyana																														
Copepoda									2							1		1							2					
Corallina (Encrusting Pink)																														
Coralline Paint																														
Corophiidae																	1													
Cossura consimilis	5		2	1	4	2	2	4		3																				
Ctenophora																														
Cumacea	3	4		3		3	1	1		6							1					1								
Cylichna thetidis																														
Cylichnina striata																														
Cypridinodes reticulata									1																					
Diasterope grisea																														
Diplodonta sp.																														
Diplodonta striatula																														
Dorvilleidae			1		1			2			10	1	1	1	1	5		2	4	2		1			5			2	2	1
Ebalia laevis		1								1																				
Echinocardium cordatum								1																						
Echinoidea																														
Edwardsia sp.							1	1							1															

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Ennucula strangei						1																								
Epigonichthys hectori						1	1								1	1	2		1						1					
Euchone sp.				1	1			2	2	1																				
Eunicidae																														
Euphilomedes sp.	4	1	3	2	1				1	3							2	1			1			1	2					
Eurydice sp.																														
Flabelligeridae			1								1		1																	
Gastropoda (rissoid like)																														
Gastropoda (micro snails)																														
Gastrotricha																														
Glyceridae	1	1			1						1	1																		
Goniadidae	1			1		2	2	1	5				1			1	2				5						1		3	
Gonimyrtea concinna																														
Haustoriidae	1		3	5			1							1										1						
Hemichordata						1															2						1	1	1	
Hemichordata (zooids)																												1		
Hesionidae					3				3	1				4						1	1			2					1	
Heteromastus filiformis																						1								
Hiatella arctica																		1												
Hunkydora novozelandica																														
Hydrozoa		1		1																										
Leitoscoloplos kerguelensis																														
Leptochiton inquinatus																														
Leuroleberis zealandica															1															
Limaria orientalis														1																
Liocarcinus corrugatus																														
Lumbrineridae		1				1		1		1												2								
Lysianassidae	9	1	2	1					2	3				4				7						3		2	1		1	
Magelona dakini																														
Magelona sp.				2							1																			
Maldanidae	27	24	21	30	10	7	2	4	12	11	1	1		2	1	7	1	3		3	1	3								
Munnidae						1																								

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Myadora subrostrata																														
Mysidacea																														
Natantia unid.																														
Natatolana sp.								1																						
Neanthes cricognatha																		1												
Nebaliacea	1						2											1						1						
Nematoda	6	4	3	7	9	10	10	3	12	26	6		1	9	17	4	28	18	5	4	14	6	1	24	7	2		3	5	6
Nematoda sp. A																														
Nemertea	5	3	3	5		6	9	5	2	13	2	1	1	7	1	8	22	3		7	5	4	3	2	4		2	3	2	1
Nereididae																														
Nereididae sp. A											4	3			12	3	6	3	2						3					
Notocallista multistriata							1																							
Notomastus sp.				1					1			1		1		4	1			3		2			2	1	1	1	1	
Nucula nitidula																														
Oligochaeta					1	2	1		1	1	4	2		2		1	6	7	1	2	9	15	21	34	5	8	2	1	2	1
Onuphis aucklandensis	4	9	1			1		1	1		1	1		1		2	3	7	3	2	6	4	2	3	2				2	
Ophichthidae																														
Ophiuroidea	7	3	8	4	2	5	3	4	3	7	1	2			1								1							
Orbiniidae																										1				
Orbiniidae juv.																														
Ostracoda	1			4		2		1	1						1			1			2	1	3	4						
Owenia petersenae	2																													
Oweniidae						8				1												1								
Paguridae																				3										
Paphies australis																														
Paraonidae	6	4	7	6	7	37	25	4	29	24	2		1			3	1	1		1	1	3	1		1				1	2
Paraprionospio sp.	1	1							1																					
Parasterope quadrata																												1		
Pectinaria australis																														
Pennatulacea																														
Philine sp.			1																											
Phoronida		3		1																										

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Phoxocephalidae	2	1	6	2			1	1		1	1			1		1	2			3	3	3	1	3	2		1	1		
Phyllodocidae	1	2				1			1													1		6						
Pilargidae										1																				
Platyhelminthes																														
Pleuromeris zelandica																														
Poecilochaetidae																														
Polydorid		5				1																								
Polynoidae	3	1	2		1	3	4	5	1	6			2							1		1								
Porifera																				1										
Porifera (orange encrusting)																														
Pratulum pulchellum					1																							1		
Prionospio sp.		1	2	1	2	3		1			2		3	9	2	5	10	1	2	14	2			2	2		2	1	2	
Prionospio yuriel	3		2	3		1	2	9	1	1				1	4															
Processa moana												1																		
Pupa affinis																														
Pupa kirki			1				1																							
Retusidae																														
Ruditapes largillierti																														
Rutiderma sp.							1			1										1										
Sabellidae	2	5	1	2		4	1	3	2			1				2	1					2								
Saccella bellula																														
Saccella maxwelli	1				1				1																					
Scalibregmatidae																					1									
Scoloplos cylindrifer								1																						
Scoloplos sp.				1						1	1	1			1									1						
Serpula sp.																														
Serpulidae																				1										
Sigalionidae																	1									1			1	
Sigapatella tenuis																														
Sipuncula																														
Solariella tryphenensis																														
Solemya parkinsoni									1	1																				

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Taxa	11.1	11.2	11.3	11.4	11.5	12.1	12.2	12.3	12.4	12.5	13.1	13.2	13.3	13.4	13.5	14.1	14.2	14.3	14.4	14.5	15.1	15.2	15.3	15.4	15.5	16.1	16.2	16.3	16.4	16.5
Sphaeromatidae																														
Sphaerosyllis sp.	5	2	2			7	2	3	5	7	3	2		2	1	6	7			4	2		1	3	2	1	1		1	
Spionidae				1																										
Spiophanes kroyeri	14	19	3	7	8	1	2	6	1	3																				
Spiophanes modestus	24	25	19	58	29	42	9	19	21	8			3			6	8				4	1	5	8	1			1	1	
Spirorbidae																				2										
Syllidae	2	1	10	2	1	13	5	8	3	1	2	3		4		5	3			1	4	4	1	4	1	2	4	2	2	5
Tanaidacea	2	1	2	1	1		1		1		1			1			1		2		1		5	2	4	1				1
Terebellidae	6	1	4	2			2					1		2				1			2	1		2	1			1		
Terebellides stroemii										1						1			1											
Terebra circumcincta																														
Thyasiridae	1																													
Travisia olens																								1						
Ungulinidae	1																													
Upogebia sp.															1															
Xenophora neozelanica																		1												
Zeacolpus pagoda pagoda																														
# taxa	36	34	34	34	25	35	30	28	32	32	23	18	10	22	18	22	24	22	13	24	22	22	16	23	19	10	11	16	17	8
# individuals	164	140	133	168	98	178	99	96	122	143	49	25	15	58	53	75	120	67	27	64	69	59	52	115	49	22	17	23	29	18

average per site	11	12	13	14	15	16
# taxa	33	31	18	21	20	12
# individuals	141	128	40	71	69	22

average per area	Disposal Area 3.2
# taxa	23
# individuals	78

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

3.2A

Taxa	23_3_2A_ RNZ2016INF036	23_3_2A_ RNZ2016INF037	23_3_2A_ RNZ2016INF038	23_3_2A_ RNZ2016INF039	23_3_2A_ RNZ2016INF040	24_3_2A_ RNZ2016INF041	24_3_2A_ RNZ2016INF042	24_3_2A_ RNZ2016INF043	24_3_2A_ RNZ2016INF044	24_3_2A_ RNZ2016INF045	25_3_2A_ RNZ2016INF046	25_3_2A_ RNZ2016INF047	25_3_2A_ RNZ2016INF048	25_3_2A_ RNZ2016INF049	25_3_2A_ RNZ2016INF050	26_3_2A_ RNZ2016INF051	26_3_2A_ RNZ2016INF052	26_3_2A_ RNZ2016INF053	26_3_2A_ RNZ2016INF054	26_3_2A_ RNZ2016INF055	27_3_2A_ RNZ2016INF056	27_3_2A_ RNZ2016INF057	27_3_2A_ RNZ2016INF058	27_3_2A_ RNZ2016INF059	27_3_2A_ RNZ2016INF060	28_3_2A_ RNZ2016INF061	28_3_2A_ RNZ2016INF062	28_3_2A_ RNZ2016INF063	28_3_2A_ RNZ2016INF064	28_3_2A_ RNZ2016INF065
Acarina															1															
Aglaophamus sp.																												1		
Alpheus sp.																														
Amalda northlandica																														
Ampelisca sp.																														
Ampharetidae	1	2	1		2							1	1				2	1			1	4	1		2		2	1		
Amphinomidae																						1								1
Amphipoda	1		2	1				1	1	12	5		3	1	6	14	8	1	3	1		2	3	4		1	3	7	1	3
Annelida indet.																						3				1	2	2		
Anthozoa																														
Anthuridea	1	1	1		1		1						2	1	1		1					1	1				2	1	1	
Aonides trifida																			2									1		
Arachnanthus sp.																														
Aricidea sp.			3			2	2	1		1		2							1			1								
Armandia maculata																														
Ascidiacea																														
Ascidian (orange colonial)																												1		
Asellota																2												1		
Asteroidea																														
Austrofusus glans																														
Austrovenus stutchburyi								1																						
Barantolla lepte					1																									
Bathytoma murdochi																														
Bivalvia Unid.																														

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Bivalvia Unid. (juv)																1														
Brachyura (juv.)																														
Bryozoa (bushy)																1														
Bryozoa (Conical Discoida	9	3	3	2	4	2	2	12	6	9	2	10	3	5	14	1						1								
Bryozoa (encrusting)															1	1	1			1	1					1				
Callianassidae																														
Capitella sp.																														
Capitellidae																														
Caprellidae										3																				
Chaetognatha																														
Chrysopetalidae																														
Cirolanidae	1				1																									
Cirratulidae			1			1	4	2	4		4	1		1	5	2						5	1		2		2	1		4
Cominella quoyana																														
Copepoda								1		1			1	1	2	1	3	1	1	1				1	3		1	1		
Corallina (Encrusting Pink)																												1		
Coralline Paint																													1	
Corophiidae																														
Cossura consimilis																														
Ctenophora									7			1		1					1		2	1	1	1				2	1	
Cumacea			2	1												3	3	1	1		1				1			1	1	
Cylichna thetidis																														
Cylichnina striata																														
Cypridinodes reticulata																												1		
Diasterope grisea										1																				
Diplodonta sp.																														
Diplodonta striatula																														
Dorvilleidae					1						1	1			1							1	5		1					
Ebalia laevis																			1											
Echinocardium cordatum																														
Echinoidea																											1			
Edwardsia sp.																														

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Ennucula strangei														1																
Epigonichthys hectori	1														1	1		1								1				
Euchone sp.																									1					
Eunicidae																														
Euphilomedes sp.			1		1								1		1		1													
Eurydice sp.									1								1	2	1			1			2			1		
Flabelligeridae			1													1	3	1				1					1			
Gastropoda (rissoid like)																			1											
Gastropoda (micro snails)																												1		
Gastrotricha																														
Glyceridae																								2				1		
Goniadidae	1		2	4	1			1													1						1			
Gonimyrtea concinna																														
Haustoriidae				1										1	1	1			3											
Hemichordata		1	9		2					1			1												1					
Hemichordata (zooids)	1																							1			3	4	1	
Hesionidae			1					1								1	1		1		1			1	1		2			
Heteromastus filiformis	1		1																											
Hiatella arctica																														
Hunkydora novozelandica																														
Hydrozoa																														
Leitoscoloplos kerguelensis																														
Leptochiton inquinatus																	1								1			2		
Leuroleberis zealandica																														
Limaria orientalis																												2		
Liocarcinus corrugatus																														
Lumbrineridae									1			1					1	1									1			
Lysianassidae			2						4						2							1		1				1		
Magelona dakini																														
Magelona sp.						1							1										1							
Maldanidae	9				5	1		4		3	2	3	6	1	2		4	1	1		1	2			1		1	1		3
Munnidae										1																				

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Myadora subrostrata																														
Mysidacea																														
Natantia unid.																														
Natatolana sp.																														
Neanthes cricognatha																														
Nebaliacea																														
Nematoda	3	9	5		10	3	1	1	6	4	2	8	6	22	19	6	19	14	12	39	18	25	10	19	37		20	27	20	14
Nematoda sp. A				1				2			2			3	1	1	1	3		1										
Nemertea	3	2	1	1	4			1			6	4	3	4	1	1	10		1		2	1	5		3			1		2
Nereididae																							4				16		19	
Nereididae sp. A		1	1	6	1		1		2					1	1	7	13	5	8	12	2	6						12		5
Notocallista multistriata																														
Notomastus sp.	1				2				1				2	2		1			1		1	5	1		2		2			1
Nucula nitidula	1																													1
Oligochaeta	1	7	1	1	5			1	4	1	1	3	2	2		2		14	3		2	3	1	2	2			1		1
Onuphis aucklandensis		1			4							2						1			1	1	1							
Ophichthidae			1																											
Ophiuroidea					2			2		2							3				2						1		1	
Orbiniidae																												1		
Orbiniidae juv.																														
Ostracoda	1							1	2		1	1		1		1					1	1						2		
Owenia petersenae																														1
Oweniidae	1				1							1					2													
Paguridae			1																1											
Paphies australis																			1											
Paraonidae	1		5		3		1	1	2	3	1	3		1								1	1							
Paraprionospio sp.																														
Parasterope quadrata					1									1														1		1
Pectinaria australis																														
Pennatulacea																														
Philine sp.													1		1												1			
Phoronida																														

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Phoxocephalidae		1		1					1						1		1	1	3				1							1
Phyllodocidae												1			1		1											1		
Pilargidae																														
Platyhelminthes																														
Pleuromeris zelandica																														
Poecilochaetidae																												1		
Polydorid																									1					
Polynoidae																2		1				1				1				
Porifera																	1													
Porifera (orange encrusting)																												1		1
Pratulum pulchellum																								1	1					
Prionospio sp.	2	4	7	8	1	1	2	1		1		2	2	1	6	4	1	2	2			7		1	5		4	5		4
Prionospio yuriel																														
Processa moana						1		1									1										1			1
Pupa affinis																														
Pupa kirki																														
Retusidae																														
Ruditapes largillierti																														
Rutiderma sp.																														
Sabellidae		1	1						1	1												1								
Saccella bellula																														
Saccella maxwelli																														
Scalibregmatidae																														
Scoloplos cylindrifer																														
Scoloplos sp.				1											2	1	1	1			1	1				1	1			
Serpula sp.																														
Serpulidae																														
Sigalionidae									1																		1		1	
Sigapatella tenuis																												1		
Sipuncula																						1								
Solariella tryphenensis																														
Solemya parkinsoni																														

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

	23.1	23.2	23.3	23.4	23.5	24.1	24.2	24.3	24.4	24.5	25.1	25.2	25.3	25.4	25.5	26.1	26.2	26.3	26.4	26.5	27.1	27.2	27.3	27.4	27.5	28.1	28.2	28.3	28.4	28.5
Sphaeromatidae				1																		1			1					
Sphaerosyllis sp.	2	1	9	19	4		1		1		3		4	8	5	4	7	8	4			4	2	6	6		10	13		6
Spionidae																														
Spiophanes kroyeri																														
Spiophanes modestus				1								1																		
Spirorbidae																														
Syllidae		4	3	4	7	1	1	4	5	3	4	7	1	2	3	1	1	1				9		1	4		2	3		6
Tanaidacea		1			3					1	1		1	8	4	1	3	3	4	2	1	1		1	1			3		1
Terebellidae	1	2		1				1	1	1	3						2	1				2						1		1
Terebellides stroemii																														
Terebra circumcincta																														
Thyasiridae																														
Travisia olens																														
Ungulinidae																														
Upogebia sp.																														
Xenophora neozelanica																														
Zeacolpus pagoda pagoda										1		1																		
Taxa																														
# taxa	21	16	25	17	24	9	10	20	19	19	15	20	18	22	25	26	29	22	23	7	17	32	16	14	22	6	24	38	10	20
# individuals	43	41	65	54	67	13	16	40	51	50	38	54	41	69	83	62	97	65	57	57	39	96	39	42	79	6	81	109	47	58

average per site	23	24	25	26	27	28
# taxa	21	15	20	21	20	20
# individuals	54	34	57	68	59	60

average per area	Reference Area 3.2A
# taxa	20
# individuals	55

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

	3.2B																													
Taxa	29_3_2B_ RNZ2016INF066	29_3_2B_ RNZ2016INF067	29_3_2B_ RNZ2016INF068	29_3_2B_ RNZ2016INF069	29_3_2B_ RNZ2016INF070	30_3_2B_ RNZ2016INF071	30_3_2B_ RNZ2016INF072	30_3_2B_ RNZ2016INF073	30_3_2B_ RNZ2016INF074	30_3_2B_ RNZ2016INF075	31_3_2B_ RNZ2016INF076	31_3_2B_ RNZ2016INF077	31_3_2B_ RNZ2016INF078	31_3_2B_ RNZ2016INF079	31_3_2B_ RNZ2016INF080	32_3_2B_ RNZ2016INF081	32_3_2B_ RNZ2016INF082	32_3_2B_ RNZ2016INF083	32_3_2B_ RNZ2016INF084	32_3_2B_ RNZ2016INF085	33_3_2B_ RNZ2016INF086	33_3_2B_ RNZ2016INF087	33_3_2B_ RNZ2016INF088	33_3_2B_ RNZ2016INF089	33_3_2B_ RNZ2016INF090	34_3_2B_ RNZ2016INF091	34_3_2B_ RNZ2016INF092	34_3_2B_ RNZ2016INF093	34_3_2B_ RNZ2016INF094	34_3_2B_ RNZ2016INF095
Acarina		1																												
Aglaophamus sp.	2				1	3					2				2	1	1		1								1			1
Alpheus sp.																			1	1										
Amalda northlandica																								1	1			1	1	
Ampelisca sp.					1													1			1		1		1		1			1
Ampharetidae	1		1			2	2	1	1		1										1		2	2	1	2	1		3	3
Amphinomidae						1																								
Amphipoda	4	1	4	6		1	14	13	7	6	10	1	1	8	3		2	1	2	1		8	2		1	3		2	2	3
Annelida indet.								1	2																					
Anthozoa																														
Anthuridea	2	1	3			2	6	2	2	1	2			1	1	1	2	2	1	4	1	1		1	2	1		2		
Aonides trifida																														
Arachnanthus sp.							1																							
Aricidea sp.	1		2	2		1					1							2								1				
Armandia maculata																														
Ascidiacea							2			2																				
Ascidian (orange colonial)																														
Asellota										1																				
Asteroidea				1										1																
Austrofusus glans						1					1								1											
Austrovenus stutchburyi																														
Barantolla lepte																	1													
Bathytoma murdochi																													1	
Bivalvia Unid.																														

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Bivalvia Unid. (juv)									2				1			1									1					
Brachyura (juv.)											1																			
Bryozoa (bushy)																														
Bryozoa (Conical Discoidal)		1											1																	
Bryozoa (encrusting)										1							1		1			1						1		
Callianassidae				1																										
Capitella sp.																														
Capitellidae							1																1		2					
Caprellidae																														
Chaetognatha																														
Chrysopetalidae																														
Cirolanidae																														
Cirratulidae		1	4	2	1		4	2	2	2	2	2		3	1			2						1			3			1
Cominella quoyana																									1					
Copepoda																2	1	1	2	8										
Corallina (Encrusting Pink)																														
Coralline Paint										1																				
Corophiidae																														
Cossura consimilis						4																								
Ctenophora					1						1		1							1										10
Cumacea	1		1			2	3		1		3		1		2		1	3			2	3			1	1		1		1
Cylichna thetidis																											1			
Cylichnina striata																								1	1					
Cypridinodes reticulata		1											1																	
Diasterope grisea									1			1								1	1			1	1					1
Diplodonta sp.				2								1						1				1	5				1	1		
Diplodonta striatula			1		1																									
Dorvilleidae		1			1		6	2	2	8		1								1										
Ebalia laevis																														
Echinocardium cordatum																														
Echinoidea	1																													
Edwardsia sp.		1							1		1	1			2															

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Ennucula strangei																														
Epigonichthys hectori		1			1		1		3											1										
Euchone sp.						1															1				1					
Eunicidae	1					1	1																							
Euphilomedes sp.						2						1		3		2		1										3		2
Eurydice sp.																														
Flabelligeridae						1	1				1										1	1								
Gastropoda (rissoid like)						1																								
Gastropoda (micro snails)																														
Gastrotricha																				1										
Glyceridae					1																									
Goniadidae			1				1	1	4		2			1	1	2		1				2	1	1	1	1	1	1	1	
Gonimyrtea concinna		1	1																					1						
Haustoriidae		1			1	1		2	2				2			3		2		3	3		3			3		1		
Hemichordata		1								1		1									1									
Hemichordata (zooids)																														
Hesionidae			1									1			1							1			1					
Heteromastus filiformis																														
Hiatella arctica																														
Hunkydora novozelandica																											1			
Hydrozoa		1																												
Leitoscoloplos kerguelensis														1						1										
Leptochiton inquinatus							1													1										
Leuroleberis zealandica																														
Limaria orientalis																				1										
Liocarcinus corrugatus																														
Lumbrineridae			1																		1				1	1				
Lysianassidae		4	1		1	1			1				3			2		3		1			5	5	9	8	4	14	1	9
Magelona dakini																		1												
Magelona sp.									1				1		1															
Maldanidae	75	18	85	52	7	40	3	1		3	25	3	4	2	26	33	33	67	18	1	45	2	5		2	5	1	3	3	3
Munnidae							1	1									1													1

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Myadora subrostrata																					1									
Mysidacea					2																									
Natantia unid.						2										1														
Natatolana sp.																														
Neanthes cricognatha					1																									
Nebaliacea						1																			1	1				
Nematoda	5	8	7	1	4	4	4	16	15	1		28	1		3				1	11		1	7	4	8	1	2	2	1	3
Nematoda sp. A																														
Nemertea	9	6	1	1		6	9	3	2	9	1	9		1	1		1	1	1	3	1		1		1				1	1
Nereididae																1														
Nereididae sp. A																														
Notocallista multistriata	1																			1										
Notomastus sp.							2	1	2	3	1												1						1	
Nucula nitidula	1				2	2										3	1		1					5		1	1			
Oligochaeta	1				1			3	3																					
Onuphis aucklandensis	21	4	9	3	2	8	1	2	9	1	4			2	2	5	3	2	1	1	5	2	2	7	1	2	3	4	4	1
Ophichthidae																														
Ophiuroidea						3	2									1		1	2		1									
Orbiniidae	3														2				1											
Orbiniidae juv.																										2				
Ostracoda		1		4	2			1	7		3		3			2						2	4	21	21	24	31	15	33	1
Owenia petersenae	1				4	3	1	1	1														1							
Oweniidae																														
Paguridae						2																								
Paphies australis																														
Paraonidae				2	4	3	2	1	3	1	1			3			1	1	1	1		3	2		1		1	1	1	
Paraprionospio sp.						1							1						1		1									
Parasterope quadrata																														
Pectinaria australis	1											1					1	1												
Pennatulacea																								1						
Philine sp.				1				1											1											
Phoronida	4			9				1	3			1		1	10			3	10	1	7	1		1	1	2		7	3	1

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Phoxocephalidae	4	2	14	5	8	5	3	2	7	1	1		13	7	1	8	5	5	4	10	4	5	7	13	28	6	1	4	8	9
Phyllodocidae	3			2	1			1	5			1		1				1		1			2	1			2		2	1
Pilargidae																														
Platyhelminthes	1														1															
Pleuromeris zelandica		1																				1		1						
Poecilochaetidae																														
Polydorid	2		3	2																1		1								
Polynoidae																		1	1											
Porifera																														
Porifera (orange encrusting)																														
Pratulum pulchellum			1				1																							
Prionospio sp.	1	2	4	1	4	3	3	12	4	4	2		8	7				1	9	11		2	4	4	3	2	1		1	2
Prionospio yuriel						1																								
Processa moana																1														
Pupa affinis																		1	1		1									
Pupa kirki																														
Retusidae																														
Ruditapes largillierti							1																							
Rutiderma sp.								1								1														
Sabellidae		2		5	1	5	10	1	2	5	1	2	1			2	1	1	1	1	6	1	1		2	1	1	3		1
Saccella bellula																				1										
Saccella maxwelli				1																										
Scalibregmatidae																														
Scoloplos cylindrifer																														
Scoloplos sp.				1	4						1		2	1																
Serpula sp.				1			1			3														1						
Serpulidae																														
Sigalionidae					1			1																						
Sigapatella tenuis																														
Sipuncula																														
Solariella tryphenensis									1																					
Solemya parkinsoni																	1													

Appendix A2: Synthesised Data for Cawthron Institute ID and Counts for grab samples collected Cawthron Institue in Disposal Area 3.2 and Reference Areas 3.2A and 3.2B

Taxa	29.1	29.2	29.3	29.4	29.5	30.1	30.2	30.3	30.4	30.5	31.1	31.2	31.3	31.4	31.5	32.1	32.2	32.3	32.4	32.5	33.1	33.2	33.3	33.4	33.5	34.1	34.2	34.3	34.4	34.5
Sphaeromatidae																														
Sphaerosyllis sp.	3	1		1	1	2	1	10	2	2		2	2				1	1	1			1	2						2	
Spionidae																														
Spiophanes kroyeri	5		1	4	3	8							1	1			3				1				1					
Spiophanes modestus	32	1	9	29	26	28	4	2	62	1	11	31		78	16	1	1	27	5	5	3	9	16		38	5	3	6	13	8
Spirorbidae							1																							
Syllidae	5	4	3			4	6	5	5	18	3						3	1			2	1	2	1		3	1	1		
Tanaidacea				2	3	2	5	2		1	1				1	1	2		1	3				1		1	1	2	5	7
Terebellidae	1	2	2	1	2	1	1	1	1	1	1	1	1						1			4		6	3	8	2	4	4	3
Terebellides stroemii			1				1		1												1					2			4	
Terebra circumcincta											1																			
Thyasiridae																														
Travisia olens																					1	1								
Ungulinidae																														
Upogebia sp.																														
Xenophora neozelanica																														
Zeacolpus pagoda pagoda	1						1																		1					
# taxa	30	27	25	27	31	38	37	31	34	24	28	19	20	18	19	21	22	29	27	29	24	25	23	23	31	25	23	22	22	24
# individuals	193	69	161	142	93	159	108	94	167	77	85	89	49	122	77	74	67	136	71	78	92	56	77	81	138	87	65	79	95	74

average per site	29	30	31	32	33	34
# taxa	28	33	21	26	25	23
# individuals	132	121	84	85	89	80

average per area	Reference Area 3.2B
# taxa	26
# individuals	99

Hill Laboratories
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ANALYSIS REPORT

Client:	Cawthron Institute (Nelson)	**Lab No:**	1578823 SPv2
Contact:	Deanna Elvines	**Date Registered:**	05-May-2016
	C/- Cawthron Institute (Nelson)	**Date Reported:**	02-Jun-2016
	Private Bag 2	**Quote No:**	76487
	Nelson Mail Centre	**Order No:**	
	Nelson 7042	**Client Reference:**	Sediment Analyses
		Add. Client Ref:	RNZ
		Submitted By:	Olivia Johnston

Amended Report

This report replaces an earlier report issued on the 20 May 2016 at 2:18 pm
At the client's request, organic analyses have been added to four samples.

Sample Type: Sediment

Sample Name:		RNZ2016SED001 11_3.2	RNZ2016SED002 12_3.2	RNZ2016SED003 13_3.2	RNZ2016SED004 14_3.2	RNZ2016SED005 15_3.2
Lab Number:		1578823.1	1578823.2	1578823.3	1578823.4	1578823.5
Individual Tests						
Particle size analysis*		See attached report	See attached report	See attached report	See attached report	See attached report
Total Recoverable Silver	mg/kg dry wt	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.3	4	6	6.3	4.9
Total Recoverable Cadmium	mg/kg dry wt	0.032	0.038	0.012	< 0.010	< 0.010
Total Recoverable Chromium	mg/kg dry wt	14.5	15.0	6.7	6.4	5.7
Total Recoverable Copper	mg/kg dry wt	1.4	1.8	0.8	0.6	0.5
Total Recoverable Lead	mg/kg dry wt	2.7	2.8	1.32	1.23	1.05
Total Recoverable Mercury	mg/kg dry wt	0.013	0.016	< 0.010	< 0.010	< 0.010
Total Recoverable Nickel	mg/kg dry wt	5.6	7.5	4.8	3.3	4.0
Total Recoverable Zinc	mg/kg dry wt	14.7	15.5	8.1	7.0	6.4

Sample Name:		RNZ2016SED006 16_3.2	RNZ2016SED007 19_2.2	RNZ2016SED008 23_3.2A	RNZ2016SED009 24_3.2A	RNZ2016SED010 25_3.2A
Lab Number:		1578823.6	1578823.7	1578823.8	1578823.9	1578823.10
Individual Tests						
Particle size analysis*		See attached report	See attached report	See attached report	See attached report	See attached report
Total Recoverable Silver	mg/kg dry wt	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	4.5	3.5	7.2	5.0	6.8
Total Recoverable Cadmium	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.012
Total Recoverable Chromium	mg/kg dry wt	4.3	7.3	5.6	4.3	4.9
Total Recoverable Copper	mg/kg dry wt	0.5	0.4	0.7	0.4	0.6
Total Recoverable Lead	mg/kg dry wt	0.96	1.06	1.33	0.99	1.20
Total Recoverable Mercury	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Recoverable Nickel	mg/kg dry wt	3.4	2.0	4.2	3.9	5.0
Total Recoverable Zinc	mg/kg dry wt	5.2	8.9	6.4	5.2	6.8

Sample Name:	RNZ2016SED011 26_3.2A	RNZ2016SED012 27_3.2A	RNZ2016SED013 28_3.2A	RNZ2016SED014 29_3.2B	RNZ2016SED015 30_3.2B
Lab Number:	1578823.11	1578823.12	1578823.13	1578823.14	1578823.15

Sample Type: Sediment						
	Sample Name:	RNZ2016SED011 26_3.2A	RNZ2016SED012 27_3.2A	RNZ2016SED013 28_3.2A	RNZ2016SED014 29_3.2B	RNZ2016SED015 30_3.2B
	Lab Number:	1578823.11	1578823.12	1578823.13	1578823.14	1578823.15
Individual Tests						
Particle size analysis*		See attached report	See attached report	See attached report	See attached report	See attached report
Total Recoverable Silver	mg/kg dry wt	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	6.8	5.3	5	5.5	5.7
Total Recoverable Cadmium	mg/kg dry wt	0.010	< 0.010	0.012	0.018	0.013
Total Recoverable Chromium	mg/kg dry wt	5.6	4.7	4.4	16.6	7.9
Total Recoverable Copper	mg/kg dry wt	0.6	0.7	0.7	1.0	0.6
Total Recoverable Lead	mg/kg dry wt	1.36	1.24	1.47	2.1	1.36
Total Recoverable Mercury	mg/kg dry wt	< 0.010	0.013	< 0.010	< 0.010	< 0.010
Total Recoverable Nickel	mg/kg dry wt	4.8	5.1	5.9	5.2	4.5
Total Recoverable Zinc	mg/kg dry wt	6.0	6.4	5.8	13.4	7.1

	Sample Name:	RNZ2016SED016 31_3.2B	RNZ2016SED017 32_3.2B	RNZ2016SED018 33_3.2B	RNZ2016SED019 34_3.2B	RNZ2016SED061 14_3.2
	Lab Number:	1578823.16	1578823.17	1578823.18	1578823.19	1578823.23
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	-	81
Particle size analysis*		See attached report	See attached report	See attached report	See attached report	-
Total Recoverable Silver	mg/kg dry wt	< 0.02	< 0.02	< 0.02	< 0.02	-
Total Organic Carbon*	g/100g dry wt	-	-	-	-	< 0.13
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	5.1	5	4.9	4.2	-
Total Recoverable Cadmium	mg/kg dry wt	0.015	0.030	< 0.010	0.010	-
Total Recoverable Chromium	mg/kg dry wt	13.9	21	10.0	9.1	-
Total Recoverable Copper	mg/kg dry wt	0.8	1.6	0.6	0.5	-
Total Recoverable Lead	mg/kg dry wt	2.2	3.3	1.49	1.33	-
Total Recoverable Mercury	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total Recoverable Nickel	mg/kg dry wt	4.4	8.0	4.0	3.8	-
Total Recoverable Zinc	mg/kg dry wt	12.3	18.9	8.4	8.0	-
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	-	-	-	-	< 0.0010
alpha-BHC	mg/kg dry wt	-	-	-	-	< 0.0010
beta-BHC	mg/kg dry wt	-	-	-	-	< 0.0010
delta-BHC	mg/kg dry wt	-	-	-	-	< 0.0010
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 0.0010
cis-Chlordane	mg/kg dry wt	-	-	-	-	< 0.0010
trans-Chlordane	mg/kg dry wt	-	-	-	-	< 0.0010
2,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.0010
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.0010
2,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.0010
4,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.0010
2,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.0010
4,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.0010
Total DDT Isomers	mg/kg dry wt	-	-	-	-	< 0.006
Dieldrin	mg/kg dry wt	-	-	-	-	< 0.0010
Endosulfan I	mg/kg dry wt	-	-	-	-	< 0.0010
Endosulfan II	mg/kg dry wt	-	-	-	-	< 0.0010
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.0010
Endrin	mg/kg dry wt	-	-	-	-	< 0.0010
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.0010
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.0010
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.0010
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.0010
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.0010

Sample Type: Sediment						
Sample Name:		RNZ2016SED016 31_3.2B	RNZ2016SED017 32_3.2B	RNZ2016SED018 33_3.2B	RNZ2016SED019 34_3.2B	RNZ2016SED061 14_3.2
Lab Number:		1578823.16	1578823.17	1578823.18	1578823.19	1578823.23
Organochlorine Pesticides Trace in Soil						
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.0010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	-	< 0.002
Polycyclic Aromatic Hydrocarbons Trace in Soil						
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.002
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.002
Anthracene	mg/kg dry wt	-	-	-	-	< 0.002
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	< 0.002
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	< 0.002
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	< 0.002
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	< 0.002
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	< 0.002
Chrysene	mg/kg dry wt	-	-	-	-	< 0.002
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	< 0.002
Fluoranthene	mg/kg dry wt	-	-	-	-	< 0.002
Fluorene	mg/kg dry wt	-	-	-	-	< 0.002
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	< 0.002
Naphthalene	mg/kg dry wt	-	-	-	-	< 0.012
Phenanthrene	mg/kg dry wt	-	-	-	-	< 0.005
Pyrene	mg/kg dry wt	-	-	-	-	< 0.002
Polychlorinated Biphenyls Trace in Soil						
PCB-18	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-28	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-31	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-44	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-49	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-52	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-60	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-77	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-81	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-86	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-101	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-105	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-110	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-114	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-118	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-121	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-123	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-126	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-128	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-138	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-141	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-149	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-151	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-153	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-156	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-157	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-159	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-167	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-169	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-170	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-180	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-189	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-194	mg/kg dry wt	-	-	-	-	< 0.0010

Sample Type: Sediment						
Sample Name:		RNZ2016SED016 31_3.2B	RNZ2016SED017 32_3.2B	RNZ2016SED018 33_3.2B	RNZ2016SED019 34_3.2B	RNZ2016SED061 14_3.2
Lab Number:		1578823.16	1578823.17	1578823.18	1578823.19	1578823.23
Polychlorinated Biphenyls Trace in Soil						
PCB-206	mg/kg dry wt	-	-	-	-	< 0.0010
PCB-209	mg/kg dry wt	-	-	-	-	< 0.0010
Total PCB (Sum of 35 congeners)	mg/kg dry wt	-	-	-	-	< 0.04
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.005
Monobutyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.007
Tributyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.004
Triphenyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.003
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	-	< 8
C10 - C14	mg/kg dry wt	-	-	-	-	< 20
C15 - C36	mg/kg dry wt	-	-	-	-	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	-	< 70

Sample Name:		RNZ2016SED062 15_3.2	RNZ2016SED066 24_3.2A	RNZ2016SED071 29_3.2B		
Lab Number:		1578823.24	1578823.28	1578823.33		
Individual Tests						
Dry Matter	g/100g as rcvd	80	80	76	-	-
Total Organic Carbon*	g/100g dry wt	< 0.13	< 0.13	0.16	-	-
Organochlorine Pesticides Trace in Soil						
Aldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
alpha-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
beta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
delta-BHC	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
cis-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
trans-Chlordane	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
2,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
4,4'-DDD	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
2,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
4,4'-DDE	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
2,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
4,4'-DDT	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Total DDT Isomers	mg/kg dry wt	< 0.006	< 0.006	< 0.006	-	-
Dieldrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan I	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan II	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endrin	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endrin aldehyde	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Endrin ketone	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Heptachlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Methoxychlor	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Polycyclic Aromatic Hydrocarbons Trace in Soil						
Acenaphthene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Acenaphthylene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Anthracene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-

Sample Type: Sediment						
Sample Name:		RNZ2016SED062 15_3.2	RNZ2016SED066 24_3.2A	RNZ2016SED071 29_3.2B		
Lab Number:		1578823.24	1578823.28	1578823.33		
Polycyclic Aromatic Hydrocarbons Trace in Soil						
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Chrysene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Fluoranthene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Fluorene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Naphthalene	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Phenanthrene	mg/kg dry wt	< 0.005	< 0.006	< 0.006	-	-
Pyrene	mg/kg dry wt	< 0.002	< 0.002	< 0.002	-	-
Polychlorinated Biphenyls Trace in Soil						
PCB-18	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-28	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-31	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-44	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-49	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-52	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-60	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-77	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-81	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-86	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-101	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-105	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-110	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-114	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-118	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-121	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-123	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-126	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-128	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-138	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-141	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-149	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-151	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-153	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-156	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-157	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-159	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-167	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-169	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-170	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-180	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-189	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-194	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-206	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
PCB-209	mg/kg dry wt	< 0.0010	< 0.0010	< 0.0010	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.04	< 0.04	< 0.04	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	< 0.005	< 0.005	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	< 0.007	< 0.007	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	< 0.004	< 0.004	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	< 0.003	< 0.003	-	-

Sample Type: Sediment						
	Sample Name:	RNZ2016SED062 15_3.2	RNZ2016SED066 24_3.2A	RNZ2016SED071 29_3.2B		
	Lab Number:	1578823.24	1578823.28	1578823.33		
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 9	< 9	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	-	-

Analyst's Comments

The detection limit for Naphthalene and Phenanthrene was raised due to an elevated blank level found during the analysis.

Appendix No.1 - Particle Size Report - 1578823

Appendix No.2 - Particle Size Report - 1578823

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-19, 23-24, 28, 33
Organochlorine/Polychlorinated biphenyls Trace in Soil	Sonication extraction, SPE cleanup, GC & GC-MS analysis. Tested on dried sample	0.0010 - 0.02 mg/kg dry wt	23-24, 28, 33
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, trace level.	0.010 - 0.4 mg/kg dry wt	1-19
Polycyclic Aromatic Hydrocarbons Trace in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis US EPA 8270C. Tested on as received sample [KBIs:5784,4273,2695]	0.002 - 0.010 mg/kg dry wt	23-24, 28, 33
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	23-24, 28, 33
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	23-24, 28, 33
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	23-24, 28, 33
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-19
Particle size analysis*	Malvern Laser Sizer particle size analysis. Subcontracted to Earth Sciences Department, Waikato University, Hamilton.	-	1-19
Total Recoverable Silver	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.02 mg/kg dry wt	1-19
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	23-24, 28, 33

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Samples were sieved at 2mm and particles below 2mm were analysed using the Malvern Lasersizer.
Below are the proportions above and below 2mm

Sample No	% > 2mm	%< 2mm
1578823.3	22.5	77.5
1578823.4	3.1	96.9
1578823.5	4.6	95.4
1578823.6	10.7	89.3
1578823.7	1.1	98.9
1578823.8	7.2	92.8
1578823.1	8.6	91.4
1578823.11	20.9	79.1
1578823.12	23.5	76.5
1578823.13	24.0	76.0
1578823.15	12.7	87.3

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name: 1578823.1
SOP Name: Sediment
Measured: Wednesday, 18 May 2016 2:44:32 p.m.

Sample Source & type:
Measured by: rodgers
Analysed: Wednesday, 18 May 2016 2:44:34 p.m.

Sample bulk lot ref: 2016084/1
Result Source: Measurement

Particle Name: Sediment
Accessory Name: Hydro 2000G (A)
Analysis model: General purpose
Sensitivity: Enhanced

Particle RI: 1.500
Absorption: 0.2
Size range: 0.020 to 2000.000 um
Obscuration: 25.51 %

Dispersant Name: Water
Dispersant RI: 1.330
Weighted Residual: 0.536 %
Result Emulation: Off

Concentration: 0.1097 %Vol
Span : 2.127
Uniformity: 0.684
Result units: Volume

Specific Surface Area: 0.253 m²/g
Surface Weighted Mean D[3,2]: 23.720 um
Vol. Weighted Mean D[4,3]: 224.507 um
Standard Deviation 212.633 um

d(0.1): 13.723 um **d(0.5):** 184.500 um **d(0.9):** 406.138 um

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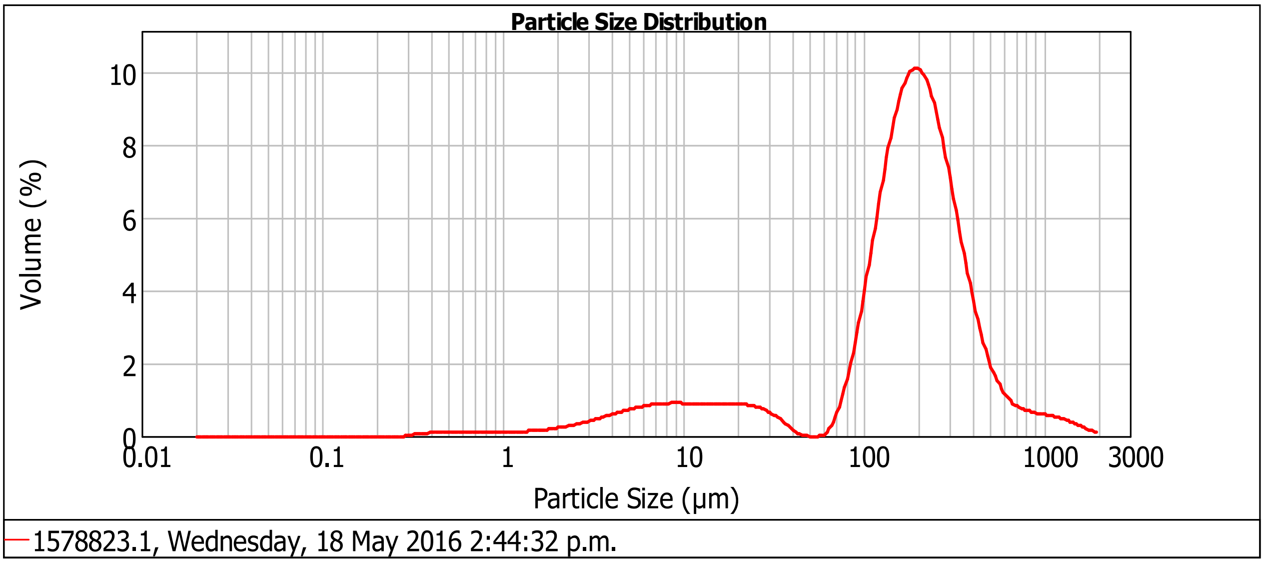

Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	1.53	44.000	15.25	149.000	36.62	500.000	93.83	1680.000	99.82
0.060	0.00	3.900	3.18	53.000	15.26	177.000	47.27	590.000	95.56	2000.000	100.00
0.120	0.00	7.800	6.67	63.000	15.28	210.000	58.58	710.000	96.77		
0.240	0.00	10.000	8.14	74.000	15.71	250.000	69.57	840.000	97.58		
0.490	0.27	15.600	10.74	88.000	17.43	300.000	79.29	1000.000	98.30		
0.700	0.56	31.000	14.48	105.000	21.28	350.000	85.61	1190.000	98.94		
0.980	0.83	37.000	15.05	125.000	27.64	420.000	90.78	1410.000	99.45		

Operator notes:

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Result Analysis Report

Sample Name:
1578823.2

SOP Name:
Sediment

Measured:
Wednesday, 18 May 2016 2:49:47 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 2:49:49 p.m.

Sample bulk lot ref:
2016084/2

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Enhanced

Particle RI:
1.500

Absorption:
0.2

Size range:
0.020 to 2000.000 um

Obscuration:
18.76 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.558 %

Result Emulation:
Off

Concentration:
0.0451 %Vol

Span :
3.043

Uniformity:
0.966

Result units:
Volume

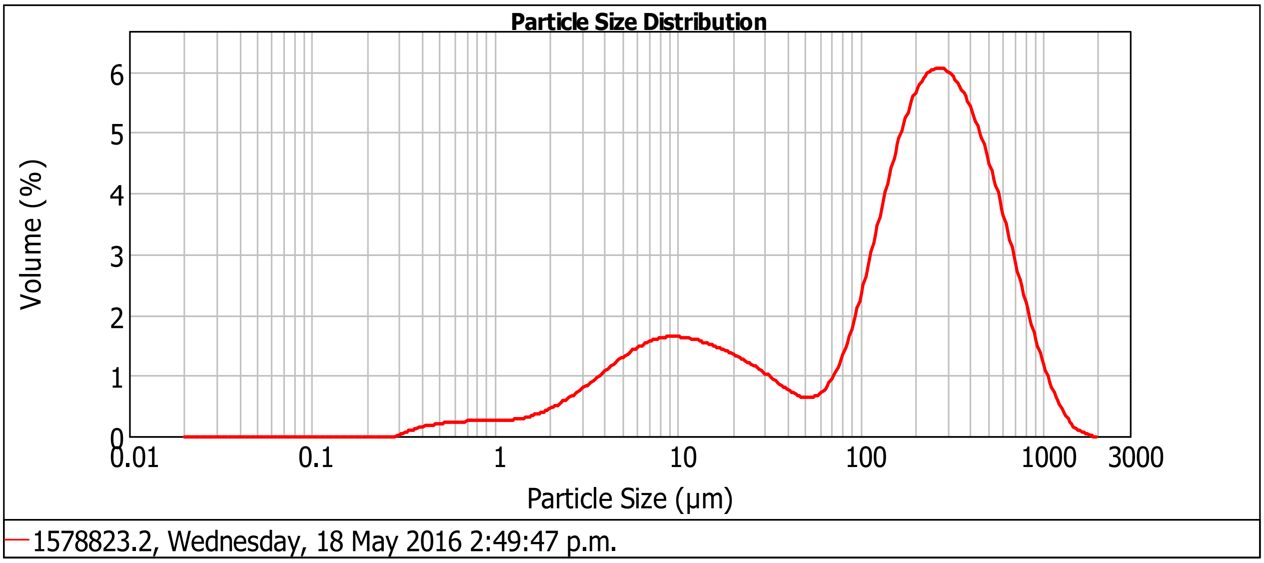
Specific Surface Area:
0.43 m²/g

Surface Weighted Mean D[3,2]:
13.938 um

Vol. Weighted Mean D[4,3]:
252.039 um

Standard Deviation
252.12 um

d(0.1): 6.232 um **d(0.5): 192.796 um** **d(0.9): 592.985 um**



Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.050	0.00	2.000	2.94	44.000	27.20	149.000	41.54	500.000	85.33	1680.000	99.98
0.060	0.00	3.900	6.09	53.000	28.00	177.000	46.99	590.000	89.87	2000.000	100.00
0.120	0.00	7.800	12.27	63.000	28.75	210.000	53.16	710.000	93.90		
0.240	0.00	10.000	14.92	74.000	29.68	250.000	59.92	840.000	96.55		
0.490	0.41	15.600	19.52	88.000	31.20	300.000	67.14	1000.000	98.37		
0.700	0.95	31.000	25.27	105.000	33.58	350.000	73.10	1190.000	99.38		
0.980	1.49	37.000	26.34	125.000	36.99	420.000	79.70	1410.000	99.85		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.3

SOP Name:

Measured:
Wednesday, 18 May 2016 3:06:08 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 3:06:09 p.m.

Sample bulk lot ref:
2016084/3

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
9.15 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
1.700 %

Result Emulation:
Off

Concentration:
0.1008 %Vol

Span :
1.863

Uniformity:
0.5

Result units:
Volume

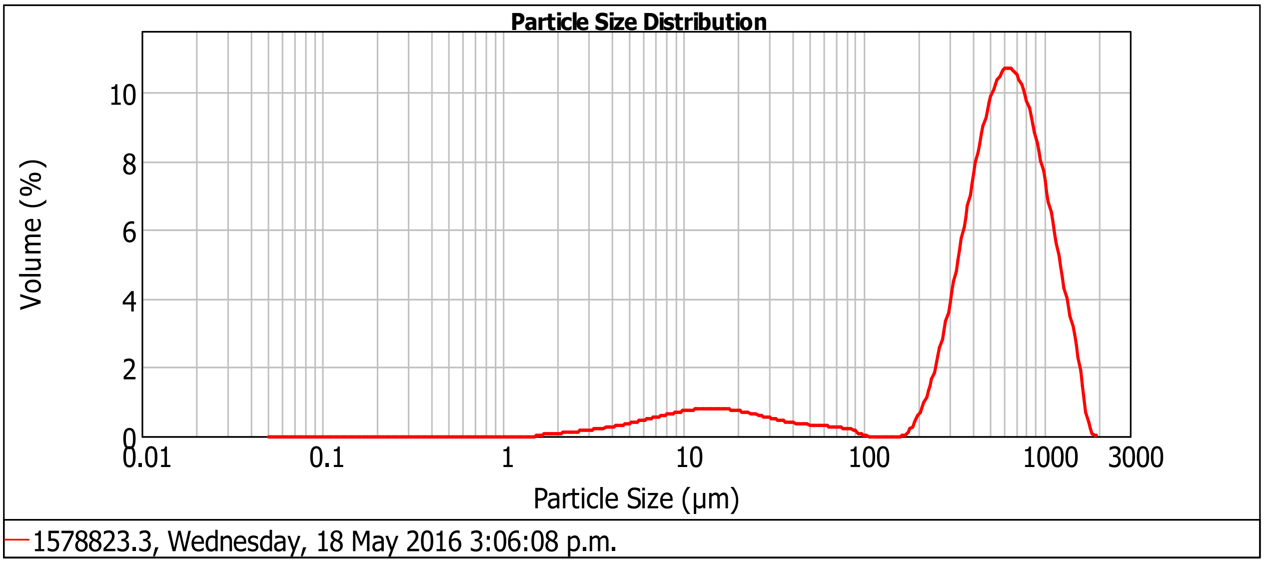
Specific Surface Area:
0.0775 m²/g

Surface Weighted Mean D[3,2]:
77.374 um

Vol. Weighted Mean D[4,3]:
617.198 um

Standard Deviation
369.036 um

d(0.1): 41.755 um **d(0.5): 580.502 um** **d(0.9): 1123.321 um**



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.10	44.000	10.13	149.000	11.51	500.000	40.02	1680.000	99.82
0.060	0.00	3.900	0.80	53.000	10.54	177.000	11.51	590.000	51.13	2000.000	100.00
0.120	0.00	7.800	2.71	63.000	10.89	210.000	11.98	710.000	64.05		
0.240	0.00	10.000	3.79	74.000	11.18	250.000	13.49	840.000	75.07		
0.490	0.00	15.600	6.06	88.000	11.43	300.000	16.89	1000.000	84.78		
0.700	0.00	31.000	9.13	105.000	11.51	350.000	21.67	1190.000	92.19		
0.980	0.00	37.000	9.68	125.000	11.51	420.000	29.86	1410.000	97.05		

Operator notes:

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MALVERN INSTRUMENTS

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Result Analysis Report

Sample Name:
1578823.4

SOP Name:

Measured:
Wednesday, 18 May 2016 3:56:54 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 3:56:56 p.m.

Sample bulk lot ref:
2016084/4

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
13.11 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
1.894 %

Result Emulation:
Off

Concentration:
0.6562 %Vol

Span :
1.260

Uniformity:
0.387

Result units:
Volume

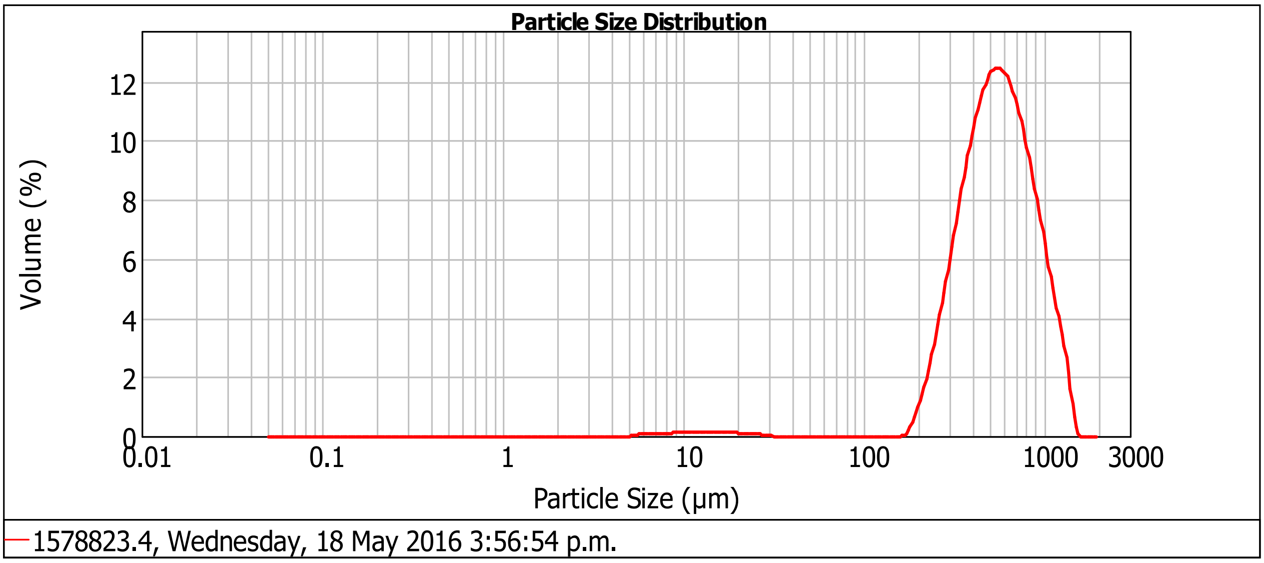
Specific Surface Area:
0.018 m²/g

Surface Weighted Mean D[3,2]:
333.807 um

Vol. Weighted Mean D[4,3]:
603.367 um

Standard Deviation
274.189 um

d(0.1): 300.504 um **d(0.5): 552.885 um** **d(0.9): 997.288 um**



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	1.20	149.000	1.20	500.000	41.85	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	1.20	177.000	1.20	590.000	55.30	2000.000	100.00
0.120	0.00	7.800	0.19	63.000	1.20	210.000	1.97	710.000	69.74		
0.240	0.00	10.000	0.38	74.000	1.20	250.000	4.52	840.000	81.03		
0.490	0.00	15.600	0.79	88.000	1.20	300.000	9.94	1000.000	90.12		
0.700	0.00	31.000	1.20	105.000	1.20	350.000	17.12	1190.000	96.25		
0.980	0.00	37.000	1.20	125.000	1.20	420.000	28.60	1410.000	99.71		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.5

SOP Name:

Measured:
Wednesday, 18 May 2016 4:02:53 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 4:02:55 p.m.

Sample bulk lot ref:
2016084/5

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
19.07 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
1.304 %

Result Emulation:
Off

Concentration:
0.3821 %Vol

Span :
1.456

Uniformity:
0.461

Result units:
Volume

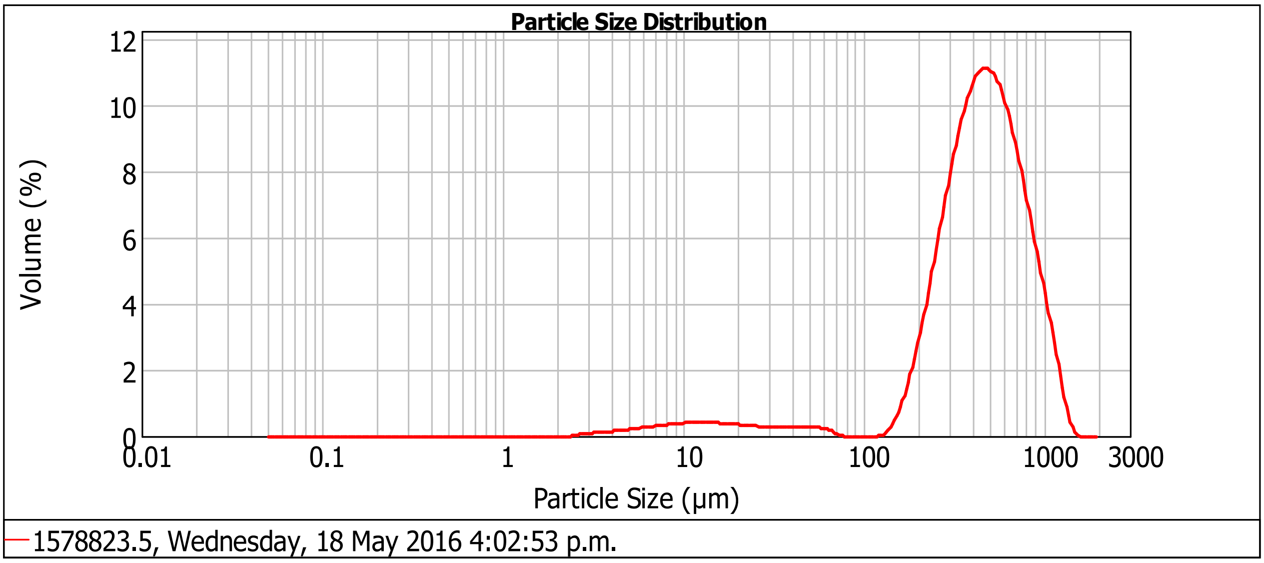
Specific Surface Area:
0.0456 m²/g

Surface Weighted Mean D[3,2]:
131.618 um

Vol. Weighted Mean D[4,3]:
497.639 um

Standard Deviation
270.118 um

d(0.1): 209.672 um   **d(0.5):** 456.274 um   **d(0.9):** 874.222 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	5.29	149.000	6.25	500.000	56.67	1680.000	100.00
0.060	0.00	3.900	0.27	53.000	5.65	177.000	7.35	590.000	68.36	2000.000	100.00
0.120	0.00	7.800	1.33	63.000	5.93	210.000	10.03	710.000	79.94		
0.240	0.00	10.000	1.93	74.000	6.07	250.000	14.99	840.000	88.34		
0.490	0.00	15.600	3.13	88.000	6.07	300.000	22.92	1000.000	94.65		
0.700	0.00	31.000	4.63	105.000	6.07	350.000	31.74	1190.000	98.55		
0.980	0.00	37.000	4.96	125.000	6.07	420.000	44.03	1410.000	99.95		

Operator notes:

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Private Bag 3105
Hamilton, New Zealand

Result Analysis Report

Sample Name:
1578823.6

SOP Name:

Measured:
Wednesday, 18 May 2016 4:07:50 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 4:07:52 p.m.

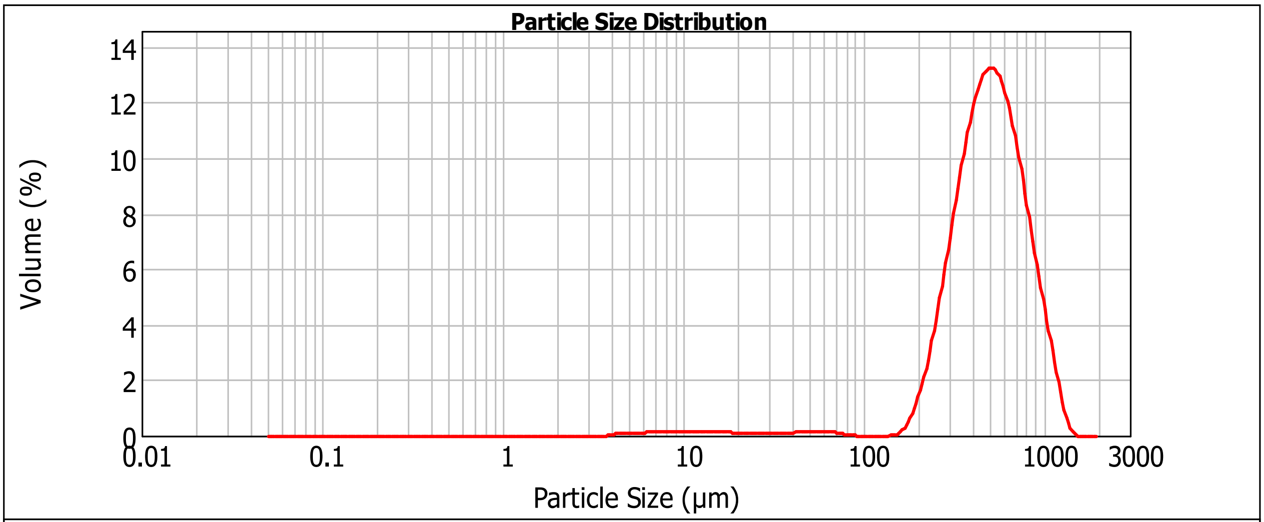
Sample bulk lot ref:
2016084/6

Result Source:
Measurement

Particle Name: Sediment	**Accessory Name:** Hydro 2000G (A)	**Analysis model:** General purpose	**Sensitivity:** Normal
Particle RI: 1.500	**Absorption:** 0.2	**Size range:** 0.050 to 2000.000 um	**Obscuration:** 14.78 %
Dispersant Name: Water	**Dispersant RI:** 1.330	**Weighted Residual:** 1.509 %	**Result Emulation:** Off

Concentration: 0.5627 %Vol	**Span :** 1.197	**Uniformity:** 0.378	**Result units:** Volume
Specific Surface Area: 0.0237 m²/g	**Surface Weighted Mean D[3,2]:** 252.960 um	**Vol. Weighted Mean D[4,3]:** 539.538 um	**Standard Deviation** 242.384 um

d(0.1): 276.201 um **d(0.5):** 501.305 um **d(0.9):** 876.095 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	1.84	149.000	2.40	500.000	49.77	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	2.03	177.000	2.58	590.000	63.96	2000.000	100.00
0.120	0.00	7.800	0.46	63.000	2.22	210.000	3.74	710.000	78.09		
0.240	0.00	10.000	0.72	74.000	2.36	250.000	6.91	840.000	88.01		
0.490	0.00	15.600	1.20	88.000	2.40	300.000	13.40	1000.000	94.98		
0.700	0.00	31.000	1.63	105.000	2.40	350.000	21.85	1190.000	98.87		
0.980	0.00	37.000	1.71	125.000	2.40	420.000	35.06	1410.000	99.98		

Operator notes:

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Result Analysis Report

Sample Name: 1578823.7

SOP Name:

Measured: Wednesday, 18 May 2016 4:17:06 p.m.

Sample Source & type:

Measured by: rodgers

Analysed: Wednesday, 18 May 2016 4:17:08 p.m.

Sample bulk lot ref: 2016084/7

Result Source: Measurement

Particle Name: Sediment

Accessory Name: Hydro 2000G (A)

Analysis model: General purpose

Sensitivity: Normal

Particle RI: 1.500

Absorption: 0.2

Size range: 0.050 to 2000.000 um

Obscuration: 14.37 %

Dispersant Name: Water

Dispersant RI: 1.330

Weighted Residual: 1.697 %

Result Emulation: Off

Concentration: 0.8625 %Vol

Span : 1.322

Uniformity: 0.406

Result units: Volume

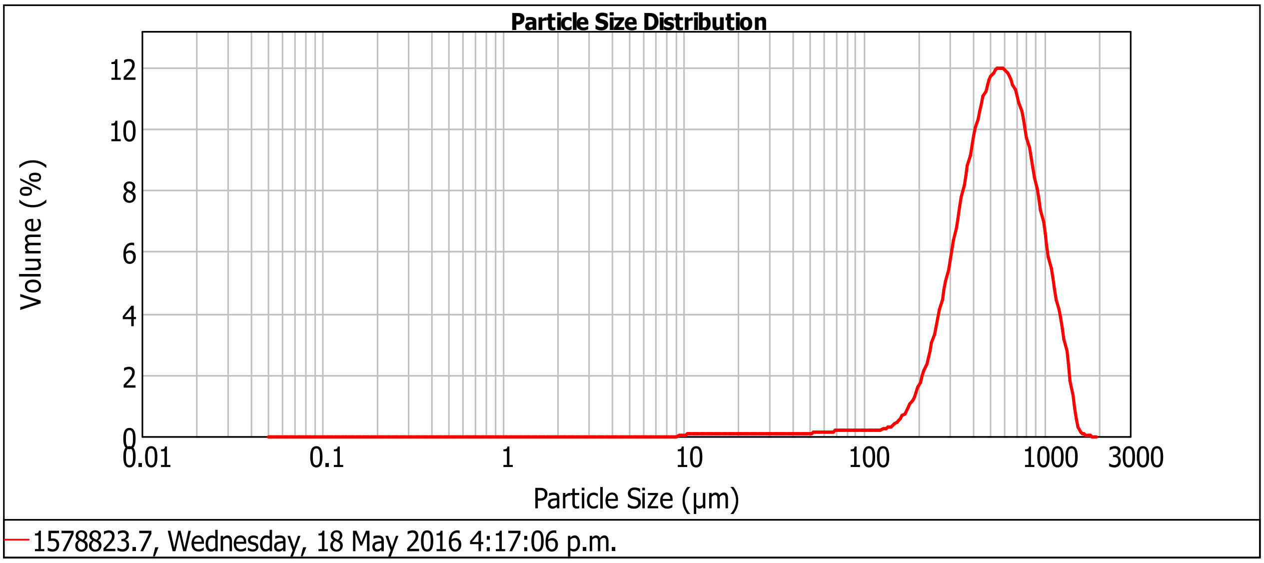
Specific Surface Area: 0.0152 m²/g

Surface Weighted Mean D[3,2]: 393.714 um

Vol. Weighted Mean D[4,3]: 599.922 um

Standard Deviation 286.183 um

d(0.1): **278.011** **um** **d(0.5):** **551.799** **um** **d(0.9):** **1007.495** **um**



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	0.74	149.000	2.08	500.000	42.39	1680.000	99.99
0.060	0.00	3.900	0.00	53.000	0.86	177.000	2.77	590.000	55.25	2000.000	100.00
0.120	0.00	7.800	0.00	63.000	1.01	210.000	4.26	710.000	69.34		
0.240	0.00	10.000	0.00	74.000	1.17	250.000	7.21	840.000	80.55		
0.490	0.00	15.600	0.23	88.000	1.37	300.000	12.55	1000.000	89.67		
0.700	0.00	31.000	0.59	105.000	1.56	350.000	19.28	1190.000	95.91		
0.980	0.00	37.000	0.66	125.000	1.76	420.000	29.95	1410.000	99.48		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.8

SOP Name:

Measured:
Wednesday, 18 May 2016 4:21:49 p.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Wednesday, 18 May 2016 4:21:51 p.m.

Sample bulk lot ref:
2016084/8

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
16.54 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
1.464 %

Result Emulation:
Off

Concentration:
0.5503 %Vol

Span :
1.251

Uniformity:
0.398

Result units:
Volume

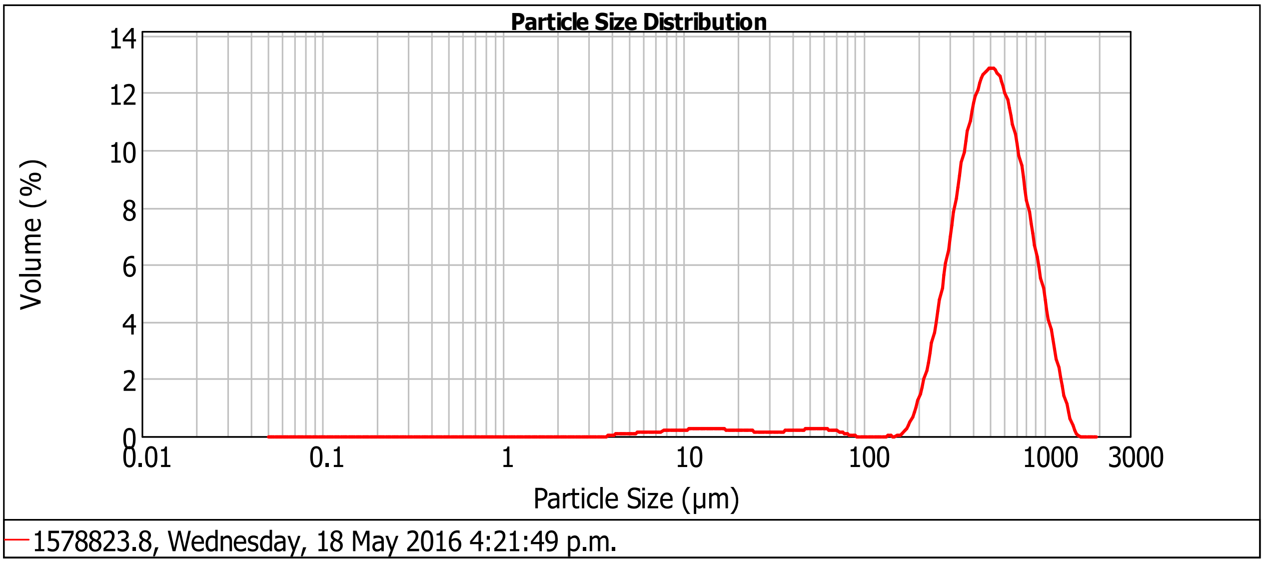
Specific Surface Area:
0.0273 m²/g

Surface Weighted Mean D[3,2]:
219.393 um

Vol. Weighted Mean D[4,3]:
542.916 um

Standard Deviation
257.675 um

d(0.1): **270.110** **um** **d(0.5):** **502.601** **um** **d(0.9):** **898.772** **um**



Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	2.82	149.000	3.68	500.000	49.56	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	3.11	177.000	3.78	590.000	63.33	2000.000	100.00
0.120	0.00	7.800	0.53	63.000	3.39	210.000	4.79	710.000	77.08		
0.240	0.00	10.000	0.85	74.000	3.60	250.000	7.77	840.000	86.88		
0.490	0.00	15.600	1.55	88.000	3.68	300.000	14.07	1000.000	94.00		
0.700	0.00	31.000	2.41	105.000	3.68	350.000	22.33	1190.000	98.24		
0.980	0.00	37.000	2.60	125.000	3.68	420.000	35.24	1410.000	99.91		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name: 1578823.9

SOP Name:

Measured: Wednesday, 18 May 2016 4:26:31 p.m.

Sample Source & type:

Measured by: rodgers

Analysed: Wednesday, 18 May 2016 4:26:33 p.m.

Sample bulk lot ref: 2016084/9

Result Source: Measurement

Particle Name: Sediment

Accessory Name: Hydro 2000G (A)

Analysis model: General purpose

Sensitivity: Normal

Particle RI: 1.500

Absorption: 0.2

Size range: 0.050 to 2000.000 um

Obscuration: 9.42 %

Dispersant Name: Water

Dispersant RI: 1.330

Weighted Residual: 1.565 %

Result Emulation: Off

Concentration: 0.6571 %Vol

Span : 1.087

Uniformity: 0.337

Result units: Volume

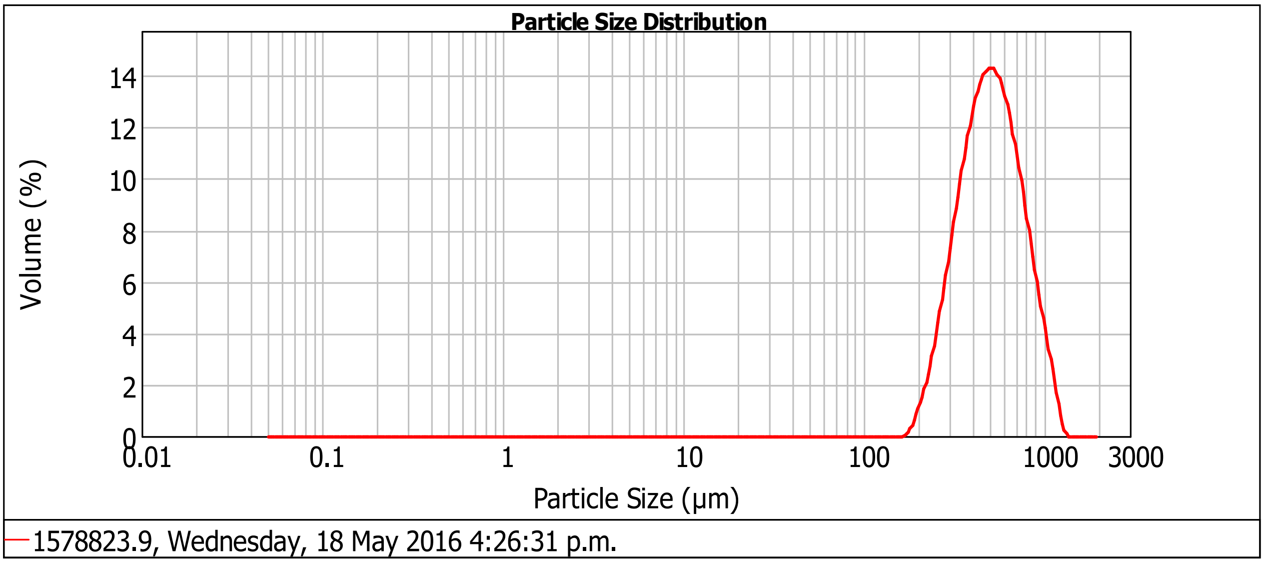
Specific Surface Area: 0.0128 m²/g

Surface Weighted Mean D[3,2]: 467.557 um

Vol. Weighted Mean D[4,3]: 544.858 um

Standard Deviation 214.469 um

d(0.1): 299.850 um **d(0.5): 506.214 um** **d(0.9): 850.290 um**



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	0.00	149.000	0.00	500.000	48.84	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	0.00	177.000	0.00	590.000	64.14	2000.000	100.00
0.120	0.00	7.800	0.00	63.000	0.00	210.000	0.78	710.000	79.15		
0.240	0.00	10.000	0.00	74.000	0.00	250.000	3.60	840.000	89.39		
0.490	0.00	15.600	0.00	88.000	0.00	300.000	10.02	1000.000	96.19		
0.700	0.00	31.000	0.00	105.000	0.00	350.000	18.82	1190.000	99.62		
0.980	0.00	37.000	0.00	125.000	0.00	420.000	32.94	1410.000	100.00		

Operator notes:

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Result Analysis Report

Sample Name: 1578823.10
SOP Name:
Measured: Wednesday, 18 May 2016 4:30:56 p.m.

Sample Source & type:
Measured by: rodgers
Analysed: Wednesday, 18 May 2016 4:30:57 p.m.

Sample bulk lot ref: 2016084/10
Result Source: Measurement

Particle Name: Sediment
Accessory Name: Hydro 2000G (A)
Analysis model: General purpose
Sensitivity: Normal

Particle RI: 1.500
Absorption: 0.2
Size range: 0.050 to 2000.000 um
Obscuration: 10.97 %

Dispersant Name: Water
Dispersant RI: 1.330
Weighted Residual: 1.738 %
Result Emulation: Off

Concentration: 0.7666 %Vol
Span : 1.284
Uniformity: 0.395
Result units: Volume

Specific Surface Area: 0.0129 m²/g
Surface Weighted Mean D[3,2]: 464.788 um
Vol. Weighted Mean D[4,3]: 568.054 um
Standard Deviation 258.201 um

d(0.1): 282.648 um **d(0.5):** 513.233 um **d(0.9):** 941.694 um

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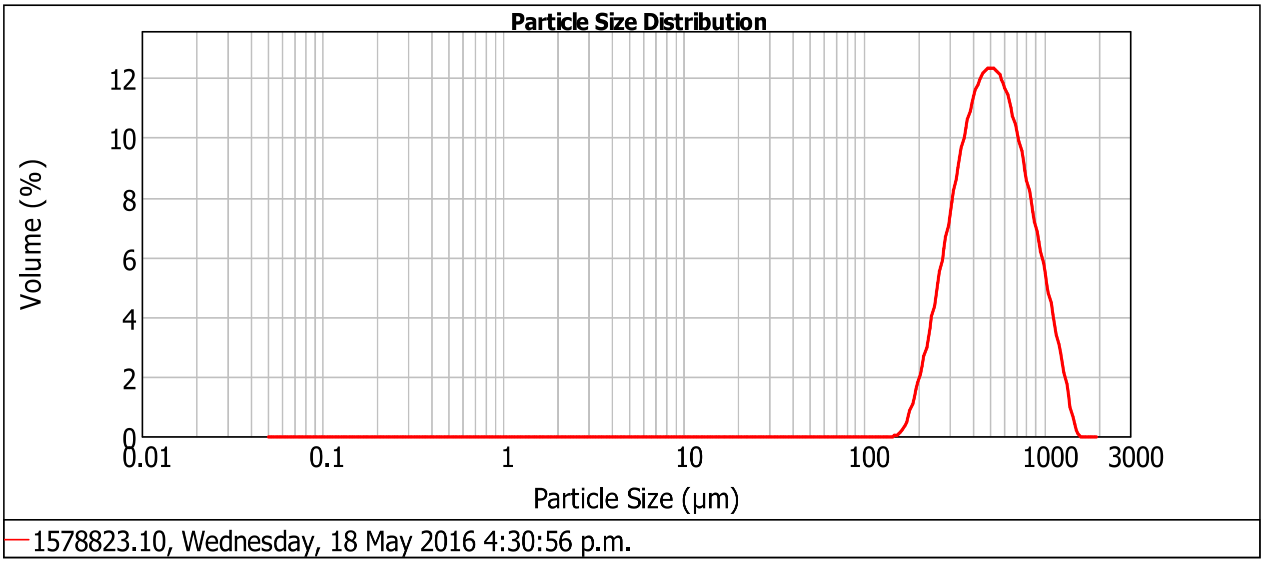

Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	0.00	149.000	0.00	500.000	47.89	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	0.00	177.000	0.21	590.000	61.11	2000.000	100.00
0.120	0.00	7.800	0.00	63.000	0.00	210.000	1.76	710.000	74.58		
0.240	0.00	10.000	0.00	74.000	0.00	250.000	5.58	840.000	84.61		
0.490	0.00	15.600	0.00	88.000	0.00	300.000	12.70	1000.000	92.37		
0.700	0.00	31.000	0.00	105.000	0.00	350.000	21.31	1190.000	97.42		
0.980	0.00	37.000	0.00	125.000	0.00	420.000	34.10	1410.000	99.83		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.11

SOP Name:
Sediment

Measured:
Thursday, 19 May 2016 10:54:50 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 10:54:52 a.m.

Sample bulk lot ref:
2016084/11

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Enhanced

Particle RI:
1.500

Absorption:
0.2

Size range:
0.020 to 2000.000 um

Obscuration:
13.15 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.566 %

Result Emulation:
Off

Concentration:
0.4583 %Vol

Span :
1.336

Uniformity:
0.418

Result units:
Volume

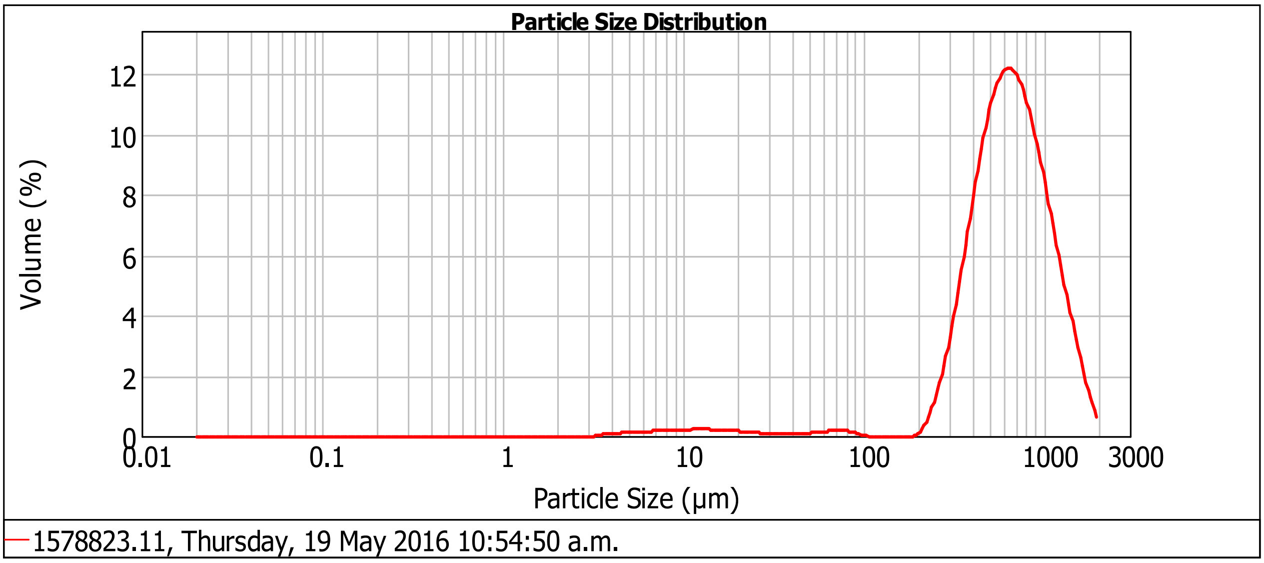
Specific Surface Area:
0.0255 m²/g

Surface Weighted Mean D[3,2]:
235.629 um

Vol. Weighted Mean D[4,3]:
711.266 um

Standard Deviation
354.533 um

d(0.1): **341.801** **um** **d(0.5):** **645.893** **um** **d(0.9):** **1204.965** **um**



Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	2.46	149.000	3.18	500.000	30.24	1680.000	98.61
0.060	0.00	3.900	0.06	53.000	2.58	177.000	3.18	590.000	42.78	2000.000	100.00
0.120	0.00	7.800	0.68	63.000	2.74	210.000	3.20	710.000	57.52		
0.240	0.00	10.000	1.01	74.000	2.92	250.000	3.95	840.000	70.07		
0.490	0.00	15.600	1.64	88.000	3.12	300.000	6.49	1000.000	81.09		
0.700	0.00	31.000	2.31	105.000	3.18	350.000	10.82	1190.000	89.50		
0.980	0.00	37.000	2.39	125.000	3.18	420.000	19.15	1410.000	95.14		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.12

SOP Name:

Measured:
Thursday, 19 May 2016 11:05:42 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:05:43 a.m.

Sample bulk lot ref:
2016084/12

Result Source:
Measurement

Particle Name: Sediment	**Accessory Name:** Hydro 2000G (A)	**Analysis model:** General purpose	**Sensitivity:** Normal
Particle RI: 1.500	**Absorption:** 0.2	**Size range:** 0.050 to 2000.000 um	**Obscuration:** 12.82 %
Dispersant Name: Water	**Dispersant RI:** 1.330	**Weighted Residual:** 0.547 %	**Result Emulation:** Off

---

Concentration: 0.8829 %Vol	**Span :** 1.371	**Uniformity:** 0.424	**Result units:** Volume
Specific Surface Area: 0.0131 m²/g	**Surface Weighted Mean D[3,2]:** 456.590 um	**Vol. Weighted Mean D[4,3]:** 703.268 um	**Standard Deviation** 347.045 um

d(0.1): 336.765 um **d(0.5):** 627.155 um **d(0.9):** 1196.701 um

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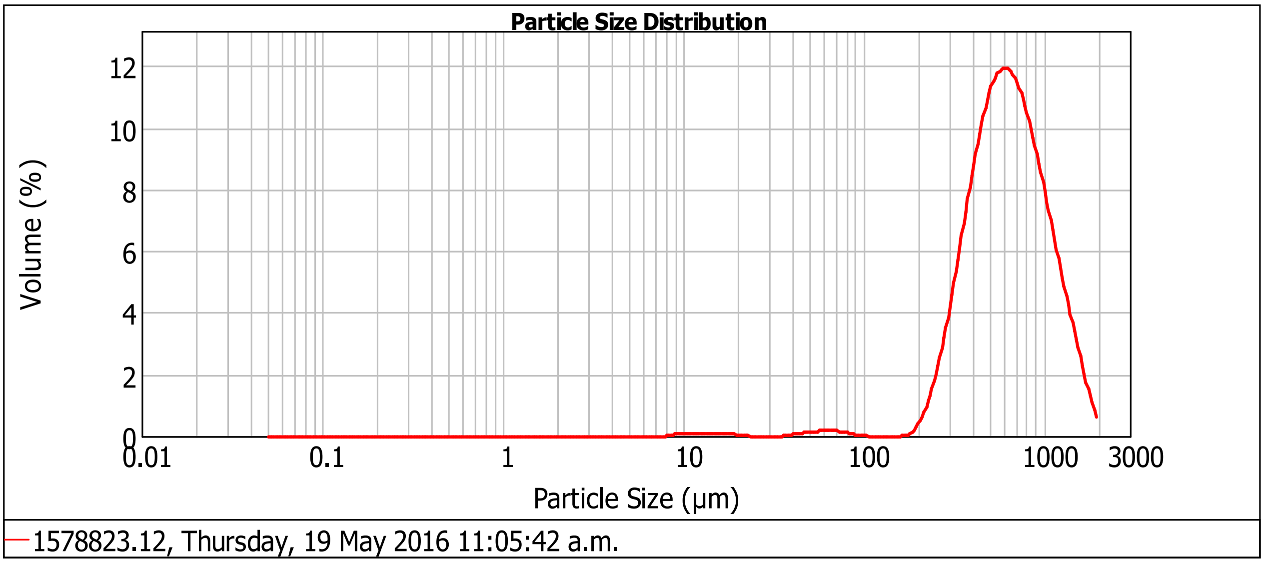

Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	0.49	149.000	1.15	500.000	32.61	1680.000	98.61
0.060	0.00	3.900	0.00	53.000	0.63	177.000	1.15	590.000	45.22	2000.000	100.00
0.120	0.00	7.800	0.00	63.000	0.82	210.000	1.41	710.000	59.55		
0.240	0.00	10.000	0.08	74.000	1.00	250.000	2.74	840.000	71.47		
0.490	0.00	15.600	0.31	88.000	1.12	300.000	6.24	1000.000	81.84		
0.700	0.00	31.000	0.44	105.000	1.15	350.000	11.55	1190.000	89.78		
0.980	0.00	37.000	0.44	125.000	1.15	420.000	20.92	1410.000	95.21		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.13

SOP Name:

Measured:
Thursday, 19 May 2016 11:10:11 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:10:13 a.m.

Sample bulk lot ref:
2016084/13

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
13.52 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.478 %

Result Emulation:
Off

Concentration:
0.7557 %Vol

Span :
1.330

Uniformity:
0.416

Result units:
Volume

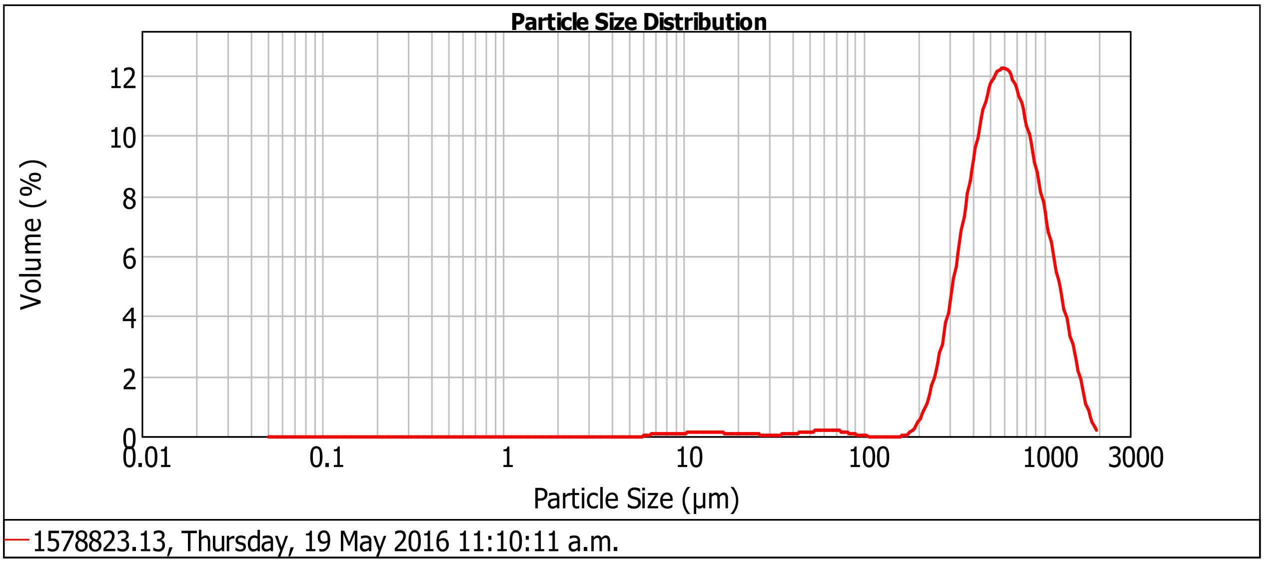
Specific Surface Area:
0.0162 m²/g

Surface Weighted Mean D[3,2]:
370.921 um

Vol. Weighted Mean D[4,3]:
669.388 um

Standard Deviation
325.739 um

d(0.1): **325.265** **um** **d(0.5):** **603.555** **um** **d(0.9):** **1128.137** **um**



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	1.09	149.000	1.82	500.000	35.11	1680.000	99.38
0.060	0.00	3.900	0.00	53.000	1.26	177.000	1.82	590.000	48.17	2000.000	100.00
0.120	0.00	7.800	0.11	63.000	1.46	210.000	2.14	710.000	62.77		
0.240	0.00	10.000	0.27	74.000	1.65	250.000	3.60	840.000	74.63		
0.490	0.00	15.600	0.61	88.000	1.79	300.000	7.36	1000.000	84.62		
0.700	0.00	31.000	0.93	105.000	1.82	350.000	12.99	1190.000	91.98		
0.980	0.00	37.000	0.98	125.000	1.82	420.000	22.88	1410.000	96.75		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.14

SOP Name:

Measured:
Thursday, 19 May 2016 11:14:36 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:14:38 a.m.

Sample bulk lot ref:
2016084/14

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
17.73 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.358 %

Result Emulation:
Off

Concentration:
0.1548 %Vol

Span :
1.767

Uniformity:
0.484

Result units:
Volume

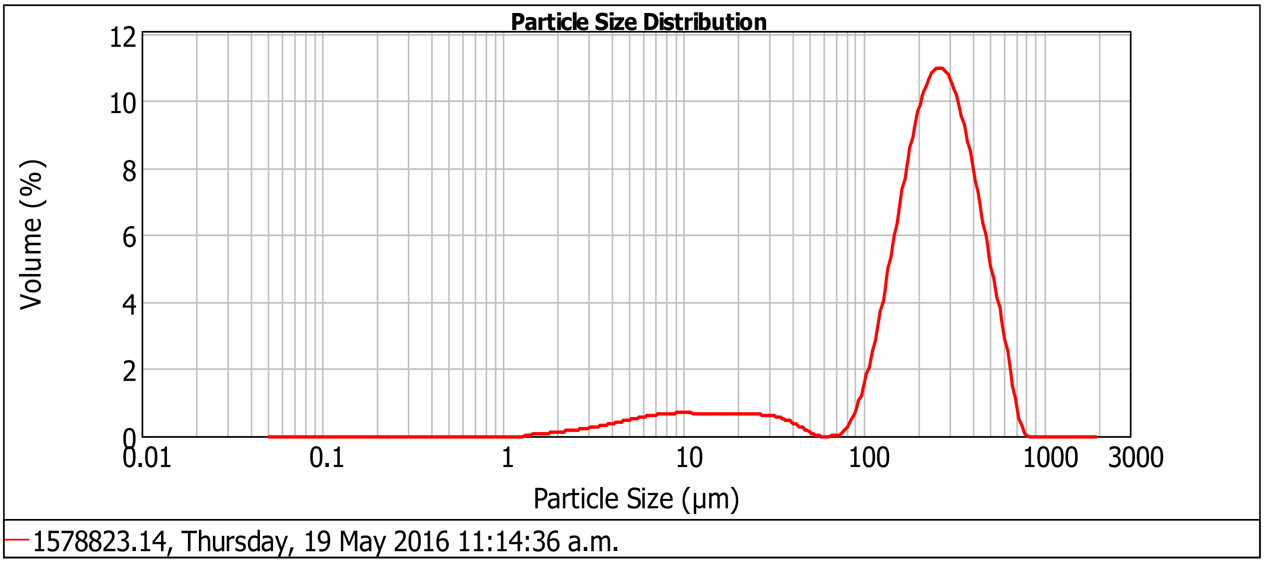
Specific Surface Area:
0.103 m²/g

Surface Weighted Mean D[3,2]:
58.320 um

Vol. Weighted Mean D[4,3]:
260.070 um

Standard Deviation
150.393 um

d(0.1): 35.054 um **d(0.5):** 244.077 um **d(0.9):** 466.285 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.21	44.000	10.65	149.000	21.21	500.000	92.64	1680.000	100.00
0.060	0.00	3.900	1.18	53.000	10.86	177.000	29.30	590.000	97.30	2000.000	100.00
0.120	0.00	7.800	3.57	63.000	10.86	210.000	39.63	710.000	99.84		
0.240	0.00	10.000	4.68	74.000	10.87	250.000	51.71	840.000	100.00		
0.490	0.00	15.600	6.65	88.000	11.16	300.000	64.74	1000.000	100.00		
0.700	0.00	31.000	9.54	105.000	12.51	350.000	75.02	1190.000	100.00		
0.980	0.00	37.000	10.18	125.000	15.63	420.000	85.29	1410.000	100.00		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.15

SOP Name:

Measured:
Thursday, 19 May 2016 11:19:06 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:19:08 a.m.

Sample bulk lot ref:
2016084/15

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
12.24 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.579 %

Result Emulation:
Off

Concentration:
0.5384 %Vol

Span :
1.338

Uniformity:
0.43

Result units:
Volume

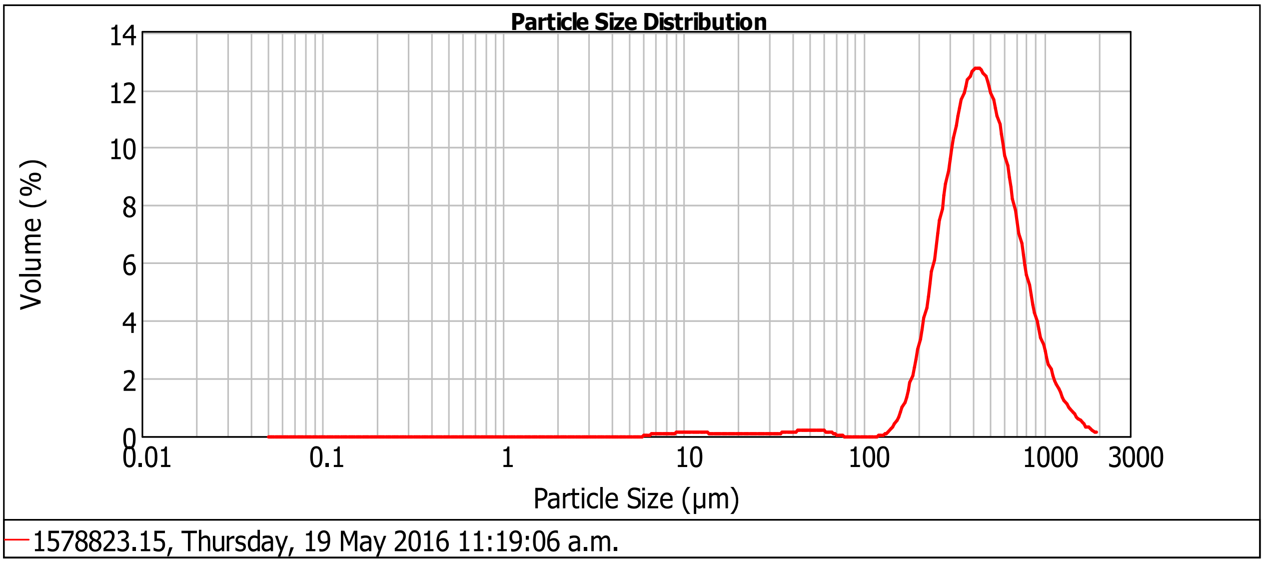
Specific Surface Area:
0.0204 m²/g

Surface Weighted Mean D[3,2]:
293.653 um

Vol. Weighted Mean D[4,3]:
495.997 um

Standard Deviation
261.343 um

d(0.1): 241.464 um **d(0.5):** 438.561 um **d(0.9):** 828.058 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	1.29	149.000	2.00	500.000	60.75	1680.000	99.74
0.060	0.00	3.900	0.00	53.000	1.53	177.000	3.02	590.000	72.95	2000.000	100.00
0.120	0.00	7.800	0.12	63.000	1.74	210.000	5.78	710.000	83.68		
0.240	0.00	10.000	0.30	74.000	1.84	250.000	11.38	840.000	90.47		
0.490	0.00	15.600	0.64	88.000	1.84	300.000	20.87	1000.000	94.98		
0.700	0.00	31.000	0.99	105.000	1.84	350.000	31.62	1190.000	97.61		
0.980	0.00	37.000	1.12	125.000	1.84	420.000	46.38	1410.000	99.01		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name: 1578823.16

SOP Name:

Measured: Thursday, 19 May 2016 11:23:36 a.m.

Sample Source & type:

Measured by: rodgers

Analysed: Thursday, 19 May 2016 11:23:38 a.m.

Sample bulk lot ref: 2016084/16

Result Source: Measurement

Particle Name: Sediment

Accessory Name: Hydro 2000G (A)

Analysis model: General purpose

Sensitivity: Normal

Particle RI: 1.500

Absorption: 0.2

Size range: 0.050 to 2000.000 um

Obscuration: 16.54 %

Dispersant Name: Water

Dispersant RI: 1.330

Weighted Residual: 0.324 %

Result Emulation: Off

Concentration: 0.1483 %Vol

Span : 1.820

Uniformity: 0.504

Result units: Volume

Specific Surface Area: 0.0998 m²/g

Surface Weighted Mean D[3,2]: 60.102 um

Vol. Weighted Mean D[4,3]: 220.858 um

Standard Deviation 132.261 um

d(0.1): 33.480 um **d(0.5):** 202.248 um **d(0.9):** 401.599 um

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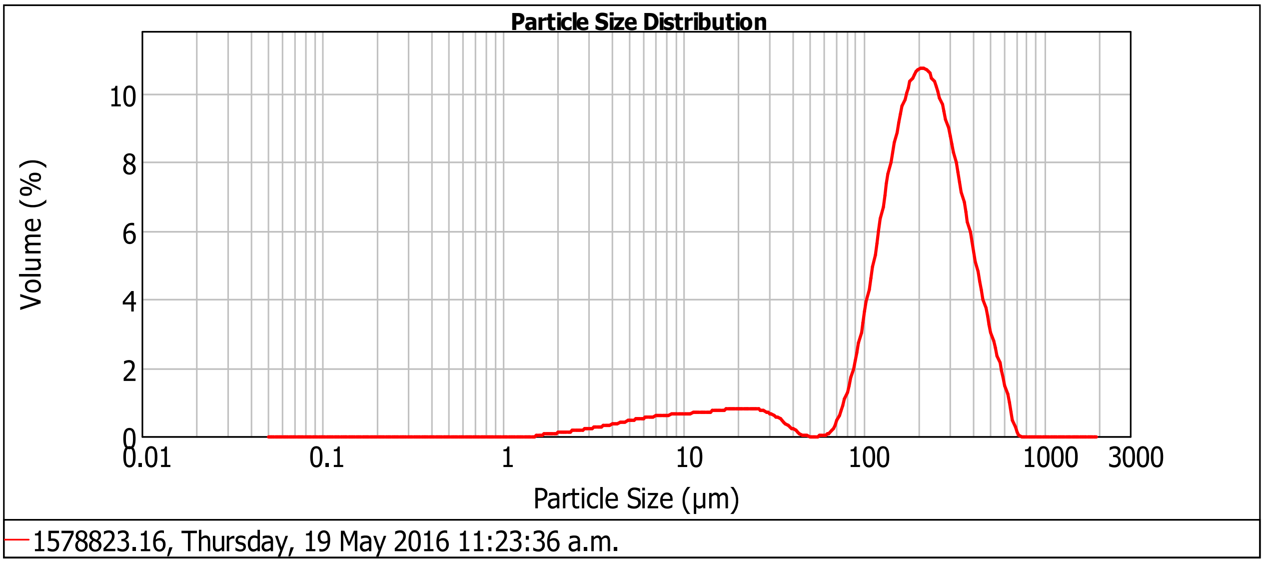

Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.050	0.00	2.000	0.10	44.000	10.56	149.000	30.17	500.000	96.22	1680.000	100.00
0.060	0.00	3.900	0.97	53.000	10.57	177.000	40.83	590.000	98.92	2000.000	100.00
0.120	0.00	7.800	3.16	63.000	10.58	210.000	52.65	710.000	100.00		
0.240	0.00	10.000	4.19	74.000	10.84	250.000	64.75	840.000	100.00		
0.490	0.00	15.600	6.22	88.000	12.23	300.000	76.23	1000.000	100.00		
0.700	0.00	31.000	9.70	105.000	15.63	350.000	84.30	1190.000	100.00		
0.980	0.00	37.000	10.31	125.000	21.52	420.000	91.55	1410.000	100.00		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.17

SOP Name:

Measured:
Thursday, 19 May 2016 11:28:16 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:28:18 a.m.

Sample bulk lot ref:
2016084/17

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
17.91 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.322 %

Result Emulation:
Off

Concentration:
0.0998 %Vol

Span :
2.766

Uniformity:
0.831

Result units:
Volume

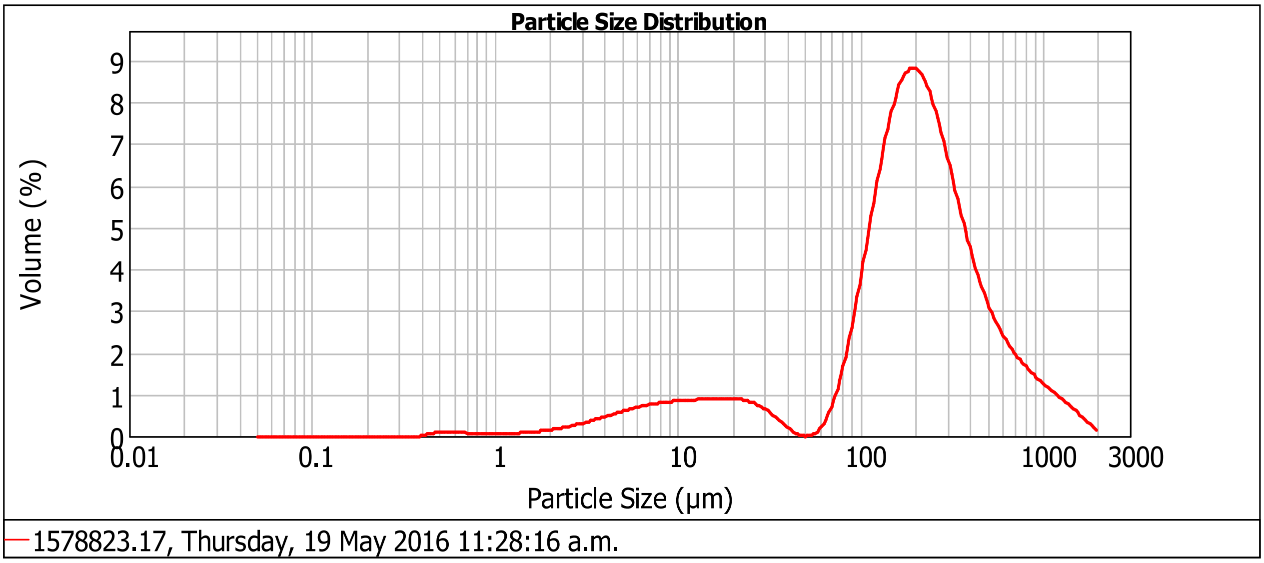
Specific Surface Area:
0.175 m²/g

Surface Weighted Mean D[3,2]:
34.326 um

Vol. Weighted Mean D[4,3]:
272.203 um

Standard Deviation
269.3 um

d(0.1): 19.024 um **d(0.5):** 199.216 um **d(0.9):** 570.033 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.85	44.000	13.41	149.000	33.81	500.000	87.53	1680.000	99.68
0.060	0.00	3.900	2.08	53.000	13.43	177.000	43.19	590.000	90.58	2000.000	100.00
0.120	0.00	7.800	4.97	63.000	13.54	210.000	53.04	710.000	93.25		
0.240	0.00	10.000	6.30	74.000	14.17	250.000	62.68	840.000	95.19		
0.490	0.08	15.600	8.83	88.000	16.04	300.000	71.51	1000.000	96.81		
0.700	0.27	31.000	12.60	105.000	19.81	350.000	77.66	1190.000	98.09		
0.980	0.43	37.000	13.17	125.000	25.74	420.000	83.38	1410.000	99.03		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name:
1578823.18

SOP Name:

Measured:
Thursday, 19 May 2016 11:33:13 a.m.

Sample Source & type:

Measured by:
rodgers

Analysed:
Thursday, 19 May 2016 11:33:15 a.m.

Sample bulk lot ref:
2016084/18

Result Source:
Measurement

Particle Name:
Sediment

Accessory Name:
Hydro 2000G (A)

Analysis model:
General purpose

Sensitivity:
Normal

Particle RI:
1.500

Absorption:
0.2

Size range:
0.050 to 2000.000 um

Obscuration:
18.67 %

Dispersant Name:
Water

Dispersant RI:
1.330

Weighted Residual:
0.331 %

Result Emulation:
Off

Concentration:
0.5671 %Vol

Span :
1.194

Uniformity:
0.377

Result units:
Volume

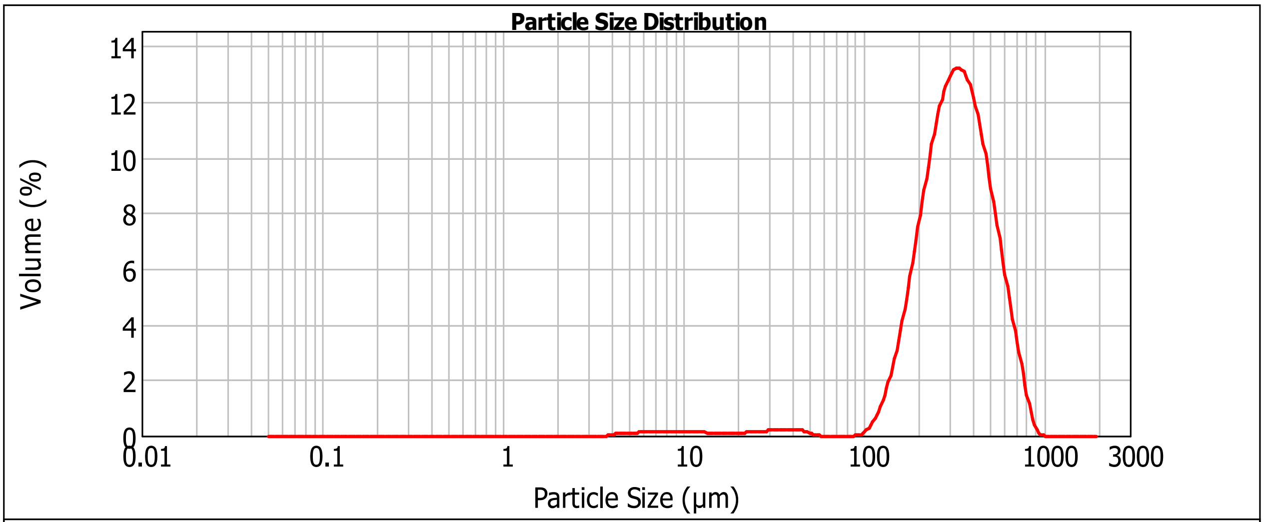
Specific Surface Area:
0.0305 m²/g

Surface Weighted Mean D[3,2]:
196.500 um

Vol. Weighted Mean D[4,3]:
351.329 um

Standard Deviation
156.885 um

d(0.1): 179.187 um **d(0.5):** 326.989 um **d(0.9):** 569.467 um



1578823.18, Thursday, 19 May 2016 11:33:13 a.m.

Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	2.14	149.000	5.11	500.000	83.08	1680.000	100.00
0.060	0.00	3.900	0.00	53.000	2.32	177.000	9.56	590.000	91.55	2000.000	100.00
0.120	0.00	7.800	0.49	63.000	2.32	210.000	17.09	710.000	97.43		
0.240	0.00	10.000	0.73	74.000	2.32	250.000	28.15	840.000	99.73		
0.490	0.00	15.600	1.09	88.000	2.32	300.000	42.60	1000.000	100.00		
0.700	0.00	31.000	1.67	105.000	2.38	350.000	55.89	1190.000	100.00		
0.980	0.00	37.000	1.91	125.000	3.02	420.000	70.97	1410.000	100.00		

Operator notes:

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MALVERN INSTRUMENTS

MASTERSIZER 2000

Result Analysis Report

Sample Name: 1578823.19
SOP Name:
Measured: Thursday, 19 May 2016 11:38:41 a.m.

Sample Source & type:
Measured by: rodgers
Analysed: Thursday, 19 May 2016 11:38:43 a.m.

Sample bulk lot ref: 2016084/19
Result Source: Measurement

Particle Name: Sediment
Accessory Name: Hydro 2000G (A)
Analysis model: General purpose
Sensitivity: Normal

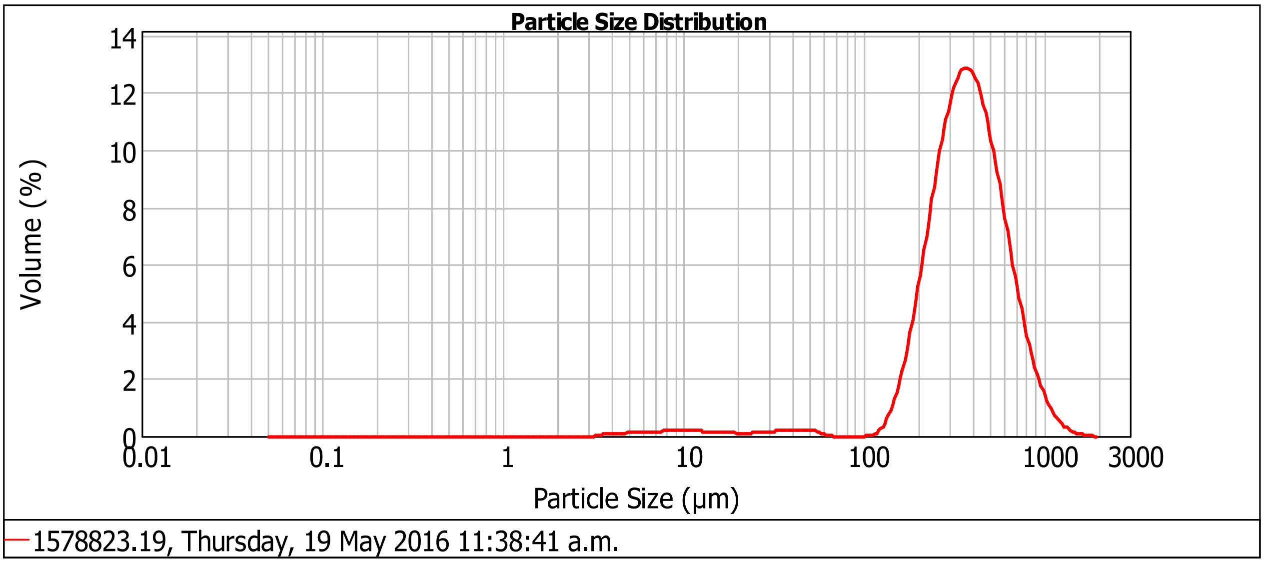
Particle RI: 1.500
Absorption: 0.2
Size range: 0.050 to 2000.000 um
Obscuration: 16.54 %

Dispersant Name: Water
Dispersant RI: 1.330
Weighted Residual: 0.374 %
Result Emulation: Off

Concentration: 0.4830 %Vol
Span : 1.284
Uniformity: 0.414
Result units: Volume

Specific Surface Area: 0.0312 m²/g
Surface Weighted Mean D[3,2]: 192.288 um
Vol. Weighted Mean D[4,3]: 412.727 um
Standard Deviation 208.666 um

d(0.1): 203.166 um **d(0.5):** 373.485 um **d(0.9):** 682.542 um



Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %	Size (μm)	Vol Under %
0.050	0.00	2.000	0.00	44.000	2.48	149.000	3.74	500.000	73.14	1680.000	99.98
0.060	0.00	3.900	0.06	53.000	2.75	177.000	6.18	590.000	83.36	2000.000	100.00
0.120	0.00	7.800	0.65	63.000	2.88	210.000	11.22	710.000	91.43		
0.240	0.00	10.000	0.95	74.000	2.88	250.000	19.71	840.000	95.89		
0.490	0.00	15.600	1.45	88.000	2.88	300.000	32.10	1000.000	98.37		
0.700	0.00	31.000	2.01	105.000	2.88	350.000	44.53	1190.000	99.49		
0.980	0.00	37.000	2.23	125.000	2.95	420.000	59.80	1410.000	99.89		

Operator notes:

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 1	V 1	V 1	V 1	V 1A	V 1A	V 1A	V 1A	V 1A	V 2	V 2	V 2	V 2
Sample Type: Sediment	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B
Sample Name:	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	28/02/16	28/02/16	28/02/16	28/02/16
Lab Number:	1545303.1	1545303.3	1545303.4	1545303.5	1545303.7	1545303.8	1545303.1	1545303.11	1545303.13	1545223.1	1545223.2	1545223.4	1545223.5
Dry Matter (g/100g as rcvd)	79	-	79	-	80	-	83	-	-	86	-	85	-
Total Organic Carbon (g/100g dry wt)	-	< 0.13	-	< 0.13	-	< 0.05	-	< 0.05	< 0.13	-	< 0.05	-	< 0.05
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-
Irgarol	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-
Isoproturon	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	-	3.4	-	3.5	-	2.2	-	2.2	2.5	-	2.4	-	2.2
Total Recoverable Cadmium	-	< 0.010	-	0.011	-	< 0.010	-	< 0.010	0.013	-	< 0.010	-	< 0.010
Total Recoverable Chromium	-	8.9	-	11.4	-	6.9	-	7.2	5.9	-	7.5	-	18.2
Total Recoverable Copper	-	0.5	-	0.6	-	0.7	-	0.7	0.4	-	0.4	-	0.5
Total Recoverable Lead	-	1.12	-	1.4	-	1.07	-	1.56	0.81	-	0.91	-	1.43
Total Recoverable Mercury	-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	< 0.010	-	< 0.010	-	< 0.010
Total Recoverable Nickel	-	1.9	-	2.5	-	1.6	-	1.8	1.9	-	2.1	-	8.7
Total Recoverable Zinc	-	9.1	-	11.7	-	8.1	-	8.5	5.7	-	9.3	-	6.2
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Acenaphthylene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Anthracene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Benzo[a]anthracene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Benzo[a]pyrene (BAP)	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Benzo[g,h,i]perylene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Benzo[k]fluoranthene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Chrysene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Dibenzo[a,h]anthracene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 1	V 1	V 1	V 1	V 1A	V 1A	V 1A	V 1A	V 1A	V 2	V 2	V 2	V 2
Sample Type: Sediment	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B
Fluoranthene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Fluorene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Indeno(1,2,3-c,d)pyrene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Naphthalene	< 0.14	-	< 0.14	-	< 0.14	-	< 0.13	-	-	< 0.13	-	< 0.13	-
Phenanthrene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Pyrene	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-	< 0.03	-	< 0.03	-
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Bis(2-chloroethyl)ether	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Bis(2-chloroisopropyl)ether	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
4-Bromophenyl phenyl ether	< 0.4	-	-	-	< 0.4	-	-	-	-	< 0.4	-	-	-
4-Chlorophenyl phenyl ether	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2,6-Dinitrotoluene	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Nitrobenzene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
N-Nitrosodi-n-propylamine	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
alpha-BHC	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
beta-BHC	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
delta-BHC	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
gamma-BHC (Lindane)	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
4,4'-DDD	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
4,4'-DDE	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
4,4'-DDT	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Dieldrin	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 1	V 1	V 1	V 1	V 1A	V 1A	V 1A	V 1A	V 1A	V 2	V 2	V 2	V 2
Sample Type: Sediment	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B
Endosulfan I	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Endosulfan II	< 2	-	-	-	< 2	-	-	-	-	< 2	-	-	-
Endosulfan sulphate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Endrin	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
Endrin ketone	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Heptachlor	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Heptachlor epoxide	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Hexachlorobenzene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Acenaphthylene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Anthracene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Benzo[a]anthracene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Benzo[a]pyrene (BAP)	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Benzo[g,h,i]perylene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Benzo[k]fluoranthene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
1&2-Chloronaphthalene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Chrysene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Dibenzo[a,h]anthracene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Fluoranthene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Fluorene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Indeno(1,2,3-c,d)pyrene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
2-Methylnaphthalene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Naphthalene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Phenanthrene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Pyrene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 1	V 1	V 1	V 1	V 1A	V 1A	V 1A	V 1A	V 1A	V 2	V 2	V 2	V 2
Sample Type: Sediment	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B
4-Chloro-3-methylphenol	< 5	-	-	-	< 5	-	-	-	-	< 5	-	-	-
2-Chlorophenol	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2,4-Dichlorophenol	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2,4-Dimethylphenol	< 3	-	-	-	< 3	-	-	-	-	< 3	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	< 3	-	-	-	< 3	-	-	-	-	< 3	-	-	-
2-Methylphenol (o-Cresol)	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2-Nitrophenol	< 5	-	-	-	< 5	-	-	-	-	< 5	-	-	-
Pentachlorophenol (PCP)	< 30	-	-	-	< 30	-	-	-	-	< 30	-	-	-
Phenol	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2,4,5-Trichlorophenol	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
2,4,6-Trichlorophenol	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	< 5	-	-	-	< 5	-	-	-	-	< 5	-	-	-
Butylbenzylphthalate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Di(2-ethylhexyl)adipate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Diethylphthalate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Dimethylphthalate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Di-n-butylphthalate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Di-n-octylphthalate	< 1.0	-	-	-	< 1.0	-	-	-	-	< 1.0	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
1,3-Dichlorobenzene	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
1,4-Dichlorobenzene	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
Hexachlorobutadiene	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
Hexachloroethane	< 0.7	-	-	-	< 0.7	-	-	-	-	< 0.7	-	-	-
1,2,4-Trichlorobenzene	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	< 10	-	-	-	< 10	-	-	-	-	< 10	-	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 1	V 1	V 1	V 1	V 1A	V 1A	V 1A	V 1A	V 1A	V 2	V 2	V 2	V 2
Sample Type: Sediment	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B
Carbazole	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Dibenzofuran	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Isophorone	< 0.5	-	-	-	< 0.5	-	-	-	-	< 0.5	-	-	-
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	-	< 0.005	-	< 0.005	-
Monobutyltin (as Sn)	< 0.007	-	< 0.007	-	< 0.007	-	< 0.007	-	-	< 0.007	-	< 0.007	-
Tributyltin (as Sn)	< 0.004	-	< 0.004	-	< 0.004	-	< 0.004	-	-	< 0.004	-	0.004	-
Triphenyltin (as Sn)	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	-	< 0.003	-	< 0.003	-
Total Petroleum Hydrocarbons in Soil													
C7 - C9	< 9	-	< 9	-	< 9	-	< 8	-	-	< 8	-	< 8	-
C10 - C14	< 20	-	< 20	-	< 20	-	< 20	-	-	< 20	-	< 20	-
C15 - C36	< 40	-	< 40	-	< 40	-	< 40	-	-	< 40	-	< 40	-
Total hydrocarbons (C7 - C36)	< 70	-	< 70	-	< 70	-	< 70	-	-	< 70	-	< 70	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 2	V3	V3	V3	V3	V3	V5	V5	V5	V5	V5	V6	V6
Sample Type: Sediment	1.0-1.7m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.4m A	0-0.5m A	0-0.5m B 2
Sample Name:	28/02/16	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16	27/02/16	27/02/16	27/02/16	27/02/16	27/02/16	28/02/16	8/02/16
Lab Number:	1545223.7	1544110.37	1544110.38	1544110.4	1544110.41	1544110.43	1545303.16	1545303.17	1545303.19	1545303.2	1545303.22	1545237.1	1545237.2
Dry Matter (g/100g as rcvd)	-	73	-	71	-	-	85	-	84	-	-	82	-
Total Organic Carbon (g/100g dry wt)	0.05	-	0.25	-	0.6	< 0.13	-	< 0.13	-	< 0.13	< 0.13	-	< 0.13
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-	-	< 0.010	-
Irgarol	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-	-	< 0.010	-
Isoproturon	-	< 0.010	-	< 0.010	-	-	< 0.010	-	< 0.010	-	-	< 0.010	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	2.6	-	5.3	-	5.5	2.3	-	2.4	-	2.2	2	-	2.3
Total Recoverable Cadmium	0.022	-	< 0.10	-	0.162	0.011	-	0.022	-	0.021	0.029	-	0.03
Total Recoverable Chromium	11.2	-	13.6	-	16.9	5.1	-	6.2	-	5.9	6.2	-	6.3
Total Recoverable Copper	0.5	-	1.3	-	1.7	0.3	-	0.6	-	0.4	0.4	-	0.5
Total Recoverable Lead	0.77	-	2.1	-	2.8	0.83	-	1.18	-	0.8	0.84	-	1.01
Total Recoverable Mercury	< 0.010	-	< 0.010	-	< 0.010	< 0.010	-	< 0.010	-	< 0.010	< 0.010	-	0.011
Total Recoverable Nickel	5.2	-	4.1	-	5.6	1.7	-	2.9	-	2.8	2.8	-	2.7
Total Recoverable Zinc	5.8	-	12.6	-	15.8	5.2	-	6.8	-	4.9	5.1	-	6.4
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Acenaphthylene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Anthracene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Benzo[a]anthracene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Benzo[a]pyrene (BAP)	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Benzo[g,h,i]perylene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Benzo[k]fluoranthene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Chrysene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Dibenzo[a,h]anthracene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 2	V3	V3	V3	V3	V3	V5	V5	V5	V5	V5	V6	V6
Sample Type: Sediment	1.0-1.7m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.4m A	0-0.5m A	0-0.5m B 2
Fluoranthene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Fluorene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Indeno(1,2,3-c,d)pyrene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Naphthalene	-	< 0.15	-	< 0.16	-	-	< 0.13	-	< 0.13	-	-	< 0.14	-
Phenanthrene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Pyrene	-	< 0.03	-	< 0.04	-	-	< 0.03	-	< 0.03	-	-	< 0.03	-
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Bis(2-chloroethyl)ether	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Bis(2-chloroisopropyl)ether	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
4-Bromophenyl phenyl ether	-	< 0.4	-	-	-	-	< 0.4	-	-	-	-	< 0.4	-
4-Chlorophenyl phenyl ether	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2,6-Dinitrotoluene	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Nitrobenzene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
N-Nitrosodi-n-propylamine	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
N-Nitrosodiphenylamine + Diphenylamine	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
alpha-BHC	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
beta-BHC	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
delta-BHC	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
gamma-BHC (Lindane)	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
4,4'-DDD	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
4,4'-DDE	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
4,4'-DDT	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Dieldrin	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 2	V3	V3	V3	V3	V3	V5	V5	V5	V5	V5	V6	V6
Sample Type: Sediment	1.0-1.7m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.4m A	0-0.5m A	0-0.5m B 2
Endosulfan I	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Endosulfan II	-	< 2	-	-	-	-	< 2	-	-	-	-	< 2	-
Endosulfan sulphate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Endrin	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
Endrin ketone	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Heptachlor	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Heptachlor epoxide	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Hexachlorobenzene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Acenaphthylene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Anthracene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Benzo[a]anthracene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Benzo[a]pyrene (BAP)	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Benzo[g,h,i]perylene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Benzo[k]fluoranthene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
1&2-Chloronaphthalene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Chrysene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Dibenzo[a,h]anthracene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Fluoranthene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Fluorene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Indeno(1,2,3-c,d)pyrene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
2-Methylnaphthalene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Naphthalene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Phenanthrene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Pyrene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 2	V3	V3	V3	V3	V3	V5	V5	V5	V5	V5	V6	V6
Sample Type: Sediment	1.0-1.7m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.4m A	0-0.5m A	0-0.5m B 2
4-Chloro-3-methylphenol	-	< 5	-	-	-	-	< 5	-	-	-	-	< 5	-
2-Chlorophenol	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2,4-Dichlorophenol	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2,4-Dimethylphenol	-	< 3	-	-	-	-	< 3	-	-	-	-	< 3	-
3 & 4-Methylphenol (m- + p-cresol)	-	< 3	-	-	-	-	< 3	-	-	-	-	< 3	-
2-Methylphenol (o-Cresol)	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2-Nitrophenol	-	< 5	-	-	-	-	< 5	-	-	-	-	< 5	-
Pentachlorophenol (PCP)	-	< 30	-	-	-	-	< 30	-	-	-	-	< 30	-
Phenol	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2,4,5-Trichlorophenol	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
2,4,6-Trichlorophenol	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	-	< 5	-	-	-	-	< 5	-	-	-	-	< 5	-
Butylbenzylphthalate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Di(2-ethylhexyl)adipate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Diethylphthalate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Dimethylphthalate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Di-n-butylphthalate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Di-n-octylphthalate	-	< 1.0	-	-	-	-	< 1.0	-	-	-	-	< 1.0	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
1,3-Dichlorobenzene	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
1,4-Dichlorobenzene	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
Hexachlorobutadiene	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
Hexachloroethane	-	< 0.8	-	-	-	-	< 0.7	-	-	-	-	< 0.7	-
1,2,4-Trichlorobenzene	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	-	< 10	-	-	-	-	< 10	-	-	-	-	< 10	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V 2	V3	V3	V3	V3	V3	V5	V5	V5	V5	V5	V6	V6
Sample Type: Sediment	1.0-1.7m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.4m A	0-0.5m A	0-0.5m B 2
Carbazole	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Dibenzofuran	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Isophorone	-	< 0.5	-	-	-	-	< 0.5	-	-	-	-	< 0.5	-
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	-	< 0.005	-	< 0.005	-	-	< 0.005	-	< 0.005	-	-	< 0.005	-
Monobutyltin (as Sn)	-	< 0.007	-	< 0.007	-	-	< 0.007	-	< 0.007	-	-	< 0.007	-
Tributyltin (as Sn)	-	< 0.004	-	< 0.004	-	-	< 0.004	-	< 0.004	-	-	< 0.004	-
Triphenyltin (as Sn)	-	< 0.003	-	< 0.003	-	-	< 0.003	-	< 0.003	-	-	< 0.003	-
Total Petroleum Hydrocarbons in Soil													
C7 - C9	-	< 9	-	< 10	-	-	< 8	-	< 8	-	-	< 8	-
C10 - C14	-	< 20	-	< 20	-	-	< 20	-	< 20	-	-	< 20	-
C15 - C36	-	< 40	-	< 40	-	-	< 40	-	< 40	-	-	< 40	-
Total hydrocarbons (C7 - C36)	-	< 70	-	< 70	-	-	< 70	-	< 70	-	-	< 70	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V6	V6	V6	V7	V7	V8	V8	V8	V8	V8	V10	V10	V10
Sample Type: Sediment	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0.5-1.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A
Sample Name:	28/02/16	28/02/16	28/02/16	26/02/16	26/02/16	28/02/16	28/02/16	28/02/16	28/02/16	28/02/16	26/02/16	26/02/16	26/02/16
Lab Number:	1545237.4	1545237.5	1545237.7	1544819.1	1544819.4	1546141.1	1546141.2	1546141.4	1546141.5	1546141.7	1545199.1	1545199.2	1545199.4
Dry Matter (g/100g as rcvd)	80	-	-	81	85	-	79	-	81	-	89	-	84
Total Organic Carbon (g/100g dry wt)	-	0.18	0.23			0.14	-	0.11	-	0.12	-	< 0.13	-
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	< 0.010	-	-			-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010
Irgarol	< 0.010	-	-			-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010
Isoproturon	< 0.010	-	-			-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	-	5.3	6.6			3.2	-	3.9	-	3.8	-	2	-
Total Recoverable Cadmium	-	0.083	0.05			0.023	-	0.022	-	0.034	-	< 0.010	-
Total Recoverable Chromium	-	10	13.5			9.3	-	10.1	-	12.6	-	11.4	-
Total Recoverable Copper	-	1.4	1.7			0.9	-	0.8	-	0.8	-	0.5	-
Total Recoverable Lead	-	1.7	2.3			1.76	-	1.73	-	1.62	-	0.57	-
Total Recoverable Mercury	-	< 0.010	0.011			< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-
Total Recoverable Nickel	-	4.2	5.4			3	-	3	-	4.7	-	5.8	-
Total Recoverable Zinc	-	11	14.7			10.4	-	11.3	-	11.1	-	4.4	-
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Acenaphthylene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Anthracene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Benzo[a]anthracene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Benzo[a]pyrene (BAP)	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Benzo[g,h,i]perylene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Benzo[k]fluoranthene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Chrysene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Dibenzo[a,h]anthracene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V6	V6	V6	V7	V7	V8	V8	V8	V8	V8	V10	V10	V10
Sample Type: Sediment	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0.5-1.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A
Fluoranthene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Fluorene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Indeno(1,2,3-c,d)pyrene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Naphthalene	< 0.14	-	-	< 0.14	< 0.13	-	< 0.14	-	< 0.14	-	< 0.12	-	< 0.13
Phenanthrene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Pyrene	< 0.03	-	-	< 0.03	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Bis(2-chloroethyl)ether	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Bis(2-chloroisopropyl)ether	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
4-Bromophenyl phenyl ether	-	-	-			-	< 0.4	-	-	-	< 0.3	-	-
4-Chlorophenyl phenyl ether	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2,6-Dinitrotoluene	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Nitrobenzene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
N-Nitrosodi-n-propylamine	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
N-Nitrosodiphenylamine + Diphenylamine	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
alpha-BHC	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
beta-BHC	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
delta-BHC	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
gamma-BHC (Lindane)	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
4,4'-DDD	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
4,4'-DDE	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
4,4'-DDT	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Dieldrin	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V6	V6	V6	V7	V7	V8	V8	V8	V8	V8	V10	V10	V10
Sample Type: Sediment	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0.5-1.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A
Endosulfan I	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Endosulfan II	-	-	-			-	< 2	-	-	-	< 2	-	-
Endosulfan sulphate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Endrin	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
Endrin ketone	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Heptachlor	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Heptachlor epoxide	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Hexachlorobenzene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Acenaphthylene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Anthracene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Benzo[a]anthracene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Benzo[a]pyrene (BAP)	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Benzo[g,h,i]perylene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Benzo[k]fluoranthene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
1&2-Chloronaphthalene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Chrysene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Dibenzo[a,h]anthracene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Fluoranthene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Fluorene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
2-Methylnaphthalene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Naphthalene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Phenanthrene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Pyrene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V6	V6	V6	V7	V7	V8	V8	V8	V8	V8	V10	V10	V10
Sample Type: Sediment	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0.5-1.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A
4-Chloro-3-methylphenol	-	-	-			-	< 5	-	-	-	< 5	-	-
2-Chlorophenol	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2,4-Dichlorophenol	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2,4-Dimethylphenol	-	-	-			-	< 3	-	-	-	< 3	-	-
3 & 4-Methylphenol (m- + p-cresol)	-	-	-			-	< 3	-	-	-	< 3	-	-
2-Methylphenol (o-Cresol)	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2-Nitrophenol	-	-	-			-	< 5	-	-	-	< 5	-	-
Pentachlorophenol (PCP)	-	-	-			-	< 30	-	-	-	< 30	-	-
Phenol	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2,4,5-Trichlorophenol	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
2,4,6-Trichlorophenol	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	-	-	-			-	< 5	-	-	-	< 5	-	-
Butylbenzylphthalate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Di(2-ethylhexyl)adipate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Diethylphthalate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Dimethylphthalate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Di-n-butylphthalate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Di-n-octylphthalate	-	-	-			-	< 1.0	-	-	-	< 1.0	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
1,3-Dichlorobenzene	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
1,4-Dichlorobenzene	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
Hexachlorobutadiene	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
Hexachloroethane	-	-	-			-	< 0.7	-	-	-	< 0.6	-	-
1,2,4-Trichlorobenzene	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	-	-	-			-	< 10	-	-	-	< 10	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V6	V6	V6	V7	V7	V8	V8	V8	V8	V8	V10	V10	V10
Sample Type: Sediment	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0.5-1.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A
Carbazole	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Dibenzofuran	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Isophorone	-	-	-			-	< 0.5	-	-	-	< 0.5	-	-
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	< 0.005	-	-	< 0.005	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005
Monobutyltin (as Sn)	< 0.007	-	-	< 0.007	< 0.007	-	< 0.007	-	< 0.007	-	< 0.007	-	< 0.007
Tributyltin (as Sn)	< 0.004	-	-	< 0.004	< 0.004	-	< 0.004	-	< 0.004	-	< 0.004	-	< 0.004
Triphenyltin (as Sn)	< 0.003	-	-	< 0.003	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003
Total Petroleum Hydrocarbons in Soil													
C7 - C9	< 9	-	-	< 8	< 8	-	< 8	-	< 8	-	< 8	-	< 8
C10 - C14	< 20	-	-	< 20	< 20	-	< 20	-	< 20	-	< 20	-	< 20
C15 - C36	< 40	-	-	< 40	< 40	-	< 40	-	< 40	-	< 40	-	< 40
Total hydrocarbons (C7 - C36)	< 70	-	-	< 70	< 70	-	< 70	-	< 70	-	< 70	-	< 70

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V10	V10	V12	V12	V12	V12	V12	V13	V13	V13	V13		V13
Sample Type: Sediment	0.5-1.0m B	1.0-1.6m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B 2	1.0-2.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-2.7m A
Sample Name:	26/02/16	26/02/16	26/02/16	26/02/16	26/02/16	6/02/16	26/02/16	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16
Lab Number:	1545199.5	1545199.7	1545290.3	1545290.4	1545290.6	1545290.7	1545290.9	1544110.1	1544110.2	1544110.4	1544110.5	1544110.7	1544110.1
Dry Matter (g/100g as rcvd)	-	-	85	-	89	-	-	-	87	-	88	-	-
Total Organic Carbon (g/100g dry wt)	< 0.13	< 0.13	-	< 0.13	-	< 0.13	< 0.13	< 0.13	-	< 0.13	-	< 0.13	< 0.13
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	-	-	< 0.010	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-
Irgarol	-	-	< 0.010	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-
Isoproturon	-	-	< 0.010	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	1.9	1.6	-	1.8	-	1.8	2.5	< 2	-	< 2	-	< 1.9	< 1.9
Total Recoverable Cadmium	< 0.010	0.012	-	< 0.010	-	< 0.010	0.029	< 0.010	-	< 0.010	-	0.01	< 0.010
Total Recoverable Chromium	4.1	7.4	-	3.7	-	3.2	7.6	3.9	-	3	-	4.3	7
Total Recoverable Copper	0.3	0.4	-	0.4	-	0.2	0.6	0.3	-	0.3	-	0.3	0.3
Total Recoverable Lead	0.57	0.75	-	0.57	-	0.5	1.09	0.6	-	0.52	-	0.62	0.52
Total Recoverable Mercury	0.018	0.01	-	< 0.010	-	< 0.010	< 0.010	< 0.010	-	< 0.010	-	< 0.010	< 0.010
Total Recoverable Nickel	1.8	3.3	-	1.6	-	2.1	3.5	1.9	-	2.5	-	2	2.8
Total Recoverable Zinc	4.1	7.4	-	4.4	-	4.2	8.9	4.4	-	3.8	-	4.5	4.7
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Acenaphthylene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Anthracene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Benzo[a]anthracene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Benzo[a]pyrene (BAP)	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Benzo[g,h,i]perylene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Benzo[k]fluoranthene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Chrysene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Dibenzo[a,h]anthracene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V10	V10	V12	V12	V12	V12	V12	V13	V13	V13	V13		V13
Sample Type: Sediment	0.5-1.0m B	1.0-1.6m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B 2	1.0-2.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-2.7m A
Fluoranthene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Fluorene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Indeno(1,2,3-c,d)pyrene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Naphthalene	-	-	< 0.13	-	< 0.13	-	-	-	< 0.13	-	< 0.13	-	-
Phenanthrene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Pyrene	-	-	< 0.03	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Bis(2-chloroethyl)ether	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Bis(2-chloroisopropyl)ether	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
4-Bromophenyl phenyl ether	-	-	< 0.4	-	-	-	-	-	< 0.4	-	-	-	-
4-Chlorophenyl phenyl ether	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2,6-Dinitrotoluene	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Nitrobenzene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
N-Nitrosodi-n-propylamine	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
alpha-BHC	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
beta-BHC	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
delta-BHC	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
gamma-BHC (Lindane)	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
4,4'-DDD	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
4,4'-DDE	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
4,4'-DDT	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Dieldrin	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V10	V10	V12	V12	V12	V12	V12	V13	V13	V13	V13		V13
Sample Type: Sediment	0.5-1.0m B	1.0-1.6m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B 2	1.0-2.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-2.7m A
Endosulfan I	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Endosulfan II	-	-	< 2	-	-	-	-	-	< 2	-	-	-	-
Endosulfan sulphate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Endrin	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
Endrin ketone	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Heptachlor	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Heptachlor epoxide	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Hexachlorobenzene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Acenaphthylene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Anthracene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Benzo[a]anthracene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Benzo[a]pyrene (BAP)	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Benzo[g,h,i]perylene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Benzo[k]fluoranthene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
1&2-Chloronaphthalene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Chrysene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Dibenzo[a,h]anthracene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Fluoranthene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Fluorene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Indeno(1,2,3-c,d)pyrene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
2-Methylnaphthalene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Naphthalene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Phenanthrene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Pyrene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V10	V10	V12	V12	V12	V12	V12	V13	V13	V13	V13		V13
Sample Type: Sediment	0.5-1.0m B	1.0-1.6m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B 2	1.0-2.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-2.7m A
4-Chloro-3-methylphenol	-	-	< 5	-	-	-	-	-	< 5	-	-	-	-
2-Chlorophenol	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2,4-Dichlorophenol	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2,4-Dimethylphenol	-	-	< 3	-	-	-	-	-	< 3	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	-	-	< 3	-	-	-	-	-	< 3	-	-	-	-
2-Methylphenol (o-Cresol)	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2-Nitrophenol	-	-	< 5	-	-	-	-	-	< 5	-	-	-	-
Pentachlorophenol (PCP)	-	-	< 30	-	-	-	-	-	< 30	-	-	-	-
Phenol	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2,4,5-Trichlorophenol	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
2,4,6-Trichlorophenol	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	-	-	< 5	-	-	-	-	-	< 5	-	-	-	-
Butylbenzylphthalate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Di(2-ethylhexyl)adipate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Diethylphthalate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Dimethylphthalate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Di-n-butylphthalate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Di-n-octylphthalate	-	-	< 1.0	-	-	-	-	-	< 1.0	-	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
1,3-Dichlorobenzene	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
1,4-Dichlorobenzene	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
Hexachlorobutadiene	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
Hexachloroethane	-	-	< 0.7	-	-	-	-	-	< 0.7	-	-	-	-
1,2,4-Trichlorobenzene	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	-	-	< 10	-	-	-	-	-	< 10	-	-	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V10	V10	V12	V12	V12	V12	V12	V13	V13	V13	V13		V13
Sample Type: Sediment	0.5-1.0m B	1.0-1.6m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B 2	1.0-2.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-2.7m A
Carbazole	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Dibenzofuran	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Isophorone	-	-	< 0.5	-	-	-	-	-	< 0.5	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	-	-	< 0.005	-	< 0.005	-	-	-	< 0.005	-	< 0.005	-	-
Monobutyltin (as Sn)	-	-	< 0.007	-	< 0.007	-	-	-	< 0.007	-	< 0.007	-	-
Tributyltin (as Sn)	-	-	< 0.004	-	< 0.004	-	-	-	< 0.004	-	< 0.004	-	-
Triphenyltin (as Sn)	-	-	< 0.003	-	< 0.003	-	-	-	< 0.003	-	< 0.003	-	-
Total Petroleum Hydrocarbons in Soil													
C7 - C9	-	-	< 8	-	< 8	-	-	-	< 8	-	< 8	-	-
C10 - C14	-	-	< 20	-	< 20	-	-	-	< 20	-	< 20	-	-
C15 - C36	-	-	< 40	-	< 40	-	-	-	< 40	-	< 40	-	-
Total hydrocarbons (C7 - C36)	-	-	< 70	-	< 70	-	-	-	< 70	-	< 70	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V14	V14	V14	V14	V14	V14	V15	V15	V15	V15	V15	V15	V16
Sample Type: Sediment	0.0-0.5m B	0.0-0.5m A	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0-0.5m A
Sample Name:	25/02/16	25/02/16	25/02/16	25/02/16	-eb-2016 12:0	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16	25/02/16	23/02/16
Lab Number:	1544110.13	1544110.14	1544110.16	1544110.17	1544110.19	1544110.22	1544110.25	1544110.26	1544110.28	1544110.29	1544110.31	1544110.34	1543364.1
Dry Matter (g/100g as rcvd)	73	-	-	81	-	-	-	86	-	88	-	-	84
Total Organic Carbon (g/100g dry wt)	-	< 0.13	< 0.13	-	< 0.13	< 0.13	< 0.13	-	< 0.13	-	< 0.13	< 0.13	0.17
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	< 0.010	-	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-	< 0.010
Irgarol	< 0.010	-	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-	< 0.010
Isoproturon	< 0.010	-	-	< 0.010	-	-	-	< 0.010	-	< 0.010	-	-	< 0.010
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	-	5	3	-	2.3	< 2	2.1	-	2.2	-	< 2	2	3.8
Total Recoverable Cadmium	-	0.024	0.014	-	0.081	0.025	0.015	-	0.014	-	< 0.010	< 0.010	< 0.02
Total Recoverable Chromium	-	8.8	5.4	-	7.1	8.8	4.4	-	4.3	-	3.6	4.2	8.5
Total Recoverable Copper	-	1.6	0.6	-	0.8	1.8	0.6	-	0.4	-	0.3	< 0.2	1.3
Total Recoverable Lead	-	1.76	0.96	-	1.05	1.11	1.12	-	0.9	-	0.53	0.49	1.61
Total Recoverable Mercury	-	< 0.010	< 0.010	-	< 0.010	< 0.010	< 0.010	-	< 0.010	-	< 0.010	< 0.010	0.02
Total Recoverable Nickel	-	5.2	3.3	-	3.7	4.9	3.1	-	2.1	-	2.1	2	5.9
Total Recoverable Zinc	-	9.5	5.3	-	6.2	6.8	6.3	-	5.1	-	3.8	3.4	9.1
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Acenaphthylene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Anthracene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Benzo[a]anthracene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Benzo[a]pyrene (BAP)	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Benzo[g,h,i]perylene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Benzo[k]fluoranthene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Chrysene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Dibenzo[a,h]anthracene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V14	V14	V14	V14	V14	V14	V15	V15	V15	V15	V15	V15	V16
Sample Type: Sediment	0.0-0.5m B	0.0-0.5m A	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0-0.5m A
Fluoranthene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Fluorene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Indeno(1,2,3-c,d)pyrene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Naphthalene	< 0.15	-	-	< 0.14	-	-	-	< 0.13	-	< 0.13	-	-	< 0.13
Phenanthrene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Pyrene	< 0.03	-	-	< 0.03	-	-	-	< 0.03	-	< 0.03	-	-	< 0.03
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Bis(2-chloroethyl)ether	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Bis(2-chloroisopropyl)ether	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
4-Bromophenyl phenyl ether	< 0.4	-	-	-	-	-	-	< 0.4	-	-	-	-	< 0.4
4-Chlorophenyl phenyl ether	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2,6-Dinitrotoluene	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Nitrobenzene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
N-Nitrosodi-n-propylamine	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
N-Nitrosodiphenylamine + Diphenylamine	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
alpha-BHC	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
beta-BHC	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
delta-BHC	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
gamma-BHC (Lindane)	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
4,4'-DDD	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
4,4'-DDE	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
4,4'-DDT	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Dieldrin	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V14	V14	V14	V14	V14	V14	V15	V15	V15	V15	V15	V15	V16
Sample Type: Sediment	0.0-0.5m B	0.0-0.5m A	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0-0.5m A
Endosulfan I	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Endosulfan II	< 2	-	-	-	-	-	-	< 2	-	-	-	-	< 2
Endosulfan sulphate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Endrin	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
Endrin ketone	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Heptachlor	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Heptachlor epoxide	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Hexachlorobenzene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Acenaphthylene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Anthracene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Benzo[a]anthracene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Benzo[a]pyrene (BAP)	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Benzo[g,h,i]perylene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Benzo[k]fluoranthene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
1&2-Chloronaphthalene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Chrysene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Dibenzo[a,h]anthracene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Fluoranthene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Fluorene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Indeno(1,2,3-c,d)pyrene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
2-Methylnaphthalene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Naphthalene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Phenanthrene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Pyrene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V14	V14	V14	V14	V14	V14	V15	V15	V15	V15	V15	V15	V16
Sample Type: Sediment	0.0-0.5m B	0.0-0.5m A	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0-0.5m A
4-Chloro-3-methylphenol	< 5	-	-	-	-	-	-	< 5	-	-	-	-	< 5
2-Chlorophenol	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2,4-Dichlorophenol	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2,4-Dimethylphenol	< 3	-	-	-	-	-	-	< 3	-	-	-	-	< 3
3 & 4-Methylphenol (m- + p-cresol)	< 3	-	-	-	-	-	-	< 3	-	-	-	-	< 3
2-Methylphenol (o-Cresol)	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2-Nitrophenol	< 5	-	-	-	-	-	-	< 5	-	-	-	-	< 5
Pentachlorophenol (PCP)	< 30	-	-	-	-	-	-	< 30	-	-	-	-	< 30
Phenol	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2,4,5-Trichlorophenol	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
2,4,6-Trichlorophenol	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	< 5	-	-	-	-	-	-	< 5	-	-	-	-	< 5
Butylbenzylphthalate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Di(2-ethylhexyl)adipate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Diethylphthalate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Dimethylphthalate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Di-n-butylphthalate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Di-n-octylphthalate	< 1.0	-	-	-	-	-	-	< 1.0	-	-	-	-	< 1.0
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
1,3-Dichlorobenzene	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
1,4-Dichlorobenzene	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
Hexachlorobutadiene	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
Hexachloroethane	< 0.8	-	-	-	-	-	-	< 0.7	-	-	-	-	< 0.7
1,2,4-Trichlorobenzene	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	< 10	-	-	-	-	-	-	< 10	-	-	-	-	< 10

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V14	V14	V14	V14	V14	V14	V15	V15	V15	V15	V15	V15	V16
Sample Type: Sediment	0.0-0.5m B	0.0-0.5m A	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	2.0-3.0m A	0-0.5m A
Carbazole	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Dibenzofuran	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Isophorone	< 0.5	-	-	-	-	-	-	< 0.5	-	-	-	-	< 0.5
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	< 0.005	-	-	< 0.005	-	-	-	< 0.005	-	< 0.005	-	-	< 0.005
Monobutyltin (as Sn)	< 0.007	-	-	< 0.007	-	-	-	< 0.007	-	< 0.007	-	-	< 0.007
Tributyltin (as Sn)	< 0.004	-	-	< 0.004	-	-	-	< 0.004	-	< 0.004	-	-	< 0.004
Triphenyltin (as Sn)	< 0.003	-	-	< 0.003	-	-	-	< 0.003	-	< 0.003	-	-	< 0.003
Total Petroleum Hydrocarbons in Soil													
C7 - C9	< 9	-	-	< 8	-	-	-	< 8	-	< 8	-	-	< 8
C10 - C14	< 20	-	-	< 20	-	-	-	< 20	-	< 20	-	-	< 20
C15 - C36	< 40	-	-	< 40	-	-	-	< 40	-	< 40	-	-	< 40
Total hydrocarbons (C7 - C36)	< 70	-	-	< 70	-	-	-	< 70	-	< 70	-	-	< 70

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V16	V16	V17	V17	V17	V17	V17	V17	V17	V18	V18	V18	V18
Sample Type: Sediment	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2m A	2-3m A	3-4m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B
Sample Name:	23/02/16	23/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16
Lab Number:	1543364.3	1543364.5	1543396.1	1543396.2	1543396.4	1543396.5	1543396.7	1543396.1	1543396.13	1544100.9	1544100.1	1544100.12	1544100.13
Dry Matter (g/100g as rcvd)	85	-	-	89	-	85	-	-	-	-	88	-	84
Total Organic Carbon (g/100g dry wt)	0.4	-	< 0.13	-	< 0.13	-	< 0.13	< 0.13	< 0.13	< 0.13	-	< 0.05	-
Antifouling cobiocides in sediment samples by LCMSMS													
Diuron	< 0.010	-	-	< 0.010	-	< 0.010	-	-	-	-	< 0.010	-	< 0.010
Irgarol	< 0.010	-	-	< 0.010	-	< 0.010	-	-	-	-	< 0.010	-	< 0.010
Isoproturon	< 0.010	-	-	< 0.010	-	< 0.010	-	-	-	-	< 0.010	-	< 0.010
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg													
Total Recoverable Arsenic	< 4	2.4	2.3	-	1.9	-	2.4	5	3.3	1.9	-	2	-
Total Recoverable Cadmium	0.03	< 0.010	< 0.02	-	< 0.010	-	< 0.010	0.024	< 0.010	< 0.010	-	0.012	-
Total Recoverable Chromium	4.1	6.1	5.4	-	3.5	-	6.4	10.5	9.8	5.4	-	9.1	-
Total Recoverable Copper	1.1	0.4	0.5	-	0.3	-	0.4	0.6	0.7	0.4	-	0.3	-
Total Recoverable Lead	0.85	0.73	0.78	-	0.57	-	0.81	1.42	0.98	0.83	-	1.14	-
Total Recoverable Mercury	0.02	< 0.010	< 0.02	-	< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	-	< 0.010	-
Total Recoverable Nickel	8.8	2.3	4.4	-	2.8	-	2.6	3.7	4.6	3.4	-	2.1	-
Total Recoverable Zinc	4.1	7.3	5.5	-	4.1	-	6.8	10.8	8.9	4.4	-	8.9	-
Polycyclic Aromatic Hydrocarbons Screening in Soil													
Acenaphthene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Acenaphthylene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Anthracene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Benzo[a]anthracene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Benzo[a]pyrene (BAP)	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Benzo[g,h,i]perylene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Benzo[k]fluoranthene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Chrysene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Dibenzo[a,h]anthracene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V16	V16	V17	V17	V17	V17	V17	V17	V17	V18	V18	V18	V18
Sample Type: Sediment	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2m A	2-3m A	3-4m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B
Fluoranthene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Fluorene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Indeno(1,2,3-c,d)pyrene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Naphthalene	< 0.14	-	-	< 0.12	-	< 0.13	-	-	-	-	< 0.13	-	< 0.13
Phenanthrene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Pyrene	< 0.03	-	-	< 0.03	-	< 0.03	-	-	-	-	< 0.03	-	< 0.03
Haloethers in SVOC Soil Samples by GC-MS													
Bis(2-chloroethoxy) methane	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Bis(2-chloroethyl)ether	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Bis(2-chloroisopropyl)ether	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
4-Bromophenyl phenyl ether	-	-	-	< 0.4	-	-	-	-	-	-	< 0.4	-	-
4-Chlorophenyl phenyl ether	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS													
2,4-Dinitrotoluene	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2,6-Dinitrotoluene	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Nitrobenzene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
N-Nitrosodi-n-propylamine	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
N-Nitrosodiphenylamine + Diphenylamine	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS													
Aldrin	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
alpha-BHC	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
beta-BHC	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
delta-BHC	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
gamma-BHC (Lindane)	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
4,4'-DDD	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
4,4'-DDE	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
4,4'-DDT	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Dieldrin	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V16	V16	V17	V17	V17	V17	V17	V17	V17	V18	V18	V18	V18
Sample Type: Sediment	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2m A	2-3m A	3-4m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B
Endosulfan I	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Endosulfan II	-	-	-	< 2	-	-	-	-	-	-	< 2	-	-
Endosulfan sulphate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Endrin	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
Endrin ketone	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Heptachlor	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Heptachlor epoxide	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Hexachlorobenzene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS													
Acenaphthene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Acenaphthylene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Anthracene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Benzo[a]anthracene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Benzo[a]pyrene (BAP)	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Benzo[g,h,i]perylene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Benzo[k]fluoranthene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
1&2-Chloronaphthalene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Chrysene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Dibenzo[a,h]anthracene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Fluoranthene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Fluorene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
2-Methylnaphthalene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Naphthalene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Phenanthrene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Pyrene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Phenols in SVOC Soil Samples by GC-MS													

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V16	V16	V17	V17	V17	V17	V17	V17	V17	V18	V18	V18	V18
Sample Type: Sediment	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2m A	2-3m A	3-4m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B
4-Chloro-3-methylphenol	-	-	-	< 5	-	-	-	-	-	-	< 5	-	-
2-Chlorophenol	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2,4-Dichlorophenol	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2,4-Dimethylphenol	-	-	-	< 3	-	-	-	-	-	-	< 3	-	-
3 & 4-Methylphenol (m- + p-cresol)	-	-	-	< 3	-	-	-	-	-	-	< 3	-	-
2-Methylphenol (o-Cresol)	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2-Nitrophenol	-	-	-	< 5	-	-	-	-	-	-	< 5	-	-
Pentachlorophenol (PCP)	-	-	-	< 30	-	-	-	-	-	-	< 30	-	-
Phenol	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2,4,5-Trichlorophenol	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
2,4,6-Trichlorophenol	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Plasticisers in SVOC Soil Samples by GC-MS													
Bis(2-ethylhexyl)phthalate	-	-	-	< 5	-	-	-	-	-	-	< 5	-	-
Butylbenzylphthalate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Di(2-ethylhexyl)adipate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Diethylphthalate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Dimethylphthalate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Di-n-butylphthalate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Di-n-octylphthalate	-	-	-	< 1.0	-	-	-	-	-	-	< 1.0	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS													
1,2-Dichlorobenzene	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
1,3-Dichlorobenzene	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
1,4-Dichlorobenzene	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
Hexachlorobutadiene	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
Hexachloroethane	-	-	-	< 0.7	-	-	-	-	-	-	< 0.7	-	-
1,2,4-Trichlorobenzene	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Other compounds in SVOC Soil Samples by GC-MS													
Benzyl alcohol	-	-	-	< 10	-	-	-	-	-	-	< 10	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V16	V16	V17	V17	V17	V17	V17	V17	V17	V18	V18	V18	V18
Sample Type: Sediment	0.5-1.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2m A	2-3m A	3-4m A	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B
Carbazole	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Dibenzofuran	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Isophorone	-	-	-	< 0.5	-	-	-	-	-	-	< 0.5	-	-
Tributyl Tin Trace in Soil samples by GCMS													
Dibutyltin (as Sn)	< 0.005	-	-	< 0.005	-	< 0.005	-	-	-	-	< 0.005	-	< 0.005
Monobutyltin (as Sn)	< 0.007	-	-	< 0.007	-	< 0.007	-	-	-	-	< 0.007	-	< 0.007
Tributyltin (as Sn)	< 0.004	-	-	< 0.004	-	< 0.004	-	-	-	-	< 0.004	-	< 0.004
Triphenyltin (as Sn)	< 0.003	-	-	< 0.003	-	< 0.003	-	-	-	-	< 0.003	-	< 0.003
Total Petroleum Hydrocarbons in Soil													
C7 - C9	< 8	-	-	< 8	-	< 8	-	-	-	-	< 8	-	< 8
C10 - C14	< 20	-	-	< 20	-	< 20	-	-	-	-	< 20	-	< 20
C15 - C36	< 40	-	-	< 40	-	< 40	-	-	-	-	< 40	-	< 40
Total hydrocarbons (C7 - C36)	< 70	-	-	< 70	-	< 70	-	-	-	-	< 70	-	< 70

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V18	V18	V19	V19	V19	V19	V19	V19A	V19A	V19A	V19A	V19A
Sample Type: Sediment	2.0-3.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1m A	0.5-1m B	1-1.5m A
Sample Name:	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16	29/02/16	29/02/16	29/02/16	29/02/16	29/02/16
Lab Number:	1544100.16	1544100.19	1544100.22	1544100.23	1544100.25	1544100.26	1544100.28	1546000.1	1546000.2	1546000.4	1546000.5	1546000.7
Dry Matter (g/100g as rcvd)	-	-	-	86	-	82	-	82	-	82	-	-
Total Organic Carbon (g/100g dry wt)	0.17	< 0.05	< 0.13	-	0.06	-	< 0.13	-	< 0.05	-	< 0.05	< 0.05
Antifouling cobiocides in sediment samples by LCMSMS												
Diuron	-	-	-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-
Irgarol	-	-	-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-
Isoproturon	-	-	-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg												
Total Recoverable Arsenic	4	2.6	2	-	2	-	2.4	-	2.9	-	2.2	2.5
Total Recoverable Cadmium	0.038	0.011	< 0.010	-	0.027	-	0.037	-	< 0.010	-	< 0.010	0.015
Total Recoverable Chromium	14.7	8.3	5.5	-	12.2	-	34	-	50	-	10.6	37
Total Recoverable Copper	0.7	0.3	0.4	-	0.5	-	0.8	-	1.1	-	0.4	0.8
Total Recoverable Lead	1.66	1	0.68	-	1.45	-	1.05	-	1.19	-	0.87	0.9
Total Recoverable Mercury	< 0.010	< 0.010	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	-	< 0.010	< 0.010
Total Recoverable Nickel	5	1.9	2.4	-	3.1	-	17.1	-	20	-	3.7	20
Total Recoverable Zinc	10.6	8.3	4.9	-	10.2	-	7.8	-	8.3	-	6.6	7.2
Polycyclic Aromatic Hydrocarbons Screening in Soil												
Acenaphthene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Acenaphthylene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Anthracene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Benzo[a]anthracene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Benzo[a]pyrene (BAP)	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Benzo[g,h,i]perylene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Benzo[k]fluoranthene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Chrysene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Dibenzo[a,h]anthracene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V18	V18	V19	V19	V19	V19	V19	V19A	V19A	V19A	V19A	V19A
Sample Type: Sediment	2.0-3.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1m A	0.5-1m B	1-1.5m A
Fluoranthene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Fluorene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Naphthalene	-	-	-	< 0.13	-	< 0.14	-	< 0.14	-	< 0.13	-	-
Phenanthrene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Pyrene	-	-	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-	-
Haloethers in SVOC Soil Samples by GC-MS												
Bis(2-chloroethoxy) methane	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Bis(2-chloroethyl)ether	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Bis(2-chloroisopropyl)ether	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
4-Bromophenyl phenyl ether	-	-	-	< 0.4	-	-	-	< 0.4	-	-	-	-
4-Chlorophenyl phenyl ether	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS												
2,4-Dinitrotoluene	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2,6-Dinitrotoluene	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Nitrobenzene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
N-Nitrosodi-n-propylamine	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS												
Aldrin	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
alpha-BHC	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
beta-BHC	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
delta-BHC	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
gamma-BHC (Lindane)	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
4,4'-DDD	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
4,4'-DDE	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
4,4'-DDT	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Dieldrin	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V18	V18	V19	V19	V19	V19	V19	V19A	V19A	V19A	V19A	V19A
Sample Type: Sediment	2.0-3.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1m A	0.5-1m B	1-1.5m A
Endosulfan I	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Endosulfan II	-	-	-	< 2	-	-	-	< 2	-	-	-	-
Endosulfan sulphate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Endrin	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
Endrin ketone	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Heptachlor	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Heptachlor epoxide	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Hexachlorobenzene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS												
Acenaphthene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Acenaphthylene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Anthracene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Benzo[a]anthracene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Benzo[a]pyrene (BAP)	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Benzo[g,h,i]perylene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Benzo[k]fluoranthene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
1&2-Chloronaphthalene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Chrysene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Dibenzo[a,h]anthracene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Fluoranthene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Fluorene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
2-Methylnaphthalene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Naphthalene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Phenanthrene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Pyrene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Phenols in SVOC Soil Samples by GC-MS												

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V18	V18	V19	V19	V19	V19	V19	V19A	V19A	V19A	V19A	V19A
Sample Type: Sediment	2.0-3.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1m A	0.5-1m B	1-1.5m A
4-Chloro-3-methylphenol	-	-	-	< 5	-	-	-	< 5	-	-	-	-
2-Chlorophenol	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2,4-Dichlorophenol	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2,4-Dimethylphenol	-	-	-	< 3	-	-	-	< 3	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	-	-	-	< 3	-	-	-	< 3	-	-	-	-
2-Methylphenol (o-Cresol)	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2-Nitrophenol	-	-	-	< 5	-	-	-	< 5	-	-	-	-
Pentachlorophenol (PCP)	-	-	-	< 30	-	-	-	< 30	-	-	-	-
Phenol	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2,4,5-Trichlorophenol	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS												
Bis(2-ethylhexyl)phthalate	-	-	-	< 5	-	-	-	< 5	-	-	-	-
Butylbenzylphthalate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Di(2-ethylhexyl)adipate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Diethylphthalate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Dimethylphthalate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Di-n-butylphthalate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Di-n-octylphthalate	-	-	-	< 1.0	-	-	-	< 1.0	-	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS												
1,2-Dichlorobenzene	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
1,3-Dichlorobenzene	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
1,4-Dichlorobenzene	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
Hexachlorobutadiene	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
Hexachloroethane	-	-	-	< 0.7	-	-	-	< 0.7	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Other compounds in SVOC Soil Samples by GC-MS												
Benzyl alcohol	-	-	-	< 10	-	-	-	< 10	-	-	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples
collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V18	V18	V19	V19	V19	V19	V19	V19A	V19A	V19A	V19A	V19A
Sample Type: Sediment	2.0-3.0m A	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-2.0m A	0-0.5m A	0-0.5m B	0.5-1m A	0.5-1m B	1-1.5m A
Carbazole	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Dibenzofuran	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Isophorone	-	-	-	< 0.5	-	-	-	< 0.5	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS												
Dibutyltin (as Sn)	-	-	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	-
Monobutyltin (as Sn)	-	-	-	< 0.007	-	< 0.007	-	< 0.007	-	< 0.007	-	-
Tributyltin (as Sn)	-	-	-	< 0.004	-	< 0.004	-	< 0.004	-	< 0.004	-	-
Triphenyltin (as Sn)	-	-	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	-
Total Petroleum Hydrocarbons in Soil												
C7 - C9	-	-	-	< 8	-	< 9	-	< 9	-	< 8	-	-
C10 - C14	-	-	-	< 20	-	< 20	-	< 20	-	< 20	-	-
C15 - C36	-	-	-	< 40	-	< 40	-	< 40	-	< 40	-	-
Total hydrocarbons (C7 - C36)	-	-	-	< 70	-	< 70	-	< 70	-	< 70	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V20	V20	V20	V20	V20
Sample Type: Sediment	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-1.5m A
Sample Name:	24/02/16	24/02/16	24/02/16	24/02/16	24/02/16
Lab Number:	1544100.1	1544100.2	1544100.4	1544100.5	1544100.6
Dry Matter (g/100g as rcvd)	-	84	-	85	-
Total Organic Carbon (g/100g dry wt)	< 0.13	-	0.06	-	0.05
Antifouling cobiocides in sediment samples by LCMSMS					
Diuron	-	< 0.010	-	< 0.010	-
Irgarol	-	< 0.010	-	< 0.010	-
Isoproturon	-	< 0.010	-	< 0.010	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic	3	-	2.6	-	2.7
Total Recoverable Cadmium	0.083	-	0.02	-	0.017
Total Recoverable Chromium	210	-	8	-	8.9
Total Recoverable Copper	3.8	-	0.5	-	0.4
Total Recoverable Lead	1.35	-	0.96	-	1.07
Total Recoverable Mercury	< 0.010	-	< 0.010	-	< 0.010
Total Recoverable Nickel	123	-	1.9	-	2.2
Total Recoverable Zinc	8.9	-	7.6	-	8.1
Polycyclic Aromatic Hydrocarbons Screening in Soil					
Acenaphthene	-	< 0.03	-	< 0.03	-
Acenaphthylene	-	< 0.03	-	< 0.03	-
Anthracene	-	< 0.03	-	< 0.03	-
Benzo[a]anthracene	-	< 0.03	-	< 0.03	-
Benzo[a]pyrene (BAP)	-	< 0.03	-	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	< 0.03	-	< 0.03	-
Benzo[g,h,i]perylene	-	< 0.03	-	< 0.03	-
Benzo[k]fluoranthene	-	< 0.03	-	< 0.03	-
Chrysene	-	< 0.03	-	< 0.03	-
Dibenzo[a,h]anthracene	-	< 0.03	-	< 0.03	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V20	V20	V20	V20	V20
Sample Type: Sediment	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-1.5m A
Fluoranthene	-	< 0.03	-	< 0.03	-
Fluorene	-	< 0.03	-	< 0.03	-
Indeno(1,2,3-c,d)pyrene	-	< 0.03	-	< 0.03	-
Naphthalene	-	< 0.13	-	< 0.13	-
Phenanthrene	-	< 0.03	-	< 0.03	-
Pyrene	-	< 0.03	-	< 0.03	-
Haloethers in SVOC Soil Samples by GC-MS					
Bis(2-chloroethoxy) methane	-	< 0.5	-	-	-
Bis(2-chloroethyl)ether	-	< 0.5	-	-	-
Bis(2-chloroisopropyl)ether	-	< 0.5	-	-	-
4-Bromophenyl phenyl ether	-	< 0.4	-	-	-
4-Chlorophenyl phenyl ether	-	< 0.5	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS					
2,4-Dinitrotoluene	-	< 1.0	-	-	-
2,6-Dinitrotoluene	-	< 1.0	-	-	-
Nitrobenzene	-	< 0.5	-	-	-
N-Nitrosodi-n-propylamine	-	< 0.7	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	-	< 0.7	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS					
Aldrin	-	< 0.5	-	-	-
alpha-BHC	-	< 0.5	-	-	-
beta-BHC	-	< 0.5	-	-	-
delta-BHC	-	< 0.5	-	-	-
gamma-BHC (Lindane)	-	< 0.5	-	-	-
4,4'-DDD	-	< 0.5	-	-	-
4,4'-DDE	-	< 0.5	-	-	-
4,4'-DDT	-	< 1.0	-	-	-
Dieldrin	-	< 0.5	-	-	-

Results as mg/kg dry wt unless stated otherwise

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V20	V20	V20	V20	V20
Sample Type: Sediment	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-1.5m A
Endosulfan I	-	< 1.0	-	-	-
Endosulfan II	-	< 2	-	-	-
Endosulfan sulphate	-	< 1.0	-	-	-
Endrin	-	< 0.7	-	-	-
Endrin ketone	-	< 1.0	-	-	-
Heptachlor	-	< 0.5	-	-	-
Heptachlor epoxide	-	< 0.5	-	-	-
Hexachlorobenzene	-	< 0.5	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS					
Acenaphthene	-	< 0.5	-	-	-
Acenaphthylene	-	< 0.5	-	-	-
Anthracene	-	< 0.5	-	-	-
Benzo[a]anthracene	-	< 0.5	-	-	-
Benzo[a]pyrene (BAP)	-	< 0.5	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	< 0.5	-	-	-
Benzo[g,h,i]perylene	-	< 0.5	-	-	-
Benzo[k]fluoranthene	-	< 0.5	-	-	-
1&2-Chloronaphthalene	-	< 0.5	-	-	-
Chrysene	-	< 0.5	-	-	-
Dibenzo[a,h]anthracene	-	< 0.5	-	-	-
Fluoranthene	-	< 0.5	-	-	-
Fluorene	-	< 0.5	-	-	-
Indeno(1,2,3-c,d)pyrene	-	< 0.5	-	-	-
2-Methylnaphthalene	-	< 0.5	-	-	-
Naphthalene	-	< 0.5	-	-	-
Phenanthrene	-	< 0.5	-	-	-
Pyrene	-	< 0.5	-	-	-
Phenols in SVOC Soil Samples by GC-MS					

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V20	V20	V20	V20	V20
Sample Type: Sediment	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-1.5m A
4-Chloro-3-methylphenol	-	< 5	-	-	-
2-Chlorophenol	-	< 1.0	-	-	-
2,4-Dichlorophenol	-	< 1.0	-	-	-
2,4-Dimethylphenol	-	< 3	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	-	< 3	-	-	-
2-Methylphenol (o-Cresol)	-	< 1.0	-	-	-
2-Nitrophenol	-	< 5	-	-	-
Pentachlorophenol (PCP)	-	< 30	-	-	-
Phenol	-	< 1.0	-	-	-
2,4,5-Trichlorophenol	-	< 1.0	-	-	-
2,4,6-Trichlorophenol	-	< 1.0	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS					
Bis(2-ethylhexyl)phthalate	-	< 5	-	-	-
Butylbenzylphthalate	-	< 1.0	-	-	-
Di(2-ethylhexyl)adipate	-	< 1.0	-	-	-
Diethylphthalate	-	< 1.0	-	-	-
Dimethylphthalate	-	< 1.0	-	-	-
Di-n-butylphthalate	-	< 1.0	-	-	-
Di-n-octylphthalate	-	< 1.0	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS					
1,2-Dichlorobenzene	-	< 0.7	-	-	-
1,3-Dichlorobenzene	-	< 0.7	-	-	-
1,4-Dichlorobenzene	-	< 0.7	-	-	-
Hexachlorobutadiene	-	< 0.7	-	-	-
Hexachloroethane	-	< 0.7	-	-	-
1,2,4-Trichlorobenzene	-	< 0.5	-	-	-
Other compounds in SVOC Soil Samples by GC-MS					
Benzyl alcohol	-	< 10	-	-	-

APPENDIX C1: Summary Chemical database for sectioned vibracore samples collected by Tonkin Taylor and analysed by R.J. Hill Laboratories

	V20	V20	V20	V20	V20
Sample Type: Sediment	0.0-0.5m A	0.0-0.5m B	0.5-1.0m A	0.5-1.0m B	1.0-1.5m A
Carbazole	-	< 0.5	-	-	-
Dibenzofuran	-	< 0.5	-	-	-
Isophorone	-	< 0.5	-	-	-
Tributyl Tin Trace in Soil samples by GCMS					
Dibutyltin (as Sn)	-	< 0.005	-	< 0.005	-
Monobutyltin (as Sn)	-	< 0.007	-	< 0.007	-
Tributyltin (as Sn)	-	< 0.004	-	< 0.004	-
Triphenyltin (as Sn)	-	< 0.003	-	< 0.003	-
Total Petroleum Hydrocarbons in Soil					
C7 - C9	-	< 8	-	< 8	-
C10 - C14	-	< 20	-	< 20	-
C15 - C36	-	< 40	-	< 40	-
Total hydrocarbons (C7 - C36)	-	< 70	-	< 70	-

Results as mg/kg dry wt unless stated otherwise

Hill Laboratories
BETTER TESTING BETTER RESULTS

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	1546000 SPv2
Contact:	A Pomfret	**Date Registered:**	02-Mar-2016
	C/- Tonkin & Taylor	**Date Reported:**	22-Apr-2016
	PO Box 5271	**Quote No:**	74906
	Auckland 1141	**Order No:**	98701
		Client Reference:	Contamination Sampling Marsden Point
		Submitted By:	J Yule

Amended Report

This report replaces an earlier report issued on the 10 Mar 2016 at 4:21 pm
Elutriation testing has been added at the request of the client.

Sample Type: Sediment

Sample Name:		V19A 0-0.5m A 29-Feb-2016 11:00 am	V19A 0-0.5m B 29-Feb-2016 11:00 am	V19A 0.5-1m A 29-Feb-2016 11:00 am	V19A 0.5-1m B 29-Feb-2016 11:00 am	V19A 1-1.5m A 29-Feb-2016 11:00 am
Lab Number:		1546000.1	1546000.2	1546000.4	1546000.5	1546000.7
Individual Tests						
Dry Matter	g/100g as rcvd	82	-	82	-	-
Total Organic Carbon*	g/100g dry wt	-	< 0.05	-	< 0.05	< 0.05
Antifouling cobiocides in sediment samples by LCMSMS						
Diuron*	mg/kg dry wt	< 0.010	-	< 0.010	-	-
Irgarol*	mg/kg dry wt	< 0.010	-	< 0.010	-	-
Isoproturon*	mg/kg dry wt	< 0.010	-	< 0.010	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	2.9	-	2.2	2.5
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.010	-	< 0.010	0.015
Total Recoverable Chromium	mg/kg dry wt	-	50	-	10.6	37
Total Recoverable Copper	mg/kg dry wt	-	1.1	-	0.4	0.8
Total Recoverable Lead	mg/kg dry wt	-	1.19	-	0.87	0.90
Total Recoverable Mercury	mg/kg dry wt	-	< 0.010	-	< 0.010	< 0.010
Total Recoverable Nickel	mg/kg dry wt	-	20	-	3.7	20
Total Recoverable Zinc	mg/kg dry wt	-	8.3	-	6.6	7.2
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Anthracene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Chrysene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Fluoranthene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Fluorene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Naphthalene	mg/kg dry wt	< 0.14	-	< 0.13	-	-
Phenanthrene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Pyrene	mg/kg dry wt	< 0.03	-	< 0.03	-	-
Haloethers in SVOC Soil Samples by GC-MS						

Sample Type: Sediment						
Sample Name:		V19A 0-0.5m A 29-Feb-2016 11:00 am	V19A 0-0.5m B 29-Feb-2016 11:00 am	V19A 0.5-1m A 29-Feb-2016 11:00 am	V19A 0.5-1m B 29-Feb-2016 11:00 am	V19A 1-1.5m A 29-Feb-2016 11:00 am
Lab Number:		1546000.1	1546000.2	1546000.4	1546000.5	1546000.7
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5	-	-	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5	-	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0	-	-	-	-
Nitrobenzene	mg/kg dry wt	< 0.5	-	-	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7	-	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 0.5	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.5	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.5	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.5	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 1.0	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.5	-	-	-	-
Endosulfan I	mg/kg dry wt	< 1.0	-	-	-	-
Endosulfan II	mg/kg dry wt	< 2	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 1.0	-	-	-	-
Endrin	mg/kg dry wt	< 0.7	-	-	-	-
Endrin ketone	mg/kg dry wt	< 1.0	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.5	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.5	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS						
Acenaphthene	mg/kg dry wt	< 0.5	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.5	-	-	-	-
Anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Chrysene	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.5	-	-	-	-
Fluorene	mg/kg dry wt	< 0.5	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.5	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.5	-	-	-	-
Pyrene	mg/kg dry wt	< 0.5	-	-	-	-
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	-	-	-	-
2-Chlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4-Dichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-

Sample Type: Sediment						
Sample Name:		V19A 0-0.5m A 29-Feb-2016 11:00 am	V19A 0-0.5m B 29-Feb-2016 11:00 am	V19A 0.5-1m A 29-Feb-2016 11:00 am	V19A 0.5-1m B 29-Feb-2016 11:00 am	V19A 1-1.5m A 29-Feb-2016 11:00 am
Lab Number:		1546000.1	1546000.2	1546000.4	1546000.5	1546000.7
Phenols in SVOC Soil Samples by GC-MS						
2,4-Dimethylphenol	mg/kg dry wt	< 3	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	-	-	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0	-	-	-	-
2-Nitrophenol	mg/kg dry wt	< 5	-	-	-	-
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	-	-	-	-
Phenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0	-	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5	-	-	-	-
Butylbenzylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0	-	-	-	-
Diethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Dimethylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-butylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Di-n-octylphthalate	mg/kg dry wt	< 1.0	-	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.7	-	-	-	-
Hexachloroethane	mg/kg dry wt	< 0.7	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	-	-	-	-
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 10	-	-	-	-
Carbazole	mg/kg dry wt	< 0.5	-	-	-	-
Dibenzofuran	mg/kg dry wt	< 0.5	-	-	-	-
Isophorone	mg/kg dry wt	< 0.5	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	-	< 0.005	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	< 0.007	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	-	< 0.004	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	< 0.003	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	-	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	-	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	-	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	< 70	-	-

Sample Type: Aqueous						
Sample Name:		V19A 0-0.5m A [Elutriation extract]				
Lab Number:		1546000.10				
Individual Tests						
Total Chromium*	g/m^3	< 0.0011	-	-	-	-
Total Nickel*	g/m^3	< 0.007	-	-	-	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment			
Test	Method Description	Default Detection Limit	Sample No

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Antifouling cobiocides in sediment samples by LCMSMS*		0.010 mg/kg dry wt	1, 4
Antifouling cobiocides suite in sediment by LCMSMS*	Ethyl acetate extraction, SPE cleanup, determination by LCMSMS.	-	1, 4
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2, 4-5, 7
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, trace level.	0.010 - 0.4 mg/kg dry wt	2, 5, 7
Elutriation testing*	Extn with (client supplied) water, eg seawater, Sed:Water 1:4 by vol, mix 30 min, settle 1 hr, filtration or centrifugation. US EPA 503/8-91/001, "Evaluation of Dredged Material for Ocean Disposal".	-	1
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1, 4
Semivolatile Organic Compounds Screening in Soil by GC-MS	Sonication extraction, GPC cleanup (if required), GC-MS FS analysis. Tested on as received sample	0.3 - 30 mg/kg dry wt	1
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	1, 4
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1, 4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1, 4
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	2, 5, 7
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	2, 5, 7

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	10
Total Chromium*	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	10
Total Nickel*	Nitric acid digestion, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

APPENDIX C3

Hill Laboratories
BETTER TESTING BETTER RESULTS

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	1544100 SUPv2
Contact:	A Pomfret	**Date Registered:**	27-Feb-2016
	C/- Tonkin & Taylor	**Date Reported:**	22-Apr-2016
	PO Box 5271	**Quote No:**	74906
	Auckland 1141	**Order No:**	98701
		Client Reference:	Contamination sampling Marsden Point
		Submitted By:	J Yule

Amended Report

This report replaces an earlier report issued on the 10 Mar 2016 at 12:28 pm
Elutriation testing has been added at the request of the client.

Sample Type: Sediment

Sample Name:		V20 0.0-0.5m A 24-Feb-2016 11:00 am	V20 0.0-0.5m B 24-Feb-2016 11:00 am	V20 0.5-1.0m A 24-Feb-2016 11:00 am	V20 0.5-1.0m B 24-Feb-2016 11:00 am
Lab Number:		1544100.1	1544100.2	1544100.4	1544100.5
Individual Tests					
Dry Matter	g/100g as rcvd	-	83.5 ± 5.0	-	84.6 ± 5.0
Total Organic Carbon*	g/100g dry wt	< 0.13 ± 0.042	-	0.055 ± 0.041	-
Antifouling cobiocides in sediment samples by LCMSMS					
Diuron*	mg/kg dry wt	-	< 0.010	-	< 0.010
Irgarol*	mg/kg dry wt	-	< 0.010	-	< 0.010
Isoproturon*	mg/kg dry wt	-	< 0.010	-	< 0.010
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic	mg/kg dry wt	2.71 ± 0.31	-	2.58 ± 0.29	-
Total Recoverable Cadmium	mg/kg dry wt	0.083 ± 0.012	-	0.0202 ± 0.0065	-
Total Recoverable Chromium	mg/kg dry wt	213 ± 26	-	8.04 ± 0.98	-
Total Recoverable Copper	mg/kg dry wt	3.83 ± 0.56	-	0.46 ± 0.15	-
Total Recoverable Lead	mg/kg dry wt	1.35 ± 0.17	-	0.96 ± 0.12	-
Total Recoverable Mercury	mg/kg dry wt	< 0.010 ± 0.0067	-	< 0.010 ± 0.0067	-
Total Recoverable Nickel	mg/kg dry wt	123 ± 13	-	1.86 ± 0.23	-
Total Recoverable Zinc	mg/kg dry wt	8.9 ± 1.5	-	7.6 ± 1.3	-
Polycyclic Aromatic Hydrocarbons Screening in Soil					
Acenaphthene	mg/kg dry wt	-	< 0.03 ± 0.0094	-	< 0.03 ± 0.0093
Acenaphthylene	mg/kg dry wt	-	< 0.03 ± 0.0070	-	< 0.03 ± 0.0070
Anthracene	mg/kg dry wt	-	< 0.03 ± 0.0097	-	< 0.03 ± 0.0096
Benzo[a]anthracene	mg/kg dry wt	-	< 0.03 ± 0.0090	-	< 0.03 ± 0.0089
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.03 ± 0.0069	-	< 0.03 ± 0.0069
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.03 ± 0.0082	-	< 0.03 ± 0.0082
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.03 ± 0.0078	-	< 0.03 ± 0.0078
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.03 ± 0.0073	-	< 0.03 ± 0.0073
Chrysene	mg/kg dry wt	-	< 0.03 ± 0.0075	-	< 0.03 ± 0.0075
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.03 ± 0.0073	-	< 0.03 ± 0.0073
Fluoranthene	mg/kg dry wt	-	< 0.03 ± 0.0071	-	< 0.03 ± 0.0071
Fluorene	mg/kg dry wt	-	< 0.03 ± 0.0073	-	< 0.03 ± 0.0072
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.03 ± 0.0070	-	< 0.03 ± 0.0070
Naphthalene	mg/kg dry wt	-	< 0.13 ± 0.044	-	< 0.13 ± 0.044
Phenanthrene	mg/kg dry wt	-	< 0.03 ± 0.0075	-	< 0.03 ± 0.0074
Pyrene	mg/kg dry wt	-	< 0.03 ± 0.0073	-	< 0.03 ± 0.0073
Haloethers in SVOC Soil Samples by GC-MS					
Bis(2-chloroethoxy) methane	mg/kg dry wt	-	< 0.5 ± 0.34	-	-

Sample Type: Sediment					
Sample Name:		V20 0.0-0.5m A 24-Feb-2016 11:00 am	V20 0.0-0.5m B 24-Feb-2016 11:00 am	V20 0.5-1.0m A 24-Feb-2016 11:00 am	V20 0.5-1.0m B 24-Feb-2016 11:00 am
Lab Number:		1544100.1	1544100.2	1544100.4	1544100.5
Haloethers in SVOC Soil Samples by GC-MS					
Bis(2-chloroethyl)ether	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	-	< 0.4 ± 0.21	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS					
2,4-Dinitrotoluene	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2,6-Dinitrotoluene	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Nitrobenzene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	-	< 0.7 ± 0.35	-	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	-	< 0.7 ± 0.43	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS					
Aldrin	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
alpha-BHC	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
beta-BHC	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
delta-BHC	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
4,4'-DDD	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
4,4'-DDE	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
4,4'-DDT	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Dieldrin	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Endosulfan I	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Endosulfan II	mg/kg dry wt	-	< 2 ± 1.4	-	-
Endosulfan sulphate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Endrin	mg/kg dry wt	-	< 0.7 ± 0.40	-	-
Endrin ketone	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Heptachlor	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Heptachlor epoxide	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Hexachlorobenzene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS					
Acenaphthene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Acenaphthylene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Anthracene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Benzo[a]anthracene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
1&2-Chloronaphthalene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Chrysene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Fluoranthene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Fluorene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
2-Methylnaphthalene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Naphthalene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Phenanthrene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Pyrene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Phenols in SVOC Soil Samples by GC-MS					
4-Chloro-3-methylphenol	mg/kg dry wt	-	< 5 ± 3.4	-	-
2-Chlorophenol	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2,4-Dichlorophenol	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2,4-Dimethylphenol	mg/kg dry wt	-	< 3 ± 1.2	-	-

Sample Type: Sediment					
Sample Name:		V20 0.0-0.5m A 24-Feb-2016 11:00 am	V20 0.0-0.5m B 24-Feb-2016 11:00 am	V20 0.5-1.0m A 24-Feb-2016 11:00 am	V20 0.5-1.0m B 24-Feb-2016 11:00 am
Lab Number:		1544100.1	1544100.2	1544100.4	1544100.5
Phenols in SVOC Soil Samples by GC-MS					
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	-	< 3 ± 1.2	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2-Nitrophenol	mg/kg dry wt	-	< 5 ± 3.4	-	-
Pentachlorophenol (PCP)	mg/kg dry wt	-	< 30 ± 68	-	-
Phenol	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Plasticisers in SVOC Soil Samples by GC-MS					
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	-	< 5 ± 3.4	-	-
Butylbenzylphthalate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	-	< 1.0 ± 5.1	-	-
Diethylphthalate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Dimethylphthalate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Di-n-butylphthalate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Di-n-octylphthalate	mg/kg dry wt	-	< 1.0 ± 0.67	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS					
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.7 ± 0.35	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.7 ± 0.35	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.7 ± 0.35	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.7 ± 0.35	-	-
Hexachloroethane	mg/kg dry wt	-	< 0.7 ± 0.36	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Other compounds in SVOC Soil Samples by GC-MS					
Benzyl alcohol	mg/kg dry wt	-	< 10 ± 6.7	-	-
Carbazole	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Dibenzofuran	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Isophorone	mg/kg dry wt	-	< 0.5 ± 0.34	-	-
Tributyl Tin Trace in Soil samples by GCMS					
Dibutyltin (as Sn)	mg/kg dry wt	-	< 0.005 ± 0.0056	-	< 0.005 ± 0.0056
Monobutyltin (as Sn)	mg/kg dry wt	-	< 0.007 ± 0.0075	-	< 0.007 ± 0.0075
Tributyltin (as Sn)	mg/kg dry wt	-	< 0.004 ± 0.0044	-	< 0.004 ± 0.0044
Triphenyltin (as Sn)	mg/kg dry wt	-	< 0.003 ± 0.0021	-	< 0.003 ± 0.0021
Total Petroleum Hydrocarbons in Soil					
C7 - C9	mg/kg dry wt	-	< 8 ± 5.4	-	< 8 ± 5.4
C10 - C14	mg/kg dry wt	-	< 20 ± 7.6	-	< 20 ± 7.6
C15 - C36	mg/kg dry wt	-	< 40 ± 9.3	-	< 40 ± 9.3
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 70 ± 14	-	< 70 ± 14

Sample Name:		V201.0-1.5m A 24-Feb-2016 11:00 am	V18 0.0-0.5m A 24-Feb-2016 1:00 pm	V18 0.0-0.5m B 24-Feb-2016 1:00 pm	V18 0.5-1.0m A 24-Feb-2016 1:00 pm
Lab Number:		1544100.6	1544100.9	1544100.10	1544100.12
Individual Tests					
Dry Matter	g/100g as rcvd	-	-	88.1 ± 5.0	-
Total Organic Carbon*	g/100g dry wt	0.052 ± 0.041	< 0.13 ± 0.042	-	< 0.05 ± 0.041
Antifouling cobiocides in sediment samples by LCMSMS					
Diuron*	mg/kg dry wt	-	-	< 0.010	-
Irgarol*	mg/kg dry wt	-	-	< 0.010	-
Isoproturon*	mg/kg dry wt	-	-	< 0.010	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic	mg/kg dry wt	2.68 ± 0.30	1.92 ± 0.24	-	2.21 ± 0.26
Total Recoverable Cadmium	mg/kg dry wt	0.0174 ± 0.0064	< 0.010 ± 0.0062	-	0.0121 ± 0.0062
Total Recoverable Chromium	mg/kg dry wt	8.9 ± 1.1	5.44 ± 0.67	-	9.1 ± 1.1
Total Recoverable Copper	mg/kg dry wt	0.45 ± 0.15	0.41 ± 0.15	-	0.35 ± 0.14
Total Recoverable Lead	mg/kg dry wt	1.07 ± 0.14	0.83 ± 0.11	-	1.14 ± 0.14

Sample Type: Sediment					
	Sample Name:	V201.0-1.5m A 24-Feb-2016 11:00 am	V18 0.0-0.5m A 24-Feb-2016 1:00 pm	V18 0.0-0.5m B 24-Feb-2016 1:00 pm	V18 0.5-1.0m A 24-Feb-2016 1:00 pm
	Lab Number:	1544100.6	1544100.9	1544100.10	1544100.12
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Mercury	mg/kg dry wt	< 0.010 ± 0.0067	< 0.010 ± 0.0067	-	< 0.010 ± 0.0067
Total Recoverable Nickel	mg/kg dry wt	2.16 ± 0.26	3.39 ± 0.37	-	2.10 ± 0.25
Total Recoverable Zinc	mg/kg dry wt	8.1 ± 1.4	4.38 ± 0.75	-	8.9 ± 1.5
Polycyclic Aromatic Hydrocarbons Screening in Soil					
Acenaphthene	mg/kg dry wt	-	-	< 0.03 ± 0.0092	-
Acenaphthylene	mg/kg dry wt	-	-	< 0.03 ± 0.0070	-
Anthracene	mg/kg dry wt	-	-	< 0.03 ± 0.0095	-
Benzo[a]anthracene	mg/kg dry wt	-	-	< 0.03 ± 0.0089	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	< 0.03 ± 0.0069	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	< 0.03 ± 0.0081	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	< 0.03 ± 0.0077	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	< 0.03 ± 0.0073	-
Chrysene	mg/kg dry wt	-	-	< 0.03 ± 0.0075	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	< 0.03 ± 0.0073	-
Fluoranthene	mg/kg dry wt	-	-	< 0.03 ± 0.0071	-
Fluorene	mg/kg dry wt	-	-	< 0.03 ± 0.0072	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	< 0.03 ± 0.0070	-
Naphthalene	mg/kg dry wt	-	-	< 0.13 ± 0.043	-
Phenanthrene	mg/kg dry wt	-	-	< 0.03 ± 0.0074	-
Pyrene	mg/kg dry wt	-	-	< 0.03 ± 0.0073	-
Haloethers in SVOC Soil Samples by GC-MS					
Bis(2-chloroethoxy) methane	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Bis(2-chloroethyl)ether	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
4-Bromophenyl phenyl ether	mg/kg dry wt	-	-	< 0.4 ± 0.21	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS					
2,4-Dinitrotoluene	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2,6-Dinitrotoluene	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Nitrobenzene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	-	-	< 0.7 ± 0.35	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	-	-	< 0.7 ± 0.40	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS					
Aldrin	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
alpha-BHC	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
beta-BHC	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
delta-BHC	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
gamma-BHC (Lindane)	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
4,4'-DDD	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
4,4'-DDE	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
4,4'-DDT	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Dieldrin	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Endosulfan I	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Endosulfan II	mg/kg dry wt	-	-	< 2 ± 1.4	-
Endosulfan sulphate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Endrin	mg/kg dry wt	-	-	< 0.7 ± 0.38	-
Endrin ketone	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Heptachlor	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS					
Acenaphthene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Acenaphthylene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-

Sample Type: Sediment					
Sample Name:		V201.0-1.5m A 24-Feb-2016 11:00 am	V18 0.0-0.5m A 24-Feb-2016 1:00 pm	V18 0.0-0.5m B 24-Feb-2016 1:00 pm	V18 0.5-1.0m A 24-Feb-2016 1:00 pm
Lab Number:		1544100.6	1544100.9	1544100.10	1544100.12
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS					
Anthracene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Benzo[a]anthracene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
1&2-Chloronaphthalene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Chrysene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Fluoranthene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Fluorene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
2-Methylnaphthalene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Naphthalene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Phenanthrene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Pyrene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Phenols in SVOC Soil Samples by GC-MS					
4-Chloro-3-methylphenol	mg/kg dry wt	-	-	< 5 ± 3.4	-
2-Chlorophenol	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2,4-Dichlorophenol	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2,4-Dimethylphenol	mg/kg dry wt	-	-	< 3 ± 1.2	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	-	-	< 3 ± 1.2	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2-Nitrophenol	mg/kg dry wt	-	-	< 5 ± 3.4	-
Pentachlorophenol (PCP)	mg/kg dry wt	-	-	< 30 ± 68	-
Phenol	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2,4,5-Trichlorophenol	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
2,4,6-Trichlorophenol	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Plasticisers in SVOC Soil Samples by GC-MS					
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	-	-	< 5 ± 3.4	-
Butylbenzylphthalate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	-	-	< 1.0 ± 5.1	-
Diethylphthalate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Dimethylphthalate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Di-n-butylphthalate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Di-n-octylphthalate	mg/kg dry wt	-	-	< 1.0 ± 0.67	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS					
1,2-Dichlorobenzene	mg/kg dry wt	-	-	< 0.7 ± 0.35	-
1,3-Dichlorobenzene	mg/kg dry wt	-	-	< 0.7 ± 0.35	-
1,4-Dichlorobenzene	mg/kg dry wt	-	-	< 0.7 ± 0.35	-
Hexachlorobutadiene	mg/kg dry wt	-	-	< 0.7 ± 0.35	-
Hexachloroethane	mg/kg dry wt	-	-	< 0.7 ± 0.36	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Other compounds in SVOC Soil Samples by GC-MS					
Benzyl alcohol	mg/kg dry wt	-	-	< 10 ± 6.7	-
Carbazole	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Dibenzofuran	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Isophorone	mg/kg dry wt	-	-	< 0.5 ± 0.34	-
Tributyl Tin Trace in Soil samples by GCMS					
Dibutyltin (as Sn)	mg/kg dry wt	-	-	< 0.005 ± 0.0056	-
Monobutyltin (as Sn)	mg/kg dry wt	-	-	< 0.007 ± 0.0075	-
Tributyltin (as Sn)	mg/kg dry wt	-	-	< 0.004 ± 0.0044	-
Triphenyltin (as Sn)	mg/kg dry wt	-	-	< 0.003 ± 0.0021	-

Sample Type: Sediment					
Sample Name:		V201.0-1.5m A 24-Feb-2016 11:00 am	V18 0.0-0.5m A 24-Feb-2016 1:00 pm	V18 0.0-0.5m B 24-Feb-2016 1:00 pm	V18 0.5-1.0m A 24-Feb-2016 1:00 pm
Lab Number:		1544100.6	1544100.9	1544100.10	1544100.12
Total Petroleum Hydrocarbons in Soil					
C7 - C9	mg/kg dry wt	-	-	< 8 ± 5.4	-
C10 - C14	mg/kg dry wt	-	-	< 20 ± 7.6	-
C15 - C36	mg/kg dry wt	-	-	< 40 ± 9.3	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	< 70 ± 14	-

Sample Name:		V18 0.5-1.0m B 24-Feb-2016 1:00 pm	V18 2.0-3.0m A 24-Feb-2016 1:00 pm	V18 1.0-2.0m A 24-Feb-2016 1:00 pm	V19 0-0.5m A 24-Feb-2016 12:00 pm
Lab Number:		1544100.13	1544100.16	1544100.19	1544100.22
Individual Tests					
Dry Matter	g/100g as rcvd	84.0 ± 5.0	-	-	-
Total Organic Carbon*	g/100g dry wt	-	0.166 ± 0.043	< 0.05 ± 0.041	< 0.13 ± 0.042
Antifouling cobiocides in sediment samples by LCMSMS					
Diuron*	mg/kg dry wt	< 0.010	-	-	-
Irgarol*	mg/kg dry wt	< 0.010	-	-	-
Isoproturon*	mg/kg dry wt	< 0.010	-	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic	mg/kg dry wt	-	4.18 ± 0.44	2.60 ± 0.30	2.49 ± 0.29
Total Recoverable Cadmium	mg/kg dry wt	-	0.0380 ± 0.0076	0.0105 ± 0.0062	< 0.010 ± 0.0062
Total Recoverable Chromium	mg/kg dry wt	-	14.7 ± 1.8	8.3 ± 1.1	5.54 ± 0.68
Total Recoverable Copper	mg/kg dry wt	-	0.68 ± 0.17	0.35 ± 0.14	0.39 ± 0.15
Total Recoverable Lead	mg/kg dry wt	-	1.66 ± 0.21	1.00 ± 0.13	0.685 ± 0.087
Total Recoverable Mercury	mg/kg dry wt	-	< 0.010 ± 0.0067	< 0.010 ± 0.0067	< 0.010 ± 0.0067
Total Recoverable Nickel	mg/kg dry wt	-	4.98 ± 0.52	1.92 ± 0.24	2.38 ± 0.28
Total Recoverable Zinc	mg/kg dry wt	-	10.6 ± 1.8	8.3 ± 1.4	4.90 ± 0.83
Polycyclic Aromatic Hydrocarbons Screening in Soil					
Acenaphthene	mg/kg dry wt	< 0.03 ± 0.0093	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03 ± 0.0070	-	-	-
Anthracene	mg/kg dry wt	< 0.03 ± 0.0096	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03 ± 0.0090	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03 ± 0.0069	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03 ± 0.0082	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03 ± 0.0078	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03 ± 0.0073	-	-	-
Chrysene	mg/kg dry wt	< 0.03 ± 0.0075	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03 ± 0.0073	-	-	-
Fluoranthene	mg/kg dry wt	< 0.03 ± 0.0071	-	-	-
Fluorene	mg/kg dry wt	< 0.03 ± 0.0072	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03 ± 0.0070	-	-	-
Naphthalene	mg/kg dry wt	< 0.13 ± 0.044	-	-	-
Phenanthrene	mg/kg dry wt	< 0.03 ± 0.0074	-	-	-
Pyrene	mg/kg dry wt	< 0.03 ± 0.0073	-	-	-
Tributyl Tin Trace in Soil samples by GCMS					
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005 ± 0.0056	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007 ± 0.0075	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004 ± 0.0044	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003 ± 0.0021	-	-	-
Total Petroleum Hydrocarbons in Soil					
C7 - C9	mg/kg dry wt	< 8 ± 5.4	-	-	-
C10 - C14	mg/kg dry wt	< 20 ± 7.6	-	-	-
C15 - C36	mg/kg dry wt	< 40 ± 9.3	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70 ± 14	-	-	-

Sample Type: Sediment					
	Sample Name:	V19 0-0.5m B 24-Feb-2016 12:00 pm	V19 0.5-1.0m A 24-Feb-2016 12:00 pm	V19 0.5-1.0m B 24-Feb-2016 12:00 pm	V19 1.0-2.0m A 24-Feb-2016 12:00 pm
	Lab Number:	1544100.23	1544100.25	1544100.26	1544100.28
Individual Tests					
Dry Matter	g/100g as rcvd	86.3 ± 5.0	-	81.9 ± 5.0	-
Total Organic Carbon*	g/100g dry wt	-	0.059 ± 0.041	-	< 0.13 ± 0.042
Antifouling cobiocides in sediment samples by LCMSMS					
Diuron*	mg/kg dry wt	< 0.010	-	< 0.010	-
Irgarol*	mg/kg dry wt	< 0.010	-	< 0.010	-
Isoproturon*	mg/kg dry wt	< 0.010	-	< 0.010	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic	mg/kg dry wt	-	2.44 ± 0.28	-	2.37 ± 0.28
Total Recoverable Cadmium	mg/kg dry wt	-	0.0271 ± 0.0069	-	0.0368 ± 0.0075
Total Recoverable Chromium	mg/kg dry wt	-	12.2 ± 1.5	-	34.1 ± 4.1
Total Recoverable Copper	mg/kg dry wt	-	0.49 ± 0.15	-	0.80 ± 0.18
Total Recoverable Lead	mg/kg dry wt	-	1.45 ± 0.18	-	1.05 ± 0.13
Total Recoverable Mercury	mg/kg dry wt	-	< 0.010 ± 0.0067	-	< 0.010 ± 0.0067
Total Recoverable Nickel	mg/kg dry wt	-	3.07 ± 0.34	-	17.1 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	-	10.2 ± 1.7	-	7.8 ± 1.3
Polycyclic Aromatic Hydrocarbons Screening in Soil					
Acenaphthene	mg/kg dry wt	< 0.03 ± 0.0095	-	< 0.03 ± 0.0098	-
Acenaphthylene	mg/kg dry wt	< 0.03 ± 0.0070	-	< 0.03 ± 0.0071	-
Anthracene	mg/kg dry wt	< 0.03 ± 0.0098	-	< 0.03 ± 0.011	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03 ± 0.0091	-	< 0.03 ± 0.0094	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03 ± 0.0069	-	< 0.03 ± 0.0070	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03 ± 0.0083	-	< 0.03 ± 0.0084	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03 ± 0.0078	-	< 0.03 ± 0.0080	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03 ± 0.0073	-	< 0.03 ± 0.0074	-
Chrysene	mg/kg dry wt	< 0.03 ± 0.0076	-	< 0.03 ± 0.0077	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03 ± 0.0074	-	< 0.03 ± 0.0074	-
Fluoranthene	mg/kg dry wt	< 0.03 ± 0.0071	-	< 0.03 ± 0.0072	-
Fluorene	mg/kg dry wt	< 0.03 ± 0.0073	-	< 0.03 ± 0.0073	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03 ± 0.0071	-	< 0.03 ± 0.0071	-
Naphthalene	mg/kg dry wt	< 0.13 ± 0.044	-	< 0.14 ± 0.046	-
Phenanthrene	mg/kg dry wt	< 0.03 ± 0.0075	-	< 0.03 ± 0.0076	-
Pyrene	mg/kg dry wt	< 0.03 ± 0.0074	-	< 0.03 ± 0.0074	-
Haloethers in SVOC Soil Samples by GC-MS					
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Bis(2-chloroethyl)ether	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	< 0.4 ± 0.21	-	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS					
2,4-Dinitrotoluene	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2,6-Dinitrotoluene	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Nitrobenzene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 0.7 ± 0.35	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	mg/kg dry wt	< 0.7 ± 0.41	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS					
Aldrin	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
alpha-BHC	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
beta-BHC	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
delta-BHC	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
4,4'-DDT	mg/kg dry wt	< 1.0 ± 0.67	-	-	-

Sample Type: Sediment					
Sample Name:		V19 0-0.5m B 24-Feb-2016 12:00 pm	V19 0.5-1.0m A 24-Feb-2016 12:00 pm	V19 0.5-1.0m B 24-Feb-2016 12:00 pm	V19 1.0-2.0m A 24-Feb-2016 12:00 pm
Lab Number:		1544100.23	1544100.25	1544100.26	1544100.28
Organochlorine Pesticides in SVOC Soil Samples by GC-MS					
Dieldrin	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Endosulfan I	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Endosulfan II	mg/kg dry wt	< 2 ± 1.4	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Endrin	mg/kg dry wt	< 0.7 ± 0.39	-	-	-
Endrin ketone	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Heptachlor	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS					
Acenaphthene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Anthracene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
1&2-Chloronaphthalene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Chrysene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Fluoranthene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Fluorene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Naphthalene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Phenanthrene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Pyrene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Phenols in SVOC Soil Samples by GC-MS					
4-Chloro-3-methylphenol	mg/kg dry wt	< 5 ± 3.4	-	-	-
2-Chlorophenol	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2,4-Dichlorophenol	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2,4-Dimethylphenol	mg/kg dry wt	< 3 ± 1.2	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3 ± 1.2	-	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2-Nitrophenol	mg/kg dry wt	< 5 ± 3.4	-	-	-
Pentachlorophenol (PCP)	mg/kg dry wt	< 30 ± 68	-	-	-
Phenol	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS					
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 5 ± 3.4	-	-	-
Butylbenzylphthalate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.0 ± 5.1	-	-	-
Diethylphthalate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Dimethylphthalate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Di-n-butylphthalate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Di-n-octylphthalate	mg/kg dry wt	< 1.0 ± 0.67	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS					
1,2-Dichlorobenzene	mg/kg dry wt	< 0.7 ± 0.35	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.7 ± 0.35	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.7 ± 0.35	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.7 ± 0.35	-	-	-

Sample Type: Sediment					
Sample Name:		V19 0-0.5m B 24-Feb-2016 12:00 pm	V19 0.5-1.0m A 24-Feb-2016 12:00 pm	V19 0.5-1.0m B 24-Feb-2016 12:00 pm	V19 1.0-2.0m A 24-Feb-2016 12:00 pm
Lab Number:		1544100.23	1544100.25	1544100.26	1544100.28
Other Halogenated compounds in SVOC Soil Samples by GC-MS					
Hexachloroethane	mg/kg dry wt	< 0.7 ± 0.36	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Other compounds in SVOC Soil Samples by GC-MS					
Benzyl alcohol	mg/kg dry wt	< 10 ± 6.7	-	-	-
Carbazole	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Dibenzofuran	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Isophorone	mg/kg dry wt	< 0.5 ± 0.34	-	-	-
Tributyl Tin Trace in Soil samples by GCMS					
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005 ± 0.0056	-	< 0.005 ± 0.0056	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007 ± 0.0075	-	< 0.007 ± 0.0075	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004 ± 0.0044	-	< 0.004 ± 0.0044	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003 ± 0.0021	-	< 0.003 ± 0.0021	-
Total Petroleum Hydrocarbons in Soil					
C7 - C9	mg/kg dry wt	< 8 ± 5.4	-	< 9 ± 5.4	-
C10 - C14	mg/kg dry wt	< 20 ± 7.6	-	< 20 ± 7.6	-
C15 - C36	mg/kg dry wt	< 40 ± 9.3	-	< 40 ± 9.3	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70 ± 14	-	< 70 ± 14	-

Sample Type: Aqueous					
Sample Name:		V20 0.0-0.5m A [Elutriation extract]			
Lab Number:		1544100.31			
Individual Tests					
Total Chromium*	g/m^3	< 0.0011 ± 0.00074	-	-	-
Total Nickel*	g/m^3	0.014	-	-	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Antifouling cobiocides in sediment samples by LCMSMS*		0.010 mg/kg dry wt	2, 5, 10, 13, 23, 26
Antifouling cobiocides suite in sediment by LCMSMS*	Ethyl acetate extraction, SPE cleanup, determination by LCMSMS.	-	2, 5, 10, 13, 23, 26
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2, 4-6, 9-10, 12-13, 16, 19, 22-23, 25-26, 28
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.010 - 60 mg/kg dry wt	2, 5, 10, 13, 23, 26
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, trace level.	0.010 - 0.4 mg/kg dry wt	1, 4, 6, 9, 12, 16, 19, 22, 25, 28
Elutriation testing*	Extn with (client supplied) water, eg seawater, Sed:Water 1:4 by vol, mix 30 min, settle 1 hr, filtration or centrifugation. US EPA 503/8-91/001, "Evaluation of Dredged Material for Ocean Disposal".	-	1
Semivolatile Organic Compounds Screening in Soil by GC-MS	Sonication extraction, GPC cleanup (if required), GC-MS FS analysis. Tested on as received sample	0.3 - 30 mg/kg dry wt	2, 10, 23

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	2, 5, 10, 13, 23, 26
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	2, 5, 10, 13, 23, 26
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 4, 6, 9, 12, 16, 19, 22, 25, 28
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	1, 4, 6, 9, 12, 16, 19, 22, 25, 28

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	31
Total Chromium*	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	31
Total Nickel*	Nitric acid digestion, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	31

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

Annexure Two: Technical Reports

l) **Recreation and Tourism Effects Assessment. Rob Greenaway and Associates. Rob Greenaway. Dated August 2017**

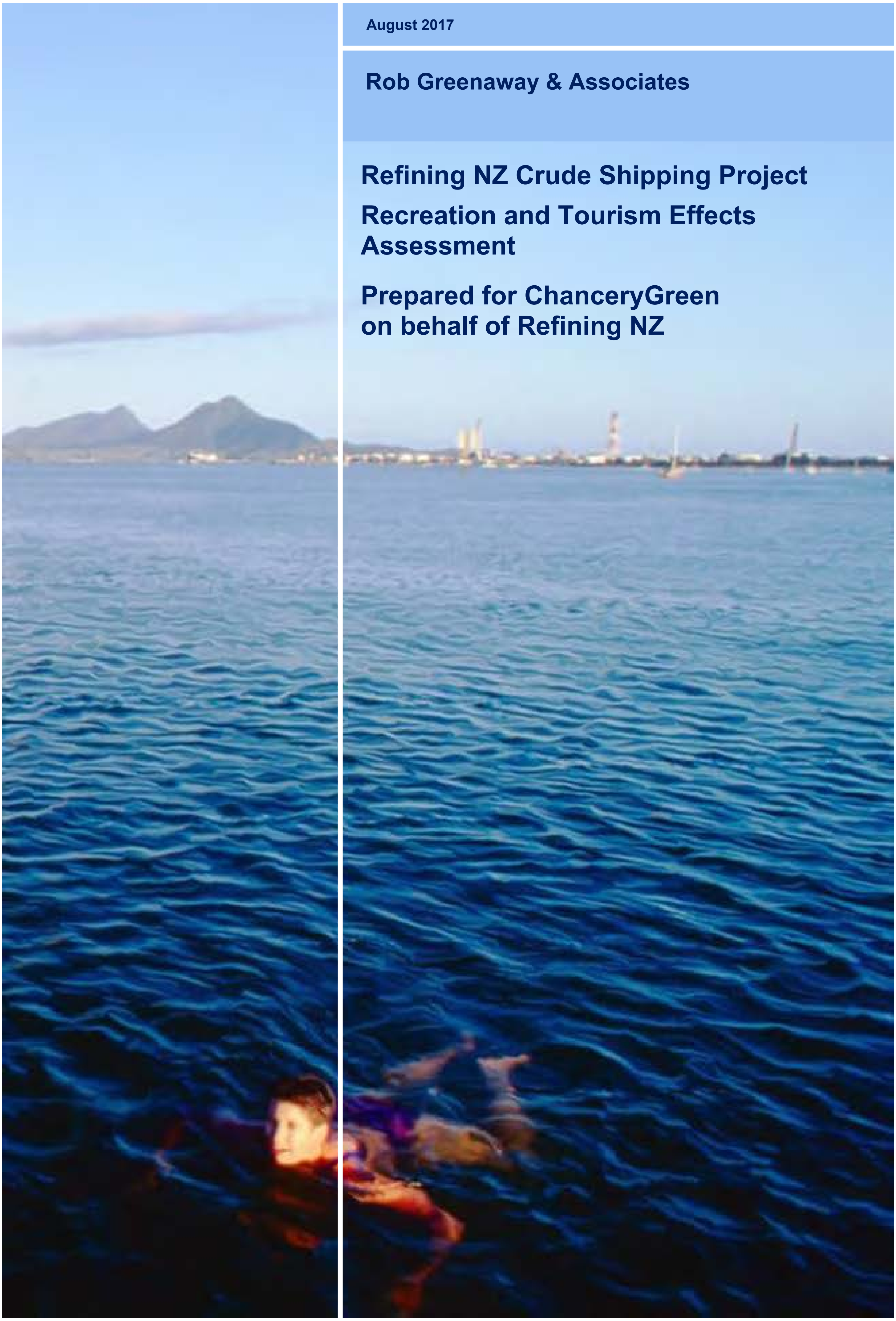
August 2017

Rob Greenaway & Associates

Refining NZ Crude Shipping Project

Recreation and Tourism Effects Assessment

Prepared for ChanceryGreen on behalf of Refining NZ



Refining NZ Crude Shipping Project

Recreation and Tourism Effects Assessment

Prepared for ChanceryGreen on behalf of Refining NZ

by Rob Greenaway & Associates

www.greenaway.co.nz

August 2017

Version status:

Final – 11 August 2017

Contents

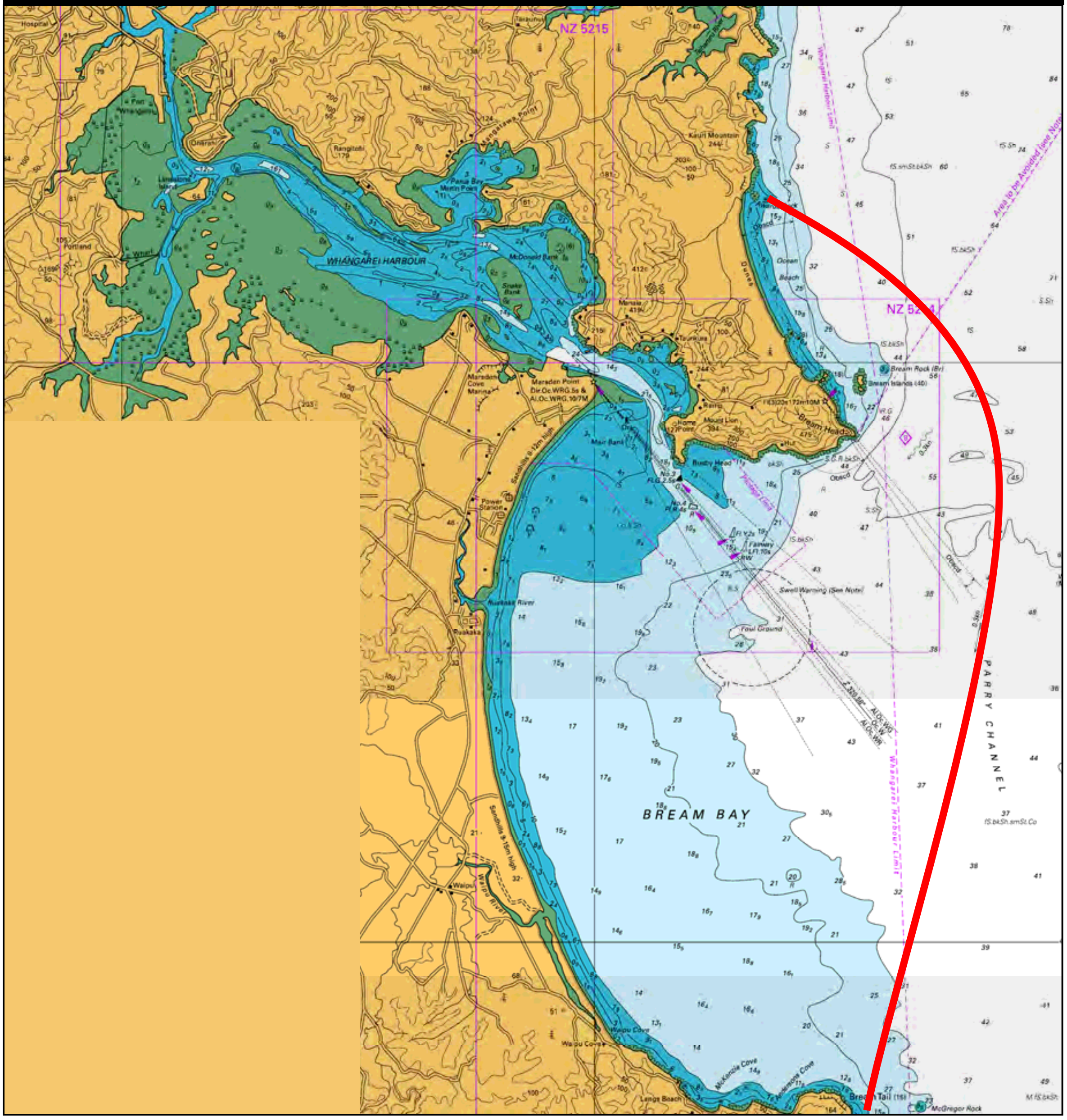
List of Figures

1 Summary

This report reviews the potential effects of Refining New Zealand Ltd's (RNZ) Crude Shipping Project ('the Project') on recreation and tourism values. This involves dredging the Whangarei Harbour entrance to allow the transit of deep-draught large crude carrier vessels (Suezmax vessels). RNZ is applying for resource consents to:

- partially realign the access channel to provide safe navigational access for fully loaded Suezmax ships,
- modify the placement of navigational aids along the new channel alignment,
- carry out capital and maintenance dredging to achieve and maintain a minimum depth to support 16.6m ship draught in the access channel, and
- dispose of dredged materials. Most of this material (up to 97.5%) will be placed more than 7km off Busby Head in approximately 45m of water depth (directly south east of the foul ground shown Figure 1). The remainder will be deposited south of the ebb tide

Figure 1: Study area: inshore from the red line spanning Awarua Rock to Bream Tail



shoal which borders Mair Bank in water depths of between 7 and 15m to supplement the coastal sand supply.

The location of these activities are illustrated in the figures in Appendix 1 of this report.

The study area is defined by the recreation settings potentially affected by the proposal and includes the inshore area from Awarua Rock to Bream Head as shown in Figure 1.

1.1 Method

This report is based on:

- A preliminary literature review completed in 2015 to identify regional marine recreation values and direct research required to identify the potential effects of the Project on these values,
- Community consultation carried out by RNZ through 2015 and 2016 (a full summary of consultation undertaken in connection with the project is provided separately),
- Team meetings between independent experts contracted by RNZ to undertake research activities for the Project and author parallel technical reports,
- An updated literature review in 2017,
- Reference to relevant technical reports commissioned by RNZ, and in particular those for marine ecology and coastal processes, and discussions with the authors of those reports,
- The release of a consultation draft of this report in early 2017, and revisions based on feedback from the consultation process, including attendance at public information days in April 2017.

1.2 Recreation activity summaries

The data indicate that the study area, and especially Whangarei Harbour, the Harbour entrance, and the marine and coastal marine settings between Marsden Point and Bream Head, are intensely-used recreation settings, and are popular for a wide range of different activity groups.

No data reviewed indicate the scale of significance of the setting for recreation and tourism (that is, state whether it is nationally, regionally or locally significant). The scale and variety of activities suggests the setting is of at least regional significance.

The following figures show summary data based on the literature reviewed in this report, and consultation findings from public open days held by Refining New Zealand – and attended by the author of this document – in March 2015 and April 2017 – and further feedback received by RNZ directly or via its website feedback form. The final two figures in this summary section (Figure 7, Figure 8) use the base data to identify moderate and high recreation activity areas.

Figure 2: Swimming / beach activity – main areas

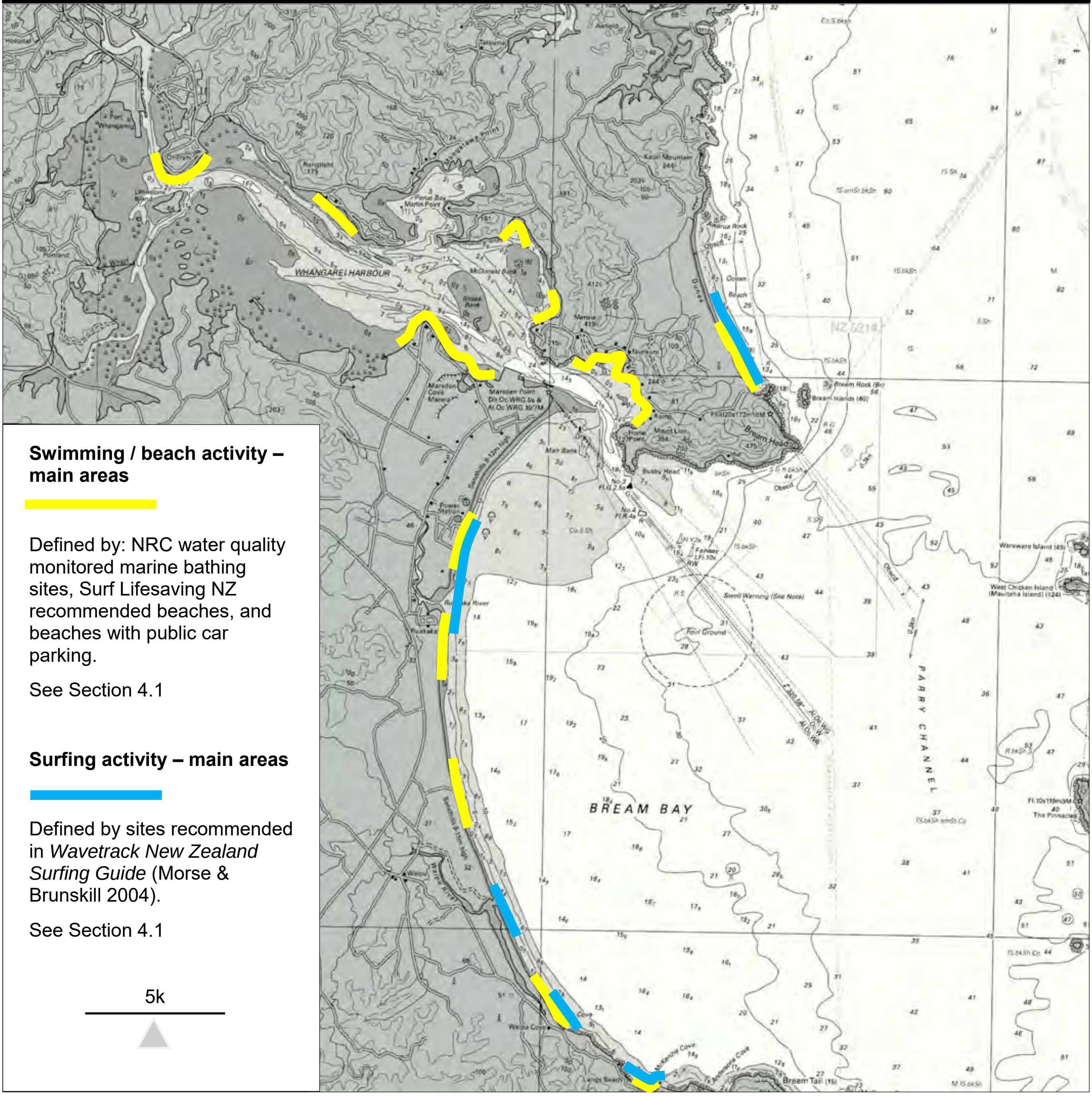


Figure 3: Fishing activity - main areas

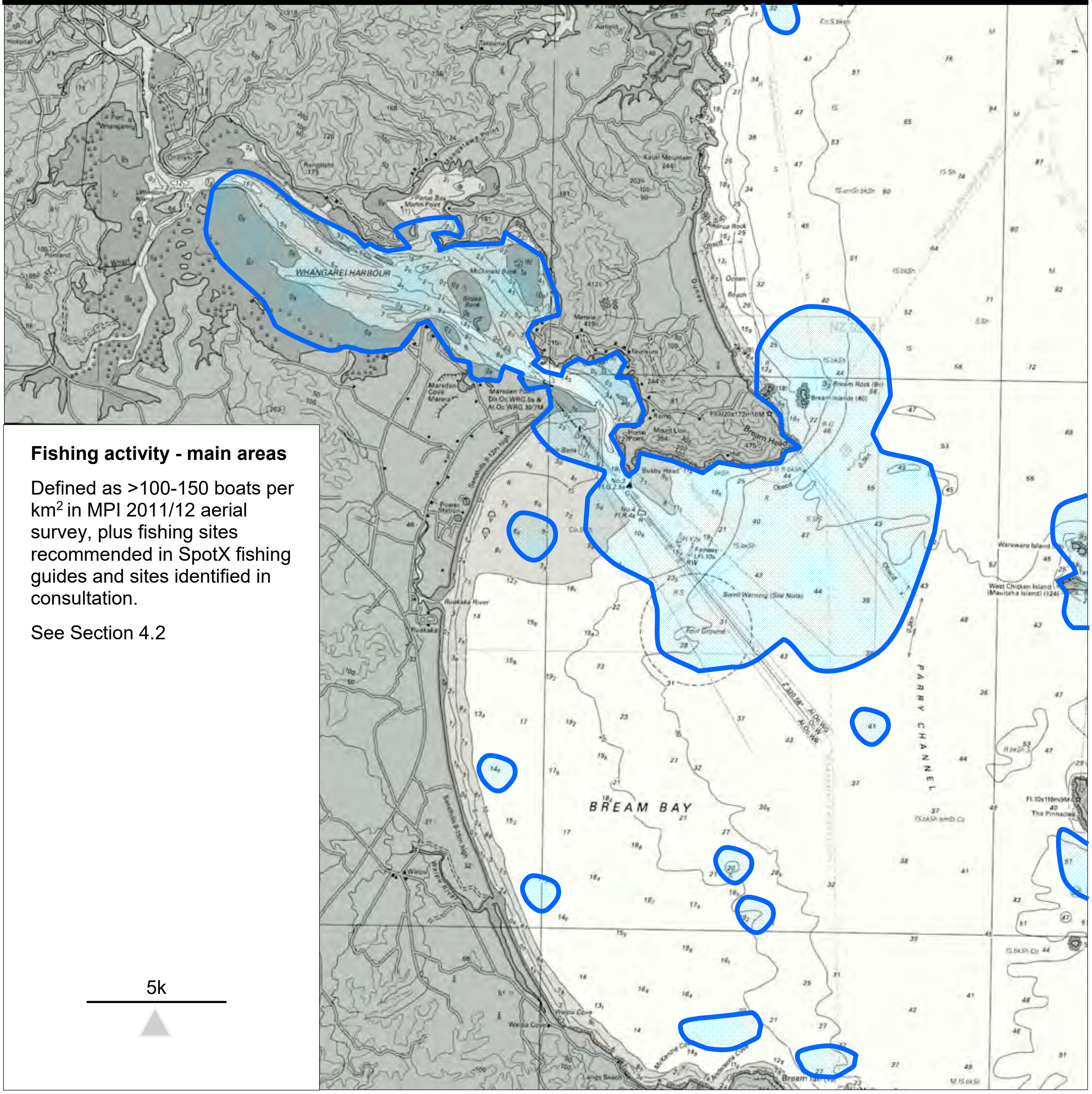


Figure 4: Shell fishing main areas – shore based (not scallops)

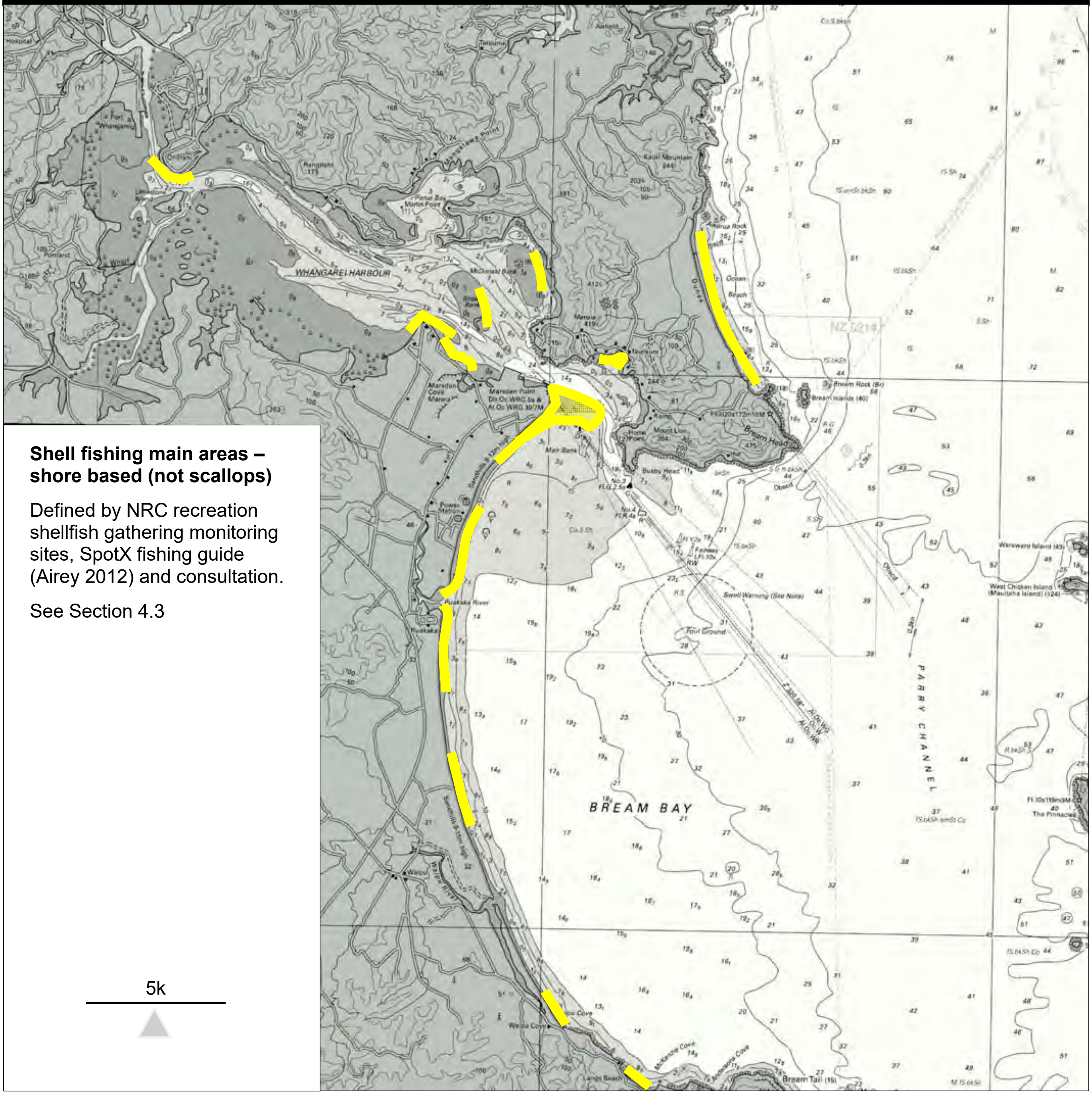
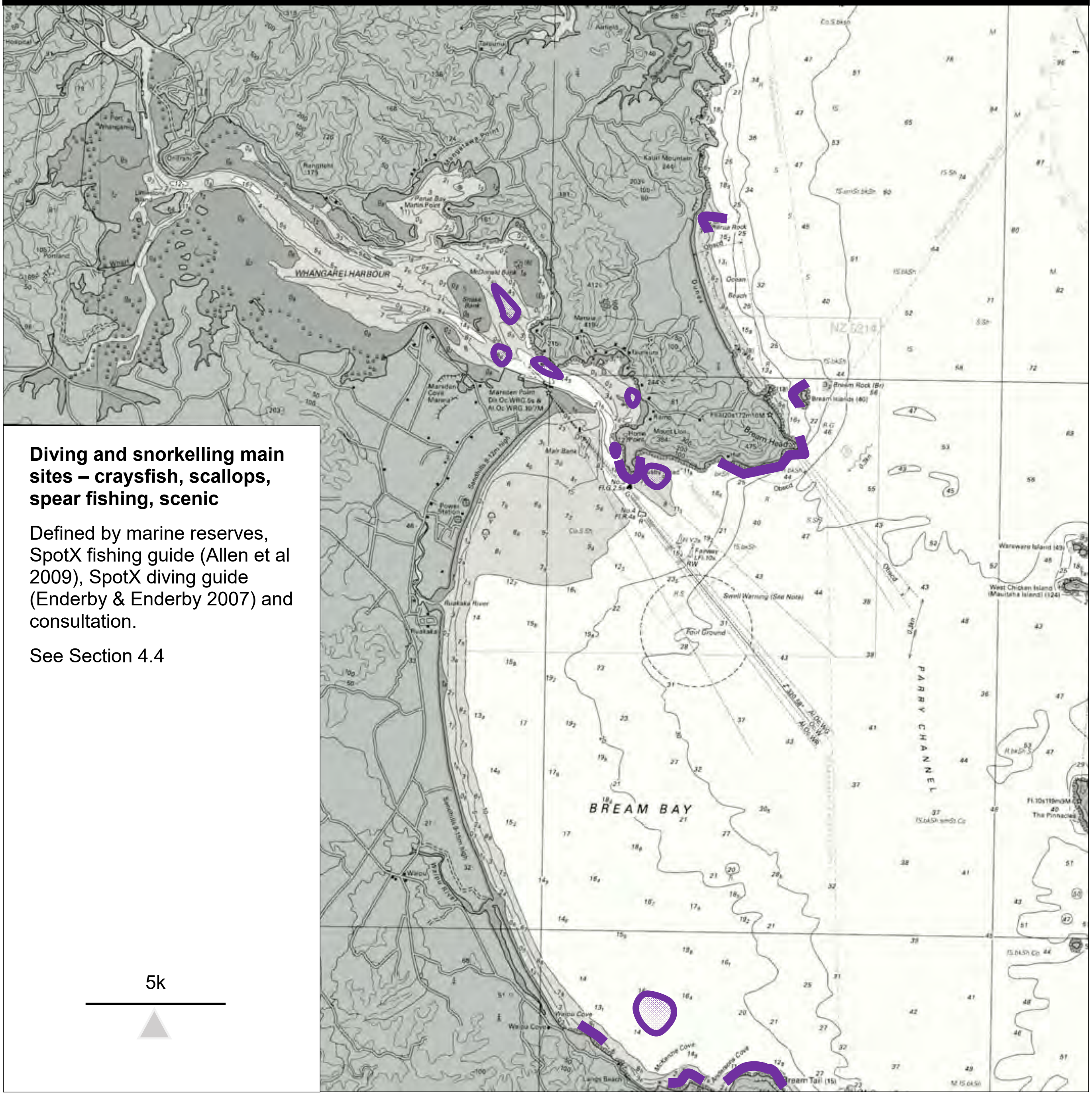


Figure 5: Diving and snorkelling main sites – craysfish, scallops, spear fishing, scenic



Diving and snorkelling main sites – craysfish, scallops, spear fishing, scenic

Defined by marine reserves, SpotX fishing guide (Allen et al 2009), SpotX diving guide (Enderby & Enderby 2007) and consultation.

See Section 4.4

Figure 6: Boating, including sailing – main sites

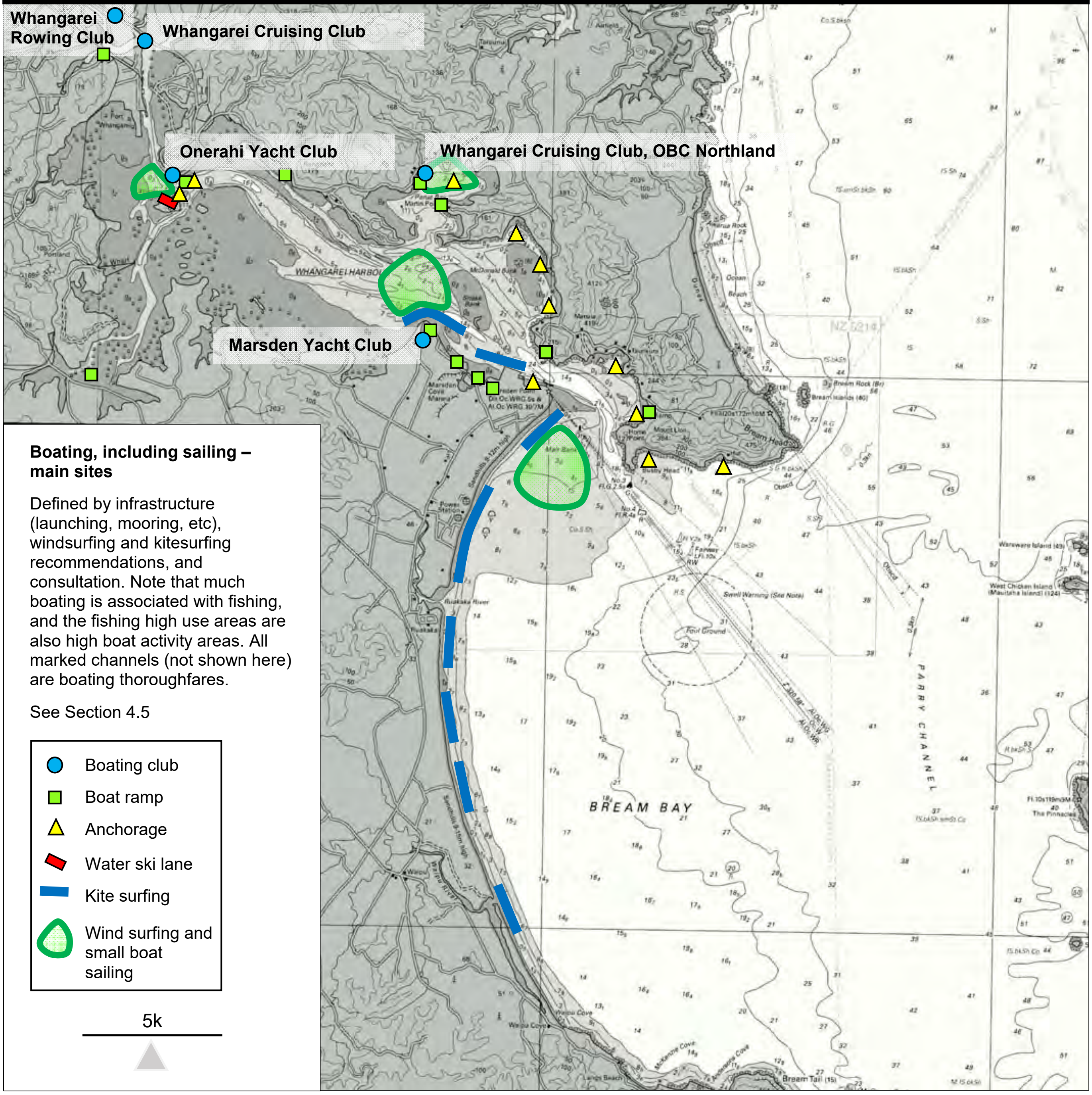


Figure 7: Summary recreation activity – high use areas

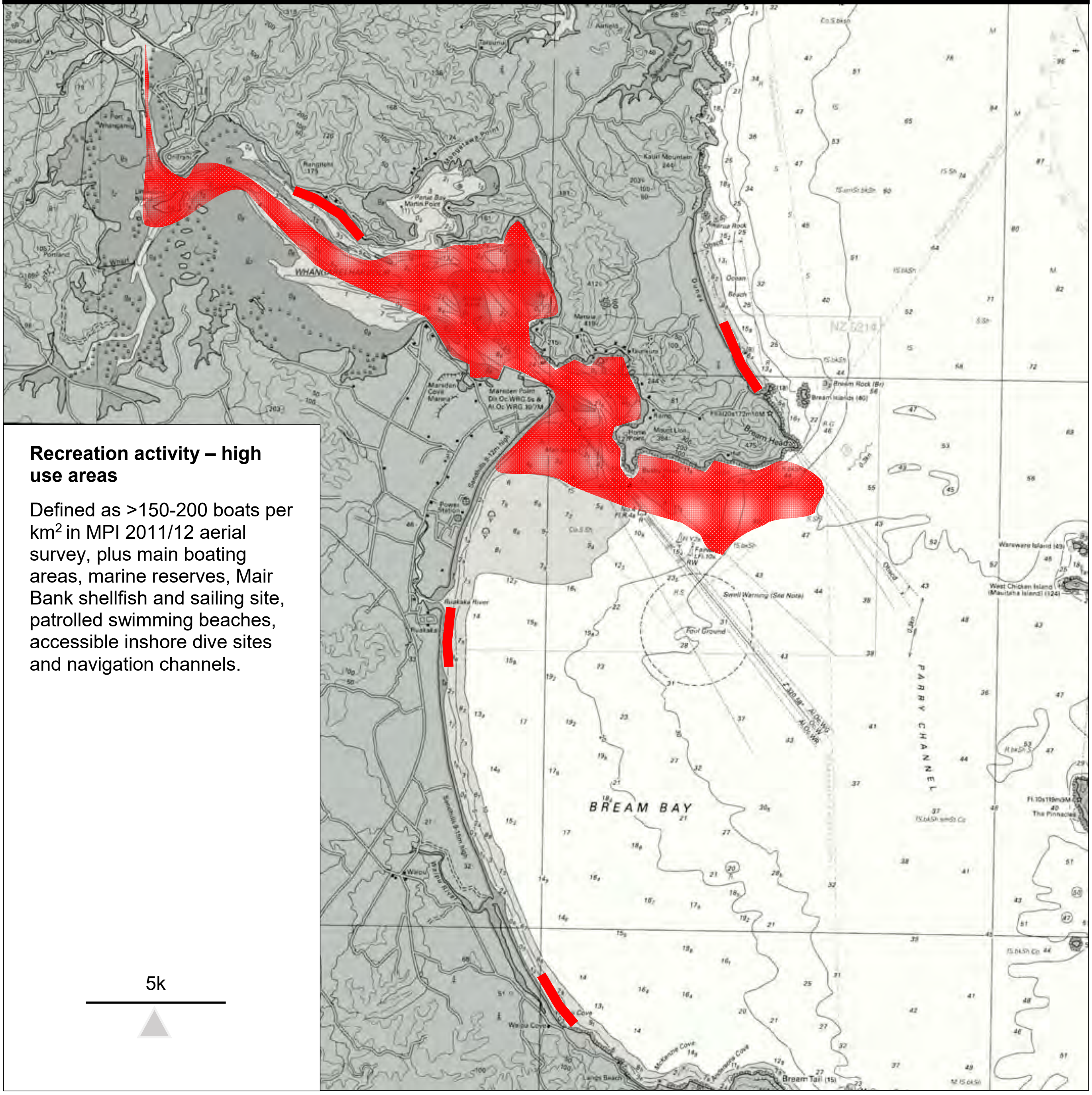
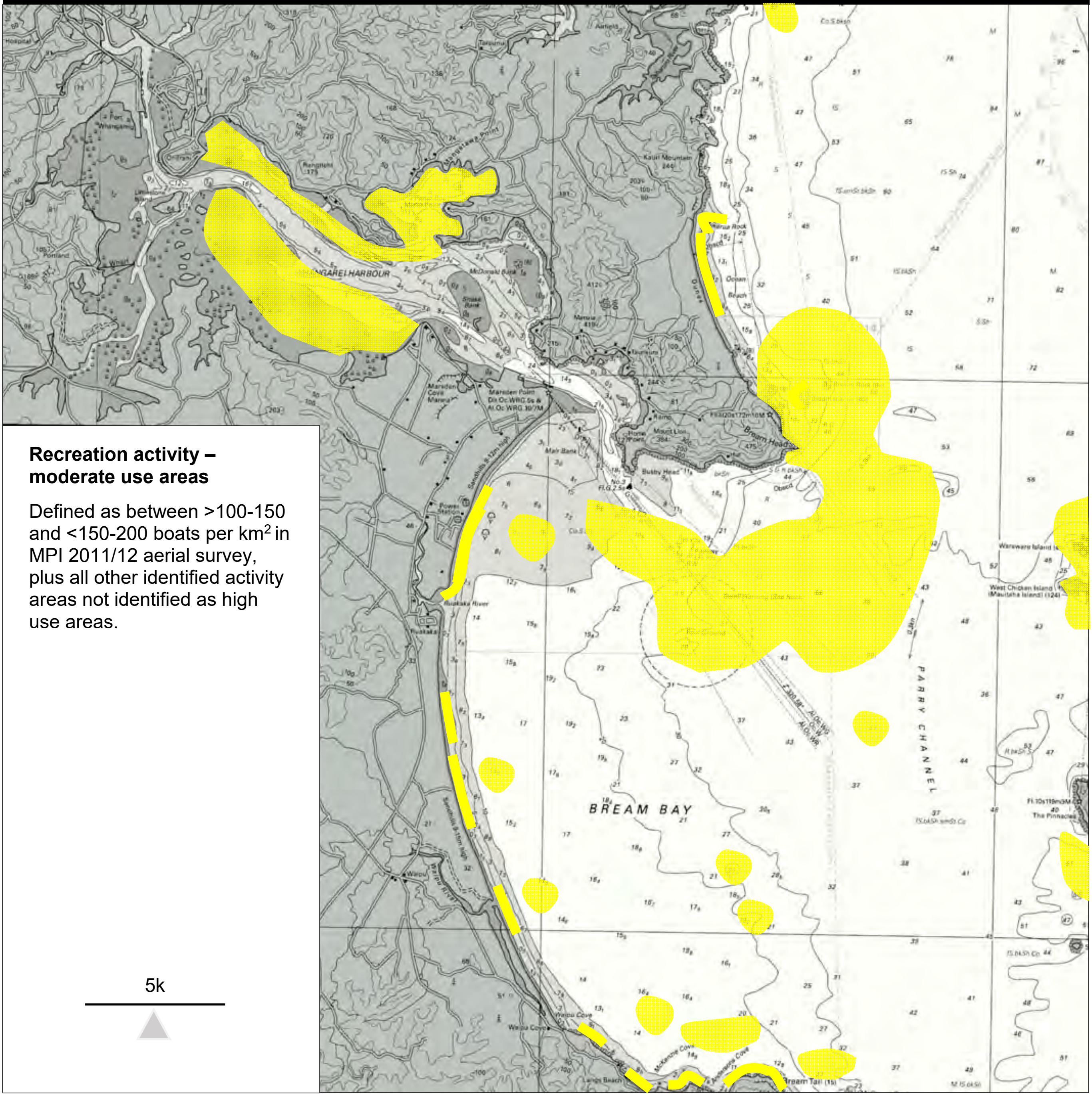


Figure 8: Summary recreation activity – moderate use areas



1.3 Potential adverse effects

The following potential effects of the proposal are of interest to recreation.

Construction and maintenance

- Turbidity effects on recreation settings (particularly swimming and diving areas) and visual amenity at and near the Harbour entrance,
- Mobilisation of contaminants and potential effects on shellfish and other seafood, and for water-contact recreation,
- Effects on marine ecology and the quality, abundance and catchability of marine species, in and around the entrance and at and near the spoil dumping site offshore during the dredging period/s, and
- Occupation of marine settings by dredges working or in transit and the creation of hazards for, especially, boaters.

Operation

- Changes to tides, currents and wave patterns resulting from altered bathymetry,
- Changes to beach and foreshore profiles resulting from changes to wave patterns, including remobilisation of dumped material,
- Effects on wave energy as a result of the passage of larger vessels,
- Effects associated with the location and operation of aids to navigation, such as navigation buoys and markers (*Navaids*).

Effects on birds, from noise, and navigation risk are separately assessed, but, in a recreation context, those effects are considered to be not relevant, nil or too low to be reviewed further. Similarly, the increased harbour depth or alignment is not considered to offer any advantage to recreational boaters due to their shallow draught.

1.4 Summary of effects

Turbidity

The dispersal of sediment from the dredging activity is likely to be strongly confined to the dredge channel and has a low chance of dispersal to any contact recreation setting. However, real-time monitoring is planned to ensure there are no effects on important marine ecosystems near the dredge channel. There is likely to be very little if any adverse effect on recreational dive and swimming sites, including on the marine life that attracts most divers.

Waves

Preferred wave heights for surfing range between 1 and 3m. Changes which might be noted by surfers only accrue during storm events with wave heights around 5m and only at the northern end of the Marsden Point surf break at Mair Bank. This is unlikely to affect surfing amenity.

Increases in wave energy could have adverse effects on diving an swimming, but effects (as small as they are modelled to be) only occur when there is little natural amenity for recreation due to natural wave action (that is, there needs to be waves in action for there to be an effect on them, and the smaller the wave, the less effect).

Tides

An acceleration in tidal strength could pose a hazard for boaters in the harbour channel. However, by deepening the channel, tidal speed generally decreases, albeit by a very small amount. There are therefore no adverse effects resulting from changes in tidal speed. There is the potential for a minor change in timing of high and low tides, which will not affect recreation participation (timing of tides change every day).

Beaches

The potential for changes to beach profiles is confined to Mair Bank, which, for recreation values, is predominantly a shellfish gathering setting. Mitigation options are proposed and a monitoring programme would be implemented. Any changes of relevance to recreation are confined and managed.

Marine ecology

Coffey (2017) indicates that the scale of effect on benthic biomass (food sources for recreationally taken fish) are expected to be ‘minor to moderate’, short-term, and to progressively ameliorate within 6 to 12 months in the dredged channel and inshore/ebb tide shoal disposal area, and within 12 to 24 months in the offshore disposal area, although at the latter an ‘ecologically constructive benthic community’ (one able to provide feeding grounds for fish) is expected to re-establish within 12 months (meaning all affected areas will be supporting recreational fish species within 6 to 12 months). This is likely to similarly result in some local displacement of fishing activity from the dredge and disposal footprints during the recovery period. However, due to the scale of the local fishing resource, the mobility of finfish, the lack of effect on biota beyond the activity footprints, the progressive recovery of the benthos and the temporary nature of the effect, the net outcome for recreational fishing from capital dredging is likely to be adverse but also minor. Maintenance dredging will have a lower scale of effect during each event, but due to its frequency (2 to 5 yearly) its net effect will also be adverse but minor. There is likely to be some temporary increase in local finfish activity as the dredging activity exposes food sources, but this is not considered to be a mitigating effect.

Contaminants

Coffey (2017) states that the material to be dredged is not contaminated with any toxins and also has very low levels of organic matter (which, if present, could lead to a drop in dissolved oxygen levels due to spikes in algal growth). This means there are no water quality issues associated with the activity.

Dredge activity

Any recreation skipper operating in or near the harbour entrance would expect to encounter large ships and to comply with harbour navigation rules. While the presence of a dredge is an additional navigational issue, it should not limit recreation participation by large and small recreational vessels. Eighty-percent of dredge activity will be in the outer channel beyond Home Point, outside recreational diving, snorkelling and swimming areas, and where there is ample navigation space. However, it is recommended that RNZ place on its website information about dredge activities (location and duration of activity) and advise the regional harbourmaster who can then make judgements about the importance of additional maritime notifications – including whether it warrants a Notice to Mariners (via LINZ). Required maritime practice means the dredge will be appropriately lit at night and will obey all marine navigation rules. The net effect on recreation participation is likely to be minor or less.

Navaids

Navaids are required structures for safe navigation. They are used by both recreational and commercial craft and need to be in the right locations. The recommendations for their placement as part of the Project are made by Royal Haskoning DHV (2016) for the purposes of navigation safety. This is a necessary response to the Project. However, if it was required due to natural changes in channel alignment, it would not be considered an adverse effect on recreation participation. Local boaters will rapidly adjust to very obvious changes in beacon location, which should be considered a pre-requisite skill for operating watercraft in a navigation channel. The proposed navaid developments are not considered to be adverse effects on recreation, and any safety improvement in navigation is likely to have a positive effect. They will require a Notice to Mariners and updates to marine charts via LINZ.

Cumulative effects

For recreation, the effects of the proposal are sufficiently slight to make it unlikely for cumulative adverse effects to arise. There are no locally consented activities identified which have not been implemented which would increase the potential for adverse effects from the proposal. There has been no identified mechanism by which the proposed activity would affect pipi beds on Mair Bank, and the relocation of sand to the ebb tide shoal will support the maintenance of habitat.

1.5 Conclusion

Whangarei Harbour, its margins and the surrounding coast are intensely used marine recreation resources, with a variety of different recreation values and almost no corner that is not used for some leisure activity. The dredging activity is proposed to be undertaken within an area used extensively and intensively for fishing and boating (although fishing and anchoring directly in the navigation channel is not prudent). Nearby settings support diving, snorkelling, swimming, surfing, kite surfing, shellfishing, beach activities, and more boating and fishing.

The main potential effects of concern for recreation relate to changes in the abundance and location of fin and shellfish, changes to water clarity and quality, changes to wave patterns and effects on shoreline processes. Navigating near an operating dredge is also of interest, but a normal part of boating near an existing commercial port.

Potential effects on water clarity and quality are minor or less for recreation values, with a real-time monitoring programme proposed to avoid any sedimentation affecting important benthic communities outside the dredge and disposal footprints. This is the result of the quality of the dredge material and the pattern of currents which confine sediment plumes to within the navigation channel.

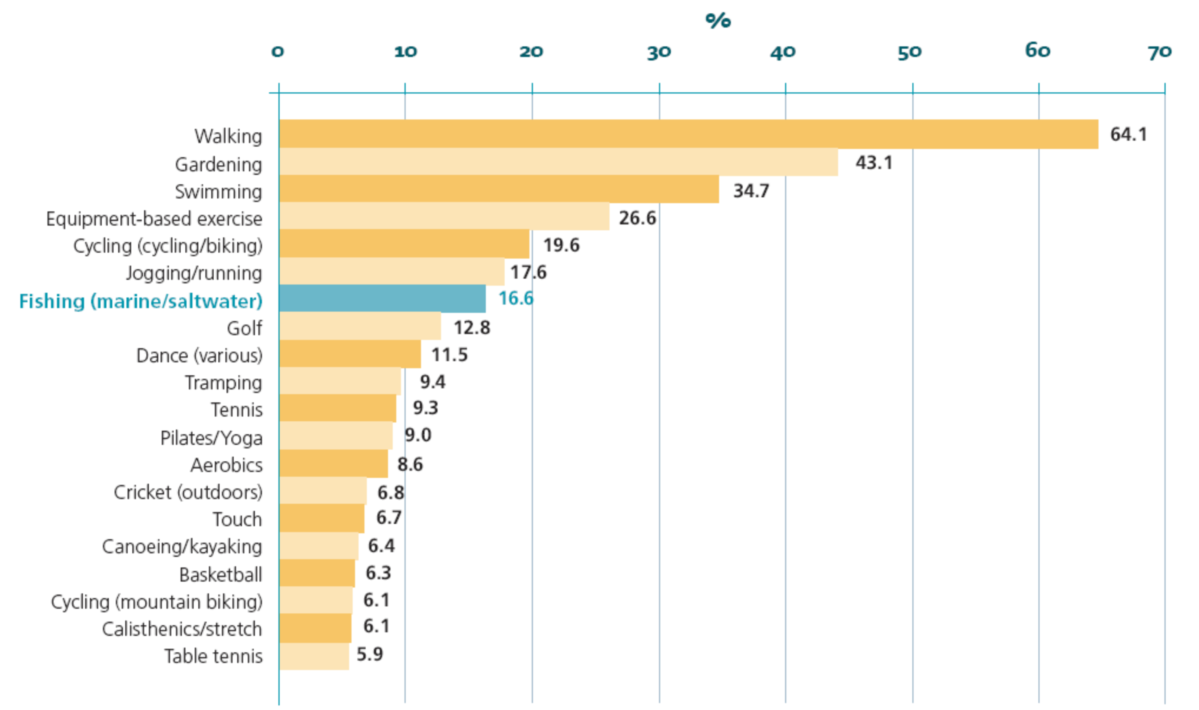
Changes to wave heights are small and variable depending on swell direction, and are unlikely to be discernible by surfers and other beach users. Changes to beach profiles are consequently unaffected by the capital dredge programme, and a sand augmentation and monitoring programme is proposed for the Mair Bank area to mitigate potential long term effects from maintenance dredging and to potentially contribute to reducing the effects of existing coastal change processes.

The main effect of interest to recreation is likely to be a temporary displacement of some fishing activity from near the dredged channel and the disposal site as they recover from bed disturbance. This effect is predicted to last for 6 to 12 months for capital dredging (the recovery time for ‘constructive benthic communities’ in all affected sites). Due to: the scale of the local fishing resource, the mobility of finfish, the lack of effect on biota beyond the activity footprints, the progressive recovery of the benthos, and the temporary nature of the effect, the net outcome for recreational fishing from capital dredging is likely to be adverse but also minor and represented by fishers choosing an alternative fishing site nearby. Maintenance dredging will have a lower scale of effect during each event, but will occur repeatedly and over time, and thus also have an adverse effect which is likely to be minor. The use of berley to attract fish is normal practice when boat-fishing, and Brian Coffey (author of Coffey (2017), pers comm) notes that using this method in a disturbed area will remain effective in attracting finfish.

2 National and regional marine recreation participation

SPARC (now Sport NZ) (2009a and 2009b) reported via the Active NZ survey that fishing, both freshwater and marine, was the seventh most important ‘active leisure’ pursuit in New Zealand with, in 2007/08, 19.5% of the national population participating, and 16.6% fishing in marine settings (approximately 540,000 people). This makes fishing more popular as a participation activity than, for example, golf, tramping, cricket, tennis and rugby (Figure 9). Almost 30% of men fished in 2007/08, and 9.7% of women. Sport NZ (2015) indicates that participation in fishing grew between 2007/08 and 2013/14 for both men and women (from 18.8% to 19.5% of the population, and 27.5% for Maori), and it was one of the main activities where additional participation was desired.

Figure 9: National sport and recreation activities with the highest participation levels (SPARC 2009b)



The level of participation in fishing (marine and freshwater) in the Northland Region is far higher than the national average with 40.2% of the region’s population fishing (59.8% of men and 26.2% of women) in 2007/08 and 37.8% in 2013/14, making it the second-most popular active recreation or sport pursuit in the region after walking (and excluding gardening, which was not reported in 2013/14). Regionally, it was the most popular activity for men and the fifth-most popular activity for women (SPARC 2009c, Sport NZ 2015a). Other research completed for Sport NZ indicates that in Northland almost all those reporting fishing as an activity are marine fishers, while a small percent are also fresh-water anglers (Sport NZ 2013).

At the national level, 3.8% of the population reported going diving in 2007/8 and 3.4% in 2013/14; and 2.4% went sailing or yachting in 2007/08 and 2.1% in 2013/14 (SPARC 2009d & Sport NZ 2015b). The Active New Zealand survey only considered physically active, non-motorised pursuits and so did not review motor boating participation. In contrast, 13.5% of adults in Northland went scuba diving in 2007/08 and 7.6% in 2013/14 (SPARC 2009c and Sport NZ 2015a), and participation in yachting was also relatively high at 3.5% (Sport NZ 2015a). The Northland Regional Council reported one permanent boat mooring for every 45 permanent Northland residents, as well as five marinas in 2002 (NRC 2002).

Kalafatelis & Magill (2013) completed a national survey of recreational boating activity for Maritime NZ with 1500 respondents. The results do not appear to have been filtered for marine activity only. This indicated, at the national level, that:

- 24% of New Zealanders aged over 18 own or use a vessel for recreation boating purposes (57% male and 43% female):
  - 15% own or use a canoe or kayak,
  - 9% own or use a power boat under 6m,
  - 9% own or use a dinghy,
  - 5% own or use a power boat over 6m,
  - 3% own or use a sail boat under 6m,
  - 2% own or use a sail boat over 6m,
  - 2% own or use a jet ski.
- During periods when boaties are 'most active', such as over summer, 24% of users of power boats under 6m go out at least weekly, and another 25% go out once every couple of weeks. Similar levels of activity are evident for other vessels, and power boats under 6m are the most frequently used.
- The average number of years of boating experience was 12.9 years, with those owning or using kayaks and canoes the least experienced.

Kalafatelis & Magill (2013) reported the number of respondents based in Northland, but as the figure is quite low (n=24) there is limited reliability in the data from this sub-group.

Vance (2014) used the data gathered by Kalafatelis & Magill (2013) and older information to review trends in boat ownership. Eight Colmar Brunton surveys completed between 2002 and 2011 gave a range of 16% to 19% of households owning at least one boat in New Zealand; or 641,000 people and 727,000 vessels. Kalafatelis & Magill (2013) gave an estimate of 900,000 vessels. Vance (2014) estimates that between 30% and 50% of boat users go out at least every couple of weeks; and that levels of ownership have been reasonably consistent since at least 2006, but with possible increases in the ownership of trailer power boats and canoes and kayaks. However, the use of different survey methods means these trends are not certain.

3 Regional recreation planning and policy

This section reviews references to the management of recreation values in the study area from planning literature published by, or about, the Department of Conservation (DOC), the Northland Regional Council (NRC), the Whangarei District Council (WDC) and the disestablished Northland Harbour Board (NHB).

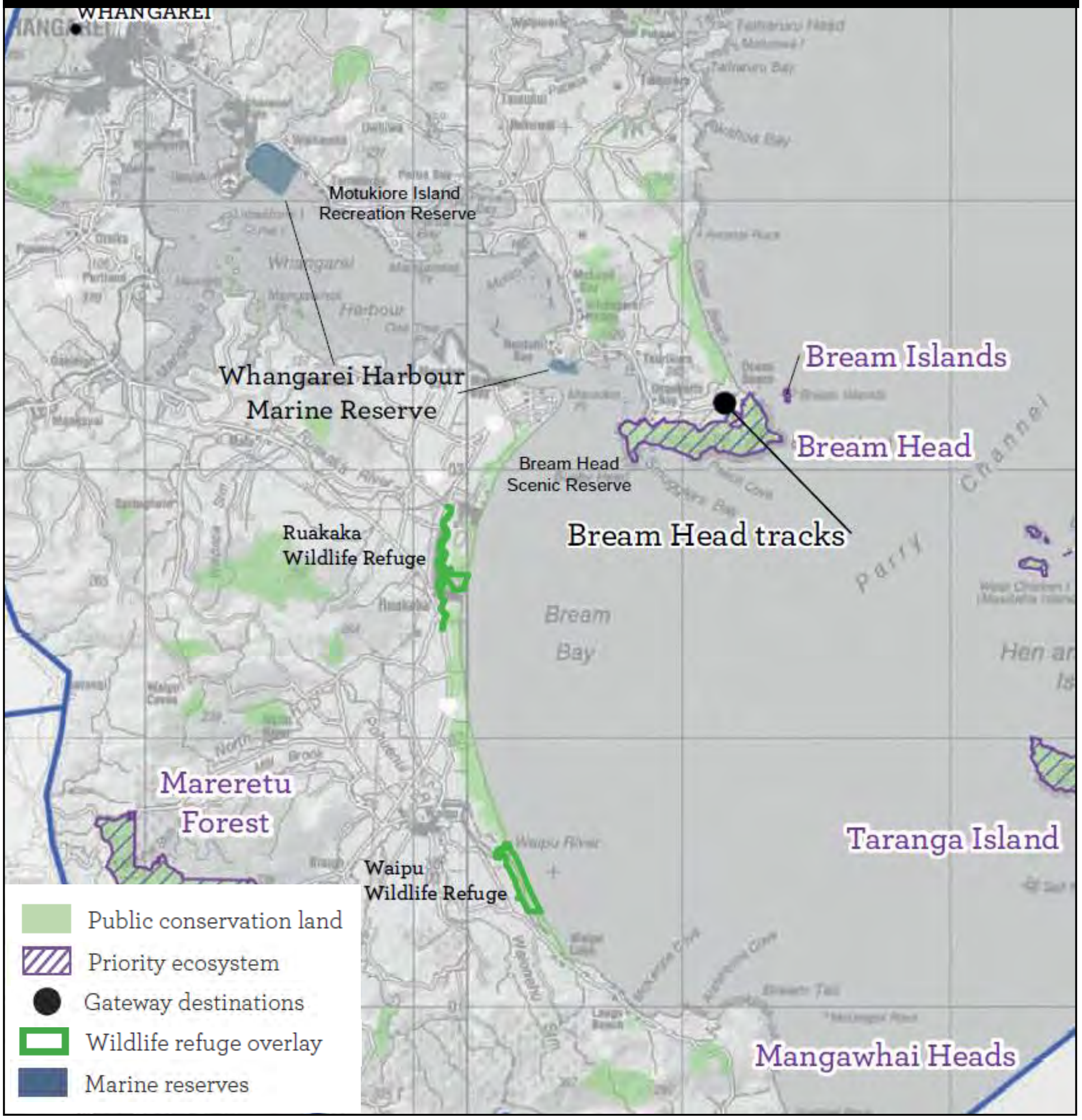
3.1 Department of Conservation

The Department of Conservation's Conservation Management Strategy (CMS) for Northland 2014-2024 (DOC 2014a) locates the study area in the 'Whangaruru–Mangawhai Coast Place'. The public conservation areas within this place and the study area are shown in Figure 10. The Bream Head tracks are identified as a 'gateway destination' (one of eight in the Northland Conservancy).[1]

The CMS describes the recreation setting as (p89):

Whangarei Harbour has some significant harbour features and estuarine habitats,

Figure 10: Public Conservation areas in the study area. DOC CMS 2014



[1] 'Gateways' are places that the Department will promote as suitable for people's first adventures in the outdoors, or repeat adventures of a gentle nature. (DOC 2104a, p10)

ranging from upper harbour mud and sand flats to deep channels, islands, extensive shellfish sand banks and deep holes near the harbour entrance. Whangarei Harbour Marine Reserve comprises two sites — Waikaraka and around Motukaroro (Passage) Island at Reotahi.

The establishment of a marine recreational park between Cape Brett, Poor Knights Islands Marine Reserve and Bream Head has been proposed as a means of making the most of the spectacular coastline to provide multiple sustainable economic benefits for Northland. The intention of a marine recreational park is to align Māori values of long term sustainability and kaitiakitanga with enhanced conservation outcomes and recreation opportunities.

Visitor use is moderate to high in this Place, especially in summer when camping and boating are very popular, along with the active use of the many sandy beaches for fishing, swimming and surfing. Snorkelling and scuba diving are also popular along the coast, particularly at the Poor Knights Islands Marine Reserve. There are four camping grounds administered by the Department, all of which are heavily used over the height of the summer months, especially since many private camps have been converted into coastal subdivisions. Tracks and walkways through many of the reserves supplement those provided by the local authority. The Te Araroa Trail follows close to the coast for its entire length through this Place. The attractions and activities are primarily used by locals, but domestic and international tourism is increasing…..

Whangarei, the major urban area and administrative centre for the Northland region, is the location for principal sites of industrial processing. It includes the only oil refinery in New Zealand, a large forestry port, cement and fertiliser works, transport systems, and other planned or existing activities adjacent to Whangarei Harbour such as at Marsden Point and lower Port Road. All of these have the potential to cause adverse impacts on natural and historic values if not closely monitored. Three pipelines carrying gas and petroleum products from the Marsden Point Oil Refinery pass through land administered by the Department, and require ongoing inspection and maintenance. The Marsden Point Oil Refinery, deep water export port and new manufacturing plants lie immediately adjacent to recreation areas, kiwi and shorebird habitat, sites important for biodiversity, historical and archaeological sites, and marine reserves. Extensive flat land and improved transport links with Auckland are creating opportunities for economic growth that are increasing pressure on natural values and the types of visitor experience.

The following outcomes for the Whangaruru–Mangawhai Coast Place are sought (p90):

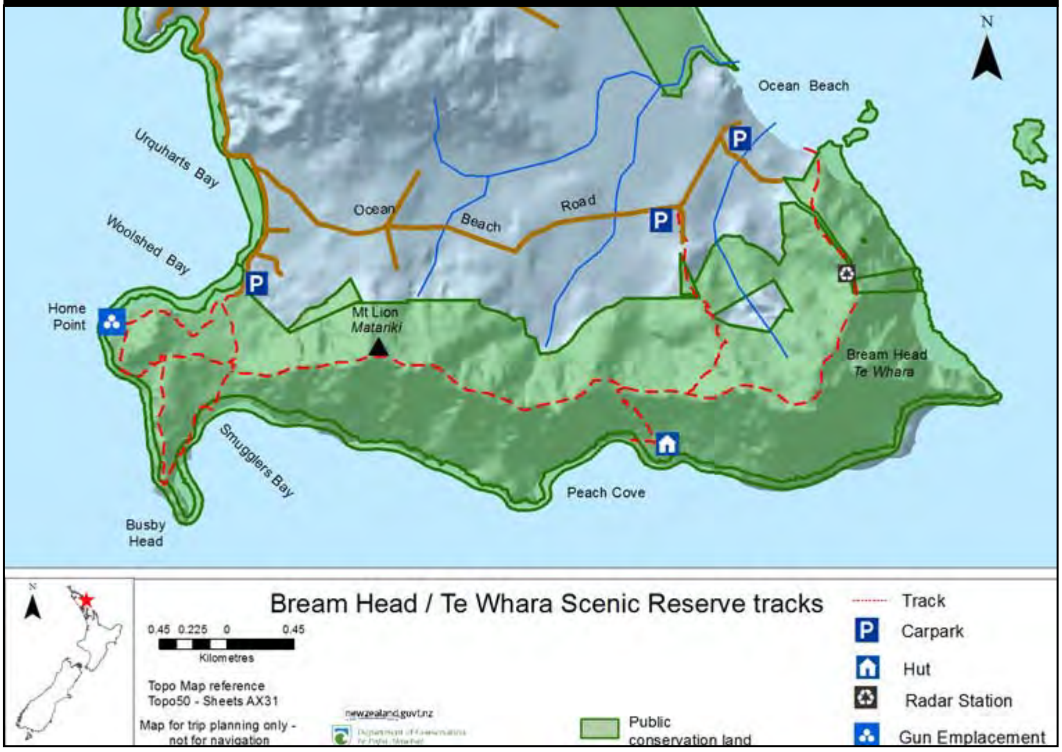
The Whangaruru–Mangawhai Coast Place is a diverse and highly used coastline centred on Whangarei, where the population and industrial and economic activity in Northland are concentrated. The Department works collaboratively with tangata whenua, other agencies, business interests and the community to achieve a net conservation benefit wherever possible….

Whangarei Heads

The Bream Head and Manaia Ridge Scenic Reserves are ecological gems where visitors get a real feel for what the nearby offshore islands are like without accessing them….

Bream Head Scenic Reserve is a Gateway Destination where visitors also enjoy coastal vistas, coastal defence historic features and pā sites from a network of *generally easy-grade walking tracks. The secluded Peach Cove Hut* [Figure 11][2] *enables a special experience of coastal biodiversity. Opportunities for visitors to participate in education, research and restoration programmes are provided by a community trust, community groups and concessionaires. In these reserves, as well as at Bream Islands Scenic Reserve and Ocean Beach, the community and tangata whenua are working together with the Department to restore and manage natural, cultural, recreational and historic values.*

Figure 11: Bream Head / Te Whara Scenic Reserve and Peach Cove location



Bream Bay and Mangawhai

The Te Araroa Trail and another popular walkway pass near/through it, providing spectacular views of the islands of the Hauraki Gulf, Bream Bay and Bream Head….

Public access to the beaches is via access points managed in collaboration with Whangarei District Council and Northland Regional Council to protect the foredunes. New recreation opportunities have been developed to enable increasing numbers of visitors to enjoy basic-facility campgrounds, walking and cycle trails, bird-watching hides, and guided tours. There is a collaborative approach between the Department, tangata whenua, local authorities and communities to ensure that recreational, residential and industrial expansion does not compromise and, wherever possible, enhances the natural, cultural and already established recreational values of the area. The long, unbroken stretch of white sandy beach at Bream Bay and Mangawhai, and the vista across the water to the islands and Bream Head are valued, enjoyed and appreciated by all.

Marine Protected Areas

The ecosystems at the internationally ranked diving destination at the Poor Knights Islands Marine Reserve and the Whangarei Harbour Marine Reserve have recovered,

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[2] http://www.doc.govt.nz/parks-and-recreation/tracks-and-walks/northland/whangarei-area/bream-head-peach-cove-track/#map retrieved 13 Nov 2014

and both sites are enjoyed by many who strongly defend their values. The marine reserves sustain diverse populations of native plants and animals. Their conservation values are recognised and valued for their contribution to the biodiversity of the wider marine environment. Visitors leave the reserves with an enhanced understanding and appreciation of the value of no-take reserves and long-term protection of the marine environment. Public enjoyment and scientific research are encouraged in marine reserves.

Human activities in marine reserves and on adjoining public conservation lands are not detrimental to scientific study or conservation values, and do not detract from the visitor experience. The Department continues to advocate for the appropriate use of land within marine reserve catchments to reduce land-based effects on marine reserves. Biosecurity measures are established where practicable and maintained to prevent the establishment of viable populations of new marine pests within marine reserves.

….Further areas on the Whangarei coastline have been identified for marine conservation initiatives and everyone enjoys a restored food-basket as a result. In conjunction with regional and district councils, tangata whenua, the community and tourism organisations, a marine recreational park is investigated to protect, enhance and increase sustainable coastal and marine tourism and recreation opportunities.

Figure 12: Excerpt from CMS Appendix 8 - Marine habitats

Ecosystem	Habitat type	Significant values	Pressures/threats	Protected areas
Whangarei Harbour	Saltmarsh Mānawa/mangroves Karepō/seagrass Intertidal sand and mudflats Estuarine beach Estuarine sand Estuarine reef High-current shallow sand High-current shallow reef	Diverse benthic invertebrate and fish assemblages. Diverse high-current assemblages at Motukaroro. Productive customary, commercial (fin and shell fish) and recreational fisheries. Important coastal and wading bird habitat. Kera wēra/killer whale foraging habitat.	Significant historic and ongoing anthropogenic impacts resulting in environmental degradation, including loss of shellfish beds and extensive karepō/seagrass meadows (and their associated fishery and biodiversity values). Overfishing. Chronic disturbance and underwater noise pollution.	Whangarei Harbour Marine Reserve—Motukaroro, Waikaraka.
Bream Bay / outer Hauraki Gulf	Saltmarsh Mānawa/mangroves Intertidal sand and mudflats Estuarine sand Moderate beach Moderate rocky shore Moderate shallow sand Moderate shallow reef Deep sand Deep mud Deep reef	Waipu, Ruakaka and Mangawhai Government Purpose Wildlife Refuge Reserve estuaries contain important coastal and wading bird habitat. Relatively pristine inshore benthic invertebrate assemblages. Productive reef systems, particularly around islands, supporting diverse invertebrate and reef fish fauna. Algal forests are an important source of nutrients to surrounding soft sediments. High natural character values.	Habitat loss due to coastal development. Sand mining. Overfishing. Disturbance to nesting shorebirds by domestic animals, people and vehicles. Removal of epifauna and habitat homogenisation by mobile fishing gear. Invasive marine species. Toxic algal blooms.	

The DOC CMS refers in the preceding quote to the investigation of a ‘marine recreational park’ in the Whangaruru–Mangawhai Coast Place. A scoping report has been prepared on this concept for the Northland Regional Council and is discussed in section 3.2 below.

Whangarei Harbour and Bream Bay are identified as marine habitats with recreation values (fisheries, high natural character and marine and avian wildlife), as well as adverse effects from overfishing and fishing gear (Appendix 8, p198) (Figure 12).

The recreation values of the Whangarei Harbour Marine Reserve (see Figure 10) are described in a DOC pamphlet, with the following introduction and activity description (DOC 2014b):

> *The reserve was established in October 2006 and is located on the east coast of Northland. The reserve is the result of over 16 years of hard work, supported by marine experts and initiated by Kamo High School students of Whangarei. Whangarei Harbour Marine Reserve comprises two sites: an intertidal mudflat/mangrove environment at Waikaraka, which is approximately 8km from Whangarei town; and a mix of sandy beach, rocky reef and small high-current outcrops at Motukaroro/Passage Island, approximately 30km from Whangarei. It protects a combined area of 253.7 hectares of shore and sea providing a safe haven where the region’s marine life can flourish.*
>
> *Visitors to the marine reserve are welcome and activities like boating, snorkelling, scuba diving, picnicking and canoeing are encouraged. We hope you enjoy your visit.*

3.2 Northland Regional Council

The *Operative Regional Policy Statement for Northland* (RPS) (NRC, May 2016) states (p91):

> *Northland’s unique coastal environment has a range of landscape, seascape and recreational qualities that make it a popular place for development. Most of our existing settlements are located in the coastal environment and this is also where most development in Northland is occurring. The coastal environment is of huge economic importance to the region (for example, tourism and aquaculture) and our coast is an attribute that sets us apart from other regions. Northland has one of the longest coastlines of any region in the country.*

The RPS does not quantify or describe regional coastal recreation values in any detail. Objective 3.2 (d) and (c) of the RPS are to:

> *Improve the overall quality of Northland’s fresh and coastal water with a particular focus on: …*
>
> *(c) Reducing sedimentation rates in the region’s estuaries and harbours;*
>
> *(d) Improving microbiological water quality at popular contact recreation sites, recreational and cultural shellfish gathering sites, and commercial shellfish growing areas to minimise risk to human health.*

Policy 4.4.1 (2) (b) refers to “maintaining and protecting significant ecological areas and habitats” that of are importance to recreation:

> *(2) In the coastal environment, avoid significant adverse effects and avoid, remedy, or mitigate other adverse effects of subdivision, use and development on:…*
>
> *(b) Habitats of indigenous species that are important for recreational, commercial, traditional or cultural purposes;*

Part 9 of the RPS states the ‘environmental results anticipated’ and, with reference to Objective 3.2 (as above), expects:

4.2. Regional-wide water quality management…

5. Compliance rates for contact recreation at popular swimming sites are maintained or improved with respect to the relevant guidelines.

The RPS does not define or refer to specific guidelines – these are stated in the *Northland Regional Council Regional Coastal Plan* (RCP). Appendix 2 includes the RCP maps for Whangarei Harbour and Bream Bay. These show the dominant management zones as Marine 1 (Protection) and Marine 2 (Conservation) Management Areas. Mooring Zones are shown in Urquharts Bay, Taurikura Bay, McLeod Bay, Parau Bay and west and east of One Tree Point. A ski lane is shown on the north-west corner of Limestone Island. Port Facilities Management Areas are also indicated.

The RCP describes regional coastal recreation values (p111):

Northland's warm climate, multitude of harbours and sandy beaches, often dramatic coastal scenery and high coastal water quality make its coast attractive for outdoor recreational pursuits. The diversity of recreational opportunities provided within Northland's coastal marine area is a major reason for its popularity both with Northlanders and visitors to the region and as a result, additional demands are placed on the coastal environment.

The region's coastline is extensively used for swimming, boating and fishing. It also contains numerous areas which are suitable for a wide range of other activities such as scuba diving, snorkelling, water skiing, surfing, windsurfing, sailing, jet-skiing, canoeing, sunbathing, horse riding, picnicking and tramping. In terms of the Resource Management Act, the coast has very high amenity value.

Recreational activity occurs mainly in Marine 1 and Marine 2 Management Areas and, to a lesser extent, in Marine 4 (Moorings) Management Areas.

Management of recreation around Northland's coast is generally only necessary where there are large numbers of recreational users and/or there are competing demands for the use of coastal space. In Northland, such situations generally occur over the summer period when large numbers of people "head for the coast" for their holidays.

The recreation section (16) of the RCP focuses on avoiding adverse effects caused by recreation and adopts a 'permissive approach' (Policy 16.4) to recreational activities in the Marine 1 and 2 Management Areas, and applies rules to limit adverse effects on environmental and amenity values and public health and safety.

Section 22 of the RCP considers capital and maintenance dredging and, although it does not refer to potential adverse effects on recreation, it considers effects on ecological values and the potential release of contaminants, and siltation.

Section 13 of the RCP reviews water quality and identifies as an issue (13.2 (2)):

The importance of water quality to safe contact recreation, shellfish gathering and other significant uses of Northland's coastal marine area, and the consequent need to provide an effective management framework for maintaining and enhancing water quality for the benefit of future generations.

With a subsequent policy (13.4 (1)):

1. To classify the waters within Northland's coastal marine area as a means of clearly identifying the water quality management aims for individual areas of coastal water, and in a manner which recognises:

(a) the high standard of existing water quality of the majority of Northland's coastal waters;

(b) existing detailed information on the quality of the waters of the Whangarei Harbour and the Bay of Islands;

(c) the importance of water quality to safe contact recreation and the quality of naturally occurring and commercially-grown edible shellfish resources;….

Water quality classifications referred to in the RCP are as stated in the NRC *Whāngārei Harbour Water Quality Plan 1990* (NRC 1990), most recently illustrated in the NRC *Whāngārei Harbour Water Quality Improvement Strategy* (NRC 2012). This relies on classes for contact recreation and general water quality including shellfish, with defined mixing zones where the relevant water quality standards may be exceeded (Figure 13, provided by NRC based on data shown in a low resolution image in NRC (2012)).

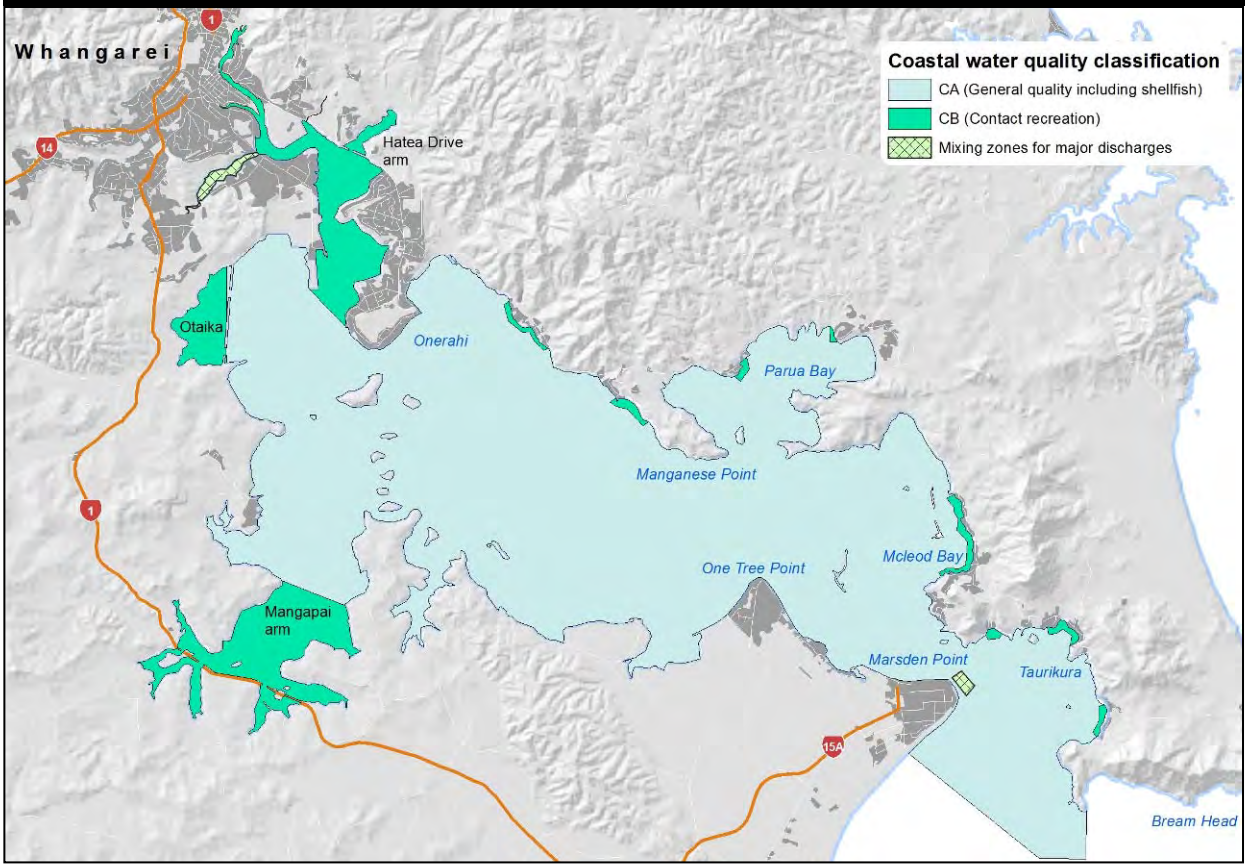
The Contact Recreation standard (CB) provides for "contact recreation and shellfish collection but not for marine ecosystems" (NRC 2012, p31). The *Water Quality Improvement Strategy* notes (NRC 2012, p31):

It is also important to note that as a result of a consent process under the Resource Management Act, a direct discharge to the harbour does not necessarily have to meet the relevant classifications and standards after reasonable mixing. However, it would be unlikely in today's environment that consent would be granted for discharges that would result in large departures from the water quality classifications and standards.

The standards are defined in Appendix 4 of the RCP, and are considered in sections 5.2.1 and 5.2.6 of this report.

The Water Quality Improvement Strategy briefly describes the recreation values of the Harbour (NRC 2012, p25):

Figure 13: Coastal water quality classification zones, Whāngārei Harbour – NRC 2012



The harbour is a place of great bounty and enjoyment. Water-based recreation in the harbour includes fishing, seafood gathering, sailing, waka ama, windsurfing, kayaking, rowing, stand-up paddle boarding, snorkelling, diving, and swimming.

Most of these activities are undertaken in the middle and lower harbour. Muddy intertidal flats, water quality issues (including poor water clarity), and limited public access (due to urban and industrial development) discourage primary contact recreation in the upper harbour. However, secondary contact uses such as waka ama (outrigger canoes), rowing, kayaking, and stand-up paddle boarding are common….

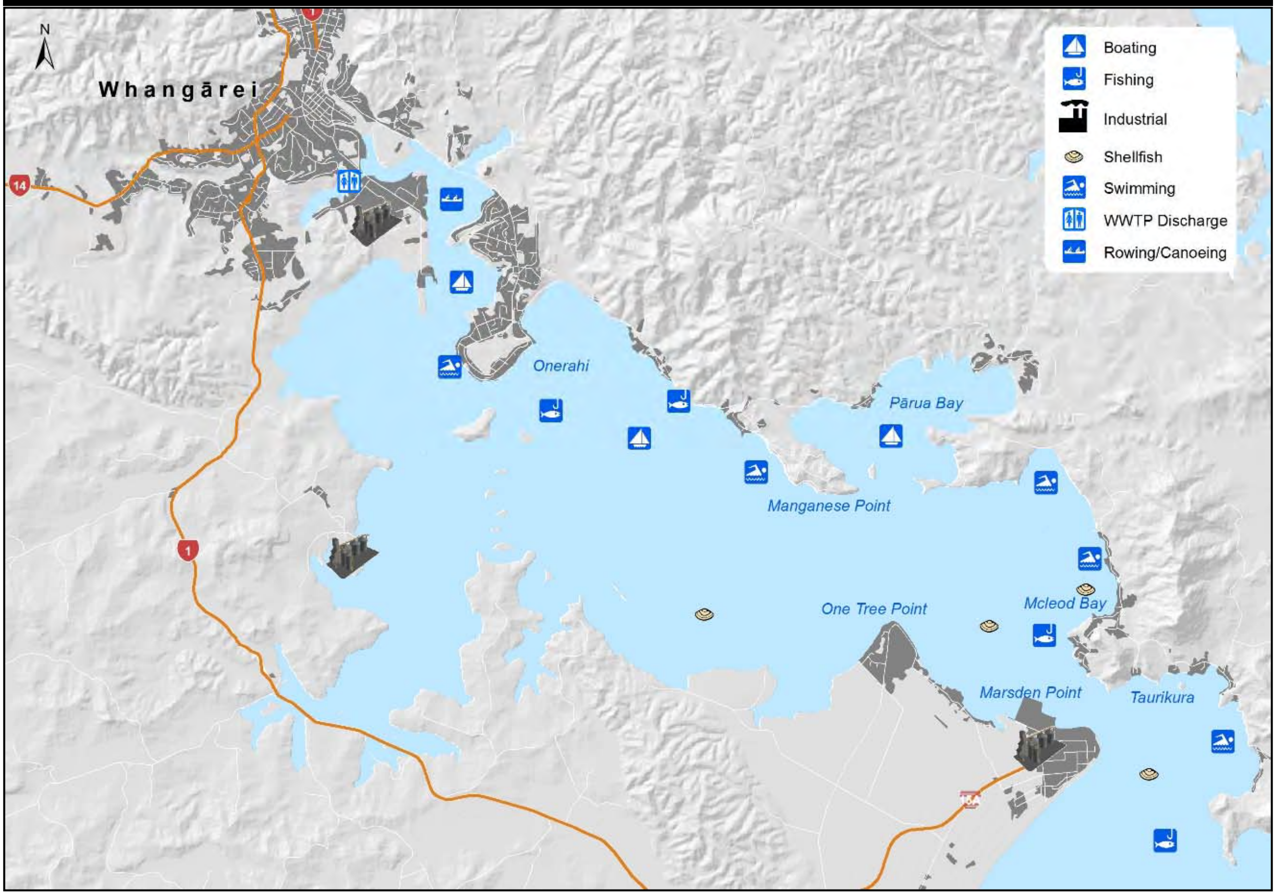
The harbour is a popular destination for domestic and overseas sailors, and is often the home of a number of international users. There are approximately 350 moorings and 430 marine berths in the harbour. Most of these are found in the Hātea River arm of the upper harbour and in the lower harbour at One Tree Point and Marsden Cove. There are also a small number of private jetties used for permanent mooring, most of which are in the Waiarohia Canal (the lower estuarine reach of the Waiarohia Stream)….

A graphic summary of 'common uses' of the Harbour is also provided (Figure 14).

The *Draft Regional Plan for Northland* (August 2016) identifies several relevant recreation settings which are described in section 4 of this report.

At the 18 March 2014 NRC Council meeting, a proposal to establish a 'national marine park' in Northland was considered. The idea was to implement a set of restrictions on commercial take, reductions in recreation catch limits, and to establish some 'no take' marine reserves, over approximately 1800km^2 extending from Cape Brett to the Whangarei Heads, and including the Poor Knights Islands (Figure 15). A 'scoping and review' report for the proposal had been prepared for NRC in 2013 (Hampson *et al* 2013 – the 'ME Report') and a review of

Figure 14: 'Common uses of the Harbour' – NRC 2012

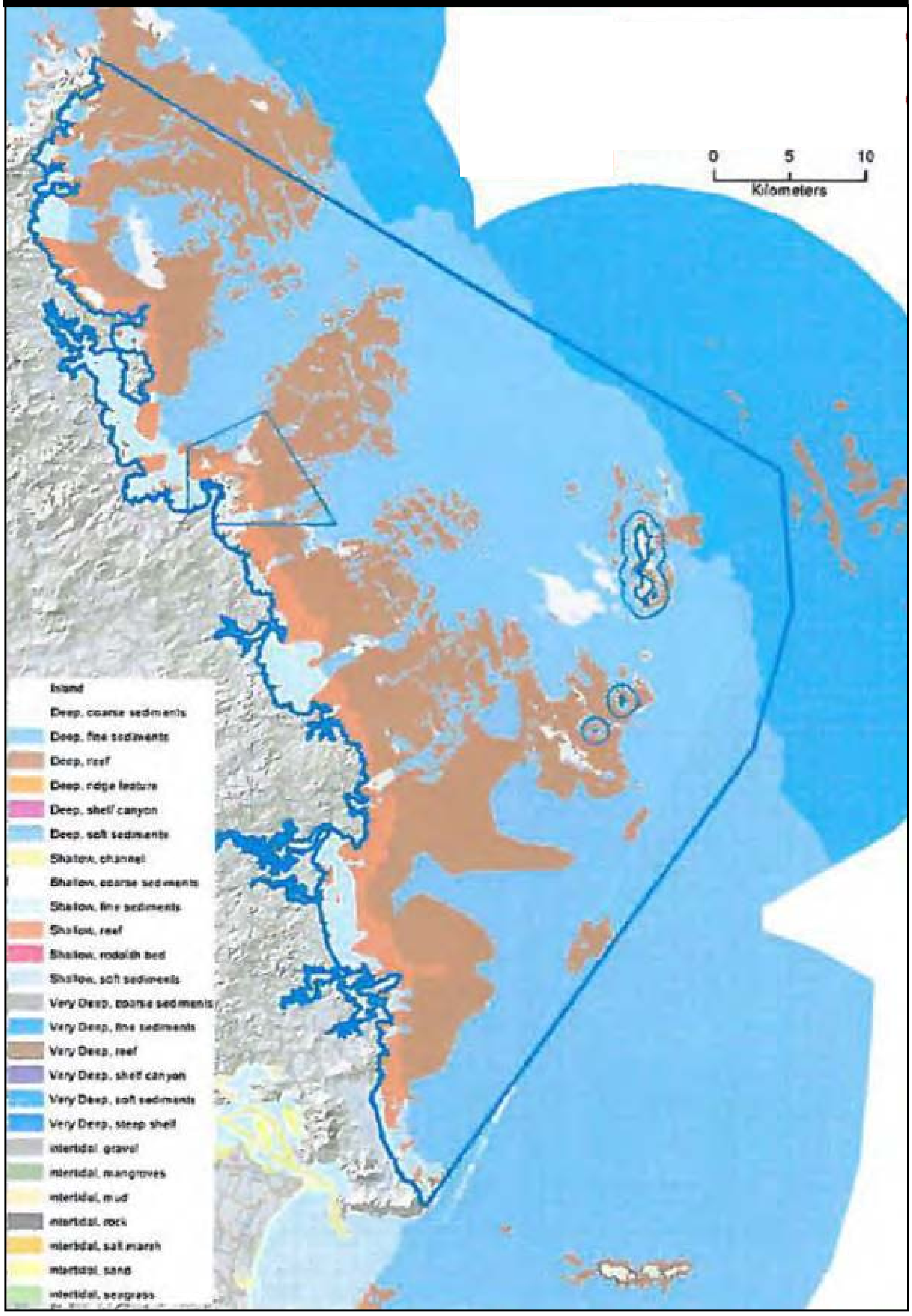


that report and a recommendation to not proceed with the idea was presented at the Council meeting (Murfitt 2014). Minutes of the meeting are not available online. The report concluded:

> *Council will be aware that there are other community groups in the region looking to progress marine park/reserve proposals (Bay of Islands and Whangaroa for example), which individually may have more chance of success than the larger marine park concept (i.e. these proposals might have a higher chance of success on ecological grounds which is the primary driver behind the Marine Reserves Act). It is considered that we do not have enough evidence that this marine park proposal is better than others in the region to justify exclusively pursuing this one over others. In addition the development of a network of smaller marine protected areas under the Marine Reserves Act could encompass the community aspirations of these other groups.*

The ME report did not quantify or assess recreation activity in the proposed marine park area.

Figure 15: Proposed Marine Park boundary in blue – from Hampson *et al* 2013



3.3 Whangarei District Council

The WDC released an Open Space Strategy in 2001 (WDC 2001). This described the recreation values of the Whangarei Harbour and its shoreline as a "a popular destination for aquatic activities, including swimming and fishing, sailing and boating, water skiing and kayaking" (p34). Identified 'threats and issues' for recreation and other values included (p34):

- *Abandoned islands, such as Matakohe/Limestone Island, have been left in a degraded state.*
- *Derelict structures litter the foreshore. Of particular concern are the jetties that are unsafe for the public to use.*
- *Boat access facilities to the harbour need upgrading and assessing.*
- *Runoff, erosion and siltation threaten the water quality of the harbour.*
- *The community is promoting a vision for marine reserves in the Whangarei Harbour.*
- *There are illegal structures, including boat sheds and baches, on coastal reserve land.*

Strengths and opportunities for the Harbour and shoreline included (p35):

- *Support community efforts to assist in protecting cultural sites and in restoring wildlife habitat, public access and understanding on Matakohe/Limestone Island.*
- *Acquire other islands in the harbour as the opportunity arises subject to funding.*
- *Assess coastal structures in the harbour and implement a removal or maintenance programme, as appropriate.*
- *Assess the boat access facilities to ensure they meet the needs of the community.*
- *Continue to plant the riparian margins to assist with stormwater filtration, bank stability and siltation. Where possible control the land-based activities that contribute to a reduction in water quality.*
- *Support the establishment of marine reserves in the Whangarei Harbour.*

Development priorities for recreation in coastal and marine settings identified in the Open Space Strategy focused primarily on improving coastal access, including in Bream Bay and throughout the Whangarei Harbour.

The Whangarei District Plan 2007 has no information on marine recreation and focuses on the terrestrial environment.

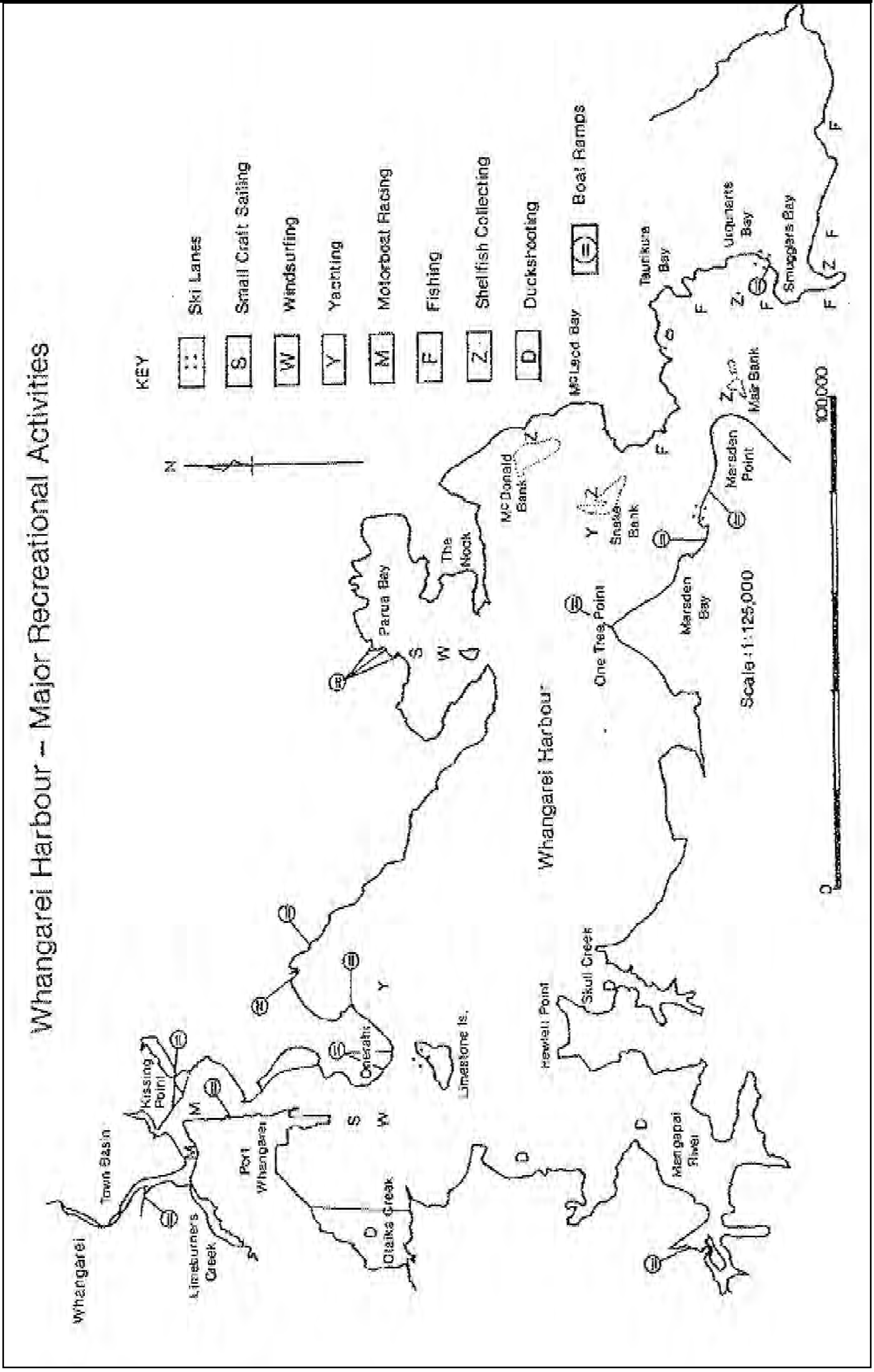
Other recreation information provided by the WDC is discussed in the activity-specific sections of this report (in section 4) .

3.4 Northland Harbour Board

The role of the Northland Harbour Board (NHB) is now carried about by the NRC. In the late 1980s the NHB completed a review of the uses and values of the Whangarei Harbour, and included a summary of recreation values relying on a telephone survey of "all the recreational user groups and clubs known to use the harbour and the harbour shore line." (NHB 1989, p113).

References to this document are made in section 4 of this report about specific activities that were identified in the late 1980s, and are updated where necessary. Figure 16 shows the main findings of NHB (1989) for the location of recreational activities in the Harbour. This report will provide some basis for trend analysis and discussions with stakeholders.

Figure 16: Recreation activities in Whangarei Harbour (NHB 1989)

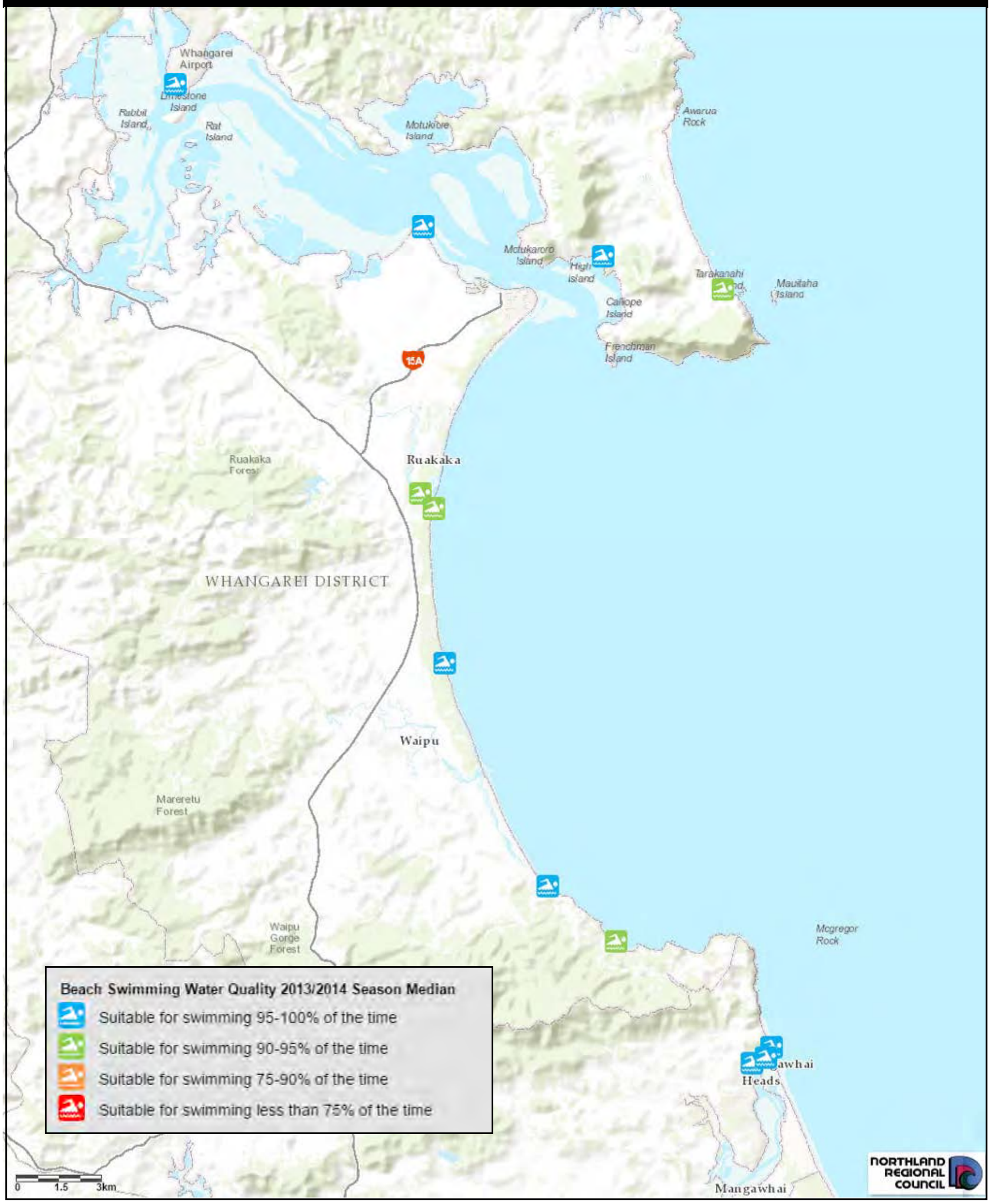


4 Activity reviews

4.1 Swimming and beach use

The NRC monitors water quality at nine popular swimming sites within the study area (Figure 17) – of 47 coastal sites throughout the region.[3] Data for the 2013/14 summer season showed bathing water quality to be generally good or very good. Results for the 2015/16 season were the same. Monitored swimming sites in the study area are shown in Figure 17 and listed below. Figure 17 shows data for the 2013/14 season. Results from the 2015/16 season onwards are presented on the LAWA national database[4].

Figure 17: NRC monitored marine bathing sites in and around Whangarei Harbour 2013/14



[3] http://www.nrc.govt.nz/Living-in-Northland/At-the-beach/Swimming-water-quality/Swimming-water-quality-results/ retrieved November 2014

[4] https://www.lawa.org.nz/explore-data/northland-region/swimming/ retrieved January 2017

- Ocean Beach
- Taurikura Beach
- Onerahi Playground
- One Tree Point
- Ruakaka Beach and River
- Uretiti Beach
- Waipu Cove
- Lang's Beach (mid)

Other swimming sites identified by the NRC are shown in Figure 14 on page 26.

The Whangarei District Council states:

> *Whangarei has a reputation as the city with 100 beaches, and offers a range of picturesque and safe places to swim, from the grand scale ocean beaches to small sandy bays along both edges of the harbour. …*
>
> *Surfing beaches at Ocean Beach and Waipu are patrolled by Surf Life Saving NZ at weekends during the summer months, generally from the end of October until early April and throughout the week during the summer school holiday in December and January.* [5]

Surf Lifesaving NZ identifies popular swimming beaches nationally on its 'Find a Beach' website, as well as beach activities popular at each site (Figure 18 for the four identified beaches in the study area).[6] All but Langs Beach is patrolled. Recommended beach activities at each are:

Figure 18: Surf Lifesaving NZ recommended beaches

Ocean Beach

- Canoeing/kayaking
- Dog walking
- Scuba diving
- Snorkelling
- Wind/kite surfing

Ruakaka Beach

- Canoeing/kayaking
- Dog walking
- Horse riding
- Wind/kite surfing
- Wind-powered vehicles

Waipu Cove

- Dog walking
- Horse riding
- Snorkelling

[5] http://www.wdc.govt.nz/FacilitiesandRecreation/Beaches-and-Coastal-Facilities/Pages/Default.aspx
[6] http://www.findabeach.co.nz/

- Wind-powered vehicles

Langs Beach

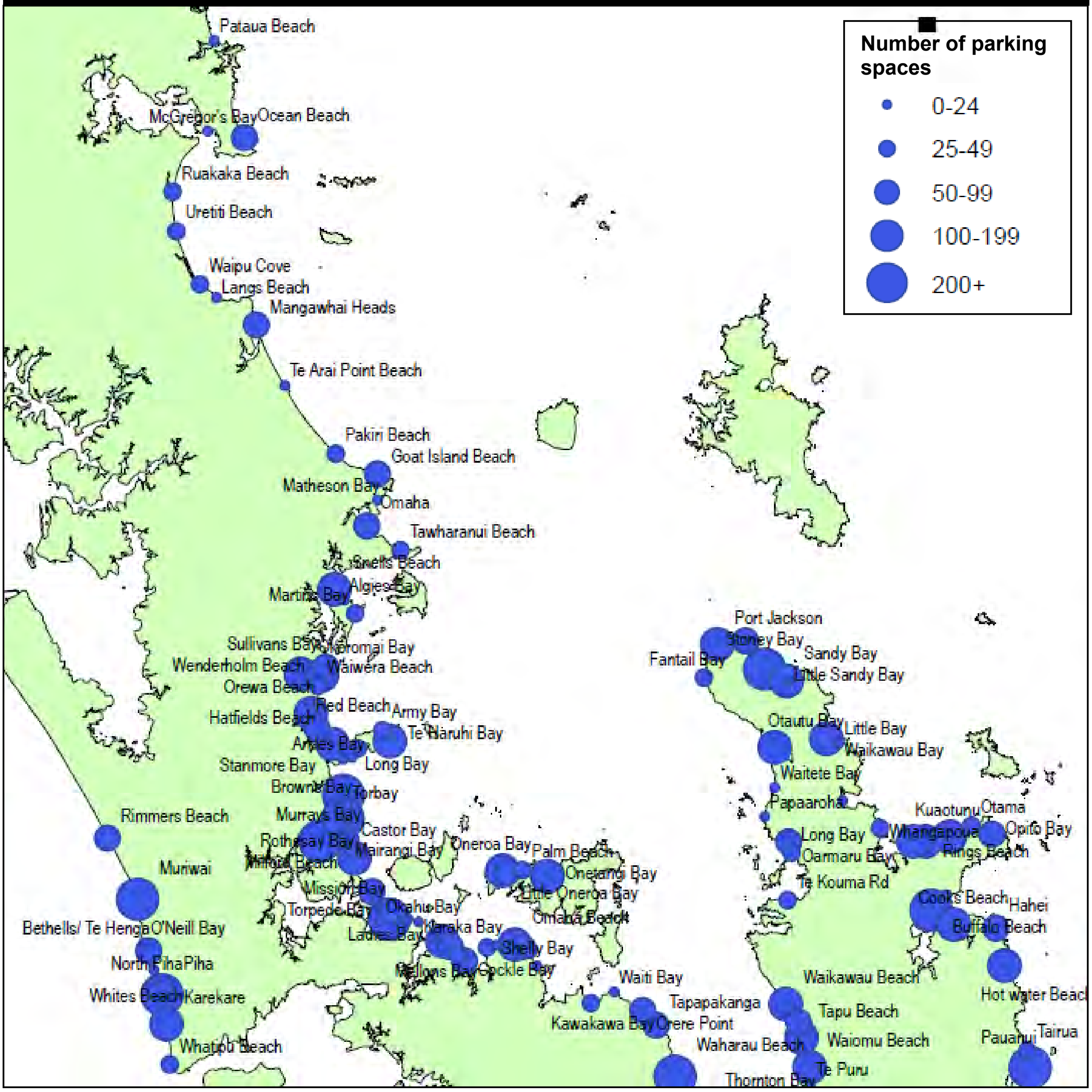
- Dog walking
- Horse riding
- Motorbikes/4WD's
- Scuba diving

Surf clubs are located Ruakaka, Waipu Cove and Ocean Beach (Whangarei Heads).[7]

The Northland Harbour Board (1989) noted (p114):

> *Swimming is not at present a widely popular pastime within the Whangarei Harbour. With the exception of the Marsden Point to One Tree Point area, the southern harbour shores contain large areas of tidal flats and mangroves. In*

Figure 19: Beaches showing number of carparking spaces 1997 (Allen et al 2009)



[7] http://www.nrc.govt.nz/Living-in-Northland/At-the-beach/Surf-clubs-and-safe-swimming/#surf

> *contrast, the northern shores consist mainly of rocky shorelines and stony beaches in the vicinity of .Whangarei Heads and Bream Head, with tidal mudflats in McLeod Bay, Parua Bay and from Tamaterau to Onerahi. Due to the lower water quality in the upper harbour, the harbour above Onerahi and the Hatea River is currently not considered to be suitable for swimming. It is anticipated that future water quality in the upper harbour will improve, consistent with the Northland Regional Council' s Water Quality Management Statement, and that swimming will be safe in the upper harbour by 1989.*

Biosecurity New Zealand released a review of coastal social values in 2009 (Allen *et al* 2009). This indicated that, at the national level, there is only a very coarse understanding of the distribution of marine recreation. The study considered beach recreation, surfing, diving, boating and seafood gathering. However, in the main, only proxy information was used to identify where these activities occur – such as the presence of a surf living saving club to identify swimming locations or a yacht club for sailing. This resulted in broad descriptions of activity patterns which are better described using more specific data sources (such as those discussed elsewhere in this report). Figure 19 shows proxy data for swimming site popularity around Coromandel, Auckland and some of Northland – the number of parking spaces provided at beach access areas – reported in Allen *et al* (2009) based on a 1997 Surf Lifesaving NZ count. Coromandel beaches – even in quite remote areas near Cape Colville – had higher provision than the beaches in the study area.

4.2 Fishing

The National Aquatic Biodiversity Information System (NABIS) provided by the Ministry for Primary Industry provides results from aerial surveys of recreational fishing effort undertaken over 2011 and 2012 (Figure 20).[8] Boats recorded include those scuba diving and so show 'fishing' effort within, for example, the marine reserve around The Poor Knight Islands. The data show the Whangarei Harbour area to be a relatively heavily fished setting, with similar vessel densities to the Bay of Islands and the inner Hauraki Gulf – although the latter has several areas with two to three times the density of vessels.

Figure 21 shows the vessel density data for the study area, with a peak of 100 to 150 vessels per km^2 immediately south of Peach Cove and a heavy concentration of activity in the main part of Whangarei Harbour and around Bream Head.

Consultation indicated that the channel boundary just outside Motukaroro Marine Reserve is a particularly good site for jigging for kingfish. Crab fishing was also identified as an activity in many harbour bays. Other preferred fishing sites identified by individuals were Three Mile Reef (approximately 5km due south of Peach Cove), and navigation buoy 9.

The Spot X national surfcasting (Draper & Airey 2012) and boat fishing (Airey 2012) guides identify many fishing opportunities in and around the study area. Relevant figures from Airey (2012) are shown in Appendix 3. These indicate diverse fishing opportunities within the study

Figure 20: Recreation fishing effort Matauri Bay to Whangamata. MPI NABIS data

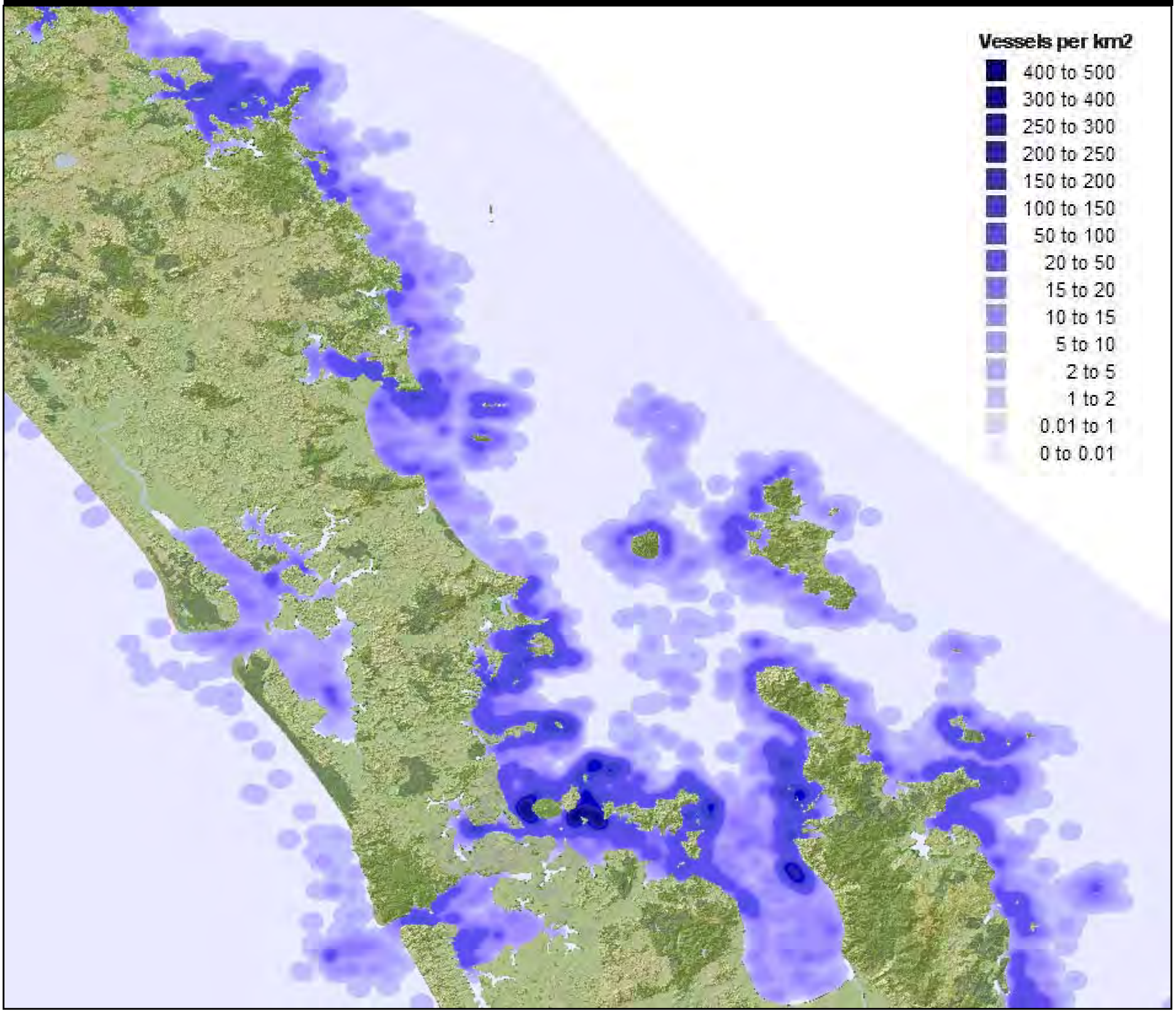
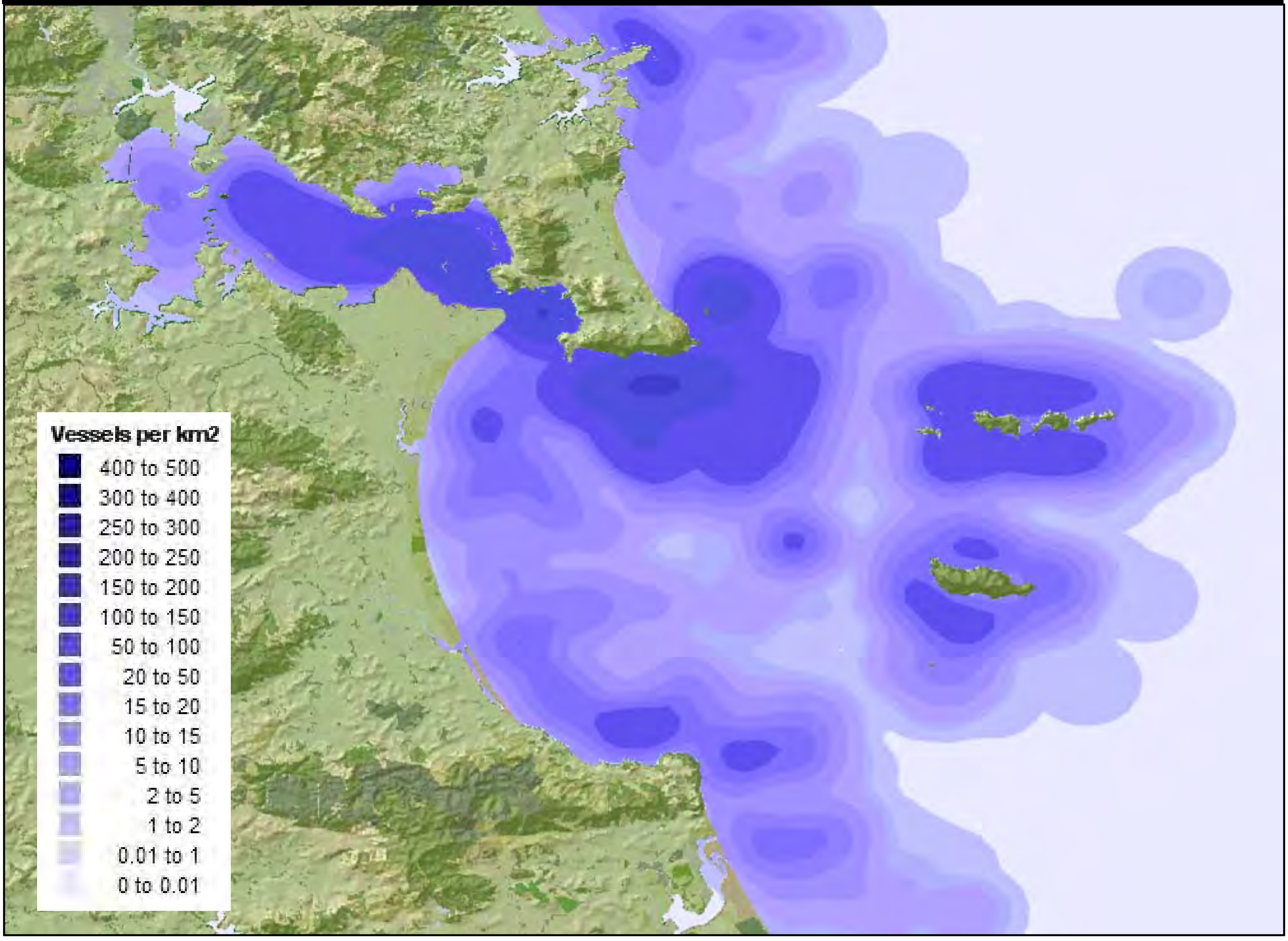


Figure 21: Recreational fishing effort in the study area. MPI NABIS data



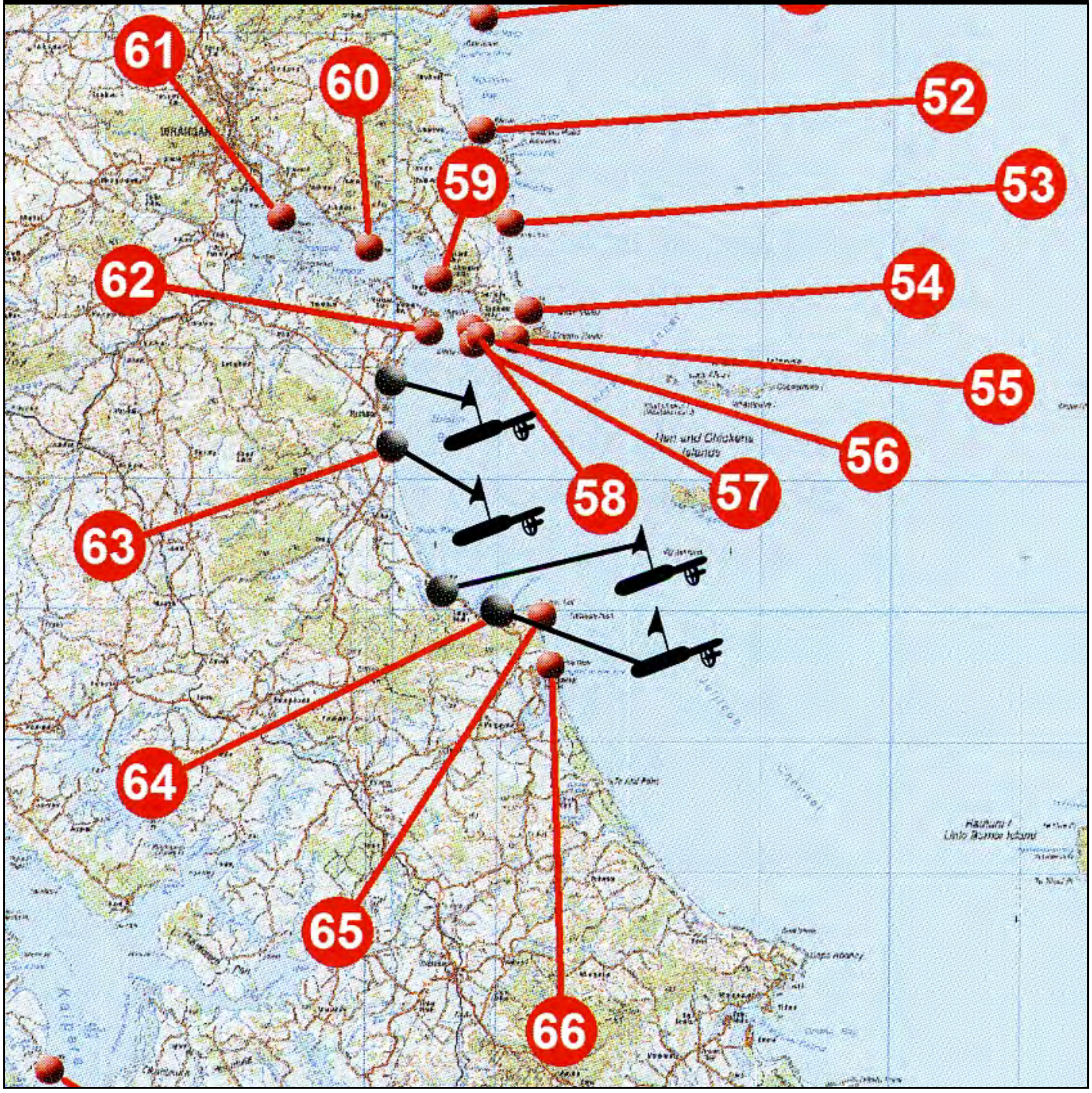
area for snapper, john dory, kingfish, trevally, kahawai and baitfish. Airey (2012) notes (p59):

> *Whangarei, Tutu kaka and the surrounding districts are noteworthy for being extraordinary fishing destinations, including excellent harbour fishing (particularly Whangarei Harbour) along with surf, rick, boat and big-game fishing.*

Reviewed sites 8 (Snake Bank Channel) and 9 (Bream Islands) in Appendix 3 are described as best fished in November and 'all year' respectively.

Figure 22 shows surf casting opportunities at (by marked number): 54 – Ocean Beach (snapper, kahawai, kingfish and trevally, autumn and winter); 55 – Peach Cove (snapper, john dory, kahawai, kingfish and trevally, autumn and winter); 56 – Smugglers Bay (snapper, kahawai and trevally, all year); 57 – Busby Head (snapper, kahawai and trevally, all year); 58 – Home Point (kingfish, kahawai, mackerel snapper and trevally, autumn and summer); 59 – McLeod Bay Jetty (baitfish, kahawai, kingfish, snapper and trevally, all year); 60 – Manganese Point (snapper, mackerel and trevally, all year); 61 – Onerahi Wharf (kahawai, john dory, kingfish snapper and trevally, all year); 62 – Marsden Point (Snapper, kahawai and trevally, autumn); 63 – Uretiti Beach (snapper, gurnard, kahawai and trevally, autumn and summer); 64 – Langs Beach (snapper, kahawai, kingfish and trevally, all year).

Figure 22: Surfcasting guide recommendation, Draper & Airey (2012)



Fishing competitions in the study area include:

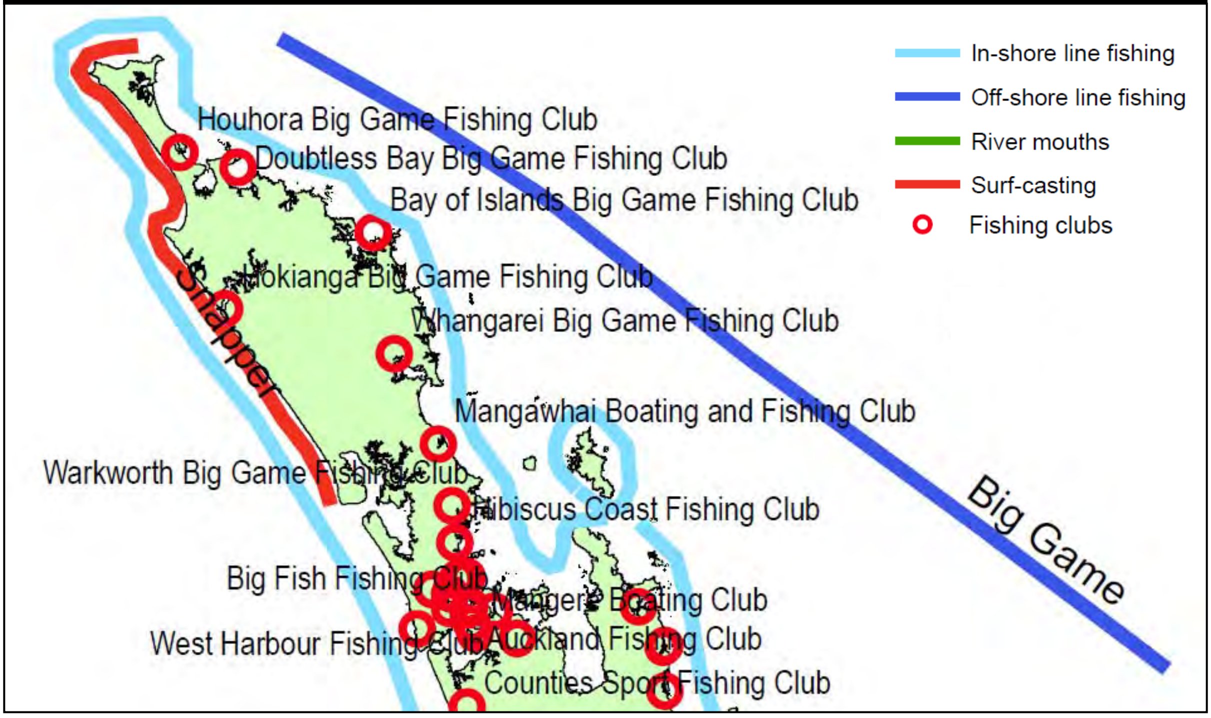
- Beach and Boat – February – based out of the Marsden Cove Marina[9]
- Orton Events New Zealand Northland Cove to Cape Kayak Fishing Challenge out of Whangarei Harbour – August[10]
- Funky Fishing Family Fishing and Diving Competition at Whangarei Heads – March[11]
- Tutukaka Light Tackle Yellowtail Kingfish Tournament – June[12]

Eight fishing clubs are identified on the 2CU online database, each of which is likely to operate fishing competitions.[13]

Allen *et al* (2009) identified in-shore and off-shore line fishing in the study area, but no surf-casting (Figure 23).

[9] http://www.beachandboat.co.nz/info/
[10] http://ortoneventsnz.co.nz/2015/cove-to-cape/index.php
[11] http://funkyfishing.co.nz/
[12] http://www.sportfishing.co.nz/Dynamic.aspx?id=11900
[13] http://2cu.co.nz/northland/listings/find/fishing%20clubs/whangarei

Figure 23: Recreational line fishing locations and fishing clubs from Allen *et al* 2009



4.3 Shellfishing

Airey (2012) shows in the charts in Appendix 3 many shellfish gathering sites in the study area. These include pipi and scallops around Snake Bank, pipi at Marsden Point and at Mair Bank, and scallops to the north of Urquharts Bay, south of Home Point, in Smugglers Bay and offshore from Langs Beach. Additional diving sites for scallops are identified in Enderby & Enderby (2007) (see section 4.4), including: Bream Head Boulder Bank; Peach Cove; Smugglers Cove; within Whangarei Harbour; and Bream Bay.

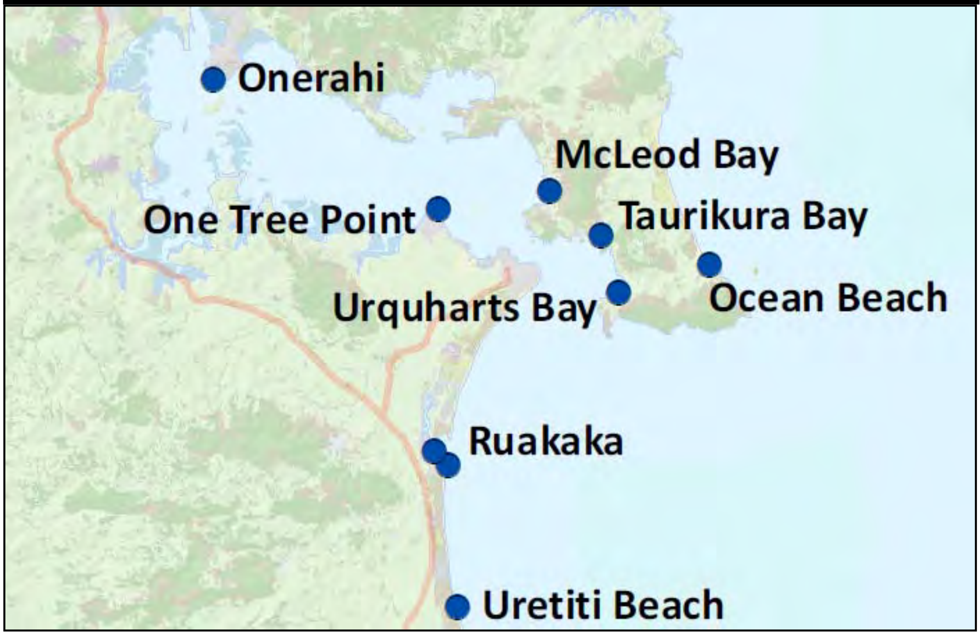
The NRC carries out an annual faecal coliform testing regime for recreational shellfish gathering at 23 sites in the Whangarei District. The sites within the study area are listed below and for the Harbour in Figure 24[14], with an indication of whether they passed or failed the relevant MfE water quality standards over the 2015/16 season:[15]

- Langs Beach (fail)
- McLeod Bay (pass)
- One Tree Point (pass)
- Onerahi (pass)
- Ruakaka Beach near surfclub (pass)
- Taurikura Beach (pass)
- Uretiti Beach (pass)
- Urquharts Bay (pass)
- Waipu Cove (pass)

[14] http://www.nrc.govt.nz/contentassets/76e6569bd9524f2b96558dd186f941b1/swimming-sites-map-2016-2017.pdf retrieved January 2017
[15] http://www.nrc.govt.nz/contentassets/a5411dade42c494cafbae094e186efab/summary-of-shellfish-gathering-results-2015-16.pdf retrieved January 2017

Ocean Beach was monitored prior to the 2015/16 season. Species gathered at these sites are not identified. Other shellfishing sites identified by the NRC are shown in Figure 14 on page 26.

Figure 24: NRC water quality monitoring sites 2016/17, Whangarei Harbour



The Northland Harbour Board (1989) noted (p113):

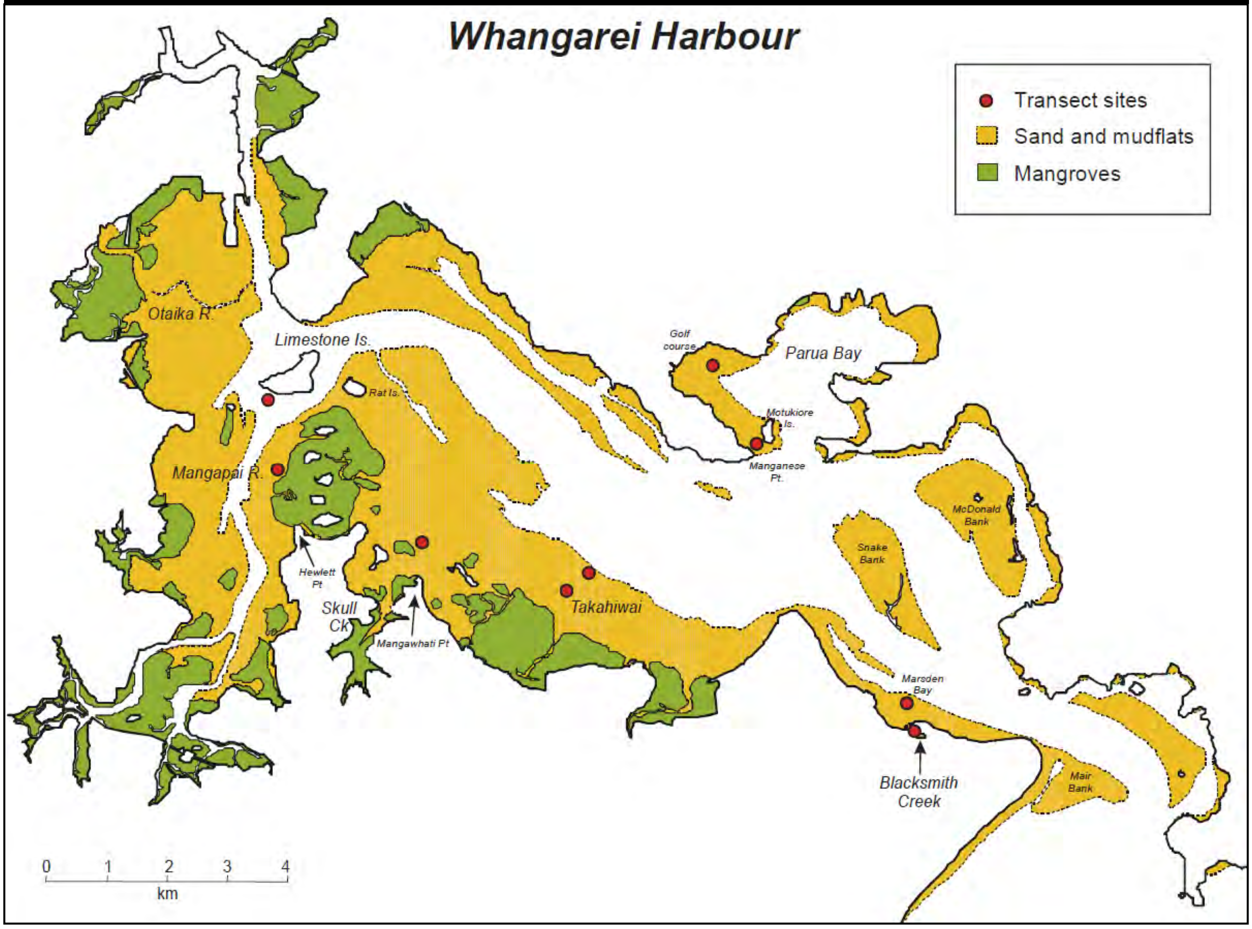
> *A variety of shellfish are gathered recreationally within the harbour. Cockles are scattered throughout the lower harbour and beds are found at Snake Bank, McLeod Bay and to a lesser extent in Parua Bay. Small beds of pipi also occur in harbour bays but the most popular area for gathering pipi is Mair Bank where large pipi are found in high densities.*

Cummings and Hatton (2003) of NIWA report on a reseeding assessment for pipi and cockles in Whangarei Harbour for the NRC. Figure 26 shows the sites considered suitable in their assessment for shellfish reseeding (the transect sites). The NIWA assessment identified two sites for cockles (Skull Creek and the Takahiwai mid-shore area) and a potential site for pipi (outer Skull Creek).

The authors noted (p iv):

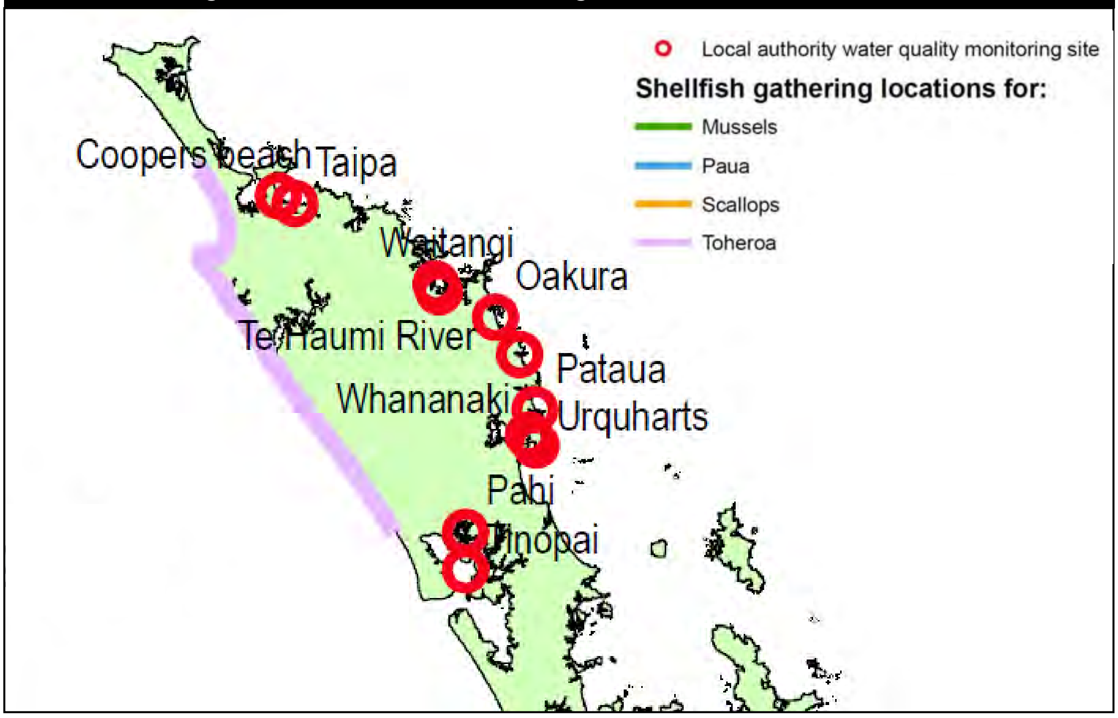
> *The areas visited are good examples of their present habitat type, with a good diversity and abundance of shellfish and other fauna present, and an abundance of bird life. However, old reports and discussions had during the course of this study indicate that some areas now have very different habitats compared to that of many years ago. Unfortunately, these habitat changes mean that cockles and pipi are unlikely to grow as large or be as abundant in these places as they were in the past.*

Figure 26: Sites assessed for suitability of future shellfish reseeding in Cummings and Hatton (2003)



Allen et al (2009) identifies no shellfish gathering sites on the east coast of Northland (Figure 25).

Figure 25: Recreational shellfishing locations from Allen *et al* 2009



Coffey (2017) reports the most recent data on shellfish abundance on Mair Bank and the Harbour (p27):

> *The most recent study commissioned by RNZ is by Pawley (2016) who reported that:*
>
> - *the bathymetry of Mair Bank appears to have changed since the 2010 and 2014 surveys. Mair Bank is no longer separated from neighbouring Marsden Bank by a channel, and the northern edge now extends further (compared to 2014). This view is supported by Williams and Hume (2014),*
> - *both the total abundance and biomass of pipis have reduced significantly since his 2010 survey. The total population has declined from around 460 million (2010) to around 4.95 million individuals, and the 2016 estimate of absolute biomass, 44.7 t, is around only 1% of the 2010 estimate (4,450 t) and less than 1% of the 2005 estimate (10,542 t).*
>
> *Between 1986 and 2010, the average commercial landings of pipi from Whangarei Harbour was 176.6 tonnes per annum (Report from the Fisheries Assessment Plenary, May 2014). It is now non-existent (Pawley, 2016). This report did not consider cockle populations.*
>
> *In recent years, an expanding bed of green-lipped mussels (Perna canaliculus) has established on Mair Bank (Pawley, 2016 and pers. comm. Riaan Elliot, Refining NZ).*
>
> *Moreover, seagrass beds at One Tree Point are currently recovering from a former dieback event (NIWA, 2004, 2005), so it is important to benchmark these changes that are not associated with the proposed dredging programme.*

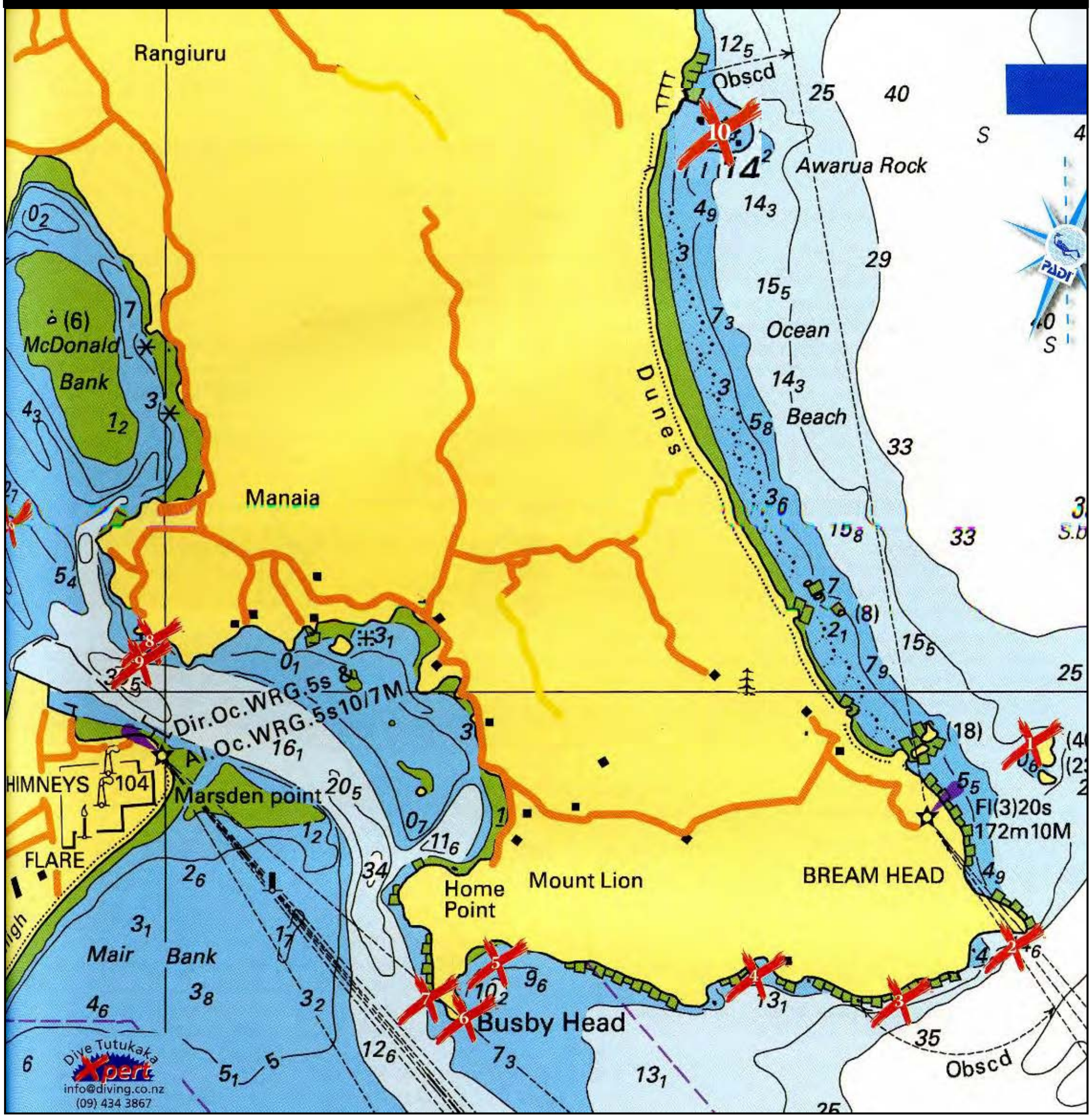
4.4 Diving

Figure 27 shows the recommendations for diving in and around the Whangarei Heads from Enderby & Enderby (2007). The numbered sites are, from the north and then anti-clockwise: 10 – Awarua Rock (crayfish, snorkelling, wall); 1 – Bream Islands (crayfish, spearfishing, wall); 2 – Bream Head (crayfish, wall); 3 – Bream Head Boulder Bank (crayfish, scallops, snorkelling); 4 – Peach Cove (crayfish, scallops, snorkelling); 5 – Smugglers Cove (crayfish, scallops, snorkelling); 6 – Busby Head (crayfish, spearfishing, wall); 7 – The Frenchman (crayfish, scenic, wall); 8 – Motukaroro South (marine reserve, photographic, wall, snorkelling); 9 – Motukaroro Northeast (marine reserve, photographic, snorkelling); 10 (hard left of figure, in page binding) – Whangarei Harbour (scallops). No sites are shown in the Harbour west of those shown in Figure 27. Dive depth ranges from zero to 30 metres. Water clarity issues are only identified for site 10 within Whangarei Harbour ("Strong current and poor visibility"). Boat traffic warnings are given for sites 4 to 10 (Whangarei Harbour).

Dive sites near Bream Tail are shown in Figure 28: 1 (on left edge) – Bream Bay (scallops, noting "Not much fish life, apart from occasional stingray and gurnard."); 2 – Waipu Cove (crayfish, spearfishing, snorkelling); 3 – Langs beach (crayfish); 4 – Bream Tail (crayfish).

The Northland Harbour Board (1989) noted (p113):

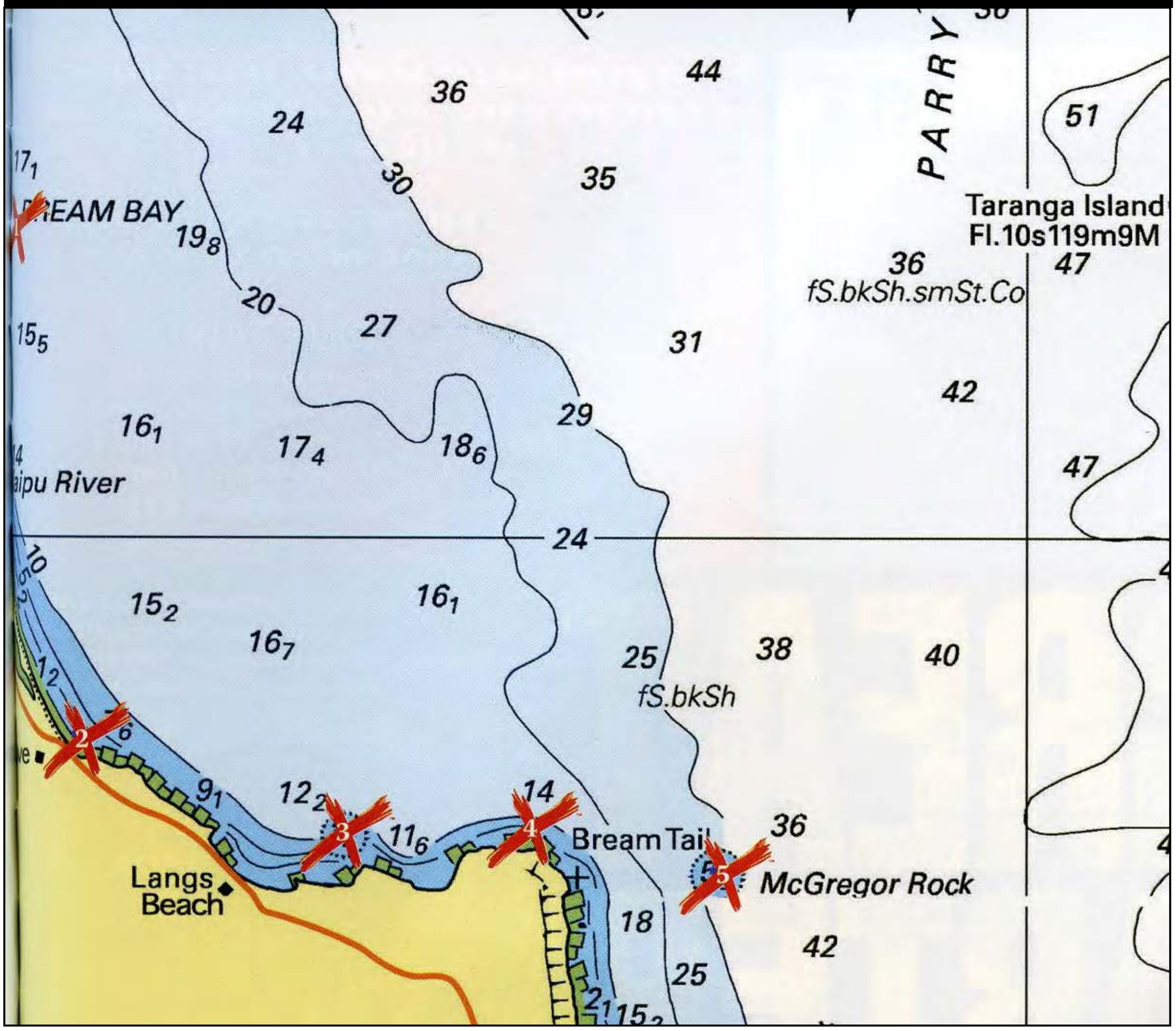
Figure 27: Diving recommendations near Bream Head, Enderby & Enderby (2007)



The most popular areas for recreational diving in the Whangarei Harbour are the northern shores near the harbour entrance. In these areas, particularly McLeod Bay, Urquharts Bay, Woolshed Bay and Smugglers Bay, scallops are found. This scallop resource is subject to heavy pressure from divers during the scallop season, which currently extends from approximately mid-July to mid-February. Large numbers of boats are launched from Urquharts Bay or McLeod Bay and divers also snorkel or dive from the shore. Due to the swift tidal currents at the harbour mouth, most diving takes place around the turn of the tide.

With the exception of scallop areas, there is very little scuba diving within the harbour. Occasional night dives take place under the Northland Harbour Board's Marsden Point wharf organised by the Whangarei Underwater Club. The major use of the harbour by dive groups is as a base from which to conduct excursions to dive spots such as the Hen and Chicken Islands . However, the coast between Smugglers Bay and Bream Head is used as an important diving area by local divers. This area provides exciting underwater scenery, scallops, crayfish and pelagic fish and thus appeals to all categories of divers from photographers to crayfish hunters and spear fishermen.

Figure 28: Diving recommendations near Bream Tail, Enderby & Enderby (2007)



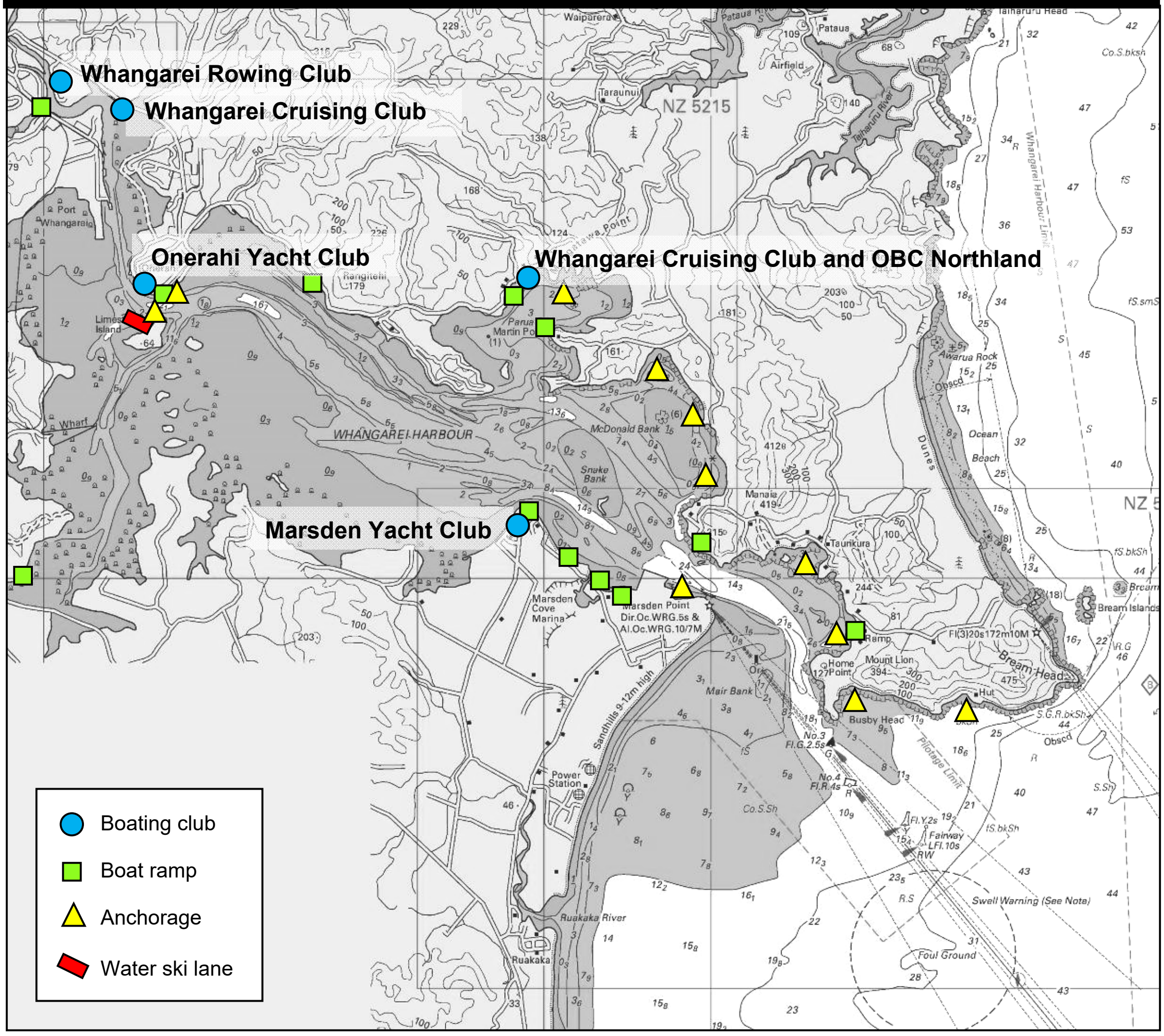
4.5 Boating

Figure 29 shows:

- Casual boat anchorages in the study area identified in *The Royal Akarana Yacht Club Coastal Cruising Handbook* (RAYC 2012). Those within Whangarei Harbour are generally identified as reliable in most conditions. Those at Smugglers Bay and Peach Cove are described as open to southerly swells (pp106 – 117).
- Boat launching ramps identified by the WDC and NRC.[16] A ramp off the map but within the study area is available on the Waipu River on Nova Scotia Drive.
- Water ski lanes (only one at Limestone Island) identified by the NRC and provided for in the NRC Navigation Safety Bylaw 2012.[17] (Northland Harbour Board (1989) described three ski lanes in the Whangarei Harbour in 1989: Limestone Island, Marsden Bay and Urquharts Bay.)
- Four boat clubs.

Mooring areas are identified in the *Operational Regional Policy Statement for Northland* planning maps in Appendix 1 to this report. Two marinas are located in the Harbour Basin

Figure 29: Anchorages, boat clubs and boat launching around Whangarei Harbour

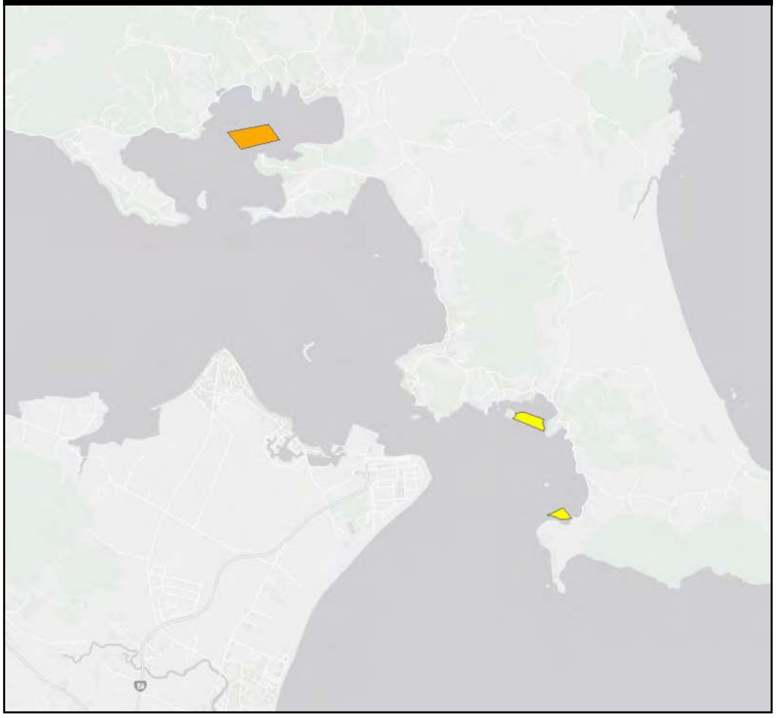


[16] http://www.nrc.govt.nz/Maritime/Boat-ramps-and-maps/#whangarei and http://www.wdc.govt.nz/FacilitiesandRecreation/Beaches-and-Coastal-Facilities/Pages/Default.aspx
[17] http://www.nrc.govt.nz/Resource-Library-Summary/Publications/Coast/Navigation-Safety-Bylaw-2012/Access-Lane-Maps/#whang

(Whangarei Marina and Riverside Drive Marina) and in Marsden Bay (Marsden Cove Marina).

The *Draft Regional Plan for Northland* (August 2016) proposes two regionally significant recreational anchorages in Taurikura and Urquharts Bays and one regionally significant storm anchorage in Parua Bay (Figure 30).

Figure 30: Draft Regional Plan regionally significant moorings



The Northland Harbour Board (1989) noted (p118):

> *The Northland Canoe Club uses the longer reaches of the upper harbour for training purposes, particularly the area from Kaiwaka Point to Kissing Point. When there is a high tide or the Hatea River is in flood, the upper Hatea River is also used. The Whangarei Rowing Club uses the same area for its activities. The group, which consists mainly of secondary school students, has a clubhouse on Northland Harbour Board land adjacent to the Pohe Island landfill.*
>
> *Sea scouts also use the harbour regularly. The Onerahi Sea Scout group has a clubhouse on Northland Harbour Board land near the foreshore at Stevens Point. The group has two boats, although their use is sometimes restricted by the exposure of the area to wind and tide conditions. Further upstream are the Shackleton Sea Scouts who have a scout den on Northland Harbour Board land near Orams Marina. Both sea scout groups take part in regattas in Parua Bay. The equivalent girls' group is the Young Mariners Club which currently uses the Whangarei Cruising Club clubrooms at Kissing Point*

The Northland Canoe Club remains active in the Harbour:[18]

> *Northland Canoe Club holds regular paddles on the Whangarei Harbour and around Northland's beautiful coastline. The most regular paddle is held on Wednesday evening, leaving form the public boat ramp next to the Onerahi Yacht Club.*

As are the Shackleton Sea Scouts (various weblinks).

The Northland Harbour Board (1989) noted (p119):

> *Windsurfing is becoming increasingly popular as a recreational activity in the harbour, particularly in the vicinity of Onerahi and at Parua Bay. There are approximately 25 members of the Whangarei Boardsailing Club, who organise races at Onerahi and also take part in the combined yacht clubs race series. The Onerahi area is not considered ideal for windsurfers especially for beginners, due to problems with mud at low tide and strong tidal flows. However, members use the area in preference to the more sheltered Parua Bay, because of its more*

[18] https://www.facebook.com/pages/Northland-Canoe-Club/165129820303461?sk=info&tab=page_info

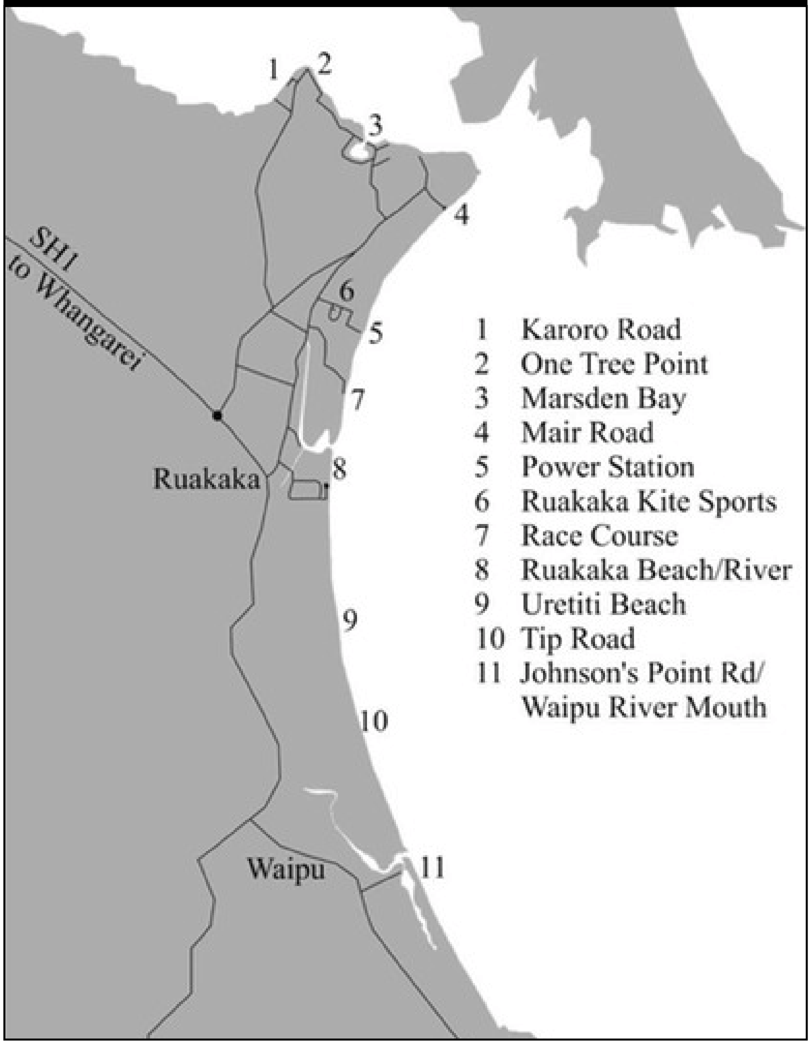
central location to the City. The club has no club facilities and members use the public toilets along the Onerahi foreshore as changing facilities.

Windsurfing New Zealand identifies three sailing sites in the Harbour (Figure 31) – One Tree Point (1), Onerahi (2) and Bream Bay (3).[19]

Ruakaka is described as a 'kitesurfing paradise', and a commercial operator (Ruakaka Kite Sports) recommends the 11 kite sites shown in Figure 32. Full details for the use of each site is provided on the company's website.[20]

Figure 31: Windsurf sites

Figure 32: Kitesurf sites (Ruakaka Kite Sports)



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19 http://www.winzurf.co.nz/windsurf/wgtnz/wgtnz11.htm
20 http://www.ruakakakitesports.co.nz/where-to-kite.html

4.6 Surfing

The NZ Coastal Policy Statement (DOC 2010) does not identify any surf breaks of national significance in the study area (three such sites in Northland are on the west coast).

The *Wavetrack New Zealand Surfing Guide* (Morse & Brunskill 2004) identifies a number of surfing sites between Ocean Beach and Bream Tail (Figure 33 and Figure 34). The scale on Figure 34 shows the authors' assessment of the quality of the surf when it is running at each site. The text for Marsden Point notes "Find longer waves and walls after harbour dredging". It is unclear to what this refers considering that the nearest dredging occurs at Northport in the upper Harbour. Section 5.2.2 of this report considers wave effects from the Project.

The comprehensive online surf information service 'surf-forecast.com' offers information on the same sites. It describes the Ocean Beach break's reliability as 'fairly consistent', and Marsden Point as 'inconsistent'.

The *Draft Regional Plan for Northland* proposes all these breaks as regionally significant (Figure 36).

Figure 33: Whangarei area surf breaks (Morse & Brunskill 2004)

Figure 34: Surf break details (Morse & Brunskill 2004)

Ocean Beach

Head east from Whangarei out to the Whangarei Heads.

Area features a beach break and various peaks breaking around rocky outcrops. Always picks up more swell than other breaks. Works on swells from east and southeast angles. Quality beach break producing solid peaks breaking on inner and outer banks. Optimum wave size 3-6ft (1-2.5m). Will handle 8ft (3m.) Break gets crowded on weekends. Head north to Procters for uncrowded waves. Good for surfers of all levels.

Marsden Point

Head north from Waipu on HWY 1. Take a right on Marsden Point Rd.

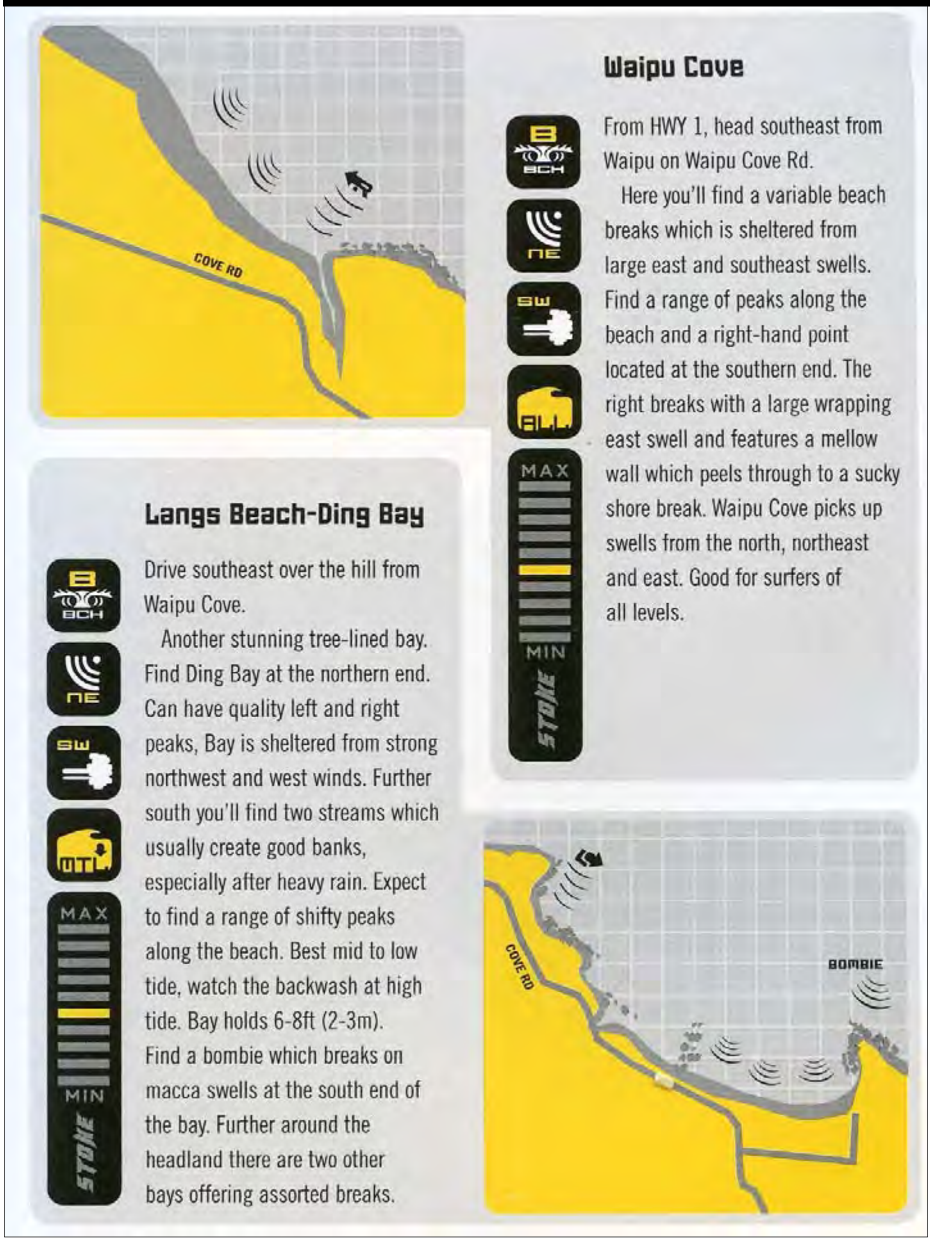
Area features a beach break with left and right peaks breaking on various inner and outer bars. Find longer waves and walls after harbour dredging. Beach picks up east and southeast sneaker swells. Also find a river bar break at the mouth of the Ruakaka River. Expect shifty banks with shape of bars changing constantly. Fun waves - good for surfers of all levels.

Waipu River

From HWY 1 take the turnoff to Waipu Cove. Take a left when you reach the river.

Check surf from across the river NB: if it looks 1-2ft, it will be 2ft bigger. Mouth of the river features a right-hand bar break depending on sand bank location. Banks are shifty and constantly changing. Be ready for a sucky takeoff and short hollow wall. Optimum wave size 3-5ft (1-2m). Break is offshore northwest, west and a light southwest. Competent surfers only.

Figure 35: Surf break details (Morse & Brunskill 2004)



Waipu Cove

From HWY 1, head southeast from Waipu on Waipu Cove Rd.

Here you'll find a variable beach breaks which is sheltered from large east and southeast swells. Find a range of peaks along the beach and a right-hand point located at the southern end. The right breaks with a large wrapping east swell and features a mellow wall which peels through to a sucky shore break. Waipu Cove picks up swells from the north, northeast and east. Good for surfers of all levels.

Langs Beach-Ding Bay

Drive southeast over the hill from Waipu Cove.

Another stunning tree-lined bay. Find Ding Bay at the northern end. Can have quality left and right peaks, Bay is sheltered from strong northwest and west winds. Further south you'll find two streams which usually create good banks, especially after heavy rain. Expect to find a range of shifty peaks along the beach. Best mid to low tide, watch the backwash at high tide. Bay holds 6-8ft (2-3m). Find a bombie which breaks on macca swells at the south end of the bay. Further around the headland there are two other bays offering assorted breaks.

Figure 36: Regionally significant surf breaks – Draft Regional Plan for Northland

4.7 Tourism and commercial marine recreation

The Ministry of Business, Innovation and Employment has upgraded is methodology for its Domestic Visitor Survey and International Visitor Surveys and specific activity participation data for the two markets are no longer provided at the regional level.

At the national level, water-based activities are some of the most popular. Unfortunately, the relevant data are not subdivided by marine and freshwater settings. This means that while 4% of domestic tourism trips included swimming in 2012 (that is, 1.68 million domestic 'trips' included swimming as an activity), this includes swimming in pools, rivers, lakes and the sea. Fishing, with 3% participation for domestic tourists (1.41 million 'trips') similarly includes trout and salmon as well as purely marine species. Boating (marine and fresh) was carried out on 517,000 trips (1.1% of all trips) and dolphin watching was enjoyed on 41,104 'trips' (0.09%). Dining (31%), visiting friends and relatives (21%) and shopping (21%) are the prime domestic tourism activities.

International tourists undertake more activities than domestics, with, for example, 92% of visitors dining and 80% shopping in 2013. Boating (marine and fresh) was undertaken by 23%, swimming by 12%, bird watching by 7%, and fishing and dolphin watching by 5%.

In Whangarei, several providers of tourism and commercial recreation activities can be located online, including:

- A-Oakura Fish Dive & Cruise
- Bream Bay Charters on CARA*J
- Cronin Fishing Charters
- Marsden Cove Fishing Charters Ltd
- El Pescador Charters
- Lady Jess Charters
- Oceandivesity Sea Adventures
- Whangarei Harbour Cruises

No references to cruise ship activity in Whangarei has been located, although there are online references indicating a desire to see them visiting the Harbour in the future:

> **Northern Advocate Oct 6 2012**[21]
>
> *Mr Jongejans* [chairman of Northland Tourism Development Group] *said Whangarei needed to get in on the "fantastic" cruise-ship industry: "Something like 40 per cent of cruise-ship passengers will come back on another, longer visit, to spend more time here."*
>
> *Though there was nowhere for the ships to berth in Whangarei at the moment, in future they could be put on a new berth at Marsden Pt and passengers taken around the district by bus or smaller boat.*
>
> **Northern Advocate Sept 22 2014**[22]
>
> *Dr Reti* [MP for Whangarei] *said he also wanted to get a slice of the cruise ship repair industry for Whangarei.*
>
> *"We've got $24 million worth (of cruise ship repairs) that are just sailing past to New Plymouth or elsewhere and while I don't want to take work from other parts of the country, I want to grow that industry so that we get a slice of the pie in Whangarei. We built the navy frigates here and have an extensive history of ship building in Whangarei and we can do it." he said….*
>
> *He would eventually like to see cruise ships stop at Marsden Pt, but first Whangarei needed a major attraction to take cruise ship passengers to.*
>
> *"We need a major attraction first, but what that is up to the council and public to decide. I don't care if it's something like the Hundertwasser Centre or the (proposed Hihiaua) Maori Cultural Centre, but once it is decided on I will help get Government support for the council's plans."*

[21] http://www.nzherald.co.nz/northern-advocate/news/article.cfm?c_id=1503450&objectid=11077392
[22] http://www.nzherald.co.nz/northern-advocate/news/article.cfm?c_id=1503450&objectid=11329210

4.8 Hunting

Wildfowl hunting is identified in Northland Harbour Board (1989) at Skull Creek, Mangapai River and Otaika Creek (p119). Manning (2001) notes (p216):

> *About 5770 hectares (80%) of the* [Whangarei] *harbour area is designated as Wildlife Refuge, which prohibits hunting and deliberate disturbance to wildlife, but does not restrict public access.*

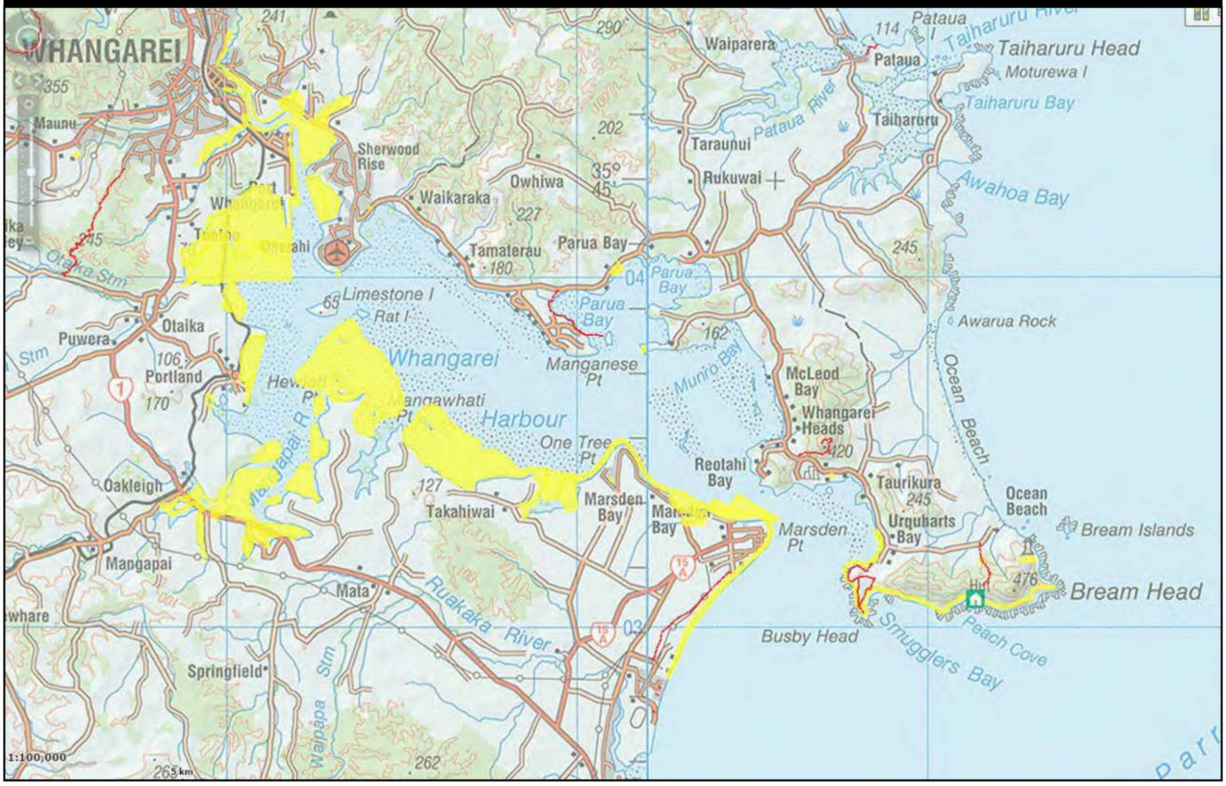
A definition of the refuge boundaries is not available online. Pierce (2005) describes the whole harbour as a wildlife refuge (p1). Refuges are also located at Ruakaka and Waipu.[23] There are no references to hunting on the Whangarei Harbour on the NZ Fish and Game Council website.

4.9 Terrestrial recreation and access

The Walking Access Commission's online Walking Access Mapping System (WAMS) describes the public access opportunities in the study area (Figure 38, next page).[24] These recreation opportunities are largely the same as those reviewed in section 3 of this report (with lands administered by DOC and WDC).

The WAMS system identifies extensive areas of 'Crown Land' in Whangarei Harbour and around Marsden Point and Bream Head (Figure 37). The status of these areas for public access will depend upon which government department manages them (if that is the case), for what purpose, and whether there is any lease or licence to occupy in place.

Figure 37: Crown Land (yellow) around Whangarei Harbour. Source: WAMS



[23] See here for a discussion about conflicts with kite surfers: http://www.doc.govt.nz/about-doc/news/media-releases/2009/kite-boarding-activity-in-ruakaka-wildlife-refuge/
[24] http://wams.org.nz/

Figure 38: Public access around Whangarei Harbour and Bream Bay excluding legal roads. Source: WAMS

5 Assessment of effects

This section results in the identification of likely adverse effects on recreation potentially caused by the Project, and a review of possible mitigations. This is based on:

- An identification of all potential adverse effects on recreation amenity (identified via parallel technical assessments and the consultation process),
- A review of the technical reports which assess those effects, and the identification of the scale and relevance of each effect,
- A summary of the effects which have the potential to change recreation amenity,
- A discussion of the scale of those effects and their potential for mitigation.

5.1 Potential adverse effects

The following potential effects of the proposal are of interest to recreation. Effects are considered for: dredging and spoil disposal periods (‘construction and maintenance’); and for the ongoing effects resulting from the modified marine settings (‘operation’). These potential effects and the relevant recreation activities are summarised in Table 1.

Construction and maintenance

- Turbidity effects on recreation settings (particularly swimming and diving areas) and visual amenity at and near the Harbour entrance,
- Mobilisation of contaminants and potential effects on shellfish and other seafood, and for water-contact recreation,
- Effects on marine ecology and the quality, abundance and catchability of marine species, in and around the entrance and at and near the spoil dumping site offshore during the dredging period/s,
- Occupation of marine settings by dredges working or in transit and the creation of hazards for, especially, boaters.

Operation

- Changes to tides, currents and wave patterns resulting from altered bathymetry,
- Changes to beach and foreshore profiles resulting from changes to wave patterns, including remobilisation of dumped material,
- Effects on wave energy as a result of the passage of larger vessels,

Effects associated with the location and operation of aids to navigation, such as navigation buoys and markers (*Navaids*).These potential effects are considered individually in the following sections.

The following potential issues are not reviewed further:

- The presence of birds, which are likely to support marine recreation or increase its value. Relevant effects of the Project is considered in the Bioresearches (2016) report on coastal birds, which finds the potential for adverse effects to be low.
- Navigation risk, which is of interest to recreational boaters. Risk for large ships reviewed by Navigatus (2016). There are no apparent issues associated with deepening and realigning the channel, and relocating or adding navigation beacons, which would affect any recreational skipper sufficiently skilled to navigate the Harbour as it is currently.

- Noise effects on people, which are assessed by Styles Group (2016). Their report considers effects on residents who remain exposed to noise for long periods, and makes recommendations to ensure compliance with relevant noise standards. Recreational visitors may venture closer to dredge activities than residents, but are mobile and temporary visitors. Compliance with required noise standards for residential areas is considered appropriate, otherwise exclusion zones could be required to prevent, for example, a recreational vessel passing within a potentially noisy environment. In any case, Styles Group (2016, p15) finds that "compliance with the relevant noise limits for permitted activities will be achieved generally by a large margin".
- Commercial fishing, which is reviewed by Boyd (2017).

Table 1: Activity by potential effect considered

	Turbidity	Waves	Tides	Beaches	Marine ecology	Contami nants	Dredge activity	Navaids
Swimming	♦	♦	♦	♦		♦		
Beach use				♦				
Fishing	♦	♦	♦		♦	♦		
Shell fish	♦	♦	♦		♦	♦		
Diving	♦	♦	♦		♦	♦		
Boating*		♦	♦	♦			♦	♦
Surfing	♦	♦	♦					

* includes small and large craft, yachts, launches, SUP, kite surfing

5.2 Technical review findings

5.2.1 Turbidity

Dredging activity will disturb the sea floor and release sediment as dredge material is removed and disposed of in spoil grounds. Released sediment may reduce water clarity and decrease amenity for contact recreation.

The NRC Regional Coastal Plan defines water clarity standards for contact recreation based on the ANZECC (2000) water quality guidelines for visual clarity and colour (RCP Appendix 4). The ANZECC guidelines as used by the RCP for contact recreation are:

> *To protect the aesthetic quality of a waterbody:*
>
> *• the natural visual clarity should not be reduced by more than 20%;*
>
> *• the natural hue of the water should not be changed by more than 10 points on the Munsell Scale.*

Contact recreation is not anticipated in the dredge disposal areas, and effects of interest relate to increased turbidity in the swimming and diving areas within the Harbour and near the entrance.

Turbidity effects are considered in Coffey (2017). Of note are the following findings:

- Water clarity, as measured by Secchi depth visibility, is generally very good east of Tamaterau (more than 2 metres) but declines further up-harbour. Bream Bay water is generally very clear (pp18, 20).
- Hard-bottom reef communities of high intrinsic, conservation and recreational value are located near the dredge channel (these include the key dive sites near the entrance).

> Real-time monitoring of turbidity is proposed to avoid effects on these habitats. The objective is to ensure adverse effects do not occur (p50).

Coffey (2017 p43) notes:

> *…. video footage of a smaller, distinct, dredging operation undertaken by Refining NZ in December 2016 - February 2017 to undertake urgent emergency works around its berthing 'dolphins' did not reveal any oil or grease films, scums or foams, and no floatable materials. Moreover, video of the plume generated by the dredge indicated the plume was not associated with a conspicuous change in the colour or visual clarity after reasonable mixing*

Plume modelling carried out by MetOcean (2017, p102) indicates that while dredging plumes within the channel could extend for up to 1200 m from the dredge site, the plume is confined to the harbour channel. There was no indication of plume dispersion to adjacent beaches, sand banks, Marine 1 (Protection) Management Areas or Marine Reserves.

Summary for turbidity

The dispersal of sediment from the dredging activity is likely to be strongly confined to the dredge channel and has a low chance of dispersal to any contact recreation setting. However, real-time monitoring is planned to ensure there are no effects on important marine ecosystems near the dredge channel. There is therefore likely to be very little if any adverse effect on recreational dive and swimming sites, including on the marine life that attracts most divers. While ANZECC guidelines for contact recreation might be exceeded near the dredge sites, they are very unlikely to be breached (or approached) in contact recreation settings. Turbidity in and near the spoil disposal grounds will not present effects on recreation amenity (beyond those considered for fishing).

5.2.2 Waves

Changes in bathymetry have the potential to alter the direction and size of waves entering the harbour. Changes to wave energy may then have consequent effects on beach profiles and inshore marine ecology. These effects may change the existing level of amenity for swimming, surfing, fishing, shellfish gathering, boating and diving.

Consultation identified a query as to whether larger ships entering the Harbour could result in larger wakes affecting beach users and boats. However, wake size is dependent on ship speed more than size or draught. As all large vessels are at reduced speeds within the harbour limits, there is no change to wake size as they get larger or have a deeper draught (R. Reinen-Hamil, Tonkin + Taylor, pers comm).

MetOcean (2017) reviews modelled effects of changes in bathymetry on tides and waves and sediment transport processes; and Tonkin + Taylor (2017) use these and other data to identify effects on coastal processes.

MetOcean (2017, p33) indicate no potential change in mean wave heights, as result of channel deepening, at Ruakaka Beach river mouth, Ruakaka Beach, Mair Bank - middle area and Mair Bank - eastern edge. The Ruakaka Beach – northern area is modelled to have a mean reduction of 1cm from an existing mean wave height of 45cm, and the Marsden - Mair Bank beach area to have an increase of 1cm from an existing mean wave height of 11cm. Slight increases are also modelled for Busby Head (+2cm from a mean of 42cm) and the western side of Smugglers Bay (+3cm from a mean of 26cm). Effects are confined to swell waves and not locally generated wind waves.

Tonkin + Taylor (2017) state in their summary:

> *The predicted change in wave height resulting from the dredged channel in average and moderate wave climate conditions are negligible (less than ± 0.02 m). This variation is an order of magnitude less than the annual variability in mean wave heights over the 35 year hindcast of 0.31 m (i.e. from 0.68 m to 0.99 m). Change to average wave heights resulting from placement of sand in the disposal areas are negligible.*
>
> *For extreme storm events there is some channel refraction effect which may result in slightly higher waves breaking on the edge of Mair Bank and towards Busby Head (between 0.1 m and 0.3 m increase with waves around 5m high). Again, comparing the inter-annual variability on wave heights, the relative change is an order of magnitude less than the annual variability of 1.36 m for the 99% wave height currently experienced. Change to storm wave heights resulting from placement of sand in the disposal areas are negligible.*

Summary for waves

Preferred wave heights for surfing range between 1 and 3 m (see section 4.6). Changes which might be noted by surfers only accrue during storm events with wave heights around 5 m and only at the northern end of the Marsden Point surf break at Mair Bank. This is very unlikely to affect surfing amenity.

Increases in wave energy could have adverse effects on diving and swimming, but effects (as small as they are modelled to be) only occur when there is little natural amenity for recreation due to natural wave action (that is, there needs to be waves in action for there to be an effect on them, and the smaller the wave, the less effect).

More heavily laden vessels will not increase ship wakes.

5.2.3 Tides

Changes in bathymetry have the potential to alter tide direction and strength. These may affect the existing level of amenity for swimming, surfing, fishing, shellfish gathering, boating and diving.

The Tonkin + Taylor (2017) report on coastal processes is relevant. This states in its summary:

> *There is generally a very small reduction in tidal velocities as a result of the channel modifications (generally less than 0.02 m/s) except along the channel between Marsden Bank and Mair Bank, within the channel between Mair Bank and Home Point and between Home Point and Busby Head. In these areas the changes are in the order of 0.1 m/s.*

Summary for tides

An acceleration in tidal strength could pose a hazard for boaters in the harbour channel. However, by deepening the channel, tidal speed generally decreases, albeit by a very small amount. There are therefore no adverse effects resulting from changes in tidal speed. The Tonkin + Taylor report also notes the potential for a minor change in timing of high and low tides, which will not affect recreation participation (timing of tides change every day).

5.2.4 Beaches

Changes to wave energy within the harbour have the potential to alter beach profiles. Gains or reductions in the height of beaches may change the availability of sand for general beach recreation and the usability of boat launching ramps.

The Tonkin + Taylor (2017) report on coastal processes is relevant. This states in its summary that no changes are anticipated to existing coastal processes on the open coast from Marsden Point to Ruakaka River or along the rocky coast from Home Point to Smugglers Bay, on the ebb tide shoal and Mair Bank or within the inner harbour area. However, there is the potential for the proposed maintenance dredging to add to the existing trend of a loss of sand at Mair Bank and the coastline extending southward from Marsden Point. It is therefore proposed to deposit a portion of the suitable dredged material within the ebb tide shoal area to enhance the supply of sand to both the shoal and the adjacent shoreline; and to monitor change in these settings over time. The conclusion is that, with this mitigation in place, any effects of dredging on shoreline processes are 'less than minor'.

Summary for beaches

The potential for changes to beach profiles – albeit slight and within a naturally dynamic setting – is confined to at and near Mair Bank and as a result of long-term maintenance dredging activity. The local recreation values are predominantly shellfish gathering. Mitigation options are proposed, via augmenting the local sand supply via depositing some suitable dredge material in the ebb tide shoal area, with an associated monitoring programme. Any changes of relevance to recreation are therefore effectively managed.

5.2.5 Marine ecology

Sedimentation, spoil deposition and changes to the sea floor at the dredging site have the potential to modify marine habitat and the availability of sea food for harvesting.

Coffey (2017, p47 ff.) reviews potential effects of the activities on fish and shellfish species and their habitats and notes:

- Local finfish are expected to avoid areas where feeding grounds have been disturbed but will return once they have recovered.
- The proposed dredging and disposal activities are likely to result in in an initial reduction of the population of species such as snapper, kahawai, shark and kingfish using the disturbed sites, but a progressive recovery would be expected to be complete with 6 to 12 months of capital dredging in the dredged channel and inshore/ebb tide shoal disposal area, and within 12 to 24 months in the offshore disposal area, although at the latter an 'ecologically constructive benthic community' (one able to provide feeding grounds for fish) is expected to re-establish within 12 months (meaning all affected areas will be supporting recreational fish species within 6 to 12 months).
- The effects of maintenance dredging are likely to be more confined than capital dredging, with smaller areas disturbed and more rapid recolonisation.
- Maintenance dredging may need to occur every 2 to 5 years in the berth pocket area and in targeted areas of the inner and mid channel to maintain navigable draft around the jetty dolphins. The outer channel may requiring maintenance work after between 5 and 10 years.

Coffey (2017, p51) recommends monitoring and control methods to avoid effects on sensitive hard bottom ecological communities adjacent to the dredging footprint.

There is likely to be some temporary increase in local finfish activity as the dredging activity exposes food sources, but this is not considered to be a mitigating effect.

Summary for marine ecology

Coffey (2017, p50) indicates that the scale of effect on benthic biomass (food sources for recreationally taken fish) are expected to be 'minor to moderate', short-term, and to progressively ameliorate within 6 to 12 months. This is likely to similarly result in some local displacement of fishing activity from the dredge and disposal footprints during the recovery period. The dredge channel is within a popular fishing area – although anchoring and fishing within the channel itself is not wise boating behaviour – as is part of the disposal footprint.

Although 80% of dredge activity will occur beyond Home Point, both the inner and outer dredge sites are within popular fishing areas.

The total regional level of participation in recreational fishing is unlikely to be affected due to the popularity of the activity and the high number of alternative fishing areas, but local displacement may increase fishing pressure in those alternative sites, particularly areas sheltered by Busby Head and within the Harbour, and accessible sites around Bream Head. No data have been encountered to indicate that these areas suffer recreation conflict or over-crowding, although most anglers prefer less fishing competition than more.

Due to the scale of the local fishing resource, the mobility of finfish, the lack of effect on biota beyond the activity footprints, the progressive recovery of the benthos, and the temporary nature of the effect, the net outcome for recreational fishing from capital dredging is likely to be adverse but also minor. Maintenance dredging will have a lower scale of effect during each event, but due to its frequency (2 to 5 yearly) its net effect will also be adverse but minor.

There is likely to be some temporary increase in local finfish activity as the dredging activity exposes food sources, but this is not considered to be a mitigating effect.

5.2.6 Contaminants

Mobilising these has the potential to affect contact recreation activities in the Harbour.

The RCP also requires for contact recreation:

> *No conspicuous oil or grease film, scums or foams, floatable or suspended materials, or emissions of objectionable odour.*

Coffey (2017, p50) states that the material to be dredged is not contaminated with any toxins and also has very low levels of organic matter (which, if present, could lead to a drop in dissolved oxygen levels due to spikes in algal growth). This means there are no water quality issues associated with the activity.

5.2.7 Dredge activity

The presence of a dredge operating within the Harbour channel has the potential to compete for marine space with recreational craft and to present a hazard. The capital dredging programme is likely to last up to six months, with maintenance dredging involving smaller vessels and much shorter timeframes. Eighty-percent of dredge activity will be in the outer channel beyond Home Point, where there is ample navigation space.

The dredge will be operating within a defined Commercial Vessel Route within the Harbour as defined by the Northland Regional Council (Figure 39)[25]. The use of these routes by large vessels – particularly east of Portland and leading from the harbour limits to Northport and Marsden Wharf – are well-established activities.

The NRC Navigation Safety Bylaw 2012 requires:

> *2.12.1 The master of every vessel shall, when navigating within harbour limits, ensure that:*
>
> *(a) automatic steering 'pilot' devices, if fitted, are not used, unless a helmsman is standing by in the immediate vicinity of the helm station or wheel. Otherwise, vessels are to be in hand-steering mode; and*

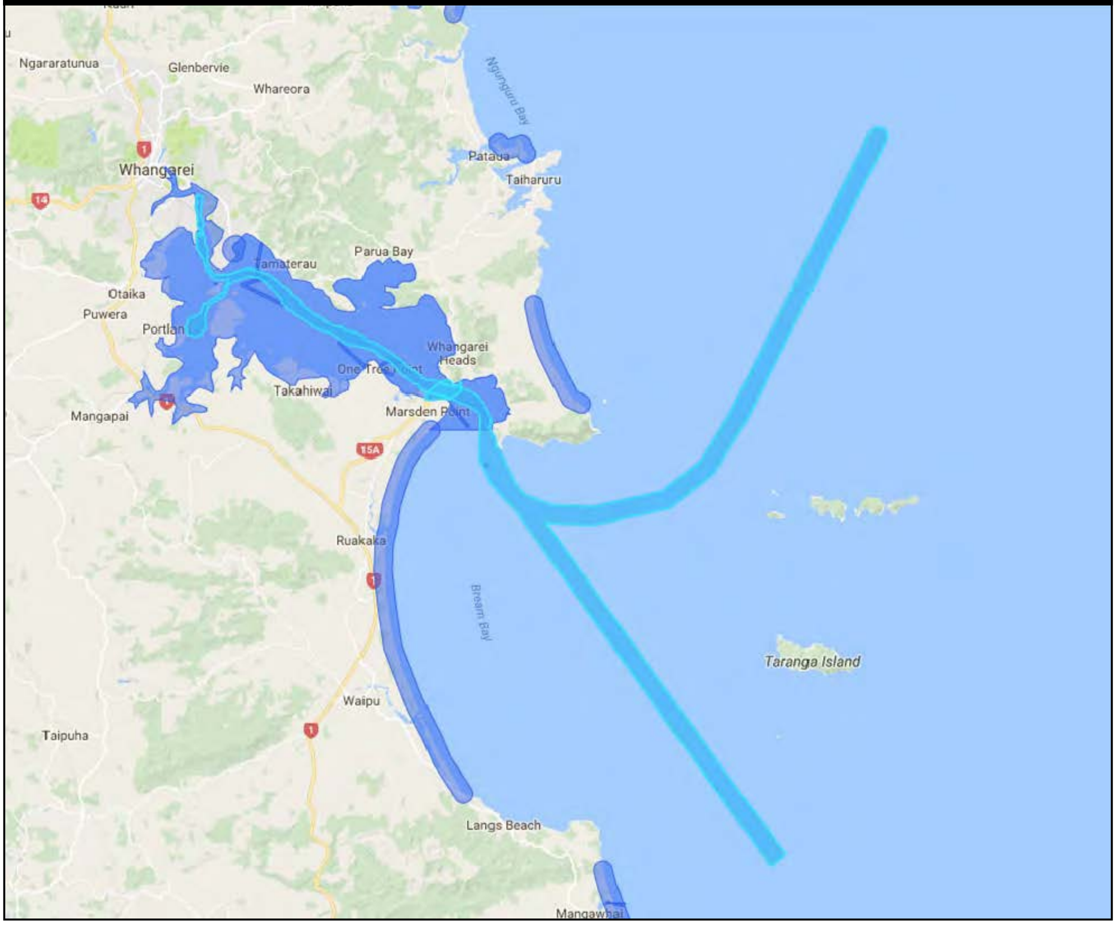
[25] https://koordinates.com/layer/3226-northland-coastal-information-polygons-coastal-use-and-value/data/14/

(b) the vessel's main engine(s) is immediately available for reducing speed, stopping or going astern at all times and without delay; and

(c) the vessel's anchors are immediately available for use in an emergency and capable of being used without power….

2.12.3 The master of every vessel under 500 gross tonnage or under 24 metres in length must not impede the navigation of any vessel of 500 gross tonnage or more when operating within harbour limits.

Figure 39: Commercial Vessel Route, Whangarei Harbour – cyan. NRC data



Rule 2.12.3 would apply to most small commercial dredge vessels operating in New Zealand. The Pelican and Kawatiri, for example, have gross tonnages of approximately 1000 tonnes.[26]

Required maritime practice means the dredge will be appropriately lit at night and will obey all marine navigation rules.

Summary for dredge activity

Any recreation skipper operating in or near the harbour entrance would expect to encounter large ships and to comply with harbour navigation rules. While the presence of a dredge is an additional navigational issue, it should not limit recreation participation by large and small recreational vessels. However, it is recommended that RNZ place on its website information about dredge activities (location and duration of activity), and promote the location of the data to boating clubs and via local print media. This will be of interest to boaties generally, and may assist cautious skippers. Advice should also be given to the regional harbourmaster who can then make judgements about the importance of additional maritime notifications –

[26] Marinetraffic.com data

including whether it warrants a Notice to Mariners (via LINZ). The net effect on recreation participation is likely to be minor or less and the presence of dredges is unlikely to limit recreation participation compared with now.

5.3 Navaids

The reformatting of the location and type of navigation aids is described by Royal Haskoning DHV (2017) and are shown in Appendix 1 to this report,

The existing channel demarcation is provided by a safe water mark (often referred to as the fairway buoy) and nine starboard buoys and nine port buoys. Eight of the existing buoys will need to be relocated to accommodate the reconfigured channel alignment. Two additional channel marker buoys (one starboard and one port) will be installed at -17.7m depth, and the existing fairway buoy will be moved to be aligned with the starboard channel markers at -25.0m depth. An improved Port Entry Light, a modified rear lead light marking the offshore approach channel, and a set of lead lights in Taurikura Bay to assist with night time navigation will also be installed.

The developments are required to mark the new channel alignment and to reduce the risk of marine accidents.

The ecological effects of their installation and operation is reviewed in Coffey (2017), who finds no issues of relevance. The navaids are located on channel edges where tidal currents tend to be strong and not within recreational diving, snorkelling or swimming areas.

The relocation of navaids will require a Notice to Mariners (via LINZ) and updates to LINZ marine charts. Such activities are common practice nationally, although many recreational boaters will be unaware of them, and when navigating familiar territory will rarely refer to charts. However, the beacons will be very obvious on the water, day and night, and there will be no introduction of new submerged marine hazards – meaning reliance on local knowledge rather than charts will remain relevant.

Recreational fishers occasionally tie to navigation aids, but this is not an option considering Maritime Rules (Maritime NZ, 2016):

> *91.14 Damage to navigation aids*
>
> *(1) No person may tie a vessel to any aid to navigation without the written permission of—*
>
> > *(a) if the aid to navigation is operated by a local authority or port company, the harbourmaster; or*
> >
> > *(b) if the aid to navigation is operated by the Maritime Safety Authority, the Director.*
>
> *(2) No person may damage, remove, deface or otherwise interfere with an aid to navigation*

Summary for navaids

Navaids are required structures for safe navigation. They are used by both recreational and commercial craft and need to be in the right locations. The recommendations for their placement as part of the Project are made by Royal Haskoning DHV (2017) for the purposes of navigation safety. This is a necessary response to the Project. Local boaters will rapidly adjust to very obvious changes in beacon location, which should be considered a pre-requisite skill for operating watercraft in a navigation channel. The proposed navaid developments are not considered to be adverse effects on recreation, and any safety improvement in navigation is likely to have a positive effect.

5.4 Cumulative effects

Cumulative effects include those which may exacerbate effects of already consented activities in the same environment which may not have been undertaken, or increasing the scale, intensity or rate of existing environmental changes.

Three currently consented local activities need to be considered, as described in Coffey (2017 pp31-33): Northport Ltd's expansion plans; The Ruakaka Wastewater Treatment Plant Ocean Outfall; and the NIWA Aquaculture Facility seawater supply and discharge.

For recreation, the effects of the proposal are sufficiently slight to make it unlikely for cumulative adverse effects to arise. Indeed, the relocation of sand material on the ebb tide shoal has the potential to reduce the rate of local coastal erosion resulting from climate change. Effects on marina biota are temporary and localised and are therefore very unlikely to add to changes in fish populations, Ongoing recreational and commercial fishing pressure will far outweigh any potential changes to local fish availability. There are no effects on fish breeding grounds or on the habitat of recreational shellfish due to the limited and controlled turbidity and sedimentation. There has been no identified mechanism by which the proposed activity would affect pipi beds on Mair Bank, and the relocation of sand to the ebb tide shoal will support the maintenance of habitat.

There are no locally consented activities identified which have not been implemented which would increase the potential for adverse effects from the proposal.

6 Conclusion

Despite the proximity of the dredging activity to an intensely and extensively used recreation setting, effects of the Project are expected to be confined and slight. This is the result of:

- Dredged material being generally of a coarse and clean nature and confined to the harbour channel when it forms a plume; and therefore little chance for effects on contact recreation and on the marine biota of interest to divers and snorkelers.
- The ability to avoid effects on marine ecosystems outside the dredge and disposal sites; and therefore little chance of adverse effects on diving, snorkelling and fishing beyond those footprints.
- Minimal effects on waves and coastal process (and so no effect on surfing), and the ability to address potential effects from maintenance dredging on sand supply at and around Mair Bank, and to offer an enhancement opportunity.
- The presence of large ships being common in the Harbour channel, and dredges therefore not being an unusual impediment to boating – although ensuring information about dredge activity is available is recommended.

Temporary displacement of fishing activity is likely in the dredge channel and at the spoil site as they recover from disturbance. For recreation, this will be the greatest effect, but due to: the scale of the fishing resource, the number of alternative sites, and the relatively short expected recovery period, the effect is likely to be minor and represented by fishers choosing an alternative fishing site nearby. The use of berley to attract fish is normal practice when boat-fishing, and Brian Coffey (author of Coffey (2017), pers comm) notes that using this method in a disturbed area will remain effective in attracting finfish.

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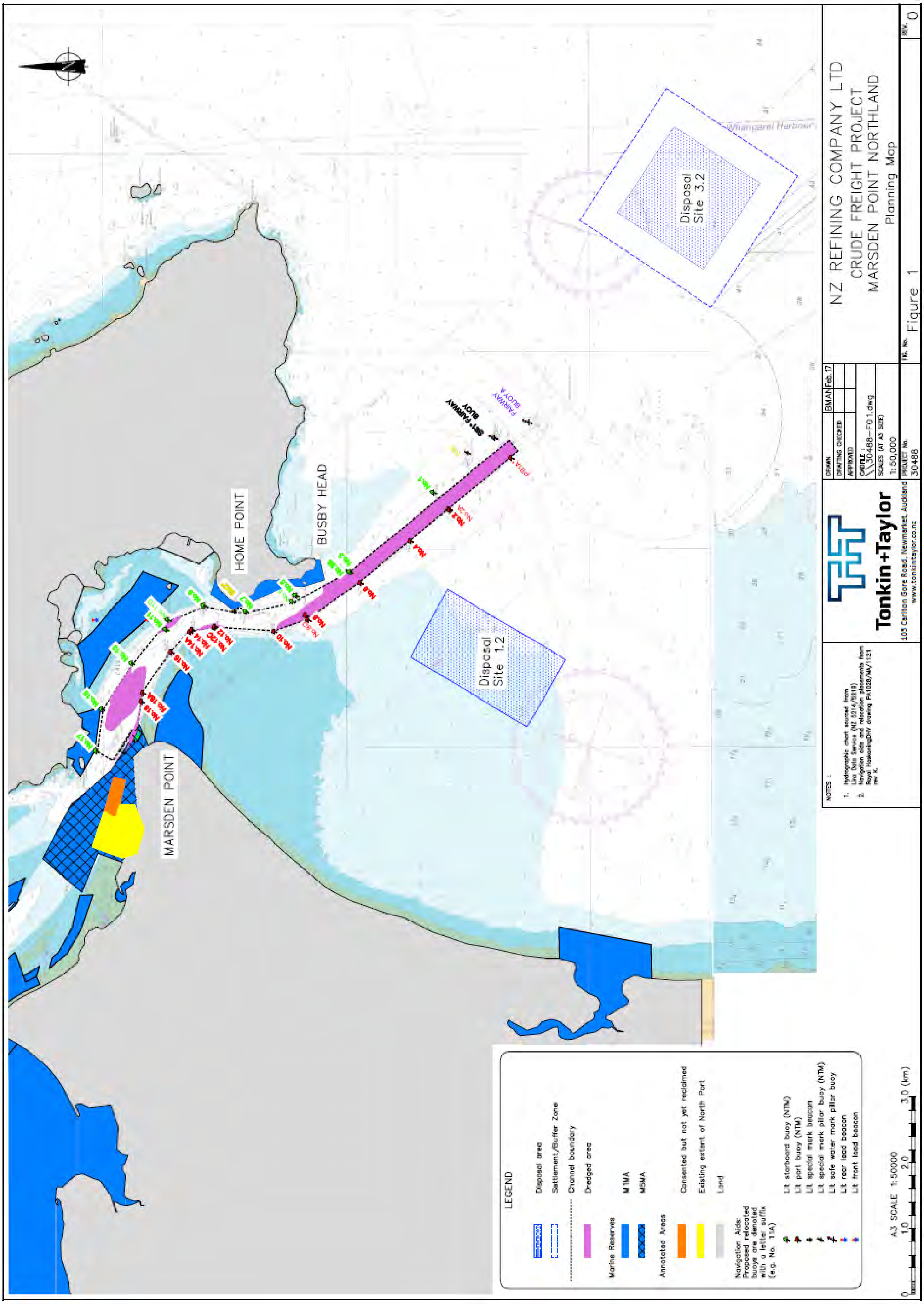
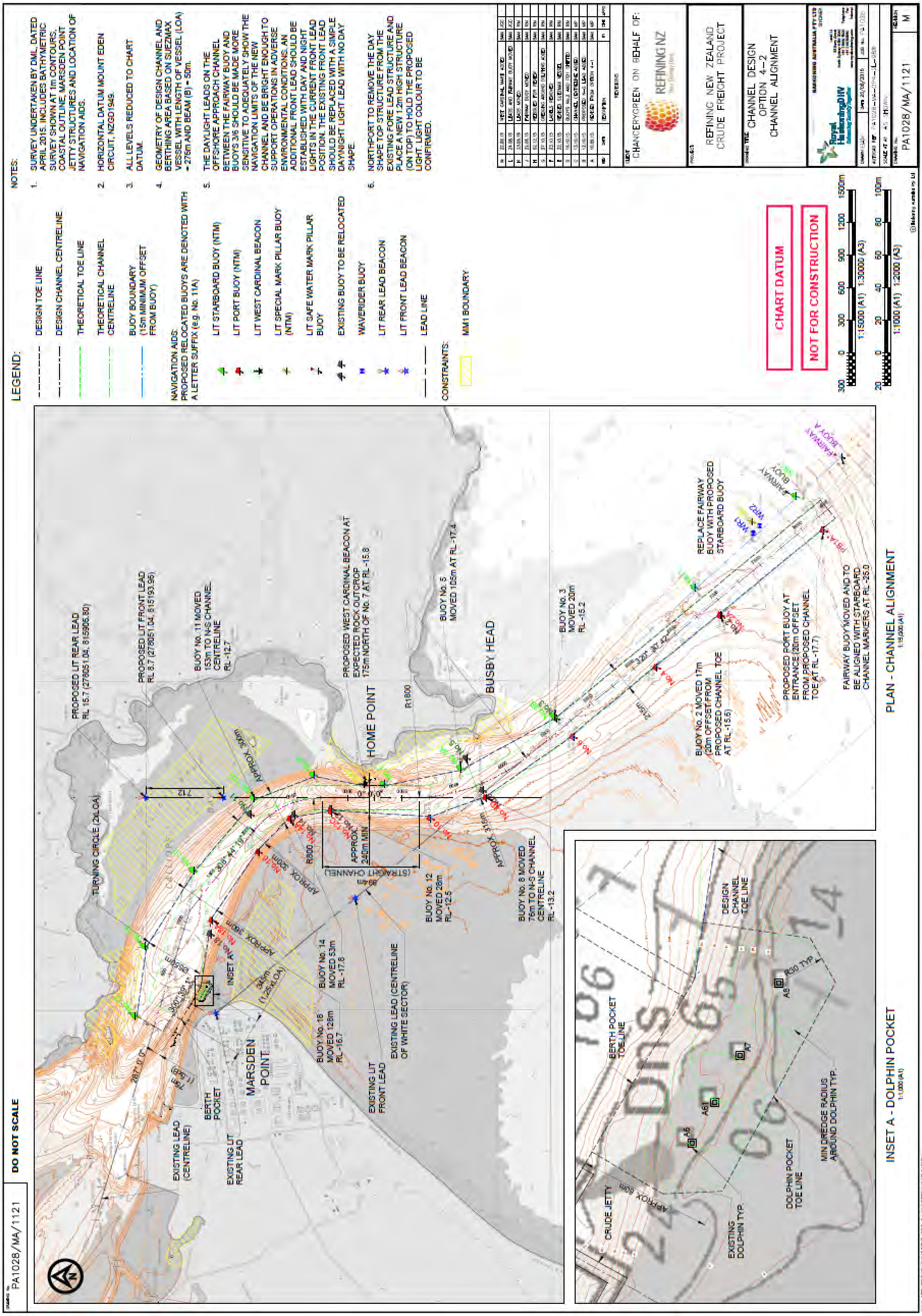
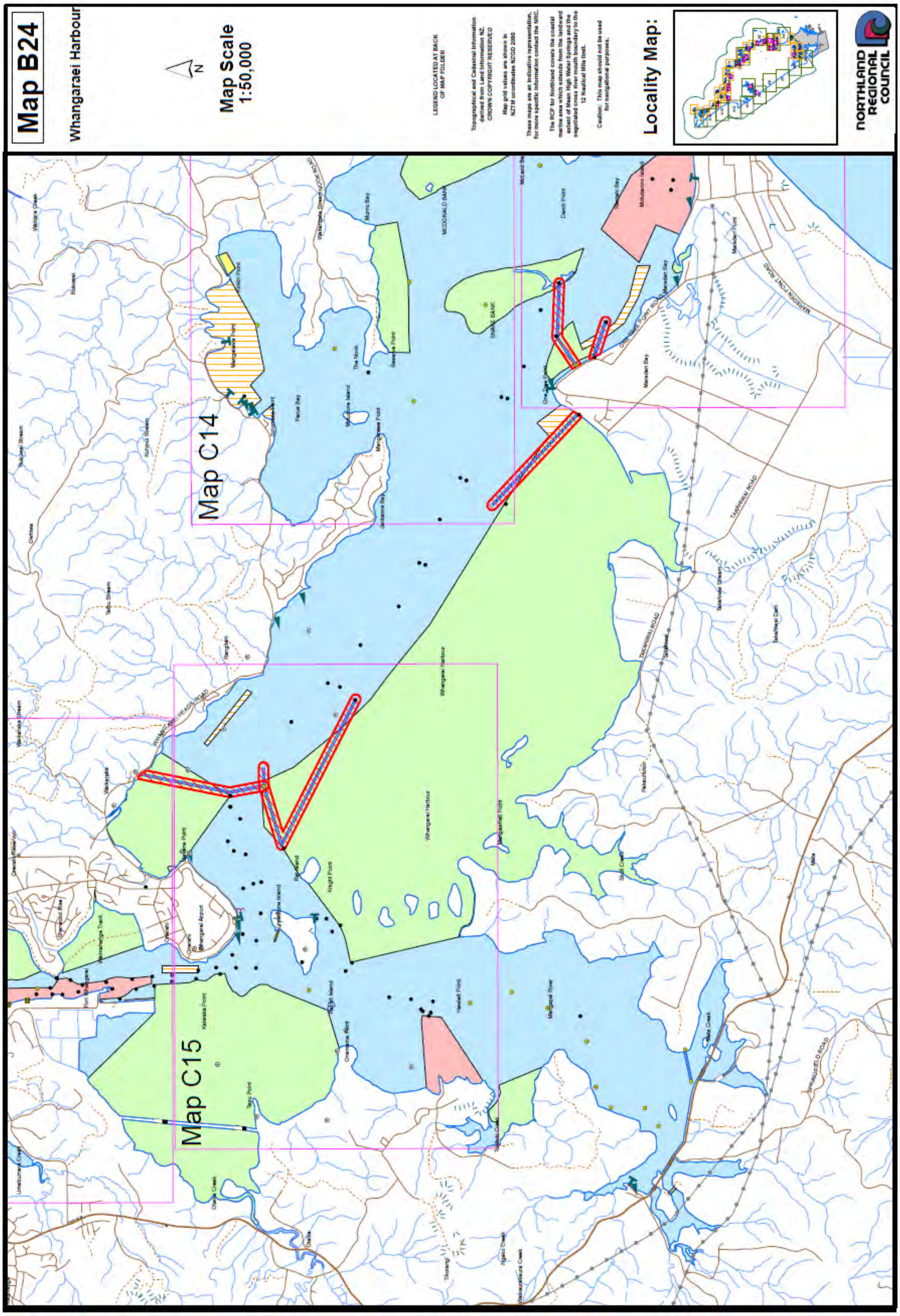
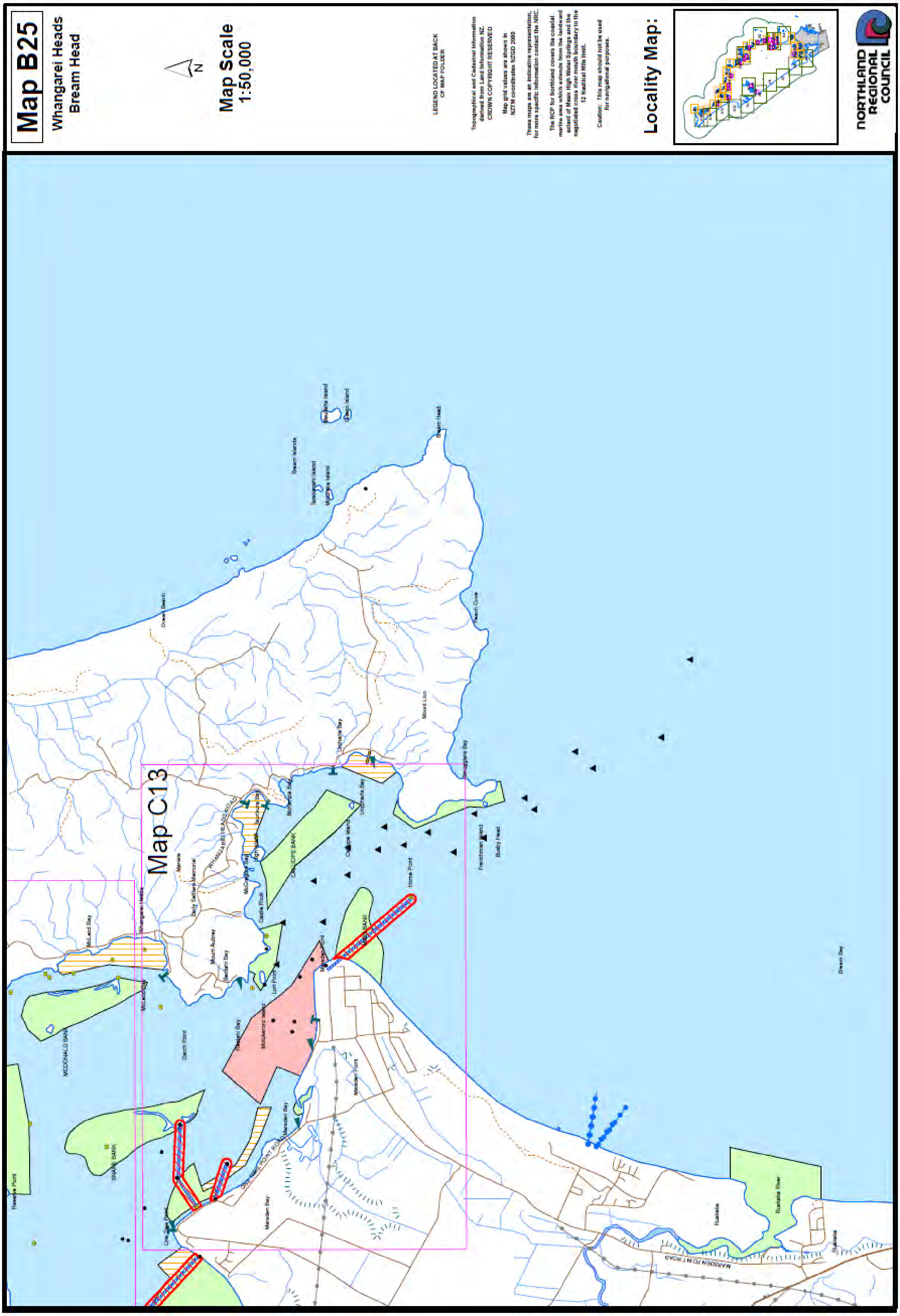
Appendix 1: Project activity maps



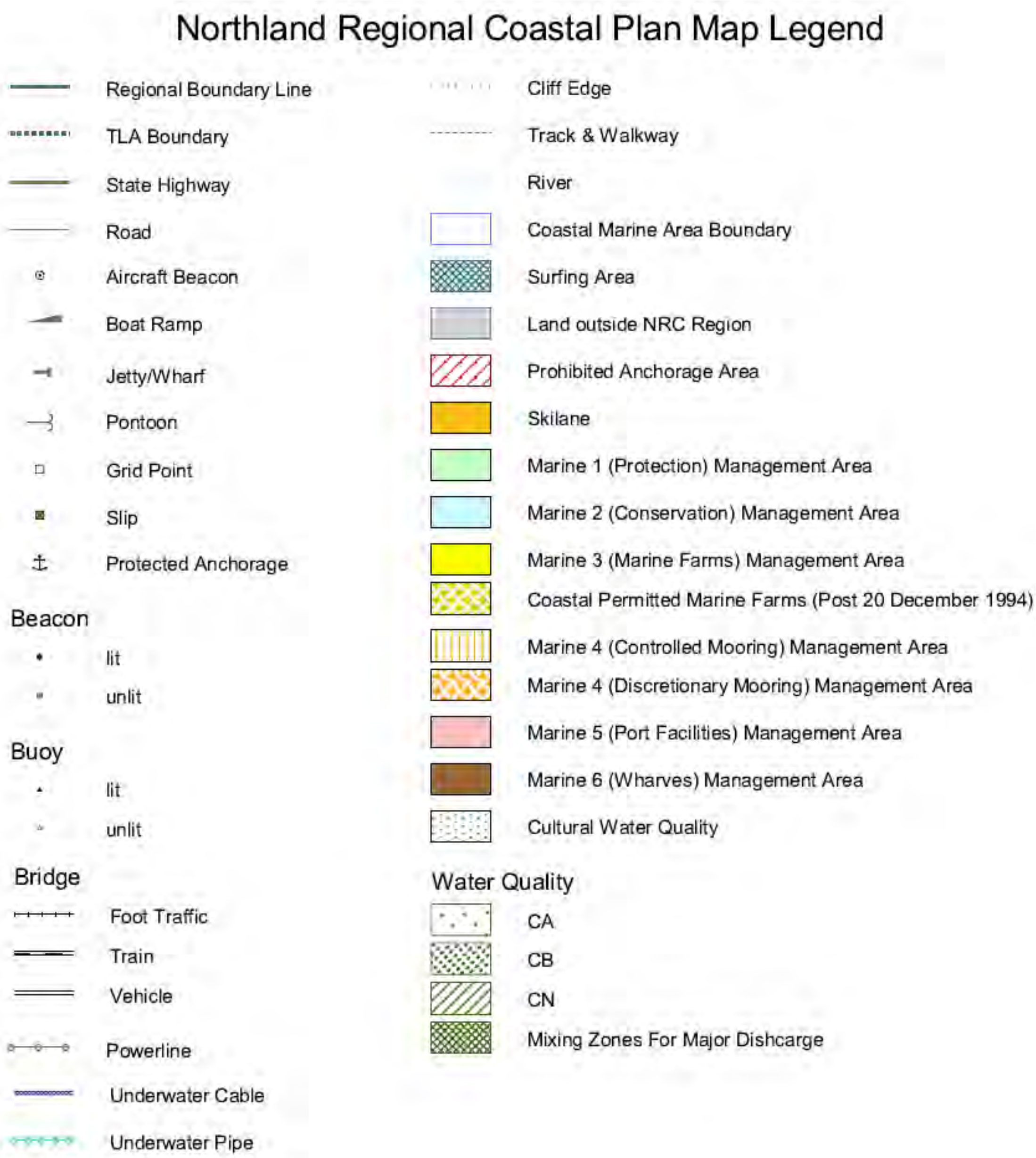

PA1028/MA/1121
DO NOT SCALE
LEGEND:
DESIGN TOE LINE
DESIGN CHANNEL CENTRELINE
THEORETICAL TOE LINE
THEORETICAL CHANNEL CENTRELINE
BUOY BOUNDARY (15m MINIMUM OFFSET FROM BUOY)
NAVIGATION AIDS:
PROPOSED RELOCATED BUOYS ARE DENOTED WITH A LETTER SUFFIX (e.g. No. 11A)
LIT STARBOARD BUOY (NTM)
LIT PORT BUOY (NTM)
LIT WEST CARDINAL BEACON
LIT SPECIAL MARK PILLAR BUOY (NTM)
LIT SAFE WATER MARK PILLAR BUOY
EXISTING BUOY TO BE RELOCATED
WAVERIDER BUOY
LIT REAR LEAD BEACON
LIT FRONT LEAD BEACON
LEAD LINE
CONSTRAINTS:
MM1 BOUNDARY
NOTES:
1. SURVEY UNDERTAKEN BY DML, DATED APRIL 2015. INCLUDES BATHYMETRIC SURVEY SHOWN AT 1m CONTOURS, COASTAL OUTLINE, MARSDEN POINT JETTY STRUCTURES AND LOCATION OF NAVIGATION AIDS.
2. HORIZONTAL DATUM MOUNT EDEN CIRCUIT, NZGD1949.
3. ALL LEVELS REDUCED TO CHART DATUM.
4. GEOMETRY OF DESIGN CHANNEL AND BERTHING AREA BASED ON SUEZMAX VESSEL WITH LENGTH OF VESSEL (LOA) = 276m AND BEAM (B) = 50m.
5. THE DAYLIGHT LEADS ON THE OFFSHORE APPROACH CHANNEL BETWEEN THE FAIRWAY BUOY AND BUOYS 3/6 SHOULD BE MADE MORE SENSITIVE TO ADEQUATELY SHOW THE NAVIGATION LIMITS OF THE NEW CHANNEL AND BE BRIGHT ENOUGH TO SUPPORT OPERATIONS IN ADVERSE ENVIRONMENTAL CONDITIONS. AN ADDITIONAL FRONT LEAD SHOULD BE ESTABLISHED WITH DAY AND NIGHT LIGHTS IN THE CURRENT FRONT LEAD POSITION. THE EXISTING FRONT LEAD SHOULD BE REPLACED WITH A SIMPLE DAY\NIGHT LIGHT LEAD WITH NO DAY SHAPE.
6. NORTHPORT TO REMOVE THE DAY SHAPE TOP STRUCTURE FROM THE EXISTING FORE LEAD STRUCTURE AND PLACE A NEW 1.2m HIGH STRUCTURE (ON TOP) TO HOLD THE PROPOSED LIGHT. LIGHT COLOUR TO BE CONFIRMED.
PROPOSED LIT REAR LEAD RL 15.7 (278051.04, 815905.80)
TURNING CIRCLE (2xLOA)
PROPOSED LIT FRONT LEAD RL 8.7 (278051.04, 815193.96)
BUOY No. 11 MOVED 153m TO N-S CHANNEL CENTRELINE RL -12.7
EXISTING LEAD (CENTRELINE)
BERTH POCKET
EXISTING LIT REAR LEAD
MARSDEN POINT
INSET A
APPROX. 300m
APPROX. 380m
APPROX. 300m
R800
BUOY No. 18 MOVED 128m RL -16.7
BUOY No. 14 MOVED 53m RL -17.6
APPROX. 240m MIN
(STRAIGHT CHANNEL)
PROPOSED WEST CARDINAL BEACON AT EXPECTED ROCK OUTCROP 175m NORTH OF No. 7 AT RL -15.8
HOME POINT
EXISTING LIT FRONT LEAD
EXISTING LEAD (CENTRELINE OF WHITE SECTOR)
R1800
BUOY No. 12 MOVED 28m RL -12.5
BUOY No. 5 MOVED 105m AT RL -17.4
APPROX. 315m
BUSBY HEAD
BUOY No. 8 MOVED 76m TO N-S CHANNEL CENTRELINE RL -13.2
BUOY No. 3 MOVED 20m RL -15.2
BUOY No. 2 MOVED 17m (20m OFFSET FROM PROPOSED CHANNEL TOE AT RL -15.6)
REPLACE FAIRWAY BUOY WITH PROPOSED STARBOARD BUOY
PROPOSED PORT BUOY AT ENTRANCE (20m OFFSET FROM PROPOSED CHANNEL TOE AT RL -17.7)
FAIRWAY BUOY MOVED AND TO BE ALIGNED WITH STARBOARD CHANNEL MARKERS AT RL -25.0
FAIRWAY BUOY
FAIRWAY BUOY A
CRUDE JETTY
APPROX. 80m
BERTH POCKET TOE LINE
EXISTING DOLPHIN TYP.
DESIGN CHANNEL TOE LINE
DOLPHIN POCKET TOE LINE
R30 TYP
MIN DREDGE RADIUS AROUND DOLPHIN TYP.
INSET A - DOLPHIN POCKET
1:1,000 (A1)
PLAN - CHANNEL ALIGNMENT
1:15,000 (A1)
CHART DATUM
NOT FOR CONSTRUCTION
1:15000 (A1) 1:30000 (A3)
1:1000 (A1) 1:2000 (A3)
CHANCERYGREEN ON BEHALF OF:
REFINING NZ
REFINING NEW ZEALAND CRUDE FREIGHT PROJECT
CHANNEL DESIGN OPTION 4-2 CHANNEL ALIGNMENT
Royal HaskoningDHV
PA1028/MA/1121
M

Appendix 2: Northland Regional Council Regional Coastal Plan maps



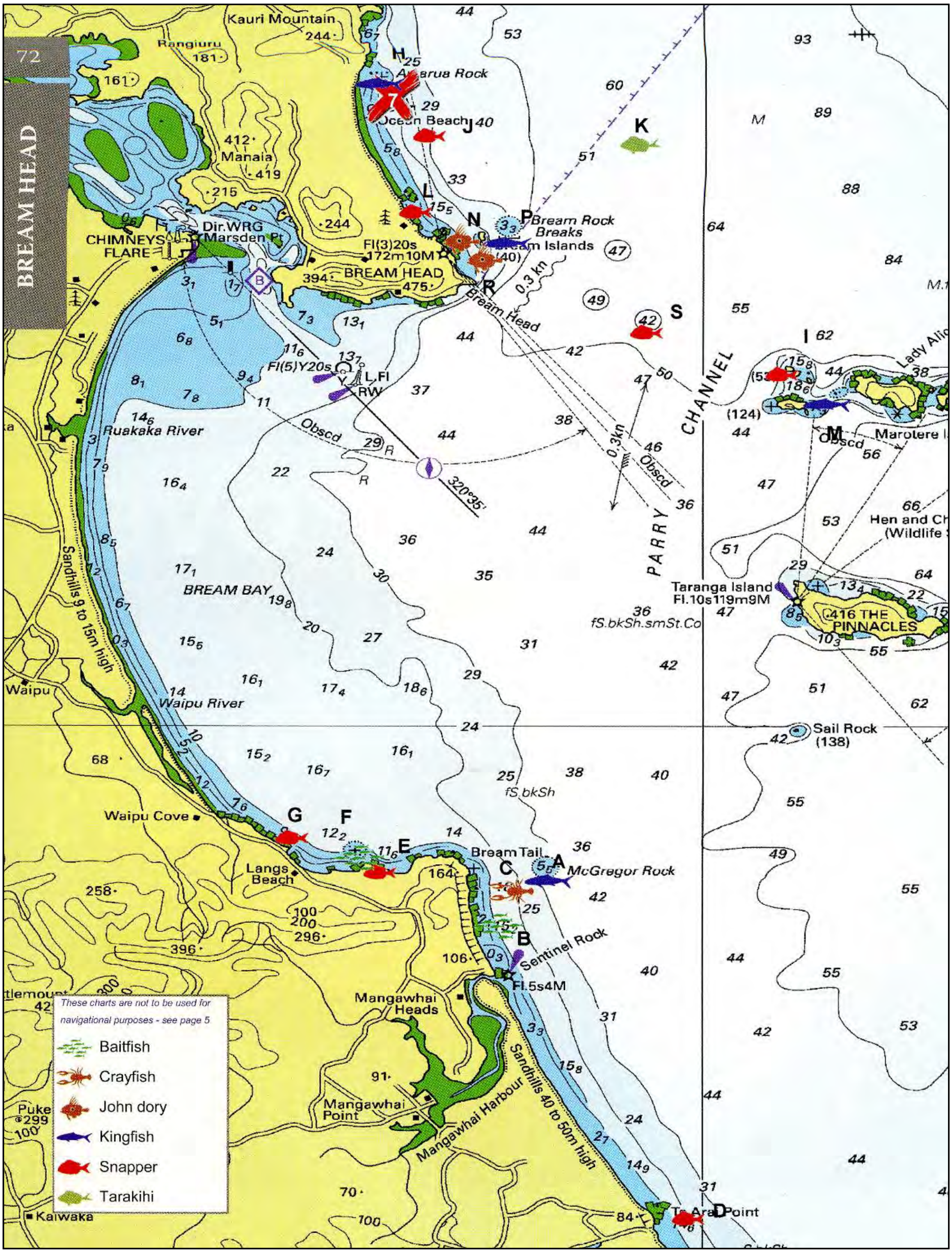


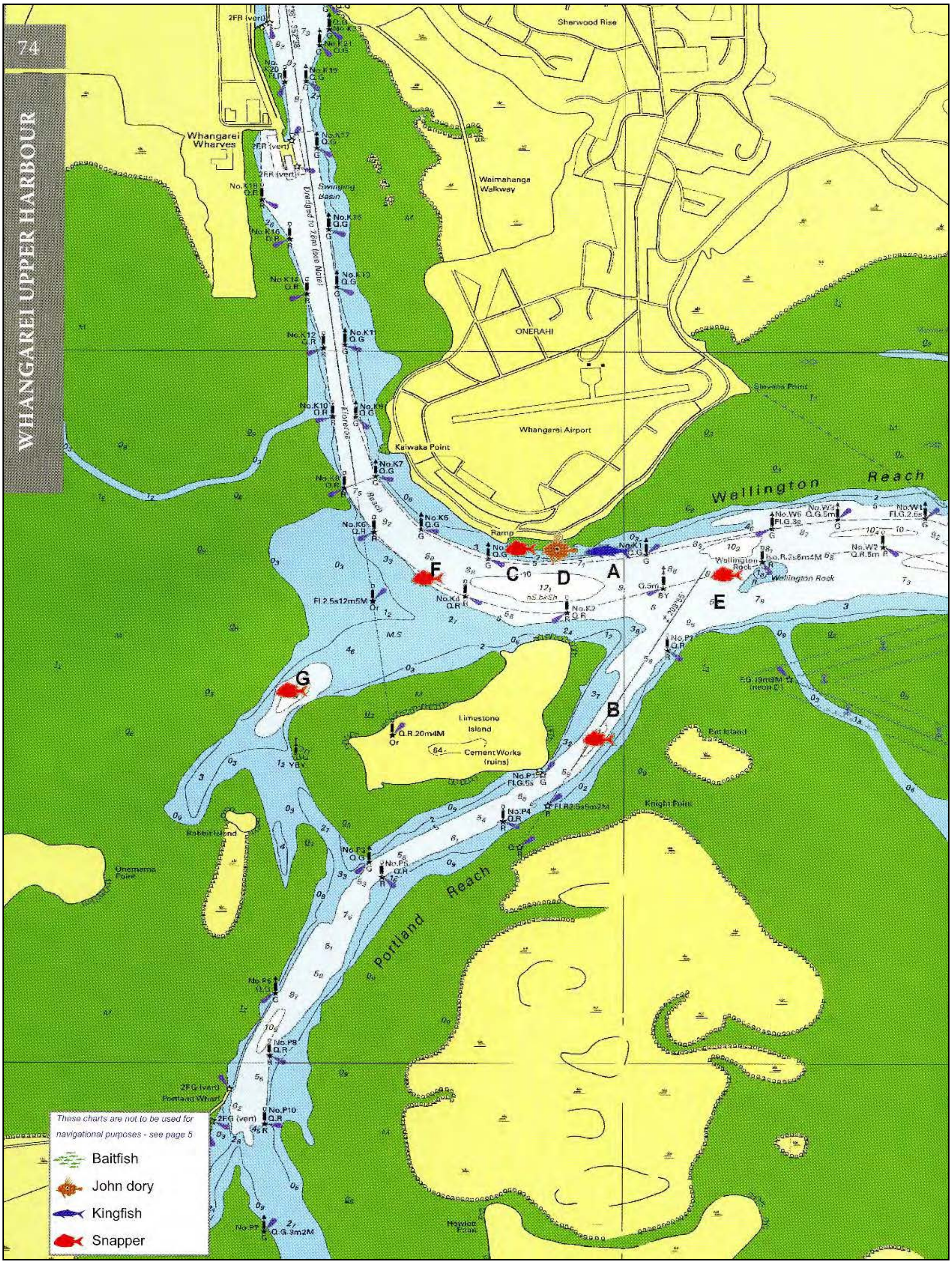
Map B25
Whangarei Heads
Bream Head
N
Map Scale
1:50,000
LEGEND LOCATED AT BACK OF MAP FOLDER
Locality Map:
NORTHLAND REGIONAL COUNCIL
Map C13

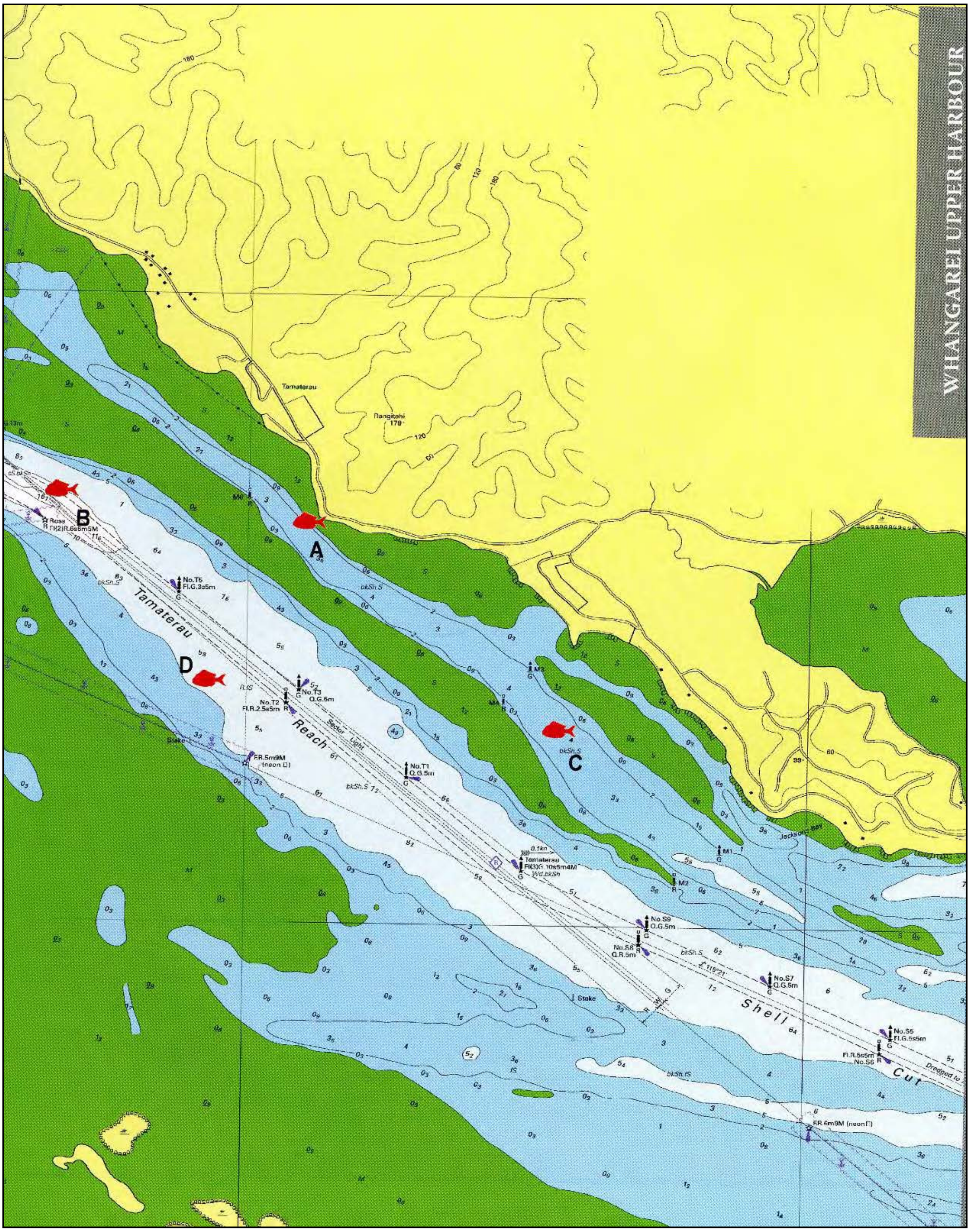

Northland Regional Coastal Plan Map Legend
Regional Boundary Line
TLA Boundary
State Highway
Road
Aircraft Beacon
Boat Ramp
Jetty/Wharf
Pontoon
Grid Point
Slip
Protected Anchorage
Beacon
lit
unlit
Buoy
lit
unlit
Bridge
Foot Traffic
Train
Vehicle
Powerline
Underwater Cable
Underwater Pipe
Cliff Edge
Track & Walkway
River
Coastal Marine Area Boundary
Surfing Area
Land outside NRC Region
Prohibited Anchorage Area
Skilane
Marine 1 (Protection) Management Area
Marine 2 (Conservation) Management Area
Marine 3 (Marine Farms) Management Area
Coastal Permitted Marine Farms (Post 20 December 1994)
Marine 4 (Controlled Mooring) Management Area
Marine 4 (Discretionary Mooring) Management Area
Marine 5 (Port Facilities) Management Area
Marine 6 (Wharves) Management Area
Cultural Water Quality
Water Quality
CA
CB
CN
Mixing Zones For Major Dishcarge

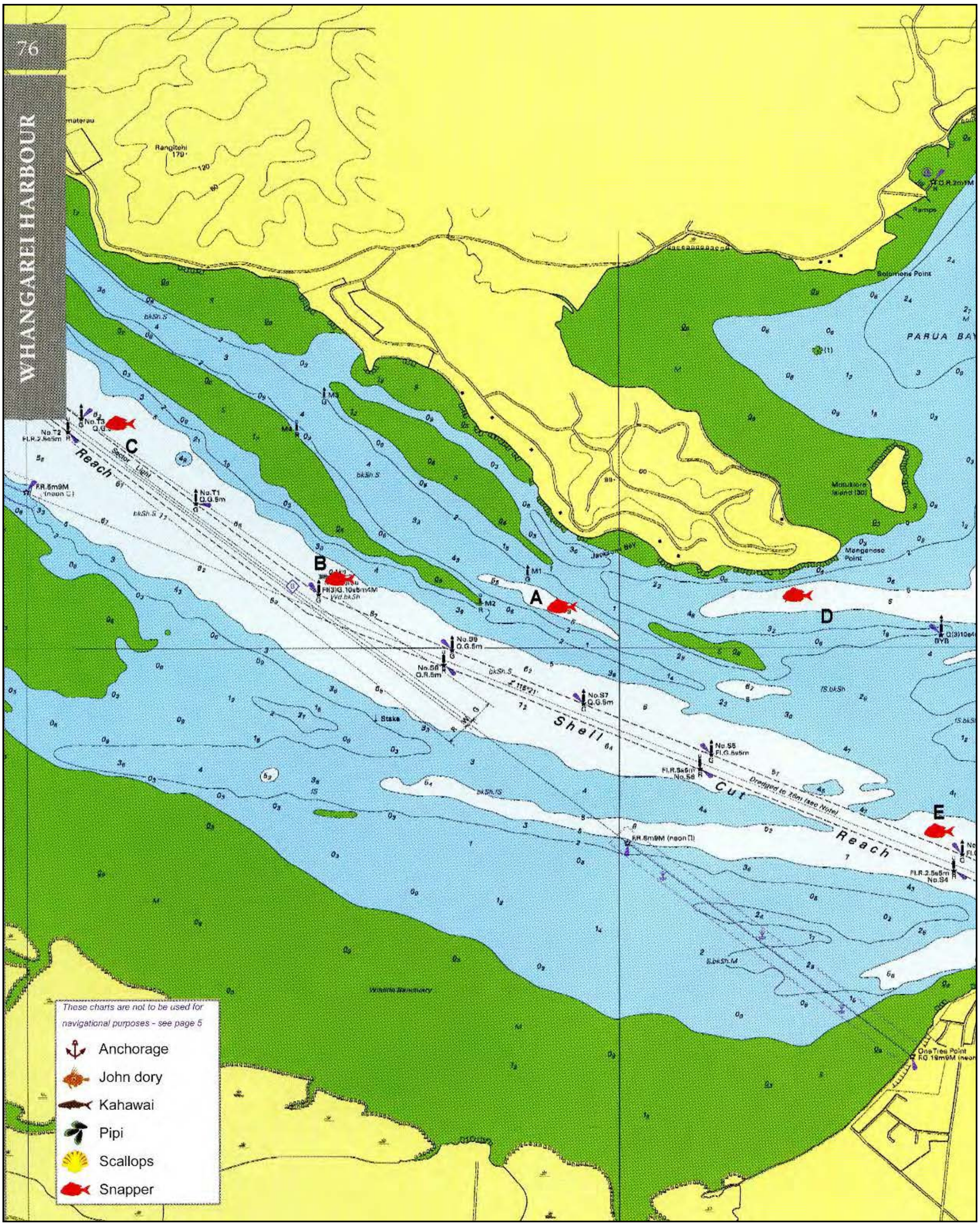
Appendix 3: Spot X fishing guide recommendations

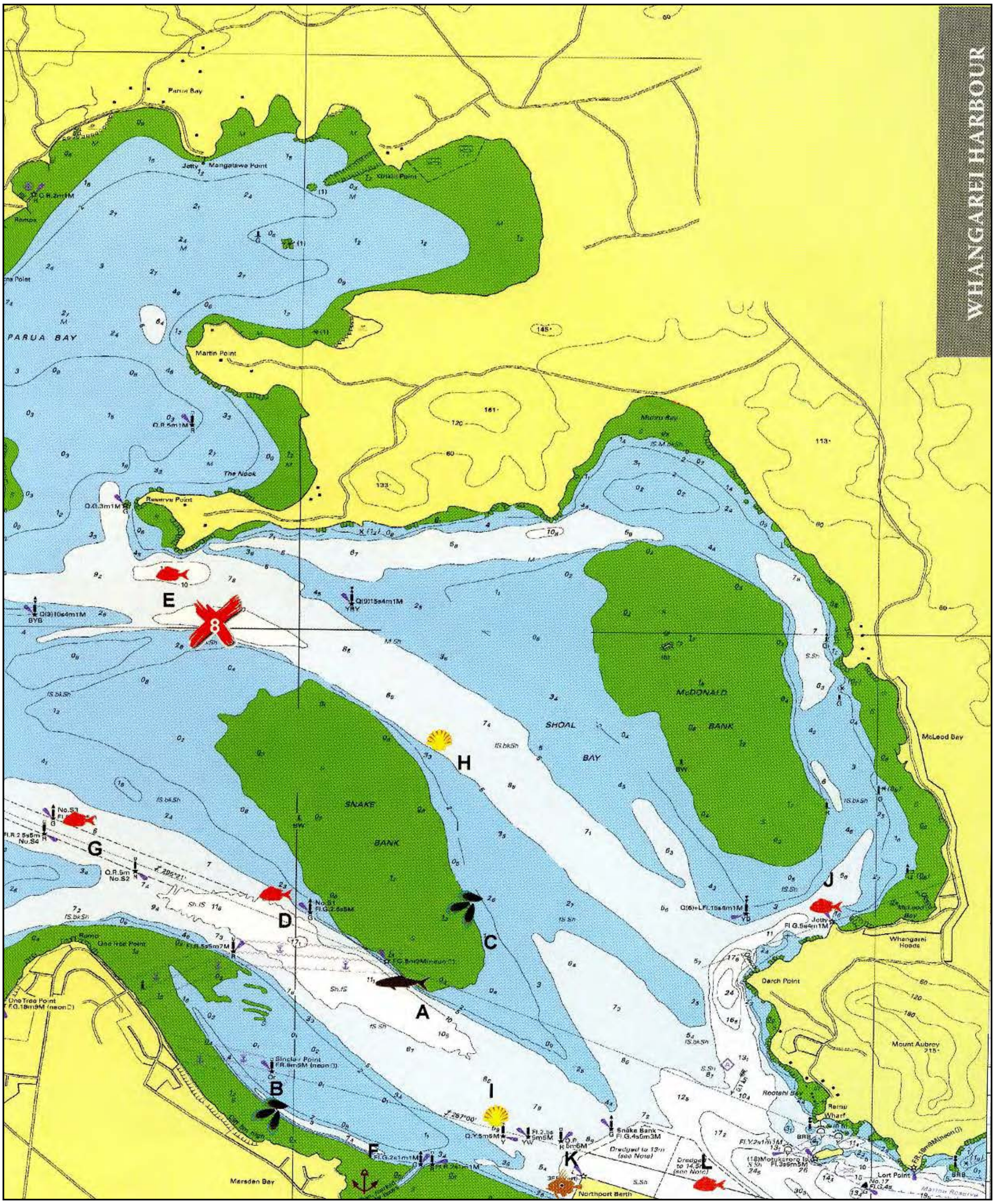
Source: Allen *et al* (2009)

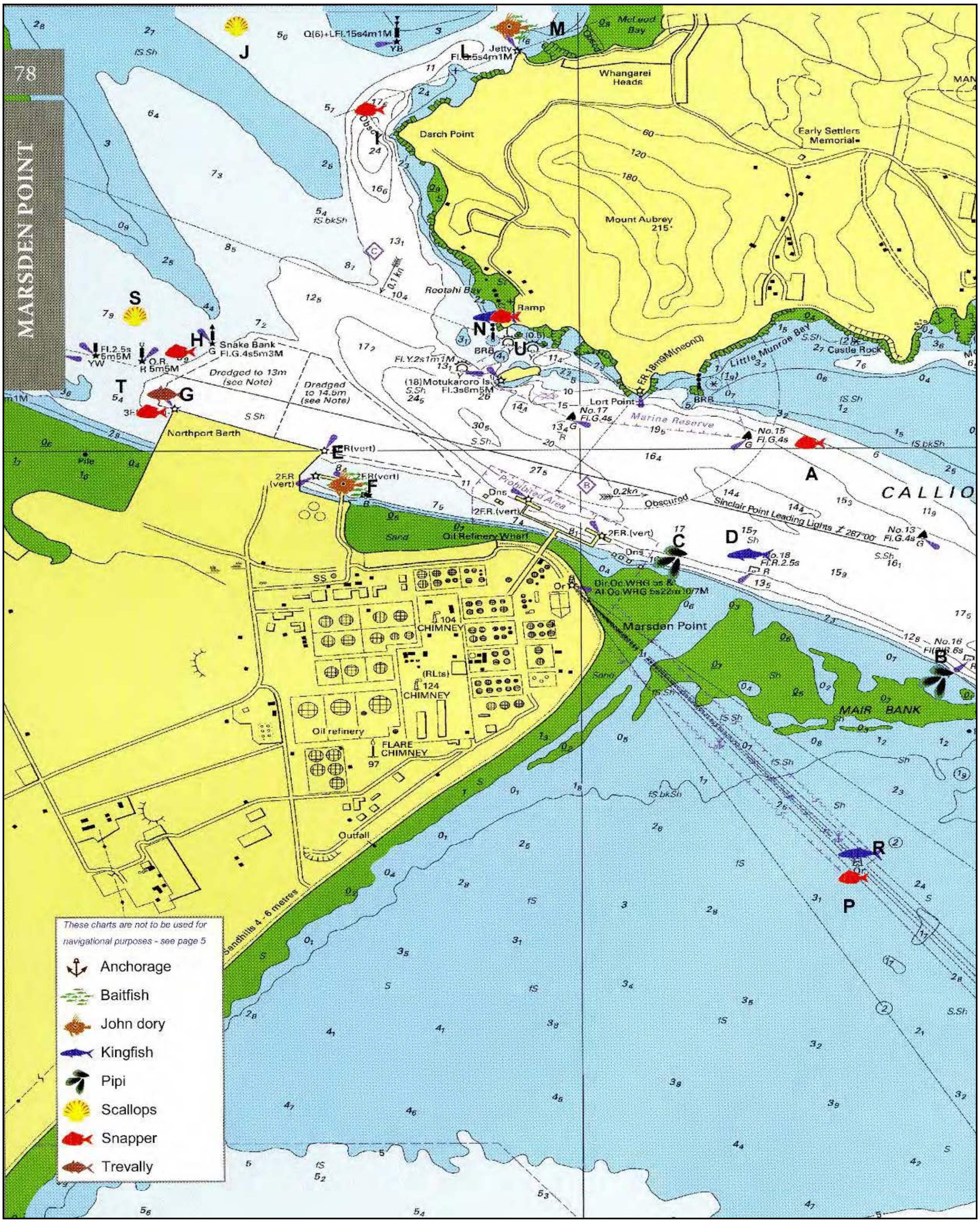


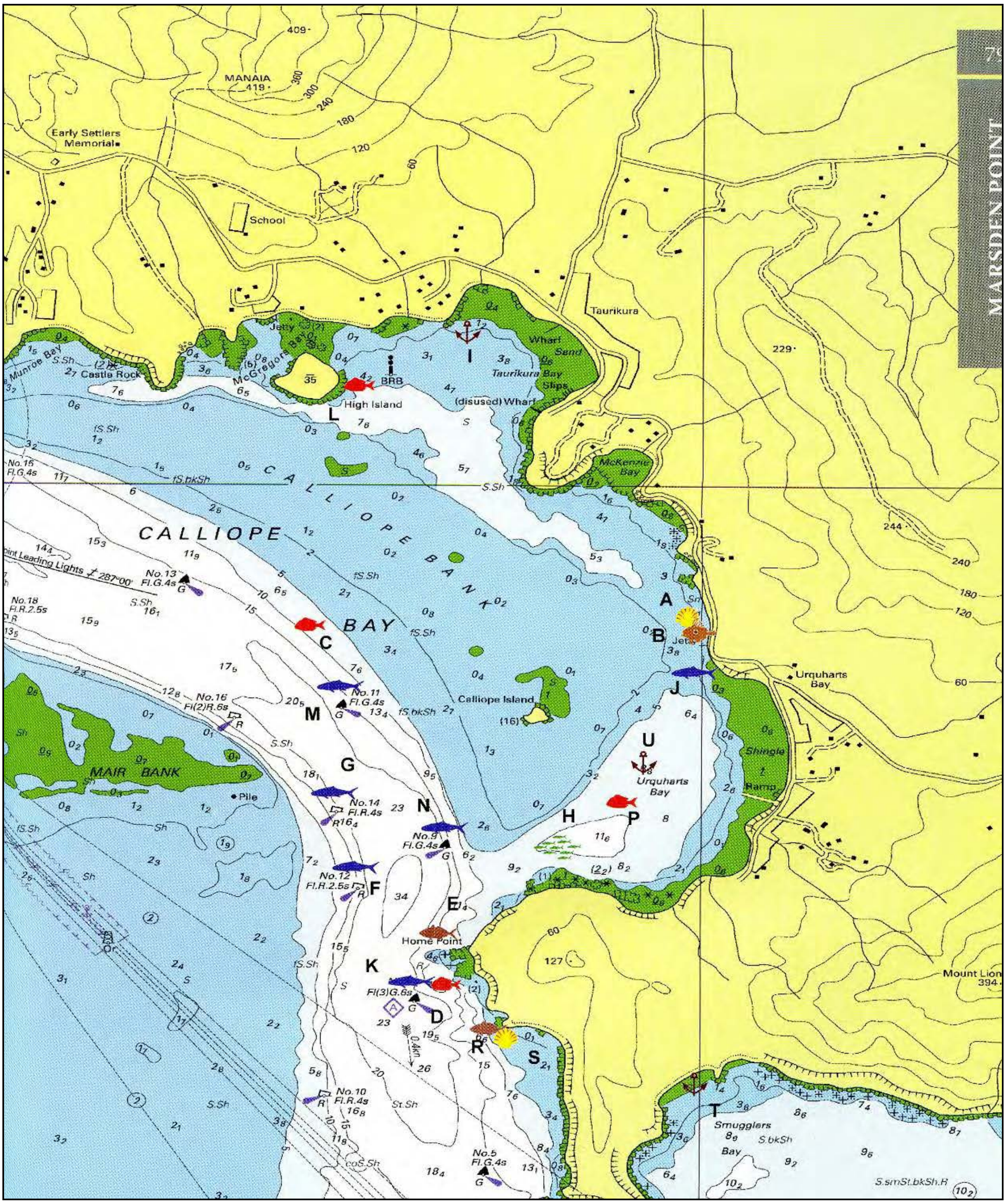

74
WHANGAREI UPPER HARBOUR
Whangarei Wharves
Sherwood Rise
Waimahanga Walkway
ONERAHI
Whangarei Airport
Kaiwaka Point
Wellington Reach
Wellington Rock
Limestone Island
Cement Works (ruins)
Portland Reach
Portland Wharf
A
B
C
D
E
F
G
These charts are not to be used for navigational purposes - see page 5
Baitfish
John dory
Kingfish
Snapper


WHANGAREI UPPER HARBOUR
Tamaterau
Tamaterau Reach
Shell Cut
A
B
C
D
Jacksons Bay


76
WHANGAREI HARBOUR
PARUA BAY
A
B
C
D
E
Reach
Shell
Cut
Reach
These charts are not to be used for navigational purposes - see page 5
Anchorage
John dory
Kahawai
Pipi
Scallops
Snapper


WHANGAREI HARBOUR
PARUA BAY
SNAKE BANK
McDONALD BANK
SHOAL BAY
Martin Point
Reserve Point
The Nook
Darch Point
Mount Aubrey
McLeod Bay
Marsden Bay
Northport Berth
A
B
C
D
E
F
G
H
I
J
K
L


78
MARSDEN POINT
These charts are not to be used for navigational purposes - see page 5
Anchorage
Baitfish
John dory
Kingfish
Pipi
Scallops
Snapper
Trevally
Whangarei Heads
Darch Point
Mount Aubrey 215
Early Settlers Memorial
Rootahi Bay
Ramp
Snake Bank
Northport Berth
Oil Refinery Wharf
Oil refinery
Marsden Point
MAIR BANK
Little Munroe Bay
Castle Rock
Lort Point
Marine Reserve
Prohibited Area
Sinclair Point Leading Lights
Motukaroro Is
Dredged to 13m (see Note)
Dredged to 14.5m (see Note)
CHIMNEY
FLARE CHIMNEY
Outfall
Sandhills 4 - 6 metres
McLeod Bay
CALLIO


MANAIA
Early Settlers Memorial
School
Taurikura
MARSDEN POINT
CALLIOPE BAY
CALLIOPE BANK
Castle Rock
McGregors Bay
High Island
Taurikura Bay
McKenzie Bay
Calliope Island
Urquharts Bay
MAIR BANK
Home Point
Smugglers Bay
Mount Lion
A
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C
D
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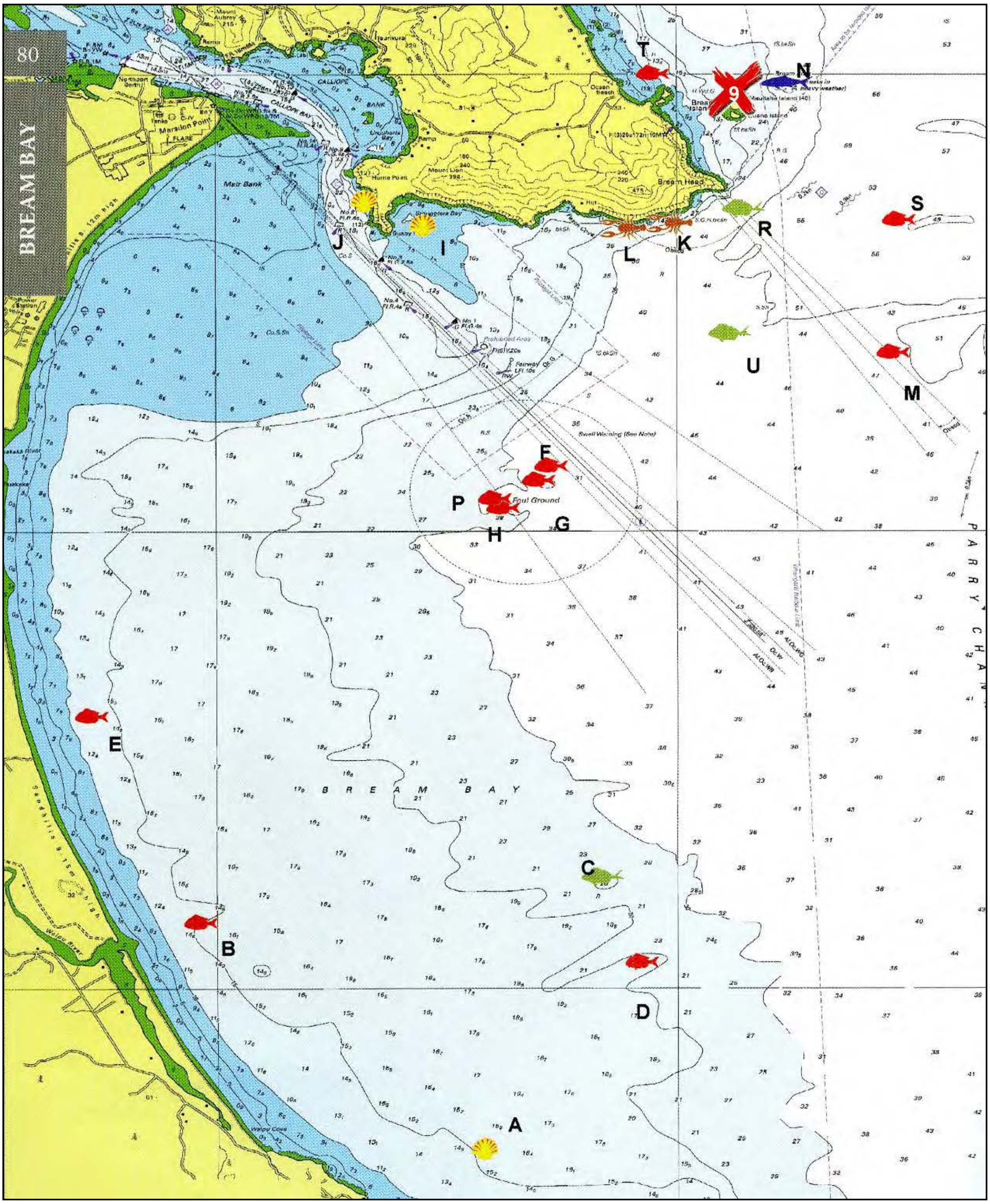
80
BREAM BAY
B R E A M   B A Y
Marsden Point
Mair Bank
Bream Head
Ocean Beach
Foul Ground
Swell Warning (See Note)
P A R R Y   C H A N
A
B
C
D
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9

CRUDE SHIPPING PROJECT

PROPOSED DEEPENING AND REALIGNING OF THE WHANGAREI HARBOUR ENTRANCE AND APPROACHES

VOLUME FIVE:

ANNEXURE TWO (q) TO ANNEXURE THIRTEEN

Prepared for:

ChanceryGreen on behalf of the New Zealand Refinery Company Limited **August 2017**

Prepared by:

Ryder

Crude Shipping Project

Proposed Deepening and Realigning of the Whangarei Harbour Entrance and Approaches

Prepared for: New Zealand Refining Company Limited

Prepared by: Gavin Kemble, *Managing Director and Environmental Planner*
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Myaan Bengosi, *Environmental Planner*

Date Finalised: August 2017

Annexure Two: Technical Reports

m) Marsden Point Crude Shipping Project – Landscape Assessment. Brown NZ Limited. Stephen Brown. Dated August 2017

n) Whangarei Harbour Dredging: Archaeological Assessment. Clough and Associates. Dr Rod Clough and Simon Bickler. Dated July 2017.

o) Crude Shipping Project – Economic Assessment of Channel Deepening at the Marsden Point Refinery. New Zealand Institute of Economic Research. Peter Clough and Mike Hensen. Dated 02 August 2017

p) Commercial Fishing in Whangarei Harbour and Bream Bay. Boyd Fisheries Consultants Ltd. Rick Boyd. Dated 11 August 2017

q) Peer Review Report of Refining NZ Crude Freight Proposal – Tangata Whenua o Whangarei Te Rerenga Paraoa DRAFT Cultural Effects Assessment. Te Onewa Consultants. Antoine Coffin. Dated 21 July 2017

Annexure Two: Technical Reports

m) **Marsden Point Crude Shipping Project – Landscape Assessment. Brown NZ Limited. Stephen Brown. Dated August 2017**

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MARSDEN POINT CRUDE SHIPPING PROJECT

LANDSCAPE ASSESSMENT (FINAL)

PREPARED FOR REFINING NEW ZEALAND

August 2017

CONTENTS:

1.0 INTRODUCTION

This report addresses proposed alterations to the shipping channel at Marsden Point – including:

- Realignment of the current channel;
- Deepening of the channel to accommodate more heavily laden tankers than those currently able to unload at Marsden Point;
- Extraction of harbour floor material to accommodate this realignment and deepening of the main navigation channel;
- Disposal of that material within parts of Bream Bay;
- Reconfiguration of some channel buoys in the vicinity of Busby Head, Home Point and Taurikura Bay at the entrance to Whangarei Harbour;
- The addition of a new beacon and navigation lights within the outer harbour; and
- Installation of two new channel marker buoys.

These modifications and developments are evaluated in terms of their visual, landscape, amenity and natural character effects, and are assessed in the context of both existing activities within Whangarei Harbour and Bream Bay, as well as against relevant statutory instruments – including sections 6 and 7 of the Resource Management Act, Policies 13 and 15 of the New Zealand Coastal Policy Statement and relevant provisions of the Northland Regional Coastal Plan.

In addition, this report addresses the temporary effects associated with dredging operations in the general vicinity of a series of bays that contain settlements, popular local beaches and reserves – stretching from Darch Point and Reotahi to Urquharts Bay – and disposal of harbour floor material within Bream Head.

2.0 PROJECT DESCRIPTION

The proposed deepening and realignment of the harbour channel to and from the Marsden Point Refinery is designed to accommodate more efficient use of the terminal and, in particular, the greater use of more fully laden, Suezmax type vessels carrying crude oil. A number of options for navigation channels have been subject to evaluation against a broad range of criteria before selection of the preferred route. The relevant criteria included basic navigation requirements, evaluation of wave and tidal conditions, effects on the sea floor and aquatic environment, effects on those living and recreating within Whangarei Harbour's outer northern bays, effects on recreational use of the harbour and Bream Bay, and even the visual effects derived from the relocation of navigational aids – notably lighting and buoys. A similar exercise has been undertaken to identify preferred disposal sites for both capital and maintenance dredging activities.

Option 4.2 (Rev. M) was ultimately chosen as the preferred navigation channel for Marsden Point (see the map on p.4). It extends for 8km between the centre of Bream Bay and Marsden Point, requiring the removal of some 3.7 million m^3 of sand from the harbour entrance's sea floor. Tonkin & Taylor's AEE report (*Crude Shipping Project – Coastal Processes Assessment*) dated February 2017, summarises the proposed extraction and disposal processes as follows in the Executive Summary:

> ***Proposed channel***
>
> *The preferred channel alignment has evolved through the design process taking into account navigational safety, potential changes to the hydrodynamic system and environmental considerations and will provide for unrestricted design vessel access except in extreme wave climate or swell events (i.e. accessible for 98% of the time).*
>
> *The proposed channel depths vary from 19.0 m below Chart Datum (CD) at the entrance to the channel, to 16.5 m below CD at the berth area with -17.9 m CD at the berth pocket. …..*
>
> *Estimated disposal volume and areas of disturbance are 3,700,000 m3 and 1.44 km2 respectively (refer Table 2-1). ……… The main areas for dredging are the outer channel and the berth pocket. In the remaining areas only targeted dredging is required. Total footprint of proposed channel area is 3.9 km2……..*
>
> ***Proposed marine disposal areas***
>
> *Refining NZ seeks some operational flexibility in the volume of material to be disposed at specific locations. Two marine disposal areas are proposed. Area 3-2 is situated approximately 45 m below Chart Datum to the south east of the channel within Bream Bay and Area 1-2 is situated on the outer part of the ebb tide shoal. Area 1-2 is included to provide a means of maintaining a sediment transport pathway to the coast. Accordingly, it is anticipated that up to 97.5% of capital dredging is to be placed in Area 3-2, between 2.5% and 5% is placed in Area 1-2 ………*
>
> *Assuming the sediment is uniformly distributed, the average height of the placement mound as a result of the capital dredging will be approximately 1.5m. However, it is possible that targeted disposal may occur within the larger disposal area to reduce capital disposal footprint and should that happen then a maximum placement height of not more than 4 m would result. …………*
>
> *The maximum placement height within Area 3-2 after 35 years of capital and then maintenance dredging would be no more than 4 m based on the conservative assumptions of 1) the upper rate of predicted annual sedimentation, 2) all maintenance dredging being placed in this area and 3) no settlement or loss of material from this area. ……..*
>
> *Both Areas 3-2 and 1-2 areas comprise sand of a similar composition to the channel area to be dredged. From a geomorphological perspective, it is appropriate to dispose of material in areas of similar composition (i.e. on a 'like for like' basis). …….*

Tonkin & Taylor's report also describes the proposed capital dredging, maintenance dredging and marine disposal areas in some detail at pages 3, 5 and 6:

2.2 Capital dredging requirements

Based on the channel alignment and section shown in Drawing 01 and Figure 2-1 the estimated disposal volume and areas of disturbance (3,638,000 cubic metres (m^3) rounded up to 3,700,000 m^3 and 1.44 square kilometres (km^2) respectively, refer Table 2-1…….

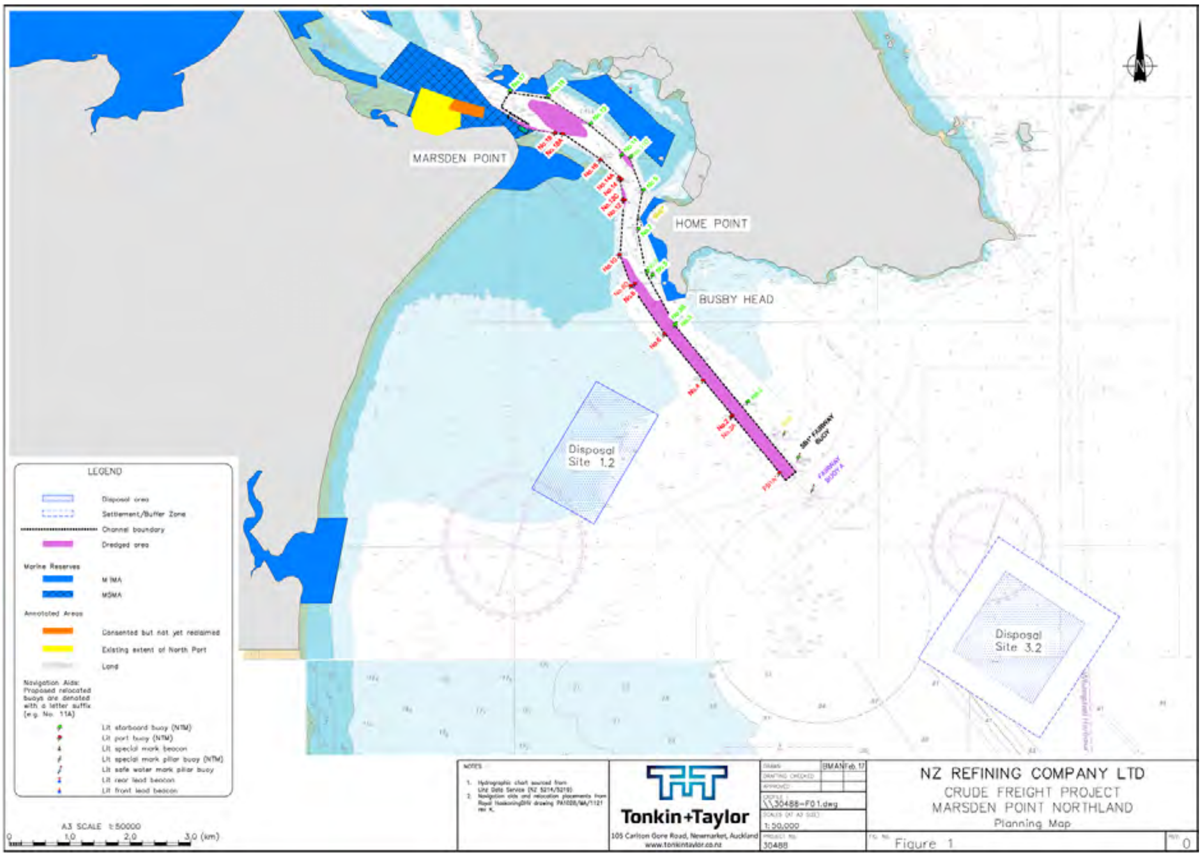
2.3 Maintenance dredging

Maintenance dredging is to be expected to be necessary, particularly within the first few years following the capital dredging as side slopes settle. The main areas where maintenance dredging will be undertaken is in the berth pocket area due to sand transported from the ebb delta over Mair Bank, and at the outer section of the channel where the majority of capital dredging has occurred. ………

Over the maximum duration of the expected consent (35 years), the volume of material required to be dredged is between 1,960,000 and 4,270,000 m^3, representing some 1.2 to 2.5% of the current ebb tide delta volume.

Maintenance dredging may need to occur every 2 to 5 years in the berth pocket area to maintain navigable draft around the jetty dolphins as well as at localised areas along the channel such as adjacent to Busby Head ……….

The Nearshore Disposal Area 1.2 (overleaf) would lie some 3.5km offshore off Ruakaka's foreshore and the adjoining Marsden B Power station site (decommissioned). The proposed capital dredging disposal site – Area 3.2 – would be located some 10.9km from the same beachfront.



Proposed Option 4.2 Rev, M Navigation Channel & Locations For Sediment Disposal

Focusing on some of the potential effects associated with the dredging and sand disposal operations, Tonkin & Taylor's report describes the sediments currently found within the proposed 'dredge area' as follows (pp.14 & 15), followed by the proposed disposal areas (pp.14 & 17):

3.5.1 Channel area

……. The surficial sediments within the main channel of Whangarei Harbour are a mix of sands and coarser material (likely to be shell) in varying proportions. Coring has shown that a minor fraction of silty material is also found at depth (around 3% silts and 0.3% clay). The

subtidal regions of the ebb tidal shoal along the edges of the proposed channel are mainly made up of sandy material (around 95%) with around 5% silts. This was observed both by diver survey as well as coring, with some shell material (5 to 10%) also found at depth in the cores. The vibrocoring data shows similar grading information to the previous studies.

3.5.2 Seabed area along ebb tide shoal and within proposed disposal areas in Bream Bay

……… Mair Bank is covered with a shell substrate, mostly consisting of Pipi shells, with deposits of fine sands in the lee of shell ridges. With increasing water depth the amount of sand interspersed with the shells increases down the edge of the bank and the remaining ebb tide shoal is predominantly fine to medium sands.

Turning, therefore, to the issue of water turbidity or plumes that might be generated by dredging and deposition in the same areas, MetOcean Solutions' report (*Crude Shipping Project, Whangarei Harbour – Predicted Physical Environmental Effects From Channel Deepening and Offshore Disposal*, June 2016) summarises the likely effects of such operations as follows (pp. iv - vi):

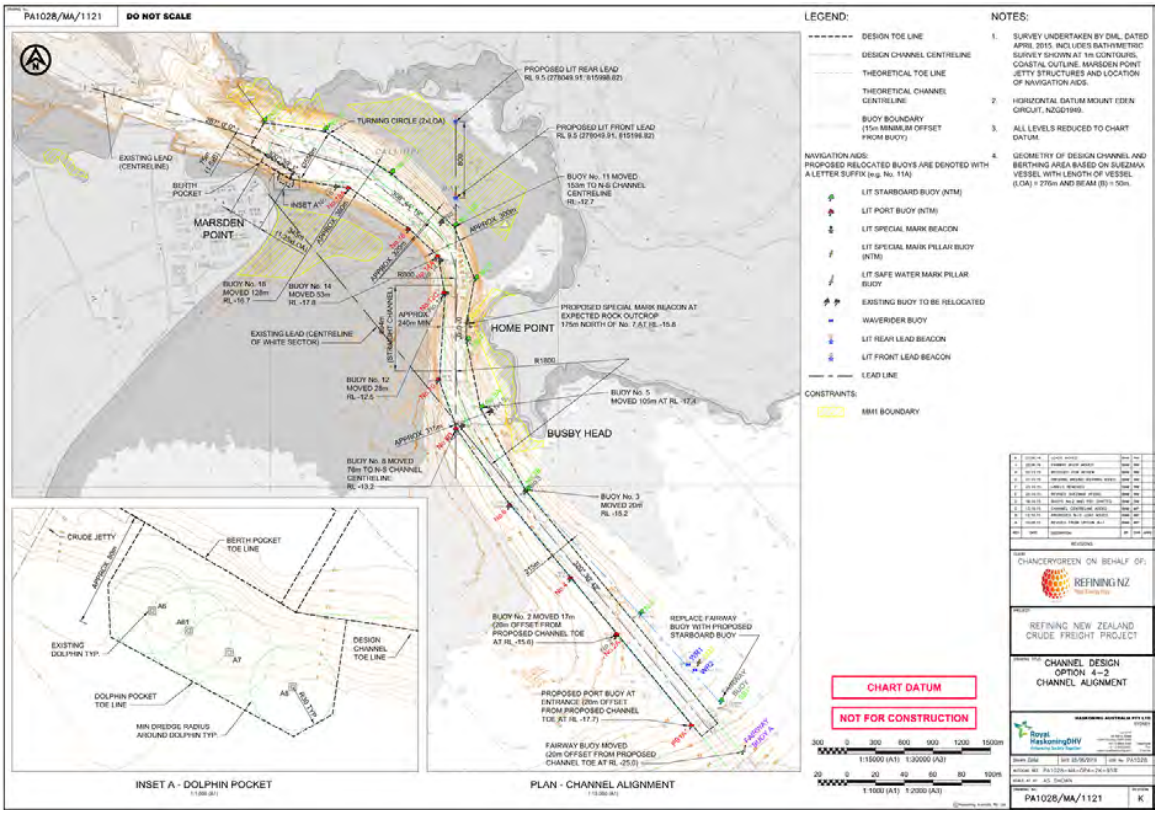
Dredging plumes

The plume dispersion associated with two different (large and small) trailing suction hopper dredgers (TSHD), one cutter suction dredger (CSD) and one Backhoe Dredger (BHD) was simulated in the present study. The sediment plumes associated with dredging, caused by the action of the drag head, are constrained within the lower water column, with negligible expression at mid-water and surface levels. In contrast, the sediment plumes associated with the overflow phase are spread across the entire water column. The resultant plumes from either source are predicted to follow the general channel alignment, consistent with the tidal currents. The maximum excursion of any plume modelled based on the 12 mg/L suspended solids concentration (SSC) threshold did not exceed 1200 m (maximum extension near bottom) and all were confined to the channel. There is no evidence of the plume dispersing to the adjacent beaches, sand banks, Marine 1 Management Areas and Marine Reserves. ……………….

Disposal plumes

The plumes caused by disposal are short lived and not highly dispersive. They typically extend along a northeast – southwest axis, preserving the adjacent reef from settlement, and 99% of the plume material is predicted to settle to the seabed within 14 hours. The disposal plumes calculated from the measured current profiles have a lesser excursion than those determined from the long term environmental hindcast, and do not show incursion towards the adjacent 3 Mile Reef to the west of the proposed disposal ground.

Other key components of the proposal include disturbance of the sea floor – mostly within the existing channel between Marsden Point and Home Point, but also affecting Mair Bank – while the relocation and / or addition of navigation lights and buoys would be more obvious signals of the change occurring underwater. The plans of Option 4.2 prepared for Refining New Zealand by Royal Haskoning DHV show the locations of these changes and new structures.



Proposed Option 4.2 Navigation Channel In Detail

In particular, DHV Royal Haskoning's report (*Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report;* November 2016, pp.24, 26, 27, 32, 35, & 45) identifies that:

- The existing Fairway Buoy A at the entrance to the navigation channel would be shifted to a position offset from the new entrance by some 20m;
- The other existing Fairway Buoy would be replaced by a new Starboard Buoy;
- A new Port Buoy would be offset 20m from the southern side of the channel entrance;
- Buoys 2, 3, 5, 8, 11, 12 and 14 would all be relocated to accommodate the revised "S" footprint of the revised navigation channel;
- A new 'lateral marker' would be located off Home Point to mark a rock outcrop next to that feature – within an HNC area identified in the Northland RPS and close to the ONL (Whangarei DP) covering Home Point;
- A new 'Front Lead' light would be located on the southern edge of Calliope Bank, offshore of McKenzie Bay: some 1150m from that bay and more than 1400m from Taurikura's main beach – within an HNC area identified in the Northland RPS; and
- A new 'Rear Lead' light would be located on the northern side of Calliope Bank, directly offshore of the main beach at Taurikura but still some 740m from it – also within an HNC area identified in the Northland RPS.

2.1 EFFECTS ASSESSMENT

Most of the proposed developments and activities at Marsden Point would affect the harbour's underwater environment to a greater degree than its above-water landscape, with the current tidal channel requiring substantial modification to accommodate more heavily, laden ships. The key landscape / natural character / amenity issues associated with the proposal are more specifically linked to the following project components and activities:

- Changes to the sea floor and biota associated with dredging;
- Modifications associated with the disposal of dredged material within Bream Bay;
- The permanent addition of the two new Lead Lights near Taurikura – affecting views from Taurikura and McKenzie Bays;
- The introduction of a new 'lateral marker' to a rock outcrop adjacent to Home Point;
- Associated plumes / water turbidity;
- Dredging and disposal activities – mainly pertaining to the effects of vessel lighting and operational noises on local residents.

Although the relocation of buoys would also signal changes to the alignment of the navigation channel in and out of Marsden Point, the overall number of buoys would scarcely change and their repositioning would have no appreciable effect on either the quantum of man-made elements found within the marine environment or their general disposition – particularly given the close proximity of a string of coastal settlements, a major oil refinery, wharves, existing vessel movements, and even the remains of a former coastal gun battery. These elements are all located in close proximity to the harbour entrance. Consequently, the balance between man-made and natural elements found at the mouth of Whangarei Harbour would be little altered by the re-positioning of existing buoys.

3.0 LANDSCAPE CONTEXT

The approaches to Whangarei Harbour are framed by the expansive coastal plain around Ruakaka to the south, and the volcanic peaks of Home Point, Mt Lion, Bream Head, then Taurikura, Mt Manaia and Mt Aubrey, to the north. At the junction of these contrasting landforms, the Marsden Point Oil Refinery also sits at the end of a distal spit that marks the very entrance to Whangarei Harbour and a succession of bays – from Little Munroe to Urquharts – that directly frame the northern side of its mouth. West of the oil refinery, Marsden Bay and One Tree Point enclose the shoreline west of Blacksmiths Creek, while a series of headlands and indented bays / coves – including McLeod Bay and Munroe Bay, together with Reserve Point and Manganese Point – line the harbour's northern coastline.

However, the catchment more directly associated with Marsden Point's navigation channel is effectively framed by the adjoining deep-water port and, across the harbour, by Darch Point – at the western edge of Reotahi (below Mt Aubrey). Home Point and Busby Head define the outer limits of the main channel, although its outer reaches – extending into Bream Bay – are more loosely framed by Bream Head and the dune / sedimentary plain around Ruakaka.

The nature of this landscape is as variable as its topographic underpinnings. The Ruakaka coastline is fronted by a shallow, mostly low lying, dune corridor, but the remains of the old Marsden B Power Station and substation, various industrial premises, the Ruakaka Sewerage Plant and scattered pockets of residential development all face out across Bream Bay. These culminate in the oil refinery at the harbour's edge – clearly defined by its complex array of storage tanks, pipe work, buildings and other infrastructure. Two unloading wharves and gantries are outliers to the main refinery, projecting out into the enclosed harbour. Tankers are often located at these wharves and their 'dolphins'. Immediately west of the refinery, Northport's deep water berths are constantly in motion, with logs being loaded onto freighters, while trucks re-supply the large timber and timber chip stockpiles behind the main wharves. This industrial node, including storage sheds, additional storage tanks and light industrial premises flanking Marsden Point Rd, is separated from Blacksmiths Creek by a planted bund.

Immediately west of the creek, a sequence of residential development – mostly traditional bungalows facing the open waters of the harbour, while more modern, beach houses cluster around the enclosed waterways of the Marsden Bay development – expands the harbour frontage subject to active occupation and use. Although views from this quarter include the margins of the deep water port and vessels berthed at both the port and oil refinery, the main outlook from Marsden Bay and One Tree Point is directly across the harbour, towards Mt Aubrey, Taurikura and the matrix of forested hills filling the northern horizon.

Looking from One Tree Point towards Mt Aubrey, Taurikura, Mt Lion & the Marsden Point Oil Refinery

This sequence of razor-edged, volcanic peaks and its broad expanse of native forest is broken into the series of headlands and bays as the individual hills descend towards the harbour's edge. These bays – sharply defined and framed by both ridges and headland promontories – contain a series of coastal settlements and developed areas:

- pockets of rural-residential development amid a 'farm park' at the western end of Parua Bay and across Reserve Point;
- more traditional bach settlements at Reotahi, Little Munroe Bay, McGregors Bay, Taurikura bay, McKenzie Bay and Urquharts Bay; and
- a small marina next to Solomons Point.

Bush, and pockets of residual pasture, extend down from the sharply elevated peaks above to wrap around, and separate, these pockets of residential occupation and activity. At the very end of this 'chain', Mt Lion and Home Point decisively mark the outer limits of the harbour, while a broad phalanx of bush extending from Home Point to Busby Head, then from the northern side of Smugglers Bay to Bream Head, helps to further reinforce the more natural qualities of this 'bookend'.

Most of the settlements between Reotahi and Urquharts Bay lie within the visual catchment of the existing refinery and its navigation channel. As a result, the refinery acts as the visual centrepiece of most views to, and across, the harbour entrance. However, this is not always the case: descending towards McGregors Bay and Taurikura Bay on Whangarei Heads Rd, the volcanic relief of the surrounding hills, and their interplay with the waters of the northern harbour reaches, is a defining feature of many views. In particular, the distinctive profile and visual presence of Mt Lion and Home Point – joint sentinels at the harbour mouth – is a key facet of the Whangarei Heads landscape. They combine to share the role of a signature feature within it.

Looking from Whangarei Heads Road near Mt Manaia towards Mt Lion and Home Point

In addition to affording a key landmark within this coastline, Mt Lion and Home Point help to imbue the wider harbour setting with a level of naturalness and aesthetic appeal that contrasts with the situation evident directly across the harbour. This, of course, is part of the appeal that the Whangarei Heads coastline continues to display for visitors and locals alike. It is precisely why so many small settlements line the northern side of the harbour: nestled into the coastline's amalgam of bush and volcanic landforms, while Whangarei Harbour's expansive water area and long views stretching down to the Brynderwyn Range both contrast with, and complement, this intimate landscape experience.

Beyond the sheltered waters and terrestrial confines of the outer harbour, the steep faced peaks and slopes of Busby Head, Mt Lion and Bream Head provide a more wholly natural setting for the existing and proposed navigation channels. Bush dominates the DoC reserve facing out into Bream Bay, contrasting with the band of remnant pasture that extends from Smugglers Bay up and over a low saddle to meet the western end of Urquharts Bay. The waters off Smugglers Bay and Bream Head mark the junction with Bream Bay and its even more open, physically exposed, sea area – with just the distant Hen and Chicken Islands (Taranga island and the Marotere Islands), on the far side of the Parry Channel, providing any degree of protection and containment from the Pacific

Ocean's swells. As a result, the waters facing the northern edge of Bream Bay are frequently wind-tossed and flecked with spray. The often wild, but also enduringly scenic qualities of this coastal landscape are therefore often matched by the turmoil of its sea surface. Although lying close to the string of coastal settlements just described, it has a much more remote, elemental, even raw nature, and, unlike the other parts of the Marsden Point's landscape setting, there is little sense of contact with the oil refinery or other areas of more obvious human activity – apart from the ships lined up offshore, waiting to berth.

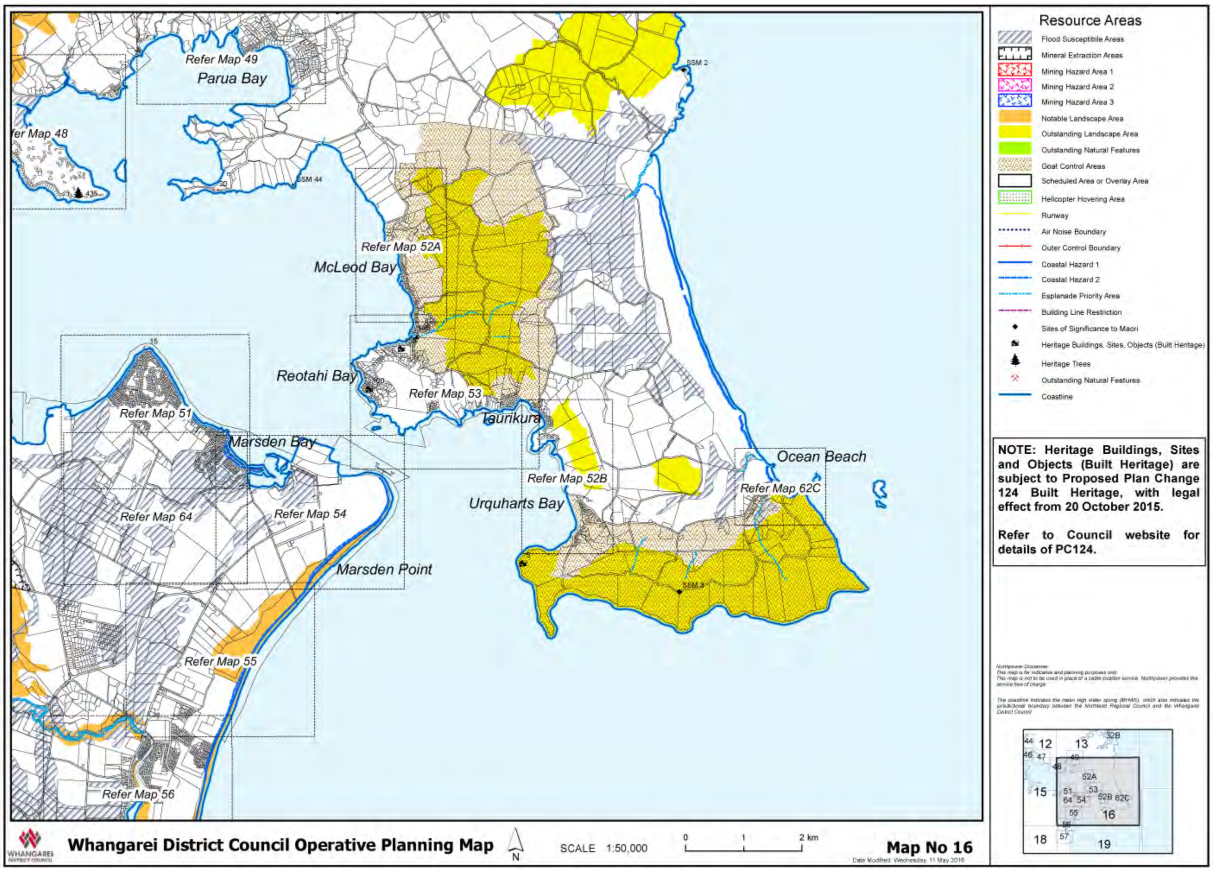
Looking from the base of Busby Head across Smugglers Bay to Mt Lion

3.1 IDENTIFIED VALUES

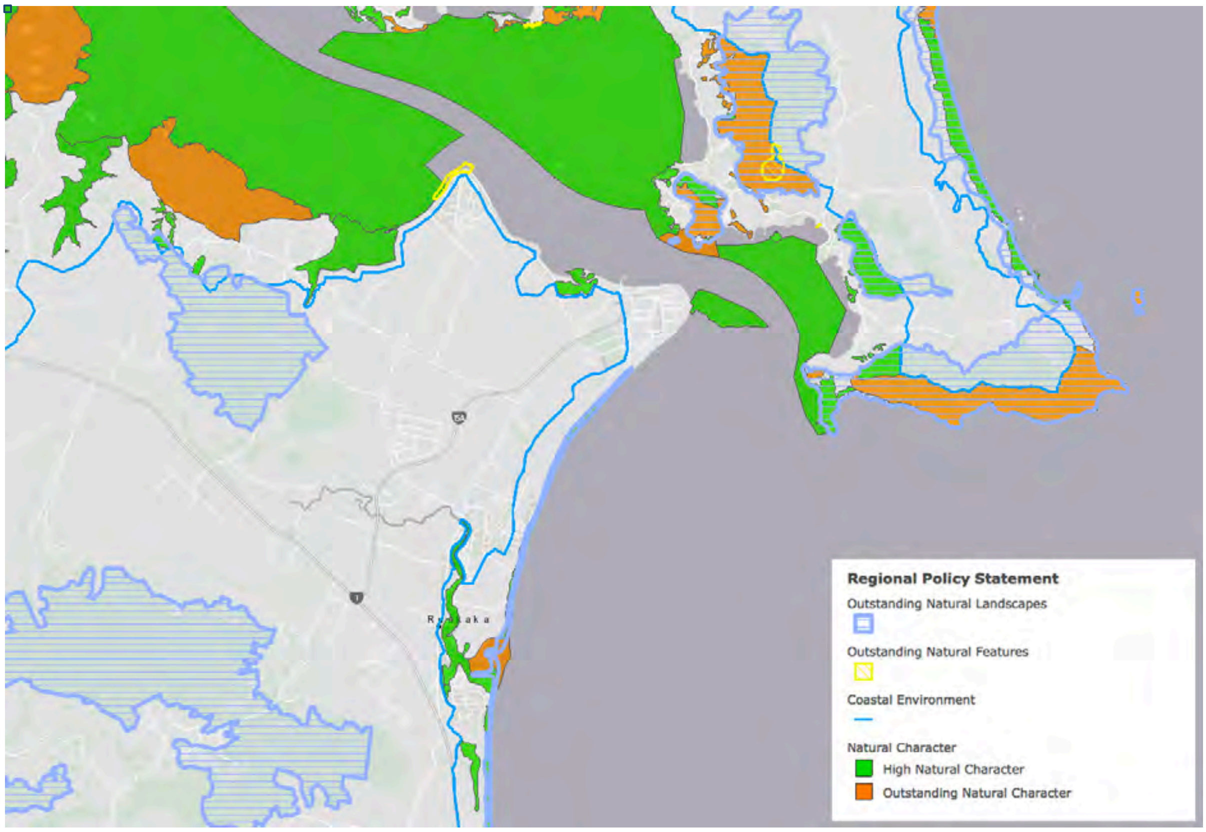
The Whangarei District Plan identifies Outstanding Natural Landscapes (ONLs) within Bream Bay and around Whangarei Heads on Map 16 of the Operative District Plan (see overleaf). In addition, the Northland Regional Policy Statement, which became operative on 9 May 2016, identifies both ONLs at the regional scale and areas of High and Outstanding Natural Character. Of most relevance to the current proposals, the Regional Policy Statement's more recent maps identify:

- Areas of high Natural Character within the harbour either side of the current navigation channel in and out of Marsden Point. Part of the HNC area covering Calliope Bank extends down past Home Point and lies north to east of the Option 4.2 corridor, while another HNC area on part of Mair Bank lies south of the proposed channel.
- A strip of Notable Landscape (district plan) and ONL (regional policy statement) running along Bream Bay's beachfront and dune corridor, south of the oil terminal boundary.
- ONLs (district plan and regional policy statement) covering the broad sweep of hills and coastal ridges that frame Whangarei Heads and Home Point, including Taurikura, Mt Lion, Busby Head, and the coastal ridges above Smugglers Bay extending out to Bream Head.
- Areas of High Natural Character flanking Home Point and the series of coastal ridges and promontories in its vicinity that culminate in Busby Head.

- An area of Outstanding Natural Character covering the seaward slopes and bluffs from Smugglers Bay through to Bream Head.



Operative Whangarei District Plan Map 16 Showing ONLs (yellow) & Notable Landscapes (orange)



Operative Northland Regional Policy Statement map showing areas of Outstanding Natural Character (orange), High Natural Character (green) & ONLs (horizontal green stripes framed by a mauve border)

To the west, most of Mt Aubrey and part of its apron of CMA either side of Lort Point is also identified as an ONC area, while Mounts Manaia, Aubrey and Taurikura – facing Whangarei Harbour and Marsden Point – are each subject to an ONL overlay.

This complex situation and the proliferation of areas subject to landscape and natural character overlays, highlights the dichotomy evident within and around the outer harbour. While its outer waters are physically enclosed and overlooked by a sequence of forested, and spectacular volcanic landforms, the margins of the harbour also engage with pockets of settlement, slopes that were once mostly in pasture and still remain so in part, and the southern harbour margins that contain an increasingly solid matrix of houses, industrial development and port related activities. Even though the crescent of Bream Bay, further south again, retains vestiges of natural character and an area of high public appeal down its coastal edge, this façade is soon succeeded by the housing development around Ruakaka, industrial premises lining Marsden Point Rd, the remains of the old Marsden B thermal power station and the local sewerage works.

This creates a highly complex, contextual setting for the navigation corridor, although the current channel – complete with its array of buoys, lighting, recreation vessels, Northport shipping and Aframax / Suezmax movements – suggests that the degree of above-surface change likely to register with both the general public and local communities would be limited.

3.2 POTENTIAL EFFECTS

In addressing the effects that the proposed dredging, disposal and infrastructure development would have on both the harbour entrance and Bream Bay, it is important to take into account the values associated with different parts of the landscape / environmental setting already described. The following are brief descriptions of some of the factors that need to be addressed as part of this process.

LANDSCAPE

The channel / harbour / Bream Bay surrounds are highly variable. However, key parts of that setting are identified as ONLs. Section 6(b) of the Resource Management Act identifies "*The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development*" as a matter of national importance. The so called 'modified Pigeon Bay' factors, that emerged in the findings of the Environment Court in the Pigeon Bay Aquaculture Limited v Canterbury Regional Council case and subsequent Wakatipu Environmental Society Inc (WESI) v Queenstown Lakes District Council cases, are now largely accepted as a starting point for the identification of such landscapes:

> *a) natural science factors: the geological, topographical, ecological and dynamic components of the landscape;*
>
> *(b) aesthetic values including memorability and naturalness;*
>
> *(c) expressiveness (legibility): how obviously the landscape demonstrates the formative processes leading to it;*
>
> *(d) transient values: occasional presence of wildlife; or its values at certain times of the day or of the year;*
>
> *(e) whether values are shared and recognised;*
>
> *(f) the landscape's value to tangata whenua;*
>
> *(g) its historical associations.*

At the very least they provide a comprehensive check list of landscape 'layers' that may or should be addressed in making determinations about the relative values to be attributed particular landscapes, and the related effects that development proposals – like the Crude Shipping Project – would have on them. The Operative Northland Regional Policy Statement builds on this by including the following summary of key characteristics and qualities associated with the ONLs surrounding Marsden Point and down the Bream Bay coastline:

BREAM HEAD / MANAIA SEQUENCE

Landscape characterisation *(including the identification of any specific characteristics)*

A highly distinctive and 'iconic' landscape sequence that defines the outer harbour and links out across the CMA toward Great Barrier Island. A gateway scene to entering mid Northland when passing over the Brynderwyn ridge. An anchoring element in a sequence of "ecological islands" with similar coastal indigenous forest associations that progress up the eastern coastline to the Bay of Islands and bridging into the mainland from local offshore islands. Collectively provide critical part of the Whangarei Heads area's social identity, providing an enframing/backdrop landform to each bay neighbourhood and a repeating theme that structures the experience of travelling through the broader Heads landscape.

Characteristic features are a very steep landform, rocky pinnacles (and headlands in some instances), high consistency of forest/shrubland cover (but with diversity in its composition) and close association with nearby harbour and open coast seascapes

Part of the distinction and definition of the component parts of this OLA results from the fact that each is typically isolated from the next within a fringe of agricultural grassland in more gentle foothills, further highlighting the rugged terrain and forest cover of the outstanding areas.

Whilst the majority of the identified unit encompasses contiguous areas of forest, scrub or shrubland vegetation, where linking or adjoining landform under pasture is clearly a part of the dominant elevated landscape element, these areas have also been included. Thus, the majority of the Bream Head sequence is within the unit, including:

- *pastured areas at the western and eastern ends;*
- *the forested ridge face of the Mt Lion Range, including the narrow areas of pasture between the forest and ridge crest;*
- *pastured areas linking Mt Aubrey with the harbour, and;*
- *areas of pasture on elevated land contained within the wider forest on the eastern face of the Manaia range.*
- *The unit is closely related to Hen and Chickens Island group (which is identified as a discrete OLA) in terms of landform, ecology, and sequence*.

EVALUATION		
Criteria	**Rank**	***Comment***
Natural Science Factors		
Representativeness	**5**	Heads sequence a signature of the Whangarei district and Northland region. Relates to view from Brynderwyn. Commonly found in photographs and other images that seek to convey an impression of Whangarei and Northland.
Rarity	**5**	High level of rarity at New Zealand level – very distinctive to this local area in terms of visual identity, geology and ecology.

Aesthetic Values		
Coherence	**4**	Strongly unified by rugged landform and contiguity of vegetation cover. Repetition of those key themes, and relationship with adjacent maritime area serves to bring an overarching coherence to the respective discrete areas, despite these being physically separated by lower land and pastoral cover.
Diversity & Complexity	**5**	Detailed and distinctive skyline. Convoluted site slopes with multitude of minor catchments. Diverse ecology.
Vividness	**5**	A bold signature and strong part of Northland's identity. Extremely distinctive and memorable. Commonly referred to at many levels by those living in the Heads area.
Naturalness	**4**	Very high levels of naturalness within unit, but influenced by proximity of settlements, farming and port complex. Proximity in turn allows for weed invasion and abutting uses that diminish naturalness. Indigenous forest cover is largely consistent over the unit, but there are some localized exceptions where elements of pasture are found in elevated locations such as the northern end of the Manaia range, where paddocks have been created near the ridgeline on localized areas that are less severe in their terrain. Closely related to marine waterbody. Small and complex drainage patterns on hill faces, largely ephemeral. Evidence of dramatic drainage and scouring during intense rainfall indicates ongoing formative processes, even in areas where landcover is predominantly natural.
Intactness	**4**	Good level of intactness within unit, although much of the vegetation cover is relatively young. Influence of natural cover along ridges on visual identity.
Experiential Values		
Expressiveness	**5**	Volcanic origins clearly conveyed by both landform and eroded skyline detail.
Sensory Qualities	**5**	Powerful views of unit entering Whangarei District and along harbour and Heads.
Transient Values	**4**	Strongly influenced by light conditions. Ridges create extremely distinctive silhouettes during dawn and dusk. Seasonal influences of rata and pohutukawa bloom.
Remoteness / Wildness	**3**	Proximity of settlements diminished, but strongly experienced to south of Bream Head and within forest.
Shared & Recognised Values	**5**	Landforms definitive in Heads community and physically shape and define where settlement has occurred.
Spiritual, Cultural & Historical Associations	**5**	Consultation was initiated during the mapping process, but has not led to any feedback within the required period. Well recorded and widely known Maori mythology applying to Manaia particularly. This is summarized on a public sign at Manaia's foot. Broad body of historical knowledge relating to early European and Nova Scotian settlement and use of Heads area.

BREAM BAY OCEAN BEACH

Landscape characterisation *(including the identification of any specific characteristics)*

The ocean beach extending between Marsden Point and the Waipu River represents the largest example of this land type on the east coast of the Region. It forms a gentle and graceful curve which, when looking north from locations to the south such as that illustrated on the photograph below, is terminated by the distinctive silhouette of the sequence of landforms making up the Manaia group.

The beach is backed by low dunes which in places forms an extensive dunefield (described above), however only the seaward margin of the foredunes are included within the landscape given the modification and weed infestation associated with the remainder of the area.

The landscape has a powerful simplicity engendered by the limited palette of colours, and the scale and form of the beach.

EVALUATION		
Criteria	**Rank**	***Comment***
Natural Science Factors		
Representativeness	**5**	Whilst not readily seen from the State Highway, Bream Bay the curve of Bream Bay is visible from the crest of the Brynderwyn range in context with Bream Head in the distance. The southern part of the Whangarei District coastline is characterised by the ocean beach that extends for some 20 km between Marsden Point at the mouth of the harbour, and Waipu Cove.

		The beach has strong endemic associations due to the native spinifex and other dune species present on the foredunes.
Rarity	**5**	The beach is similar in scale and character to a limited number of ocean beaches within the region, but retains its own character due to the beach backdrop dunelands and framing topographical features.
Aesthetic Values		
Coherence	**3**	The beach and its immediate backdrop retain a high level of coherence as a result of the simplicity of the components, and form of the feature. The modified character of the adjoining land to the west tends to detract from the coherence of the feature where built development, such as in the vicinity of the Ruakaka settlement, or Marsden Point, and encroachment by weed species.
Diversity & Complexity	**2**	The beach and its setting display a limited degree of diversity and complexity, although the ocean tends to be a dynamic element which provides its own ever changing complexity to the landscape, against the simple foil of the beach.
Vividness	**5**	The simplicity of form and colour, and the scale of the beach and its interplay with the sky results in the feature being particularly striking and displaying a high level of vividness
Naturalness	**4**	Whilst the backdrop to the beach has undergone a level of modification as a result on weed invasion, and with pockets of development encroaching on the dunefield, the beach and its immediate fore dune retain a high level of naturalness that is devoid of built development, and exotic vegetation, and maintains strong natural and coastal processes, both hydrological, and ecological.
Intactness	**3**	The beach and its immediate backdrop retain a coherence and intactness and does not show signs of modification. The backdrop to the beach does display a greater level of modification and this does, in places detract from the intactness of the landscape.
Experiential Values		
Expressiveness	**5**	The beach clearly displays the coastal processes, which formed it and continue to shape it.
Sensory Qualities	**4**	The experience of arriving at the beach is a gradual one and one that is generally experienced on foot, passing some distance though the dunes. As such, the moment of experiencing the beach is delayed and the impact of the scale of the beach, the smell of the sea and feel of the wind has greater impact than if the visitor were to arrive in a vehicle. The level of weed infestation within the back dunes, and the level of modification in terms of built development in some places tend to detract slightly, in some locations, from the sense of naturalness and therefore the sensory qualities of the beach.
Transient Values	**4**	A number of transient values are evident on the beach, including changes evidenced the tides, by changing weather and the seasons, but also by the arrival and departure of migrating birds.
Remoteness / Wildness	**3**	The beach is accessed from a limited number of locations in its mid and mid southern portion. In this area the visitor is able to experience a greater level of remoteness, which increases as the distance from the access point increases. At the northern end of the beach where greater development has occurred the sense of remoteness and wildness has been diminished.
Shared & Recognised Values	**5**	The Bream bay beach is a widely recognised feature within the Region despite its limited visibility. Its visual relationship with both Bream Head and Bream Tail is striking and an 'iconic' image of the east coast of Northland.
Spiritual, Cultural & Historical Associations	**4**	Consultation was initiated during the mapping process, but has not led to any feedback within the required period. The beach is, however valued by the community for recreational purposes and is heavily used, especially during the summer period when the camp ground at Uretiti is busy.

NATURAL CHARACTER

Policy 13 of the new NZ Coastal Policy Statement requires that the following matters be evaluated when exploring the natural character effects of development proposals within the coastal environment:

(1) To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development:

(a) avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character; and

(b) avoid significant adverse effects and avoid, remedy or mitigate other adverse

effects of activities on natural character in all other areas of the coastal environment; including by:

(c) assessing the natural character of the coastal environment of the region or district, by mapping or otherwise identifying at least areas of high natural character; and

(d) ensuring that regional policy statements, and plans, identify areas where preserving natural character requires objectives, policies and rules, and include those provisions.

(2) Recognise that natural character is not the same as natural features and landscapes or amenity values and may include matters such as:

(a) natural elements, processes and patterns;

(b) biophysical, ecological, geological and geomorphological aspects;

(c) natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks;

(d) the natural movement of water and sediment;

(e) the natural darkness of the night sky;

(f) places or areas that are wild or scenic;

(g) a range of natural character from pristine to modified; and

(h) experiential attributes, including the sounds and smell of the sea; and their context or setting.

Again, the NRPS has evaluated areas of High and Outstanding Natural Character around Marsden Point with reference to such factors. However, the worksheet descriptions of those areas close to the proposed navigation channel are largely devoid of detail apart from rather generic descriptions of the different Natural Character areas identified within the Coastal Environment and a summary of the referenced ecosystems applicable to each area:

Coastal Area Covered: *North of Uretiti to north of Marsden power station site, including Ruakaka estuary*

Dominant Coastal Criteria Used:

Ridgeline/land contour: Yes

Presence and extent of dunefields: Yes

Presence and extent of coastal lakes, lagoons, tidal estuaries, saltmarshes, or coastal wetlands:

Ruakaka River estuary, Ruakaka Racecourse Dune Lake

Other Relevant Factors:

Defined areas of coastal hazard risk:

Bream Bay/Ruakaka Beach

Presence and extent of coastal vegetation:

See Q07/128 Ruakaka Dunelands; and

Q07/130 Ruakaka River Estuary

Natural Areas of Waipu Ecological District 2007

Presence and extent of habitats of indigenous coastal species including migratory birds:

See Q07/128 Ruakaka Dunelands
Q07/129 Ruakaka Racecourse Dunelake; and

Q07/130 Ruakaka River Estuary ………….

Coastal Area Covered: *Whangarei Harbour – Darch Point to Home Point*

Open Coast – Home Point to Ocean Beach including Bream Head

Dominant Coastal Criteria Used:

Ridgeline/land contour: Yes Presence and extent of dunefields:

Ocean Beach

Presence and extent of coastal lakes, lagoons, tidal estuaries, saltmarshes, or coastal wetlands: N/A

Other Relevant Factors:

Defined areas of coastal hazard risk: Ocean Beach

Presence and extent of coastal vegetation:

See *Q07/069 Manaia Ridge Scenic Reserve and Surrounds*
Q07/070 Mount Aubrey Coastal Forest and Shrubland
Q07/073 Taurikura Ridge Bush
Q07/074 Bream Head Scenic Reserve and Surrounds; and
Q07/075 Ocean Beach Recreation Reserve and Surrounds in Natural Areas of Manaia Ecological District 2010

Presence and extent of habitats of indigenous coastal species including migratory birds: N/A ……….

Coastal Area Covered: *Bream Bay – north of Marsden power station site to Marsden Point*

South Whangarei Harbour – Marsden Point to Takahiwai

North Whangarei Harbour – Mount Aubrey

Dominant Coastal Criteria Used:

Ridgeline/land contour: Yes

Presence and extent of dunefields:

North end of Bream Bay beach

Presence and extent of coastal lakes, lagoons, tidal estuaries, saltmarshes, or coastal wetlands:

Blacksmith's Creek, Takahiwai Creek

Other Relevant Factors:

Defined areas of coastal hazard risk:

Bream Bay Beach, Marsden Cove, One Tree Point

Presence and extent of coastal vegetation:

See *Q07/128 Ruakaka Dunelands*
Q07/144 Blacksmith's Creek Estuary
Q07/143 Takahiwai Creek Estuary; and
Q07/167 Takahiwai Saltmarsh and Shrubland

in Natural Areas of Waipu Ecological District 2007

And *Q07/058 Whangarei Harbour*

in Natural Areas of Whangarei Ecological District 2001 And Q07/070 Mount Aubrey Coastal Forest and Shrubland

in Natural Areas of Manaia Ecological District 2010

Presence and extent of habitats of indigenous coastal species including migratory birds:

See *Q07/128 Ruakaka Dunelands*
Q07/144 Blacksmith's Creek Estuary
Q07/143 Takahiwai Creek Estuary; and
Q07/167 Takahiwai Saltmarsh and Shrubland

in Natural Areas of Waipu Ecological District 2007

And *Q07/058 Whangarei Harbour*

in Natural Areas of Whangarei Ecological District 2001

In fact, these somewhat rudimentary descriptions provide very little appreciation of the environmental conditions associated with the multiple areas identified as having ONC and HNC values around the entrance to Whangarei Harbour and down Bream Bay. As a result, the RPS's landscape assessment and its descriptions of individual ONLs offer more insight into the nature of the environmental setting for the proposed navigation channel than the worksheets directly addressing Natural Character values.

Underwater conditions also have a bearing on both the state of the current marine conditions at Marsden Point and the evaluation of Natural Character effects that would be generated by the Crude Shipping Project. In both respects, substantial reliance has been placed on the assessment of the current sea floor by MetOcean Solutions Ltd and of the existing aquatic biota in Bioresearchers' assessment of the Dredge Area ecology.

AMENITY

Section 7(c) of the Resource Management Act states that those exercising power under the Act shall have regard to (among other matters) "*The maintenance and enhancement of amenity values".* Such values are defined as being "*those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes".* Thus, whereas landscape is often associated with the sort of parameters already described, the concept of "amenity" focuses more directly on a certain cohesion of expression and unity of elements that give rise to a locality or landscape being considered 'pleasant', 'aesthetically cohesive' and having cultural or recreational appeal. Thus, for example, rural amenity has more to do with an area's continuity of character and aesthetic appeal than with how natural, endemic or structured and patterned it is. This may be reinforced by legible, repeated patterns – such as those associated with shelterbelts or stands of trees and repeated landforms – which become part of a locality's signature. Moreover, such patterns and elements can reflect the actions and imprint of humankind on a landscape although, more commonly, it reflects a certain repetition of residual natural features e.g. stands of bush, stream corridors or karst (limestone) outcrops.

Consequently, just as Whangarei Head's volcanic terrain, bush and harbour waters comprise the landscape's basic 'building blocks', local amenity values reside in a wide range of experiences that contribute to the aesthetic value, identity and sense of place associated with the local area – including:

- the myriad views to, and from, the harbour and its varied coastal margins;
- the recreational resources provided by local beaches and beachfronts;
- the spectacle and resource offered by the DoC reserve covering the northern side of the harbour mouth from Home Point to Bream Head, with its trails, beaches, bush and scenic promontories; and
- the waters of the harbour and Bream Bay – catering to fishermen, boaties and visitors alike.

The outlook to Whangarei Harbour and Bream Bay clearly underpins much of the locality's residential appeal, and the interaction between land and sea is unquestionably a key part of the northern coastline's identity and sense of place. Local residents on both sides of the harbour are exposed on a daily basis to the dynamic, at times dramatic, interplay between its expansive sea area with both an array of enclosing volcanic peaks and the dune plain around Ruakaka marching southwards towards the Brynderwyns.

Yet, these experiences don't exist in a vacuum, as if divorced from the very human activities and structures that surround most of the vantage points which afford this engagement and interaction.

Just as the sharp faced hills, native forest and harbour waters are key components of the outer harbour's coastal landscape, it also contains a multiplicity of long established cultural elements – from the many local settlements already described, to the oil refinery, neighbouring deep water port and current shipping lanes. These are also 'part and parcel' of the present-day Marsden Point / Whangarei Heads experience.

4.0 EFFECTS

Adverse impacts upon landscape, amenity and natural character values typically arise where there is evident discontinuity between the character and values of an existing environment and what is proposed, and where the resultant 'challenge' to the existing landscape 'order' is perceived in a negative light. Consequently, this section of the report addresses the degree of landscape / environmental change associated with the Crude Shipping Project and the nature / quality of landscape / amenity / natural character modification arising from such change.

Most projects focus on a single development and site. In this instance, however, the Crude Shipping Project involves multiple sites and a range of developments – from channel realignment (including widening and deepening) to the erection of new navigation markers and lights, and the processes of both dredging and disposal. As a result, this assessment addresses the project in terms of its key components – as set out in Section 2.1:

- The formation of the proposed channel with outer Whangarei Harbour and northern Bream Bay;
- The disposal of sand from capital dredging and maintenance dredging at Sites 3.2 and 1.2 within Bream Bay;
- The erection of two new Lead Lights near Taurikura;
- The erection of a new 'lateral marker' on an exposed rock outcrop off Home Point;
- The sand plumes / water turbidity associated with sand dredging and disposal; and
- The dredging and sand disposal operations.

Of note, and as indicated at Section 2.1, the relocation of navigation buoys is not addressed in this assessment, as it is considered that the quantum and nature of landscape / natural character effects would be little changed by this aspect of the crude shipping project.

Each of the remaining project components, identified above, is, however, analysed in detail. This involves identification of the receiving environments and audiences exposed to each component, followed by evaluation of their landscape / natural character / amenity effects. This involves the systematic analysis of factors or considerations under the following headings:

- **Existing Landscape / Natural Character / Amenity Values**
- **Prominence / Visibility** (of the proposed reclamation, piers and berths) and
- **Landscape Effects**
- **Natural Character Effects**
- **Amenity Effects**

Analysis under these 'headings' takes into account the following factors / considerations:

Existing Values:

Reflecting the relative extent to which a landscape / environment is valued in terms of:

- <u>Its Biophysical Components</u>: including landforms, vegetation cover, sea area and key cultural elements / features: buildings, other structures and activities
- <u>Its Perceptual Components</u>: aesthetic value, expressiveness, legibility (focusing on the degree to which landscape elements combine to create an attractive composition, 2D patterns, 3D sense of structure) and ephemeral / transient values

Prominence:

- Visibility / Legibility Of The Proposed Development / Activities: indicating the extent to which the development / activity proposed would be visible and visually prominent in views towards and of the outer harbour and / or Bream Bay.

Landscape Effects:

- Impacts On Landscape Elements & Patterns: the extent to which the proposal would adversely affect the structure of the landscape: its layering of elements, the interplay between different types of land use / structures, and the interaction between land and sea / harbour.
- Impacts On Visual Coherence / Unity: the extent to which the proposal would adversely affect the perceived integrity of Whangarei Harbour or Bream Bay by altering the mix of land uses and the balance between natural and man-made elements within the landscape.
- Impacts on Key Features / Landscapes (where applicable): the extent to which the presence of the proposed development / activity would disrupt or disturb views to, and of, Whangarei Harbour or Bream Bay.

Natural Character Effects:

The degree to which the development proposal would adversely affect perception and appreciation of the following characteristics associated with the existing Coastal Environment:

- Abiotic factors (essentially landform)
- Vegetation Type (native / endemic to exotic)
- Vegetation Cover & Patterns
- Land Uses / Activities: Buildings & Structures (their presence / absence)
- Water Areas
- Natural Processes

Amenity Effects:

- Visual Intrusion & Disruption of Aesthetic Cohesion: the degree to which the proposal's visual 'presence' would impair or disrupt the aesthetic cohesion of the outlook from the viewpoint and specific features / landmarks within that outlook.
- Impacts On Public Amenity: the extent to which the development / activity would adversely affect public perceptions of Whangarei Harbour or Bream Bay and their related sense of place and identity.
- Impacts on Residential Amenity: the degree to which the proposal would adversely affect residential views to, and of, Whangarei Harbour or Bream Bay and their related sense of place and identity.

Impact ratings for most viewpoints are also inevitably affected by other key factors, including viewing distances to the application site and the elevation of the proposed development / activity relative to both public and private vantage points. Where these factors alter the level of effect identified for specific viewpoints, this is also identified. Taking all of the above into account, each viewpoint analysis concludes with an overall **Impact Rating** for the individual development component. These ratings employ the following impact scale:

- No Effect
- Very Low
- Low
- Moderate
- High
- Very High
- Severe Effect

4.1 CHANNEL FORMATION

DESCRIPTION OF PROPOSAL:

Option 4.2 provides an ‘S’ shaped approach to Marsden Point, threading between the Mair and Calliope Banks. As a result, the proposed channel would largely follow the channel alignment created by natural tidal flows in and out of Whangarei Harbour (**Figure 1** below) that is currently used for shipping in and out of Marsden Point and the adjacent Northport facilities.

As shown on the **Figure 2** (overleaf), the majority of dredging would occur off the Marsden Point dolphins, as well as between Busby head and the channel entry at the centre of Bream Bay.

The process of capital dredging and maintenance dredging would be as described at pages 3 and 5 of Tonkin & Taylor’s report: *Crude Shipping Project – Coastal Processes Assessment* (February 2017).

It would involve the removal of a mixture fine, medium and coarse sands, together with shell debris, making up the majority of the total 3,638,000m^3 to be extracted in the course of capital dredging, then maintenance dredging in the range of 50,000 to 100,000m^3 per annum. Silts and clays would also be removed, but these would only make up approximately 2.0% of excavated material in the Outer Channel (Bream Bay), rising to approximately 6.0% in the Inner Channel (outside the berth pocket).

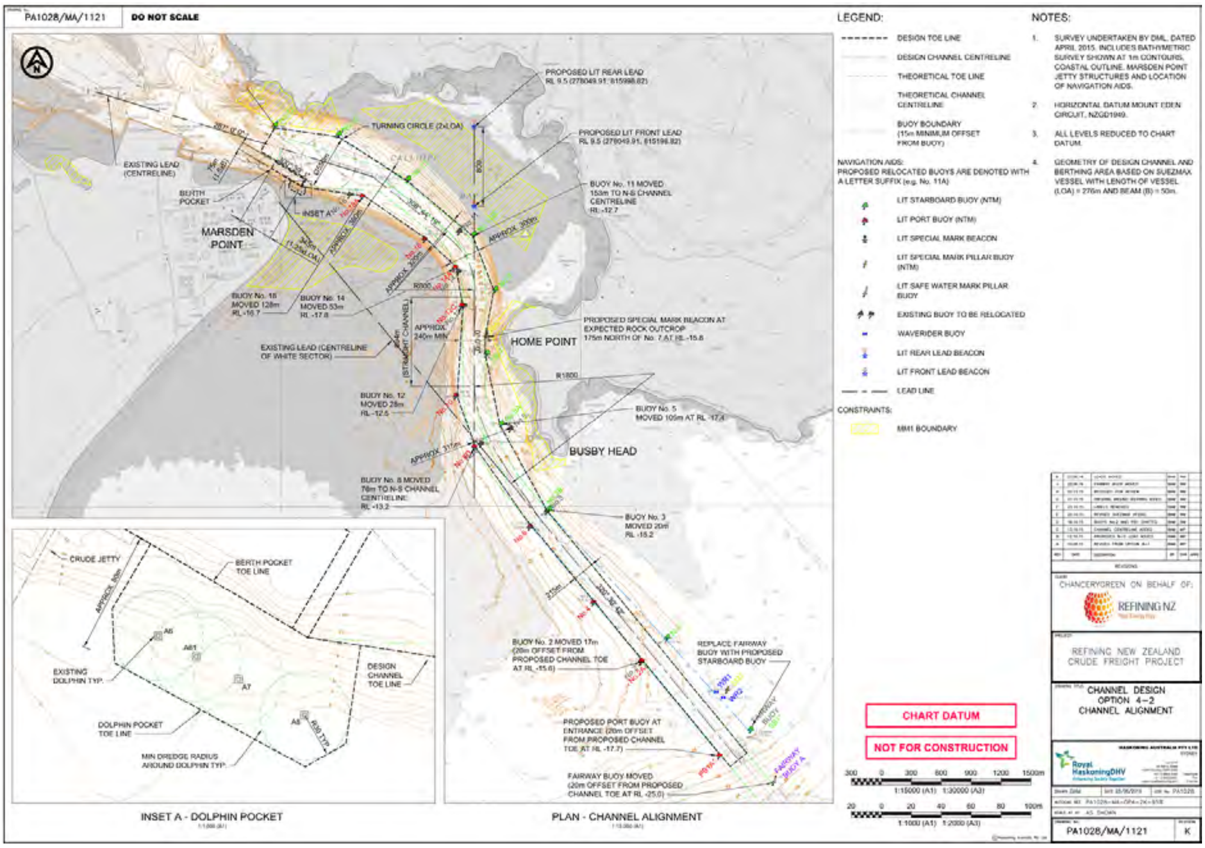


Figure 1. Final Option 4.2 Alignment (Royal Haskoning DHV: Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report)

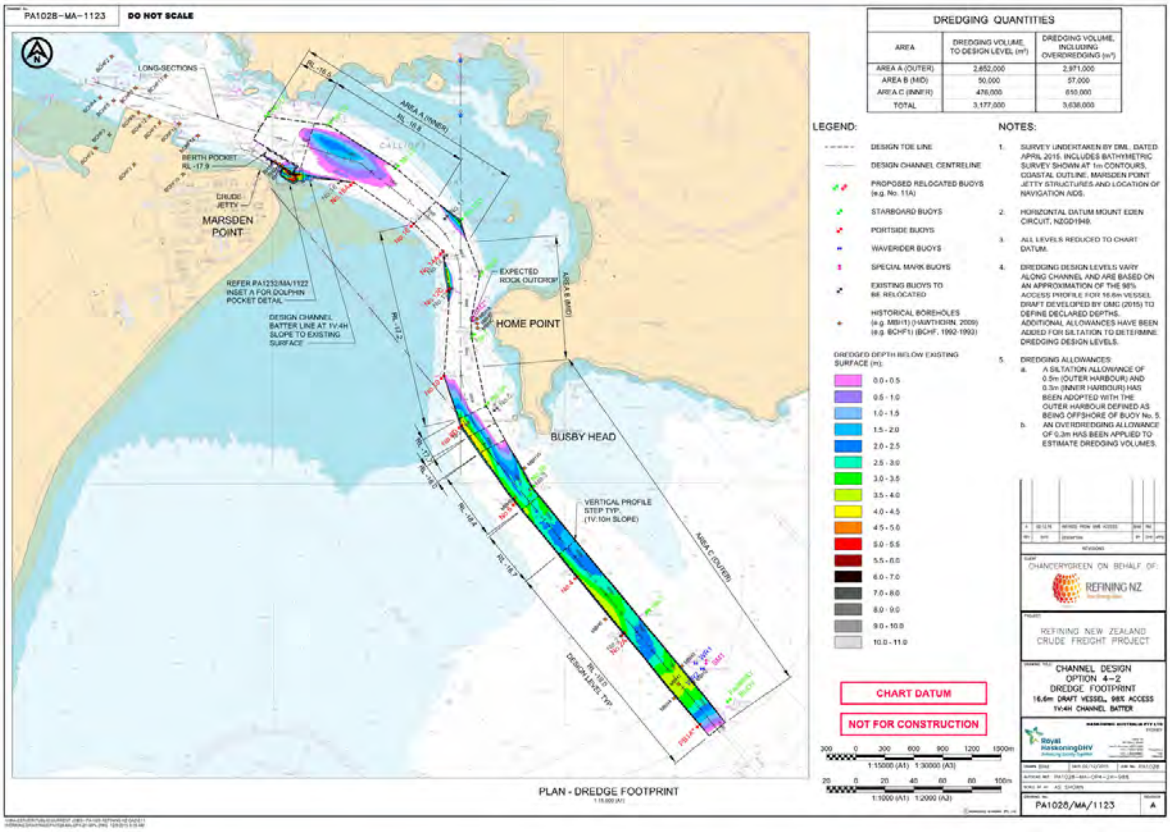


Figure 2. July Proposal for Option 4.2 showing the proposed areas of dredging (Royal Haskoning DHV: Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report)

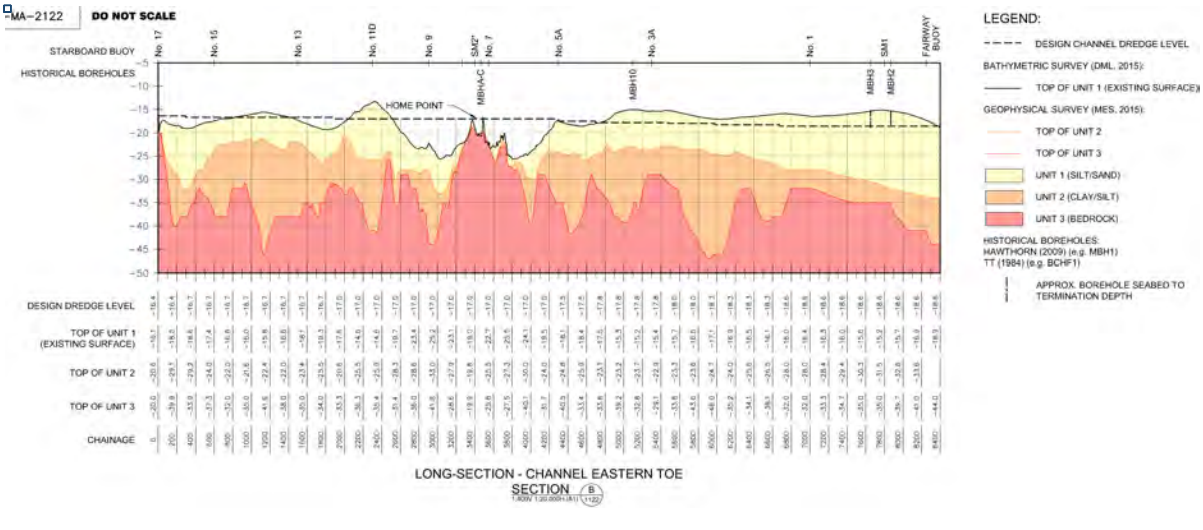


Figure 3. Long Section of Dredging showing the depth of proposed dredging and typical sea bed formations within and under the dredged corridor – comprising layers of: silt / sand; silt / clay & bedrock (Royal Haskoning DHV: Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report)

RECEIVING ENVIRONMENT(S):	The receiving environments exposed to the proposed navigation channel would be much the same as those already exposed to the current tidal channel, including (see map overleaf): ▪ the shoreline around Marsden Point and the oil refinery, extending down the Ruakaka coastline & past the Northport facilities towards One Tree Point; ▪ the margins and elevated vantage points of the DoC Reserve stretching from Bream Head to Home Point; ▪ the settlements of Reotahi, Little Munroe Bay, McGregors Bay, Taurikura Bay, McKenzie Bay and Urquharts Bay; ▪ associated public beaches; ▪ parts of Whangarei Heads Rd; ▪ the public tracks to and around Mt Lion, Taurikura, Mt Aubrey and Mt Manaia; ▪ the water areas of outer Whangarei Harbour and the northern half of Bream Bay

Looking towards the current navigation channel within Whangarei Harbour from Reotahi (above) & Urquharts Bay (below)

Looking towards the current navigation channel off Busby Head – with Bream Head to the left of view

Looking towards the current navigation channel off Busby Head – with the Brynderwyn Hills to the right of view

Looking seaward & towards the current navigation channel from Smugglers Bay

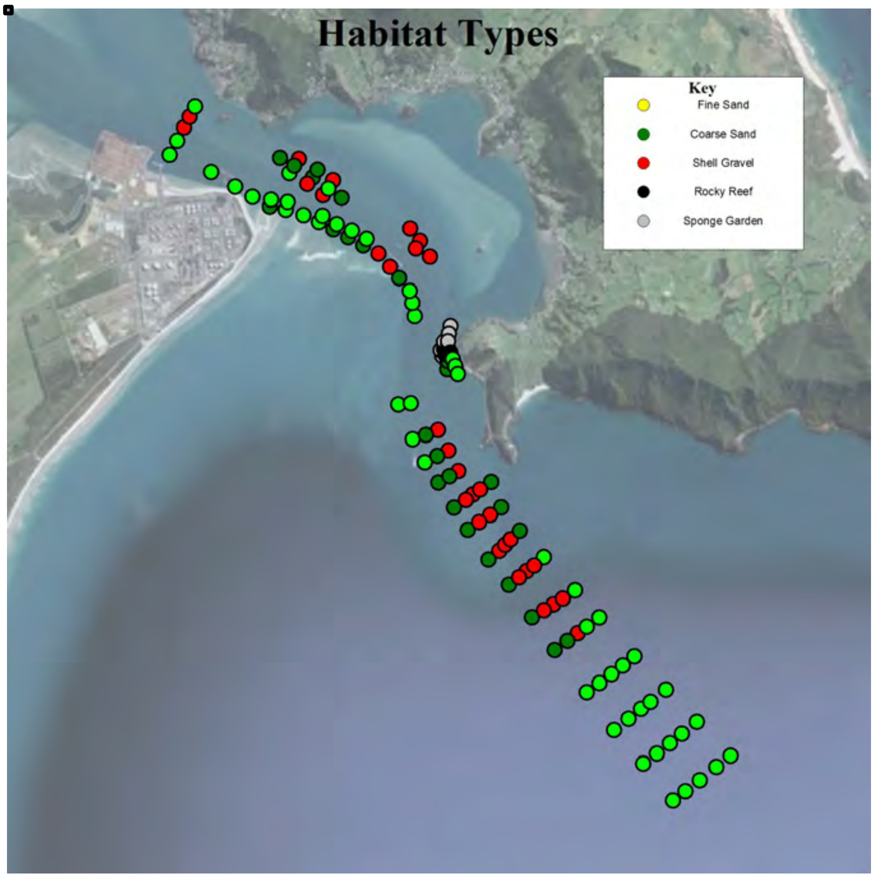
AUDIENCES:	Those more likely to see the revised channel – if only because of its realigned buoys – include: ▪ Boaties using the outer harbour and / or the northern half of Bream Bay; ▪ Recreational users of Home Point, Busby Head and Smugglers Bay – within the DoC reserve extending across Mt Lion to Bream Head; ▪ Residents within, and visitors to, the settlements of Reotahi, Little Munroe Bay, McGregors Bay, Taurikura Bay, McKenzie Bay and Urquharts Bay; ▪ Those using the associated public beaches; ▪ Those using the public tracks to and around Mt Lion, Taurikura, Mt Aubrey and Mt Manaia; ▪ Those working at the Marsden Point Oil Refinery; In addition, it is conceivable that some of those living next to, or visiting, the margins of the Ruakaka and / or One Tree Point coastlines would be exposed to the new channel. In reality, however, it is doubtful that members of the public would notice any appreciable change within either Whangarei's outer harbour or Bream Bay.
EXISTING VALUES:	**MODERATE / HIGH**: the landscape and natural character conditions of the harbour at and near Marsden Point are highly variable, combining natural headlands, volcanic peaks and forested areas with the oil refinery, deep water port, pockets of settlement and existing shipping lanes and berths. The outer reaches of Bream Bay – flanked by Bream Head and Mt Lion – together with Home Point, afford a more natural and highly appealing landscape setting for the proposed channel. Yet, this cohesion and 'unity of expression' diminishes elsewhere due to the residential occupation concentrated around Urquharts Bay, Taurikura and Reotahi, while the combined oil refinery and Northport facilities leave a much more industrial, utilitarian, 'stamp' on the outer Whangarei Harbour landscape as a whole.

Underwater, Bioresearchers' report (*Existing Environment Assessment: Ecology Of The Dredge Area – Whangarei Heads)* dated September 2016, summarises the underwater ecological habitats potentially affected by the channel developments at pages 37-39:

> *Biota and sediment characteristics within and adjacent to the proposed dredge area have been defined by samples collected at 117 sites…….*
>
> *The seabed photographs showed the presence of five distinctly different habitat types;*
>
> 1. *Fine clean sand,*
> 2. *Coarse sand with shell,*
> 3. *Coarse shell gravel,*
> 4. *Rocky reef,*
> 5. *Sponge garden.*
>
> *……….. The fine sand habitat was the most common, most diverse, and dominated by smaller biota such as polychaete worms and amphipods.*
>
> *The coarse sand habitat was present both seawards and inshore of Busby Head but differed slightly in composition inshore compared to seawards. Seawards of Busby Head the biota was dominated by the bivalve Tawera spissa and the primitive chordate, Epigonichthys hectori. Inside the harbour mouth the coarse sand habitat was dominated by the community defining bivalve Venerupis largillierti and juvenile gastropods.*
>
> *The shell gravel habitat had a higher proportion of larger species than the sandy habitats. The species composition was different from the sandy habitats with 36 taxa only found in the shell gravel habitat. The community defining bivalve Tucetona laticostata and the primitive chordate, Epigonichthys hectori were abundant in the shell gravel seaward of Home Point, but almost absent inside the harbour mouth. Inside the harbour mouth the shell gravel had greater numbers of bivalves Corbula zelandica and Venerupis largillierti and juvenile gastropods.*
>
> *The entire rocky reef and sponge garden habitat was located at Home Point and immediately up harbour from Home Point. The rocky reef habitat is significant within the harbour in that it is one of only three such subtidal reef habitat areas in the harbour mouth. That said the shallow reef area was typical of similar shallow reef habitats in north eastern New Zealand. Consequently it is locally but not regionally significant. While the deeper reef sponge garden habitat had higher numbers of schooling fish such as butterfly perch and snapper than typically seen, fish numbers were low at all other sites sampled. The sponge garden habitat had significant numbers of yellow finger sponges and grey sponges both of which are assumed to be relatively slow growing and this habitat would require a longer period of recolonisation if removed.*
>
> *No species of marine invertebrates (worms, crustacea, molluscs, etc.) reported as present in the dredge area (Appendix 3) are listed as Threatened, At Risk or Not Threatened. Species of marine fish observed are similarly not listed Threatened, At Risk or Not Threatened. The habitats with in the dredge area are therefore not considered to be of national significance. The rocky reef that extends from Home Point is locally significant in that it differs ecologically from the remainder of the dredge area which is all "soft" sediment environments. The Home Point habitat is similar to habitats located in the Motukaroro Island Whangarei Marine Reserve. Several habitats adjacent to the dredge area are considered to be of ecological significance. The Motukaroro Island Whangarei Marine Reserve immediately to the west of the dredge area by its definition as marine reserve is considered to be of national significance. The intertidal and shallow subtidal flats of Snake, Calliope and Mair banks are considered to be of regional significance based on the populations of shellfish present, and other non-marine species that are dependent on these habitats.*
>
> *Sediment chemistry and particle size were assessed at all sites to ascertain the risk associated with the disturbance of this material during dredging. The chemistry results were compared against the ANZECC interim sediment quality guidelines (where available). None of the surface sediment samples exceeded the ANZECC ISQG Low values with exception of Fluoranthene, Phenanthrene and Pyrene at site C26S. This minor exceedance at one site suggests that no adverse effects are expected to occur from the redistribution of sediments during dredging or from the disposal of the dredge spoil at a nearby marine disposal site.*
>
> *Higher percentages of very fine sands and silts will likely result in greater plumes of sediment discoloured water at the point of dredging and at the disposal site. In addition there would be greater spread of fine sediments which could potentially*

smother some habitats, resulting in loss of or changes in biota. The proportion of very fine sand and silt is generally very low in the surface sediments in the proposed dredge area. The proportion of very fine sand is highest at the furthest extent offshore of the proposed dredge area (C01) and beyond (C00). Silt was only detected in abundance at two sites; C11M, mid channel adjacent to Frenchman Island. Both samples up and downstream from this site were considerably coarser, suggesting the sample was anomalous or the result or some peculiarity in the currents in this area.

Similarly silt was detected at site HP01 in the small bay between Home Point and Busby Head. Current flow data provided by Ocean Currents Ltd. (2015) showed that a counter current (eddy) is formed in this area on both the rising and falling tides; thus the deposition of silts is natural.



These findings reveal a seabed within the proposed channel that largely comprises broad layers of sand interposed with patches of gravels and sea shells. Most of this environment has a sparse, undifferentiated, character. It is relatively homogeneous, without a great deal of diversity and biotic content.

Even so, Bioresearchers' report also identifies an important 'rocky reef and sponge garden habitat' (one of only three such sub-tidal habitats in Whangarei Harbour) northeast of Home Point: the deeper sponge garden is important in terms of both its sponge colony and the high concentration of schooling fish within it. Consequently, if affected by channel formation, recolonisation of this part of the sea floor by fish species and other taxa would take longer than within the rest of the seabed affected by dredging. Most of the remaining sea floor near Home Point was, by contrast, more notable for its relatively low fish numbers and lesser sensitivity overall. The images (overleaf) are also extracted from Bioresearchers' assessment of the seabed and its aquafauna.

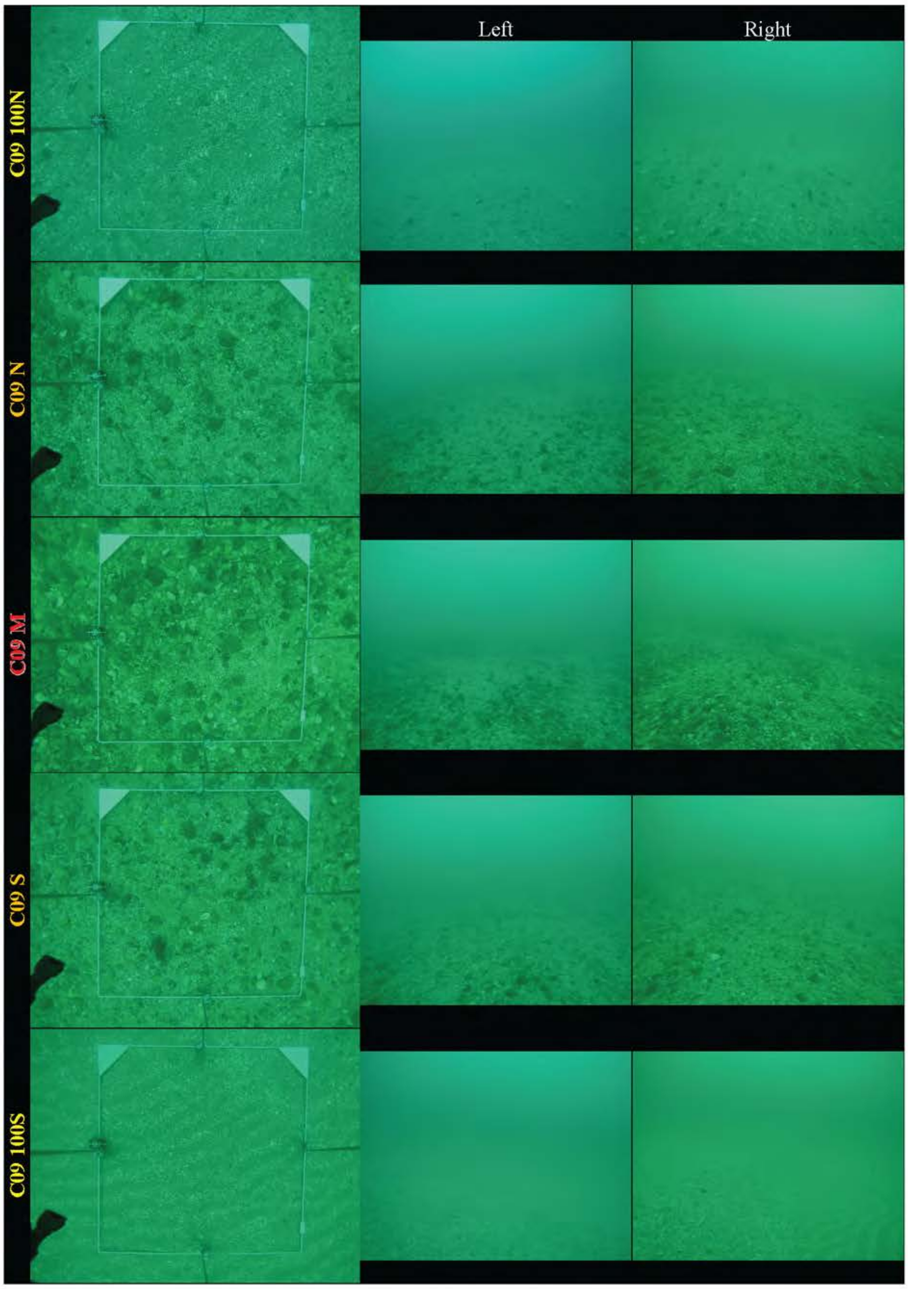


Figure 7.10 **Seabed Photographs, Transect C09, 9 April 2015.**

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Bioresearches
A Babbage Company

Typical sample of seabed video images captured by Bioresearchers in their assessment of effects on marine biota – showing a sea floor dominated by sand, gravels and shell fragments: Transect C09 – located on the south side of the Inner Channel close to Mair Bank

PROMINENCE / VISIBILITY:	**VERY LOW:** The outer harbour and northern Bream Bay are focal elements within the wider coastal landscape and environment. However, the natural tidal channel has little visual presence in its own right, with the channel markers that define its course largely 'lost' amid the array of man-made structures – from moored boats to the existing wharves and berthage dolphins – that already line the harbour margins. The oil refinery and port are commanding features within this landscape, while the sheer expanse and openness of Bream Bay – combined with the scale and grandeur of the volcanic landforms that overlook both it and Whangarei Harbour – diminish the current navigation markers to the point where they are insignificant components of the current coastal environment and landscape.

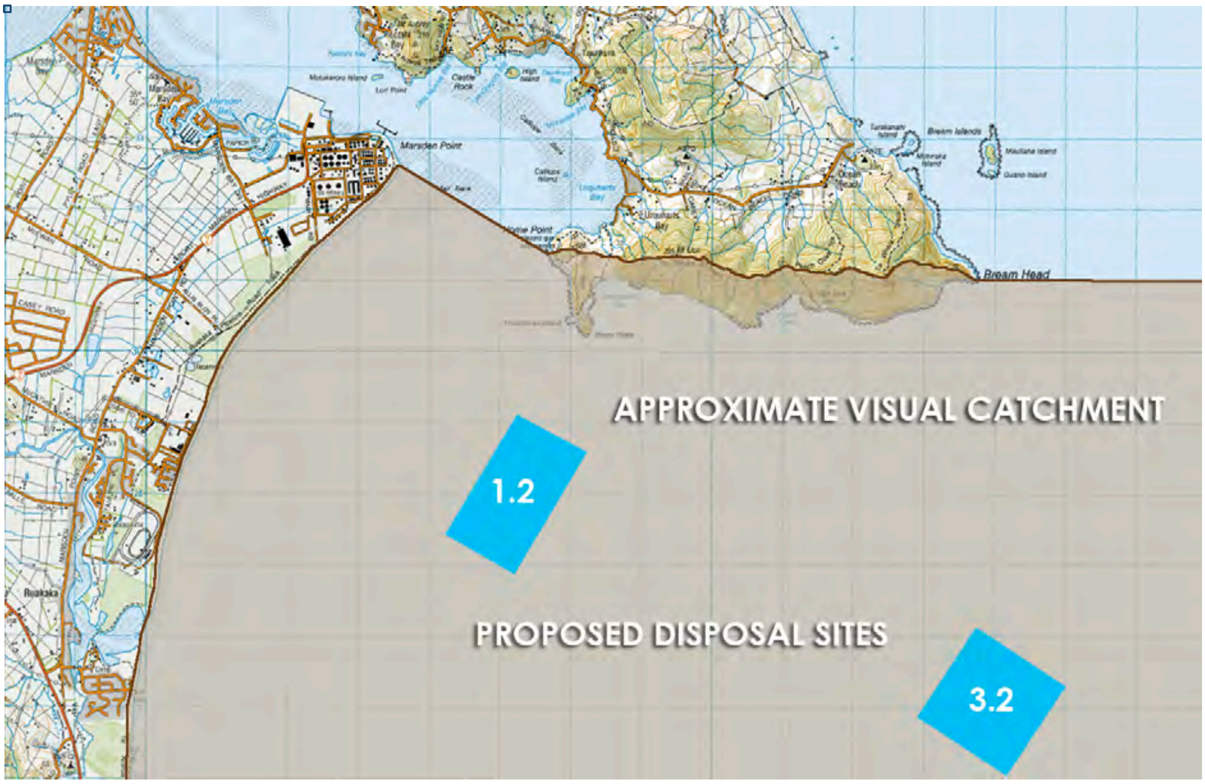
LANDSCAPE EFFECTS:	**VERY LOW:** The rearrangement of buoys within both the outer harbour and Bream Bay would make little, if any, difference to the current delineation of the navigation channel. For all intents and purposes, once dredged and re-marked, the channel would appear almost identical to that which exists at present. In addition, the relatively flat angle of viewing from most beaches and many lower lying areas of settlement means that the buoys are often viewed set against the highly modified coastline of Marsden Point and / or the landform of Home Point: their visual presence is currently quite limited and this likely to remain the case. Consequently, the proposal would have a limited effect in relation to the ONL values of Home Point.
NATURAL CHARACTER EFFECTS:	**LOW / MODERATE:** There would be no significant change to the man-made elements (essentially buoys) that define the limits of the proposed navigation channel. As a result, any direct modification of natural character values above the sea surface would be very limited – as per the discussion of landscape effects (above). Underwater, MetOcean Solutions' report shows that the sea floor around the northern to eastern edge of Mair Bank and along the southern edge of Calliope Bank would be subject to modification. The natural tidal channel would be reconfigured and extended to create an artificial formation, as is shown in the cross-sections and long-sections prepared by Royal Haskoning DHV. In effect, parts of the current channel would be extended laterally, deepened and 'squared off' – although the resulting side batters would have a natural angle of repose once given time to settle. Figure 2 highlights where this modification would be most pronounced: between the entry point to the channel in Bream Bay and Home Point, then on the final approach to the current 'dolphins' and unloading facilities. In a related vein, MetOcean Solutions report (*Crude Freight Project – Predicted Effects on the Physical Environment,* June 2016) concludes that off Marsden Point (p.iii & iv): *The proposed channel modifications are not expected to significantly change the governing sediment dynamics of the harbour entrance, and the existing complex asymmetries induced by the ebb and flood tidal flows will be maintained after deepening.* *The morphodynamics of Mair Bank are largely influenced by the bio-stabilisation provided by live shellfish and their residual shell fragments. This bio-stabilisation is expected to have a more significant effect on future evolution of the Bank than the effect of the proposed channel deepening. The studies undertaken here do not indicate that channel deepening will materially change the sedimentary outcomes on the Mair Bank.* *The sedimentary stability of Ruakaka Beach is not expected to be influenced by the slight variation in the wave conditions caused by channel deepening. However, enhanced wave refraction along the eastern ridge of the channel on the delta may increase the bed shear stress around Busby Head somewhat and Smugglers Bay in a lesser extent, although this not anticipated to disturb the stability of the sea bed, which is largely composed of sandy and shelly gravel and already occasionally subjected to 4 m wave height during storms.* *Sedimentation is expected to occur immediately adjacent to the Marsden Point jetty. Here, the tidal flows reduce and the tidal asymmetry is expected to promote infilling of the deepened areas over time at a relatively constant rate. While a reliable volumetric estimate is difficult to make with confidence, the likely evolution pattern will be of accretion from the southern shore. A degree of infilling at the toe of Mair Bank may occur where the channel has been realigned. These areas of sedimentation will require regular maintenance dredging to ensure on-going navigability.* *Infilling of the main channel south of Busby Head toward the distal margin is expected, and a programme of maintenance dredging will also be required here for ongoing navigability.* Further, at p. 76 it is pointed out that: *Subtle changes in the tidal and wave-driven currents over the eastern part of Mair Bank may result in zones of deposition and erosion on the toe of the Bank. Note the historical survey data have shown that this area is dynamic and natural bed variability of the order 0.5 m already occurs.* In effect, the proposed dredging should have an appreciable impact on the morphology of the seabed at the mouth of Whangarei Harbour, although it will also be subject to changes generated by storm events and natural tidal sequences. Once the configuration of the seabed is modified, it is expected to naturally stabilise, although maintenance dredging will

	have to respond to on-going in-filling of the berthage area off Marsden Point, around the toe of Mair Bank and off Busby Head. Tonkin & Taylor's February 2017 report also indicates that there may be some long term changes to Mair Bank, in particular (p.59): *……..it is recognised that both the capital dredging and ongoing maintenance dredging may result in a net loss of sediment from the ebb tide shoal over time that may not be replenished from natural sources (refer Figure 5-1 and Figure 5-2). While the capital dredge volumes are small in comparison to the volume of sand stored in the ebb tide delta (around 2% of the estimated volume of the ebb tide shoal) and the expected maintenance dredging volumes are also small (between 0.03% and 0.07% of the estimated volume of the ebb tide delta), these net losses of sediment may result in a reduction in the total volume of the ebb tide shoal over time. Assuming full removal of both capital and maintenance dredging from the ebb tide delta over the 35 period of the consent, this would result in around 5.6M to 7.9Mm3 of sediment removal that equates to around 3.3 to 4.7% of the existing ebb tide delta volume.* *The reduction in volume could manifest in a reduction in level of the existing ebb tide shoal area (i.e. assuming the footprint of the shoal remains the same). However, it is more likely to result in both a reduction in level and a reduction in overall plan form size of the delta, as it would be expected that ongoing coastal processes would move sand towards the shoreline. An overall change in area and height would result in smaller observed changes than if only height was reduced.* Bioresearchers' analysis confirms that most of the sea floor is dominated by medium-grain sands that this would limit the smothering of local marine habitats by dredging plumes and assist with the recolonisation of most of the sea bed. Other underwater effects would be limited by the sand-dominated, relatively depauperate, conditions within and around most of the channel corridor. In relation to the identified 'sponge garden' and, to a lesser degree, the adjoining 'rocky reef' habitat, it is clear that both lie outside the footprint of the era subject to dredging and channel formation. In addition, Refining NZ has agreed to manage the turbidity of the waters around the 'rocky reef and sponge garden' to ensure that neither is affected by the dredging operations. Consequently, the proposed channel formation would have no appreciable effect in relation to these regionally significant, and highly sensitive, habitats.
AMENITY EFFECTS:	**NONE:** there would be no appreciable change to the above water profile of the channel and the amenity associated with either the outer harbour or Bream Bay: changes to the configuration of the marker buoys would be insignificant once completed.

	Impact Rating:	**LOW / MODERATE**

4.2 SAND DISPOSAL

DESCRIPTION OF PROPOSAL:	The two sites proposed for sand disposal are both located within the centre of Bream Bay, some 3.5km and 10.9km offshore of the Ruakaka coastline and some 1.8km south and 6km southeast of Busby Head. Up to 97.5% of the 3,700,000m^3 of material dredged form the new channel would be disposed of at Site 3.2 ('offshore') as part of the Capital Dredging programme, while the remaining material – up to 2.5% – would be disposed of at Site 1.2 ('inshore'). Once the capital works are completed, maintenance dredging and disposal would also be required. Site 3.2 would cover some 2.5km^2, with a maximum area of 5.75 km^2 defining the outer limit of the area within which sediment is expected to settle. This area is situated around 45m below Chart Datum, south-east of the proposed Dredge Channel, and has been sized to accommodate all of the capital and maintenance dredging proposed for the 35 year duration of the consent period. The resulting 'placement mound' for capital dredging would have an average height of approximately 1.5m, although this could periodically rise to a maximum of 4.0m in places. Site 1.2 would also cover an area some 2.5km^2 of the seabed and would be located at the southern end of Whangarei Harbour's ebb tidal delta at a depth of 7m to 15m chart datum. Area 1- 2 is designed to enable placed sediment to be slowly transported inshore during higher energy wave events to maintain sediment volumes within the ebb delta, and would be large enough to provide a range of locations for targeted placement of the dredge material. It seems likely that this would result in targeted areas having average placement depths of around 0.6 m across 250,000m^2 at any one time, or 10% of the total disposal area.
RECEIVING ENVIRONMENT(S):	The main receiving environment likely to be exposed to disposal vessels and activity plumes is Bream Bay itself, and in particular, those parts of the central to northern bay utilised for recreational fishing and boating (see below). Yet, even within this area, most boaties and other users of Bream Bay would find it very difficult to differentiate disposal activities from more general boating and shipping activity unless very close to the area of disposal.



Looking out across central Bream Bay from the Ruakaka Surf Club (above & below)

The outlook from the southern side of Home Point towards Disposal Sites 1.2 & 3.2 south to southeast of the proposed navigation channel

The outlook from the western side of Home Point towards Disposal Site 1.2 south of the proposed navigation channel

AUDIENCES:	Those more likely to see sand disposal operations comprise recreational boaties traversing Bream Bay to and from Whangarei Harbour or the Hen and Chicken Islands.
EXISTING VALUES:	**HIGH / MODERATE**: the landward margins of Bream Bay are highly modified, containing pockets of residential development, including baches and beach houses, together with the oil refinery, the former Marsden B Power Station site, the Ruakaka Race Course, an industrial park, the local sewerage treatment plant and ponds, two camping grounds and the Waipu Cove Golf Club. Even so, the dunes and beachfront directly facing, and physically abutting, Bream Bay has been identified as an ONL in the RPS, with the narrow dune corridor behind the beach and lagoons at the mouth of the Ruakaka and Waipu Rivers anchoring this area. The dune system provides a buffer between the beachfront and its developed hinterland, with both the seaward edge of the dunes and the beachfront 'in front of it' offering spectacular views out over the expanse of Bream Bay to the Hen and Chicken Islands and the spectacular sequence of volcanic peaks clustered around Mt Lion and Bream Head. Notwithstanding the more utilitarian components of this coastal landscape, Bream Bay therefore retains a powerful focus on its least modified component – the sea – and the amalgam of islands and jagged peaks that frame Bream Bay.

PROMINENCE / VISIBILITY:	**VERY LOW:** Views to the disposal vessel from most of the land areas near Ruakaka and Home Point (stretching through to Bream Head) would be over distances of 1.8-3.5km and 6.1-10.9km to the maintenance and capital dredging sites, respectively. This, together with low viewing angles, would limit exposure to the disposal operations, from most quarters.
LANDSCAPE EFFECTS:	**VERY LOW:** The only discernible 'effect' associated with sand disposal would be the location of a vessel within the broad expanse of Bream Bay and the placement of sand down on the seabed. It is doubtful that either the disposal vessel or disposal process would have a significant visual presence, given the viewing distances indicated above. Viewed from other vessels traversing Bream Bay, the dredging vessel and disposal operations would be more obvious. But they would not be so dissimilar to other maritime activities within the Bay – associated with the passage of vessels to and from the oil refinery and Northport facilities – that they would appreciably alter perceptions of Bream Bay. To a certain extent, the dredging vessel would also become a 'known' part of the sea environment by locals, but would not greatly disturb the more important characteristics and values of Bream Bay. As a result, it is anticipated that the dredging vessel and sand disposal would have a quite limited impact on perceptions of the Bream Bay landscape.
NATURAL CHARACTER EFFECTS:	**LOW:** The above water effects of disposal operations would be largely restricted to awareness of an additional vessel within Bream Bay on a regular basis. At worst, this would add to the incursion of man-made vessels into the local maritime environment, resulting in a very slight diminution of its naturalness in absolute terms. Yet, such effects would be essentially small scale and incremental, given the sheer scale and expansive qualities of Bream Bay. Underwater, disposal would create layers and mounds of material that merge seamlessly with the relatively homogeneous sand floor found at both disposal sites. Wave and tidal action would help to disperse the mounds so that they physically coalesce with the existing sea floor.
AMENITY EFFECTS:	**VERY LOW:** Taking into account the various factors discussed in relation to Landscape and Natural Character Effects, it is considered that disposal at both sites would have a low public profile and would scarcely affect perceptions of Bream Bay's character, identity and sense of place.

Impact Rating:	LOW

4.3 LEAD LIGHTS NEAR TAURIKURA

DESCRIPTION OF PROPOSAL:

The following specifications have been supplied by Refining NZ and accords with the description of proposed Lead lights at pages 43 and 44 of DHV Royal Haskoning's report: *Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report*:

Taurikura Front Lead:

Position:	*35' 50.375 S , 174' 31.293 E*
Height:	*8.7m above chart datum, 6.0m above Mean High Water Spring*
Width:	*600mm diameter*
Construction:	*Tubular steel with steel ladder and basic 1.2m x 1.2m platform for equipment*
Colour:	*Rescue Orange front (2m x 500mm stripe) facing 180' S, remainder of the tower light cloud grey (BS5252 colour Y81-011-082)*
Light:	*Day/night range light VLB-91 of 3nm*

Photo 1 shows one of 39 similar designs being used on the Whangarei Harbour. Each of the existing beacons is 5-6m in height above Chart Datum (an average 2.8m above MHWS), and of the same proposed construction as the Taurikura Front Lead.

Taurikura Rear Lead:

Position:	*35' 49.990 S, 174' 31.293 E*
Height:	*15.7m above chart datum, 13.0m above Mean High Water Spring*
Width:	*850mm diameter*
Construction:	*Tubular steel, two 6m enclosed ladders with platform at each level. Bottom platform, 850mm x 850mm and the top platform 2m x 1.8m for equipment.*
Colour:	*Rescue Orange front (4m x 750mm stripe) facing 180' S, remainder of the tower light cloud grey (BS5252 colour Y81-011-082)*
Design:	*As per* ***Photo 2****: the lead shown has the light head elevated 19m above Chart Datum; whereas the light on proposed design would be 15.7m above Chart Datum*
Light:	*Day/night range light VLB-91 of 5nm*

Photo 2 is of a Lead called "Skips Rocket" that is currently sited near Limestone Island in the Upper Whangarei Harbour. It is employed as the 'Shell Cut Inbound Rear Lead'. This structure is 19m high (16.3m above MHWS) at chart datum to the light and 21m at chart datum (18.3m above MHWS) to the top. It has the same design specification as the proposed Taurikura Rear Lead.

Both proposed Leads would be located on the northern side of the proposed navigation channel: the Front Lead some 1150m from McKenzie bay and 1450m from Taurikura Bay – on the southern edge of Calliope Bank – and the Rear Lead some 740m from Taurikura Bay. Both lights would oriented towards the navigation channel, with their lights facing southwards, away from Little Munroe Bay, McGregors Bay, Taurikura Bay and McKenzie Bay.

In addition, they would both have a very slender, vertical profile, not unlike a power pole when viewed over any distance, although their yellow and yellow-orange colouring would set them somewhat apart from such structures. The actual light heads and reflectors would be largely absorbed by the pole structure and ladders attached to the Rear Lead, in particular.

Photo 1. ***A Front Lead as proposed for Taurikura at the outer, southern, edge of Calliope Bank 1450m from Taurikura Bay***

Photo 2. ***"Skips Rocket" off Limestone Island – as proposed for the inner side of Calliope Bank some 740m offshore of Taurikura Bay***

RECEIVING ENVIRONMENT(S):	The receiving environments exposed to the proposed navigation channel would be much the same as those already exposed to the current tidal channel, including (see map overleaf): ▪ the settlements of Taurikura Bay, McKenzie Bay and – to a lesser degree – Urquharts Bay; ▪ associated public beaches; and ▪ the water areas of outer Whangarei Harbour. Other areas that would be theoretically exposed to the Leads, but which, in reality, would offer only distant and / or fragmented views to them include: ▪ the shoreline around Marsden Point and the oil refinery; ▪ the margins and elevated vantage points of Home Point; ▪ parts of Whangarei Heads Rd; and ▪ the public tracks on Taurikura, Mt Aubrey and Mt Manaia.

Looking towards the locations of the proposed Leads from the western (above) & eastern ends of Taurikura Bay (below)

Looking towards the locations of the proposed Leads from McKenzie Bay

AUDIENCES:	Those more likely to see the proposed Leads include: ▪ Residents within, and visitors to, the settlements of Taurikura Bay, McKenzie Bay and, possibly, Urquharts Bay; ▪ Those using the associated public beaches; and ▪ Boaties using outer Whangarei Harbour. In addition, some of the following might be able to obtain distant and / or fragmentary views of the Leads: ▪ Recreational users of Home Point, Busby Head and Smugglers Bay – within the DoC reserve extending across Mt Lion to Bream Head;

	▪ Those using the public tracks to and around Mt Aubrey, Taurikura and Mt Manaia; and ▪ Those working at the Marsden Point Oil Refinery.
EXISTING VALUES:	**MODERATE / HIGH**: As is explained in relation to the Navigation Channel Assessment (Section 4.1), the landscape and natural character conditions of the harbour at and near Marsden Point are highly variable, combining natural headlands, volcanic peaks and forested areas with the oil refinery, deep water port, pockets of settlement and existing shipping lanes and berths. The outer reaches of Bream Bay – flanked by Bream Head and Mt Lion – together with Home Point afford a more natural and highly appealing landscape setting for the proposed channel. However, this cohesion and 'unity of expression' diminishes elsewhere due to the residential occupation concentrated around Urquharts Bay, Taurikura and Reotahi, while the combined oil refinery and Northport facilities leave a much more industrial, utilitarian, imprint on the outer Whangarei Harbour landscape. On the other hand, it is important to recognise that Taurikura Bay is the focus for significant recreational use, especially over the summer months and its caters to year-round use by a sizeable residential community. Nearby McKenzie Bay has a much smaller community of users, but also enjoys a relatively high level of appeal and amenity in its own right. In addition, both the proposed Leads would sit within part of the harbour environs and on part of Calliope Bank that is identified (in the Northland RPS) as having high natural character in the Northland Regional Policy Statement.
PROMINENCE / VISIBILITY:	**LOW / VERY LOW:** The Front Lead, located some 1150m from McKenzie Bay and 1450m offshore of Taurikura Bay would be all but invisible, due to its 'pencil'-like profile and its mid-harbour location set (in most views) against the backdrop of the oil refinery's complex industrial matrix and the landforms of both Marsden Point and Home Point. The Rear Lead would sit more directly offshore of a more heavily used, Taurikura Bay. It would be framed, visually, by the headlands at each end of the Bay, together with High Island, to the west, and a more distant Home Point to the east. However, viewed at a distance of some 740m from Taurikura's beachfront the Rear Lead would appear to rise just 2.5cm above MHWS[1], while the Lead's width would approximate that of a distant yacht's mast. It would, however, be considerably shorter than the masts on the yachts shown moored off Taurikura Bay (above). Viewed from the eastern end of Taurikura Bay or parts of McKenzie Bay the Lead would merge seamlessly with the distant structures of the oil refinery, whereas when viewed from the western end of Taurikura Bay it would emerge as a finely wrought, structure that sits within the harbour's water area, but is substantially 'lost' amid the masts of vessels moored closer to the shoreline (see photos above), as well as against the more remote backdrop of the Brynderwyn Hills and the margins of Marsden Point. In more dynamic views from vessels passing Calliope Bank, the Front Lead, especially, would be more apparent (as it is meant to be), but it would comprise one of a sequence of navigation structures – more than 40 markers and lights in total – that mark the lanes to and from the Port of Whangarei and the Town Basin. The outer harbour is also flanked by Northport's wharves and operational area, the oil refinery and its dolphins, and the sequence of residential development both at One Tree Point / Marsden Bay and strung along the northern reaches of the harbour. Consequently, the Leads would be visible, but are unlikely to be particularly prominent. Even at night-time, their reflectors would focus on the shipping channel, away from Taurikura Bay and the other settled beaches lining the northern side of the harbour.

1 Preceived scale is a function of height divided by distance. Allowing for parallax – which accommodates the curvature of the Earth – would reduce this apparent height even further, albeit to a very slight degree.

LANDSCAPE EFFECTS:	**VERY LOW:** Both Leads would have an extremely limited, to inconsequential, effect on the landscape values of Taurikura Bay, McKenzie Bay and the outer harbour.
NATURAL CHARACTER EFFECTS:	**VERY LOW:** Both Leads would have an extremely limited, to inconsequential, effect on the natural character values of Taurikura Bay, McKenzie Bay and the outer harbour, and the Calliope Bank HNC area overall.
AMENITY EFFECTS:	**VERY LOW:** Both Leads would have an extremely limited, to inconsequential, effect on the amenity values of Taurikura Bay, McKenzie Bay and the outer harbour.

Impact Rating:	VERY LOW

4.4 A NEW LATERAL MARKER OFF HOME POINT

DESCRIPTION OF PROPOSAL:	The proposed lateral marker to be located on an exposed rock outcrop directly west of Home Point would be appreciably smaller than the Leads just discussed (DHV Royal Haskoning's report: Refining NZ Crude Shipping Project Shipping Channel – Concept Design Report; pp.24 & 45). As shown in **Photo 3**, it would comprise a 250mm diameter tubular steel, pole that is 4.5m high – above chart datum, approximately 1.8m above MHWS. A triangular marker would be attached to the top of the pole, together with a small light.

Photo 3. – typical lateral marker of the kind proposed off Home Point

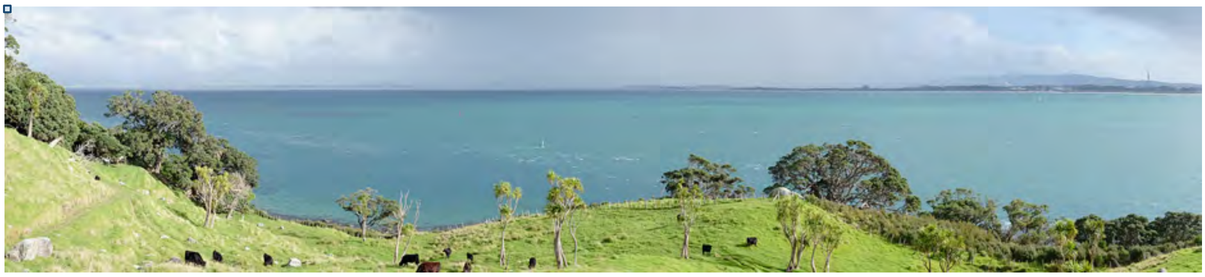
RECEIVING ENVIRONMENT(S):

The receiving environments theoretically exposed to the proposed navigation marker next to Home Point would be similar to the areas exposed to the proposed Leads, including (see map overleaf):

- Home Point Reserve, especially near the historic gun emplacements and immediately west to southwest of them;
- the settlements of McKenzie Bay and Taurikura Bay;
- associated public beaches; and
- the water areas of outer Whangarei Harbour.

Other areas that would be theoretically exposed to the Leads, but which, in reality, would offer only distant and / or fragmented views to them include:

- the shoreline around Marsden Point and the oil refinery;
- the more distant settlements and beaches at McGregors Bay and Little Munroe Bay;
- parts of Whangarei Heads Rd; and
- the public tracks on Taurikura, Mt Aubrey and Mt Manaia.



Views up Whangarei Harbour from near the Home Point gun emplacements, which could reveal the proposed marker (both above)

The outlook from the western side of Home Point; the proposed lateral marker is unlikely to be visible from this part of the reserve (both above)

AUDIENCES:	Those more likely to see the proposed lateral marker include: ▪ Recreational users of the reserve at Home Point; and ▪ Boaties using outer Whangarei Harbour. In addition, some of the following might be able to obtain distant and / or fragmentary views of the lateral markers, although it is likely to be faintly visible at best: ▪ Residents within, and visitors to, the settlements of Taurikura Bay, McKenzie Bay and – perhaps – parts of McGregors Bay and Little Munroe Bay; ▪ Those using associated public beaches; and ▪ Those using the public tracks to and around Mt Aubrey and Taurikura; and ▪ Those working at the Marsden Point Oil Refinery.
EXISTING VALUES:	**HIGH**: As is explained in relation to the Navigation Channel Assessment and Leads (Sections 4.1 and 4.3), the landscape and natural character conditions of the harbour at and near Marsden Point are highly variable, combining natural headlands, volcanic peaks and forested areas with the oil refinery, deep water port, pockets of settlement and existing shipping lanes and berths. Although, the outer reaches of Bream Bay – flanked by Bream Head, Mt Lion and Home Point – afford a more natural and highly appealing landscape setting for the proposed channel, this cohesion and 'unity of expression' diminishes elsewhere due to the residential occupation concentrated around Urquharts Bay, Taurikura and Reotahi. Moreover, the combined oil refinery and Northport facilities leave a much more industrial, utilitarian, imprint on the outer Whangarei Harbour landscape. Home Point also contains the remains of WWII gun emplacements that leave a somewhat different type of cultural / man-made mark on the local landscape; one that is entirely positive in terms of Heritage Associations, but less so in respect of the area's natural character. Even so, Home Point is part of a sequence of more natural landscapes that are experienced at the southern terminus of the Whangarei Heads, extending through to Busby Head, Mt Lion, and Bream Head. This, combined with the area's considerable aesthetic appeal, expressiveness, and other values, provide the basis for its ONL status, while the remote and wild nature of the coastline along the outer edge of the DoC reserve sets it apart from the typically more tranquil and modified confines of Whangarei Harbour. As a result, the proposed navigation marker would sit within part of Home Point's coastal environment that is identified as having high natural character value within the Northland Regional Policy Statement.
PROMINENCE / VISIBILITY:	**VERY LOW:** The proposed lateral marker would sit well below the main planes of viewing from Home Point and, in particular, the elevated tracks and area around the gun emplacements. It would only become visible if and when those visiting Home Point set out to either clamber down the steep escarpment at the coastal edge or glimpse it through bush and mature pohutukawas along the cliff-line near the old bunkers and observation point. The lateral marker would theoretically be visible from a series of bays to the north and northeast, as well. However, its thin profile and small overall size, together with its close association with the rising profile of Home Point would render it all but invisible from most such vantage points. Even in comparison with the yachts and other leisure craft commonly moored in nearby Urquharts Bay, its scale would be diminutive, and it would often be viewed set against the backdrop of Home Point's varied, rocky shoreline. In more dynamic views from passing vessels, it would be more apparent, especially from those straying closer to the rock outcrops fringing the DoC reserve. Yet, as with the Leads, it comprises one of the 40 or more navigation markers that line the shipping lanes between Bream Bay and the Port of Whangarei and nearby Town Basin. Further contextualised by the oil refinery, its berthage area and the sequence of residential development strung along the northern reaches of the harbour, it is most unlikely that the marker would have any real prominence or visual presence. At night-time, its light would be low powered, and the marker's physical separation from most nearby settlements, combined with its screening by the land mass of Home Point, would limit any effects to a very low level.

LANDSCAPE EFFECTS:	**NONE:** The lateral marker would have no appreciable impact on the Landscape values of Home Point and its DoC reserve, or the wider harbour / Bream Bay coastline, nor would it affect the adjoining Home Point ONL.
NATURAL CHARACTER EFFECTS:	**VERY LOW:** The lateral marker would, in absolute terms, very slightly reduce the natural character content and values in the vicinity of Home Point, by incrementally adding to the array of structures both within and next to the harbour's water area. Yet, this change would be so slight that it is doubtful that it would have any appreciable impact on the wider natural character values of the outer harbour and its margins, or those of Bream Bay. Consequently, it would have a minimal effect on the Home Point HNC area.
AMENITY EFFECTS:	**NONE:** Public appreciation of Home Point and its coastline, including the reserve's identity and sense of place, would not be appreciably altered by the physical presence of the proposed marker.
	Impact Rating: NONE

4.5 PLUMES ASSOCIATED WITH DREDGING & DISPOSAL

DESCRIPTION OF PROPOSAL:	

DESCRIPTION OF PROPOSAL:

The processes of dredging and disposal would result in some spillage of extracted material, resulting in the creation of colloidal plumes around the vessel(s) undertaking dredging and deposition. MetOcean Solutions Ltd has modelled a range of types of plume associated with different forms of dredging. At p.102 and 103 of their report, the following conclusions are reached:

> *The modelling of the dredging plumes has showed that:*
>
> - *The sediment plumes associated with dredging and caused by the action of the drag head (TSHD) are predicted to remain constrained within the lower water column, with negligible expression at mid-water and surface levels. In contrast, the sediment plumes associated with the overflow phase are predicted to be spread across the entire water column.*
> - *The resultant plumes from either source are predicted to follow the general channel alignment, consistent with the tidal currents. The maximum modelled excursion of any plume did not exceed 1200 m, with the plume constrained to the channel. The modelling shows no evidence of plume dispersion to the adjacent beaches, sand banks, Marine 1 (Protection) Management Areas or Marine Reserves.*
> - *The modelling shows that the large TSHD generates more extended and concentrated plumes than the smaller vessel. The overflow duration has a significant effect on the magnitude and extent of the plumes.*
> - *The sediment plumes associated with dredging and caused by the action of the rotating cutter head (CSD case) are predicted to remain constrained within the lower water column, with no expression at mid-water and surface levels.*
> - *The sediment plumes associated with dredging and caused by the excavation, hoisting and slewing phases (BHD case) are expected to generate sediment losses over the entire water column. The low production rate associated with the BHD lead, however, to a low discharge rate compared to the TSHD case.*
> - *Comparisons between plumes generated for the existing channel and the post-dredging scenario indicates that the plume excursions will decrease slightly as the channel becomes deeper due to the slightly reduced tidal velocities.*
> - *No plume dispersion extending to the adjacent beaches, sand banks, Marine 1 Management Areas and Marine Reserves were generated by the dredging plume modelling for any of the dredge scenarios.*

Turning to the issue of plumes within and around the disposal sites, MetOcean's modelling further indicates that (p.121):

> *The predicted SSC* [suspended solid concentrations] *plumes clearly follow a northeast-southwest axis, which was expected given the current climate at the disposal ground ……… Surface plumes are insignificant and the SSC progressively increases with increasing depth due to the rapid settlement of the sediments through the water column. The simulations suggest that the mid water plume may extend about 500 m from the release location for both the small and the large dredge, to the minimum concentration threshold of 12 mg/L. However, most of the plume is constrained within a radius of 50 and 100 m for the small and the large dredge, respectively. Notably, the highest SSC levels within the lower water column are predicted to the southwest of the disposal ground; consistent with the flow regime being biased to this octant. The plumes do not show significant differences in extent or direction between sites inside the disposal ground. At site PW, the closest to the 3 Mile Reef* [at the proposed channel entry in Bream Bay]*, it is important to note that the plume does not intersect with the reef area, and the probability of a plume reaching the reef is considered very low.*

As a form of corroboration, a disposal plume modelling scenario was also undertaken using the current velocity profiles recorded inside the proposed disposal ground from 15 January to 5 March, 2016. For this scenario, the plume results for both the large and the small vessels over a 24 h period exhibit a different behaviour ….. likely due to the shorter duration and the particular weather patterns at the time. Nonetheless, the results show less dispersion than the longer term modelling and no evidence of trajectory over the reef to the west of the disposal ground. ……. We therefore conclude that even taking into account this bias there is a very low probability of the plume reaching 3 Mile Reef.

As a result, it is anticipated that plumes will generally be limited to the more immediate confines of the areas subject to dredging and disposal operations. The rapid tides past Marsden Point would help to keep dredging plumes within the main tidal channel – effectively stretching them out, but keeping them well away from local beaches – while the more limited plumes around disposal vessels would often remain below the sea surface. The MetOcean Solutions Ltd report also confirms that the medium-grain sands that dominate the sea floor at Marsden Point would further assist settlement of any suspended material, and because of both tidal dilution and relatively rapid settlement, most plumes are likely to be of relatively short duration.

View of current maintenance dredging (under a separate resource consent) from Mt Aubrey: 80mm telephoto lens – January 2017

View of current maintenance dredging (under a separate resource consent) from Taurikura:
50mm (standard) lens – January 2017

View of current maintenance dredging (under a separate resource consent) from Little Munroe Bay:
50mm (standard) lens – January 2017

RECEIVING ENVIRONMENT(S):

The receiving environments / catchments theoretically exposed to dredging plumes would be very similar to those identified in relation to the proposed navigation channel / shipping lane: (see map overleaf):

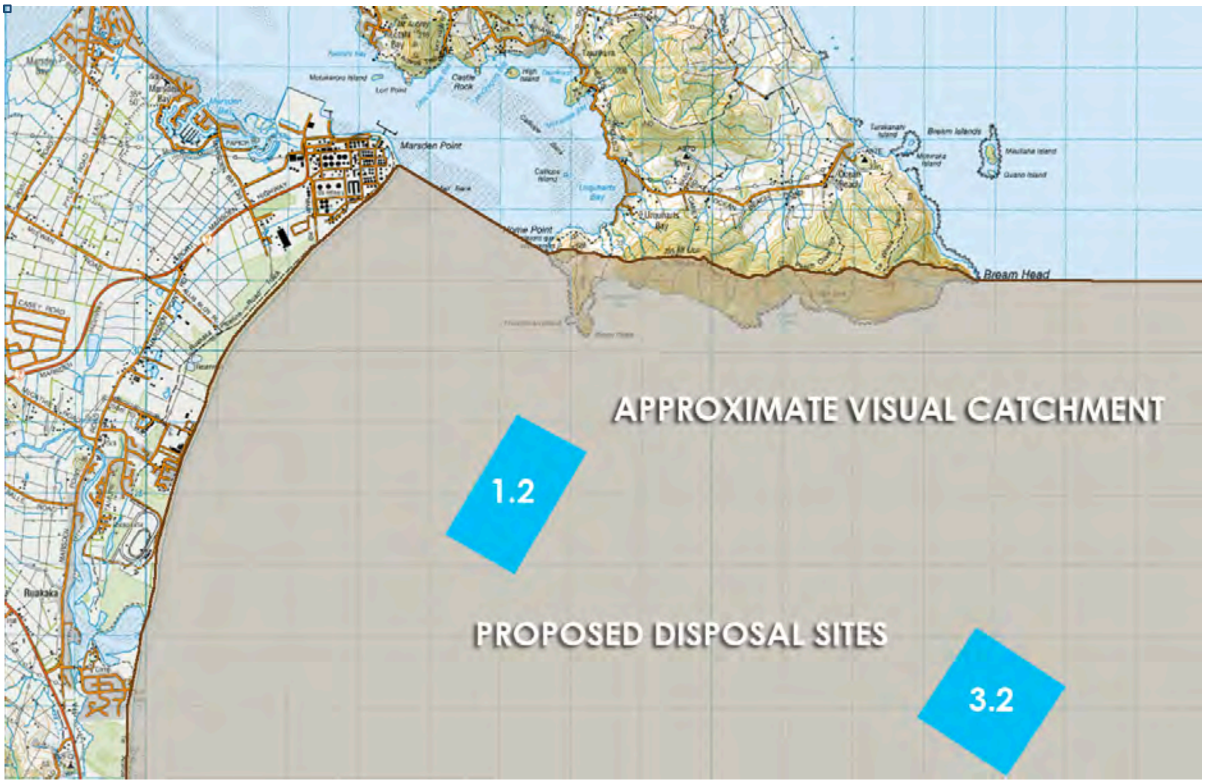
- the water areas of outer Whangarei Harbour and the northern half of Bream Bay; and
- the margins and elevated vantage points of the DoC Reserve stretching from Bream Head to Home Point.

It might also be possible that other areas would be exposed to the dredging plumes, as set out below, although it is less likely that views from these locations would differentiate plumes from the surrounding mass of water within the outer harbour and Bream Bay:

- the shoreline around Marsden Point and the oil refinery, extending down the Ruakaka coastline & past the Northport facilities towards One Tree Point;
- the settlements of Reotahi, Little Munroe Bay, McGregors Bay, Taurikura Bay, McKenzie Bay and Urquharts Bay;
- associated public beaches;
- parts of Whangarei Heads Rd; and
- the public tracks to and around Mt Lion, Taurikura, Mt Aubrey and Mt Manaia.

The main receiving environment likely to be exposed to disposal plumes comprises Bream Bay itself, and in particular, those parts of the central to northern bay utilised for recreational fishing and boating.

In addition, those parts of the DoC estate stretching from Home Point to Bream Head, including Busby Head, would also be theoretically exposed to the disposal sites, as would the western coastline from Marsden Bay down to Ruakaka, stretching towards the Waipu River and Waipu Cove. In reality, however, it is considered most unlikely that anyone would be able to see a plume from within the vast majority of this catchment (as will be explained shortly).



Looking towards the current navigation channel & area of dredging operations from Reotahi (above) & Urquharts Bay (below)

Looking out across central Bream Bay from the Ruakaka Surf Club

Looking out across central Bream Bay from the Ruakaka Surf Club

AUDIENCES:	Those more likely to see any plumes associated with dredging include: ▪ Boaties using outer Whangarei Harbour and / or the northern half of Bream Bay; and ▪ Recreational users of Home Point, Busby Head and Smugglers Bay – within the DoC reserve extending across Mt Lion to Bream Head. Other audiences that might see a plume, depending upon its location and scale, include: ▪ Residents within, and visitors to, the settlements of Reotahi, Little Munroe Bay, McGregors Bay, Taurikura Bay, McKenzie Bay and Urquharts Bay; ▪ Those using the associated public beaches; ▪ Those using the public tracks to and around Mt Lion, Taurikura, Mt Aubrey and Mt Manaia; ▪ Those working at the Marsden Point Oil Refinery. Those more likely to see sand disposal plumes comprise recreational boaties traversing Bream Bay to and from Whangarei Harbour or the Hen and Chicken Islands. They are unlikely to be visible from any land based vantage points.
EXISTING VALUES:	**MODERATE / HIGH**: The landscape and natural character conditions of the harbour at and near Marsden Point are highly variable, combining natural headlands, volcanic peaks and forested areas with the oil refinery, deep water port, pockets of settlement and existing shipping lanes and berths. The outer reaches of Bream Bay – flanked by Bream Head, Mt Lion and Home Point – afford a relatively natural and highly appealing landscape setting for the proposed channel. However, this cohesion and 'unity of expression' diminishes elsewhere due to the residential occupation concentrated around Urquharts Bay, Taurikura and Reotahi, while the combined oil refinery and Northport facilities leave a much more industrial, utilitarian, imprint on the outer Whangarei Harbour landscape. Further south, the landward margins of Bream Bay are highly modified, containing pockets of residential development, including baches and beach houses, together with the oil refinery, the former Marsden B Power Station site, the Ruakaka Race Course, an industrial park, the local sewerage treatment plant and ponds, two camping grounds and the Waipu Cove Golf Club. Even so, the dunes and beachfront directly facing and physically abutting Bream Bay has been identified as an ONL in the RPS, with the narrow dune corridor behind the beach and lagoons at the mouth of the Ruakaka and Waipu Rivers anchoring this area. The dune corridor provides a buffer between the beachfront and its developed hinterland, with both the seaward edge of the dunes and the beachfront 'in front of it' offering spectacular views out over the expanse of Bream Bay to the Hen and Chicken Islands and the spectacular sequence of volcanic peaks clustered around Mt Lion and Bream Head. Notwithstanding the more utilitarian components of this coastal landscape, Bream Bay therefore retains a powerful focus on its least modified component – the sea – and the amalgam of islands and jagged peaks that frame Bream Bay.
PROMINENCE / VISIBILITY:	**LOW:** Most vantage points around the outer reaches of Whangarei Harbour would be too low lying for easy recognition of a dredging plume and differentiation of it from the surrounding harbour waters. In particular, views from most of the settlements around its periphery, from Marsden Point and Marsden Bay / One Tree Point, even from parts of Home Point and Smugglers Bay, would be too low lying – affected by reflections off the sea and wave fetch – for a plume to clearly register. Consequently, views of a plume would be largely restricted to the more elevated tracks around Home Point extending out to Busby Head, and vessels passing in close proximity to the dredge.

LANDSCAPE EFFECTS:	**LOW:** Based on analysis undertaken by MetOcean Solutions, it appears that the discolouration of water around dredging operations would be quite physically confined. This concentration of dredging plumes would be assisted by the natural flushing of the outer harbour and the rates of settlement associated with a preponderance of medium sands (finer sands and silt would be more likely to exacerbate the suspension of material in the water column and would slow down settlement). MetOcean's modelling confirms that most dredging plumes would be confined to the area around the actual dredge and the tidal channel, well away from the harbour margins. This would keep such 'incursion' away from the more sensitive receiving environments down the northern side of the harbour – between Reotahi and Home Point – and around Marsden Bay. As a result, the anticipated plumes, with either kind of dredge, would have little impact on the perceptions of the harbour waters and their quality. At both sediment disposal sites, it is anticipated that the plumes would be even smaller and even more physically / visually isolated. They would also dissipate rapidly, without any appreciable impact on perceptions of the Bream Bay seascape. Furthermore, while such effects would be concentrated over an initial period of 5 to 6 months for capital dredging, maintenance dredging would be more infrequent and targeted – particularly around the berth pocket on the Marsden Point side of the harbour. Consequently, once the capital dredging programme is complete, the seascapes of both Whangarei Harbour and Bream Bay would return to a more stable and 'normal / natural' state.
NATURAL CHARACTER EFFECTS:	**LOW:** Any plume would inevitably have an adverse effect on the natural processes and patterns found within Bream Bay and the outer reaches of Whangarei Harbour. Yet, the greater bulk of effects on the maritime environment and its coastal margins would be confined to those underwater locations very close to the proposed channel and berth pocket, occasionally extending into the above-sea realm with plumes visible from passing vessels. The plumes created would have an impact on the appearance of the underwater environment and its habitats, but it appears that any such effects would be both physically very restricted and temporary. As is also indicated in Bioresearchers' report, most of the affected underwater environment comprises sand banks and troughs, and the nature of sand particles found within the new channel would both help to limit water turbidity changes and effects on marine habitats. Within the broader expanse of Bream Bay, disposal plumes would be screened and 'masked' by wave fetch, reflections and the sheer scale of the surrounding maritime environment. They would dissipate rapidly. Underwater, the dredge material would either settle and merge with the existing sea floor (as described at Section 4.2) or be rapidly diluted by wave action and tidal flows. As a result, effects in relation to Bream Bay would be very limited and largely restricted to the immediate vicinity of the disposal vessel.
AMENITY EFFECTS:	**LOW:** Public perception of plumes would be intermittent and specific to particular locations, as is discussed in relation to landscape effects. Although the capital dredging has the potential to create the perception of the outer harbour's waters being muddied and 'tainted' by some of those works – especially when dredging strikes pockets of silt and finer grained sand – any such effects would be of a short duration and would not have a significant impact on the longer term appeal of Whangarei Harbour from an aesthetic standpoint. The sense of place and identity of the Whangarei Heads area would not be appreciably affected by the dredging plumes. Effects associated with disposal plumes within the much more expansive, 'open ocean, environment of Bream Bay would be even more limited – as described above in relation to landscape and natural character effects. Any amenity effects would be minimal.

	Impact Rating:	LOW

4.6 DREDGING & SAND DISPOSAL OPERATIONS

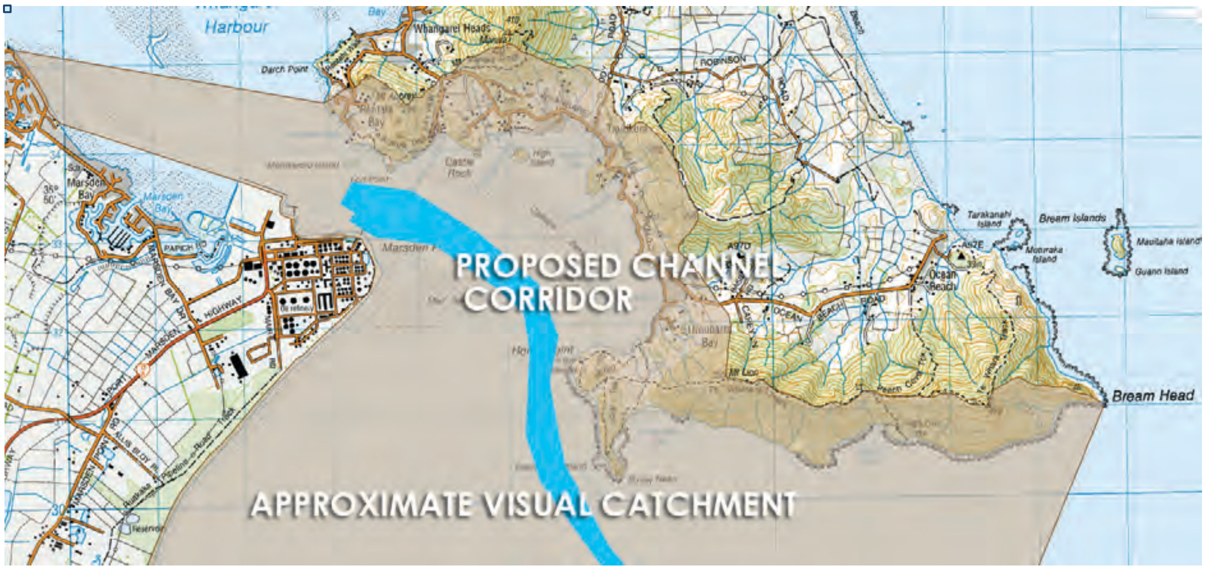
DESCRIPTION OF PROPOSAL:	A dredging vessel has yet to be specified for the Crude Shipping Project. However, in a Technical Memo dated 25 May 2016, Royal Haskoning DHV recommended the use of a Trailing Suction Hopper Dredge for most of the proposed channel and a Backhoe Dredger for the berth pocket. The former (see Figure 7 below) would involve use of a dredging head that maintains contact with the sea floor, while a Backhoe Dredger (see Figure 12 below) would involve use of an excavator mounted on a dredging pontoon. The TSHD – proposed for more widespread use by Royal Haskoning would limit the spill of material during operations, while a BHD would result in more spillage, but within a confined part of the proposed channel closer to the existing dolphins at Marsden Point. Both types of dredge would generate appreciable noise, although this is subject to specialist analysis by John Styles. Lighting would also be required on such a vessel, both at and near night-time, for operational and navigation purposes.

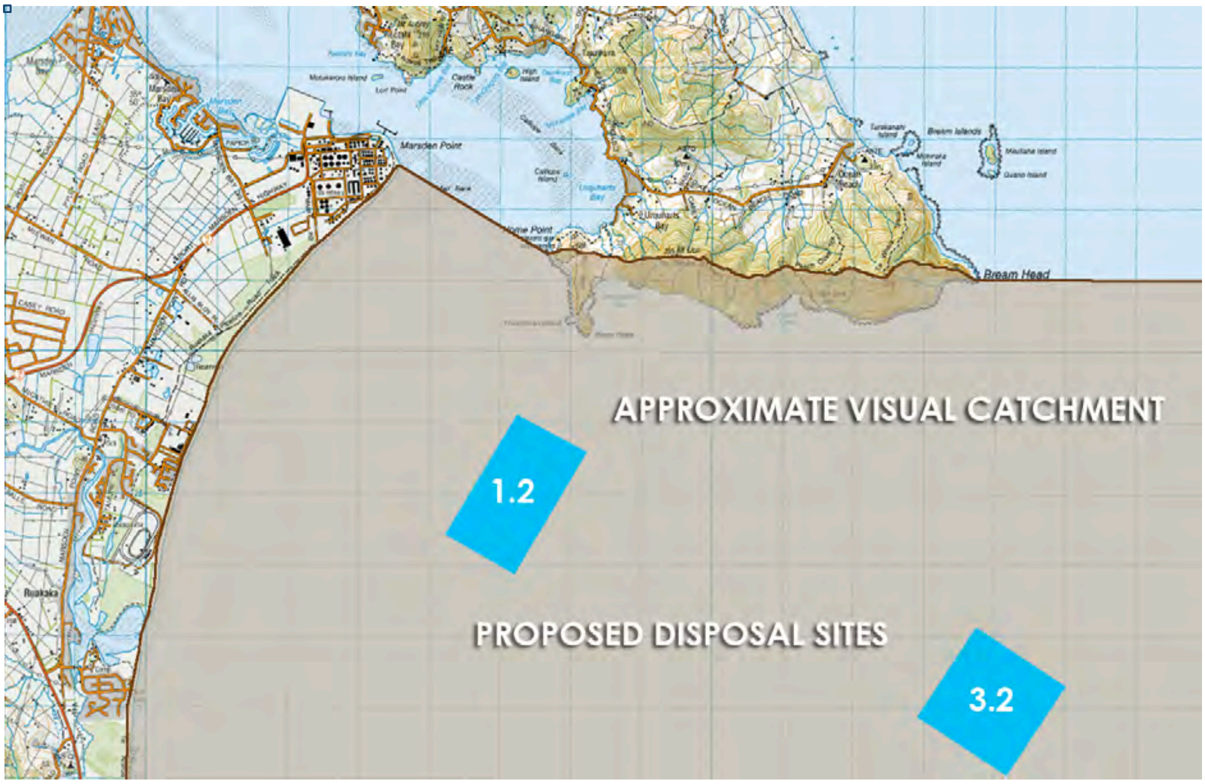
Figure 7: Trailing Suction Hopper Dredger (TSHD) (Source: IHC (Artists impression))

Figure 12: Backhoe Dredger (BHD)
Source: IADC, 2016

Dredges described in Royal Haskoning DSV Memo: Trailing Suction Hoper Dredge (above) & Backhoe (below): images from RHDSV memo

RECEIVING ENVIRONMENT:	See Section 4.1 for a description of those areas exposed to the proposed navigation channel and Section 4.5 in relation to disposal of sand within Bream Bay





AUDIENCES:	See Section 4.1 for a description of the audiences potentially exposed to dredging operations within and around the proposed navigation channel and Section 4.2 in relation to the audiences potentially exposed to sand disposal within Bream Bay.
EXISTING VALUES:	**MODERATE / HIGH**: See Section 4.1 for a description of the Existing Values pertaining to those areas around the proposed navigation channel and Sections 4.2 and 4.5 in relation to Bream Bay.
PROMINENCE / VISIBILITY:	**LOW:** The dredge would share much the same level of visibility and public exposure as other vessels operating at and near Marsden Point, and within Bream Bay, at present, although it would be significantly smaller than most freighters (timber) and tankers.

LANDSCAPE EFFECTS:	**LOW:** Freighters, oil tankers, and leisure craft are familiar components of Bream Bay and Whangarei Harbour. Tankers are frequently anchored off Marsden Point waiting to unload oil and petroleum products, while a regular parade of vessels either docks at, or passes, both the oil refinery and Northport facility. Dredging vessels would sit mid-stream on a more regular basis and noise could be generated in the immediate vicinity of the dredge, as indicated above, depending on the type of dredging method employed. In addition, the process of dredging would differ from that of conventional loading and unloading of vessels at Northport and terminal dolphins, and a dredge would also become an additional source of lighting at night-time. However, noise effects and their attenuation would be subject to the NZ Noise Standard and related conditions, while the dredge's illuminated profile would be little different from that of other anchored vessels when sitting offshore within the open expanse of Bream Bay. Within the more confined waters of Whangarei Harbour, the dredge would be closer to the settlements stretching from Reotahi to Urquharts Bay, but the oil refinery and Northport facilities would be its primary backdrop, complete with an array of lighting associated with both the refinery, port facilities and berthed vessels. In addition, it would be effectively screened from One Tree Point and Marsden Bay by the current port wharves and berthed ships, both during the day and at night. As a result, any changes to the landscape of Marsden Point would be incremental and relatively small scale, taking into account the existing operational environment.
NATURAL CHARACTER EFFECTS:	**VERY LOW:** A dredge would add to the man-made content of the outer harbour and associated activity. However, it would not alter the fundamental balance and interplay between natural and man-made components of this environment: the dredge would remain within that part of the harbour already strongly influenced by the existing oil terminal and port facilities. Furthermore, while it would be more static than other ships in the main harbour channel, it is doubtful that the issue of movement is as significant as the presence – or otherwise – of vessels in respect of such effects. Overall, it is considered that the dredge would reinforce perceptions of a maritime working environment at Marsden Point, in the general vicinity of both the oil refinery and Northport facilities. But, it would not appreciably encroach on, or degrade, those more natural features and patterns – found down the northern side of Whangarei Harbour – that remain fundamental to the natural character values identified in the Northland RPS.
AMENITY EFFECTS:	**LOW:** Set against the backdrop of the current refinery and Northport facilities, and the broad expanse of Bream Bay, the proposed dredging operations would be a minor component of the maritime landscape evidence at Marsden Point. It would largely merge with the existing shipping and related activities at the refinery and port. Theoretically, the proposed dredging and disposal operations might exacerbate a subtle shift away from the more tranquil, natural, qualities of the harbour's northern beaches and coastline by introducing another industrial element and activity to the main body of the harbour. As such, it has the potential to become the focus for concerns about 'nuisance effects' derived from the dredge's noise, lighting and activity. More objectively, however the analysis of noise effects by Styles Group (*Whangarei Harbour Entrance and Marsden Point Channel Realignment and Deepening: Assessment of Environmental (Airborne) Noise Effects*, February 2017) concludes, on p.17, that: *The noise modelling shows that comfortable compliance with the relevant noise limits is achieved for dredging inside the harbour, except when dredging is undertaken generally north of the No. 18 navigation buoy when the 45dB LAeq noise limit applies (from 8pm to 6.30am on weeknights and from 6pm to 7.30am on Saturdays, Sundays and Public Holidays) and, during unfavourable wind conditions, when the wind is blowing from any direction other than the northern quarter. The predicted noise levels for all other dredging positions under various meteorological conditions show that compliance with all of the relevant noise limits at all times of the day can be achieved, in most cases by a large margin. We have recommended that dredging activities are not undertaken north of the No. 18 buoy*

> *during unfavourable wind conditions (identified above) at times when the 45dB LAeq noise limit applies. ……….*

In relation to potential effects associated with night-time lighting Bioresearchers report on potential bird strike and other avian effects, states at paragraph 5.2.4 (*AEE Coastal Birds*, March 2017) that: "*Light is well known to attract a variety of marine birds (Montevecchi, 2016). The adverse attraction to vessel lights by seabirds is considered to be more likely in Bream Bay beyond Busby Head.*" In the same section, it is then recommended that the following measures be adopted to minimise lighting related effects on sea birds:

> *"(a) reduce all unnecessary deck and cabin lighting, cover accommodation windows at night with blinds and curtains;*
>
> *(b) where possible, orientate all deck lights so they shine only downwards and shield them to prevent upwards or horizontal light projection.*
>
> *(c) use light dimmers and timers to minimise lighting in areas where people are not constantly active;*
>
> *(d) trial different light colour options such as green coloured lights in operational areas to reduce overall light intensity levels on the vessel;*
>
> *(e) investigate the use of LED floodlights with computer controlled light levels, colours and timers."*

These measures would also appreciably reduce the visual signature of the dredge at night-time for local residents and beach users, further minimising the true potential for 'nuisance' effects derived from the dredging operations. The largely industrial backdrop to such activities near Marsden Point would further limit the potential for such concerns to be realised, while the relatively small scale of the vessel involved in dredging activities would limit its perceived incursion or encroachment into the wider environs of the outer harbour and Bream Bay.

Finally, most of the proposed dredging and disposal process would occur during an initial 6 month period, then become more intermittent after that – occurring again every 2 to 5 years. Consequently, the level of effect would diminish very rapidly after the initial 6 months of capital dredging.

LOW

4.7 KEY FINDINGS

The following table summarises the various rating derived from the assessment of effects in Sections 4.1 to 4.6:

	VALUES	PROMINENCE	LANDSCAPE EFFECTS	NATURAL CHARACTER EFFECTS	AMENITY EFFECTS	IMPACT RATING
4.1 CHANNEL FORMATION	MODERATE / HIGH	VERY LOW	VERY LOW	LOW / MODERATE	NONE	LOW / MODERATE
4.2 DISPOSAL AREAS	HIGH / MODERATE	VERY LOW	VERY LOW	LOW	VERY LOW	LOW
4.3 LEAD LIGHTS	MODERATE / HIGH	LOW / VERY LOW	VERY LOW	VERY LOW	VERY LOW	VERY LOW
4.4 HOME POINT MARKER	HIGH	VERY LOW	NONE	VERY LOW	NONE	NONE
4.5 DREDGING & DISPOSAL PLUMES	MODERATE / HIGH	LOW	LOW	LOW	LOW	LOW
4.6 DREDGING & DISPOSAL OPERATIONS	MODERATE / HIGH	LOW	LOW	VERY LOW	LOW	LOW

Given the physical extent and footprint of the Crude Shipping Project, it is perhaps surprising that both the mean effects ratings and overall impact of the proposal are not higher. However, four factors limit the overall scale of landscape, natural character and amenity effects:

- The proposed channel and disposal sites would have a very limited visual 'signature' above sea level, mainly limited to the relocation of buoys, positioning of new buoys near the channel entrance and the addition of lights and markers of the kind that are already common near Marsden Point and other parts of Whangarei Harbour. For the most part, these would be dwarfed by the combination of dramatic landforms, existing oil terminal and port facilities, and the open expanse of Bream Bay.

- Underwater, the areas subject to dredging and disposal comprise largely undifferentiated, even depauperate, sand environments. For the most part, the margins of Mair and Calliope Banks comprise relatively bare, 'sandscapes' that are dominated by medium grained sand, albeit with patches of shell, silt and gravels. A very similar situation is found within and near Disposal Sites 3.2 and 1.2. Although the 'sponge garden' and 'rocky reef' identified by Bioresearchers near Home Point deviate from this norm, they comprise relatively small components of the undersea environment overall and management of water turbidity would preclude any adverse effects on those more sensitive habitats.

- Much of the dredging activity and relocation of buoys, leads, etc would either be concentrated near the current oil refinery and port, or near the existing shipping lanes that are already quite heavily trafficked by a wide range of sea-going vessels – from Suezmax tankers to leisure craft and yachts. Even the leads off Taurikura and new lateral marker off Home Point would be viewed in the context of a landscape that contains both significant development and a scattering of moored vessels. These would help to absorb and integrate the finer grained structures proposed for closer to the northern harbour shoreline.

- The expansive scale and openness of Bream Bay, together with viewing distances to the proposed channel and disposal sites, would help to isolate activity focused on these locations.

It is anticipated that the dredging vessel – of whichever kind is finally chosen – would provide much of the focus for attention while dredging is underway. However, it would still integrate, to a considerable extent, with the existing shipping activity and movements near Marsden Point, as well as in and out of Whangarei Harbour. This, together with the physical isolation of the dredge within Bream Bay (moreso once the capital works programme is completed) should ensure that any effects associated with its presence and activities are limited and essentially incremental. In particular, Bioresearchers' recommendations in relation to lighting (to avoid bird strike) and Styles Group's conclusions and operational recommendations in relation to noise directly address such effects (see Section 4.6, Amenity Effects, above).

Cumulative Effects:

The Crude Shipping Project would give rise to multiple small scale effects, both above sea level and underwater, that pertain to specific locations within Whangarei Harbour. Moreover, the combination of dredging, sand disposal, buoy relocation, provision of new lights and markers, and even dredging plumes, could give rise to cumulative effects that affect a combination of catchments and receiving environments around Marsden Point. In particular, there would be some aggregation of underwater effects, within and around the footprint of the new shipping channel

Yet, the proposed activities and structures would be largely separated from one another both spatially and temporally, and the greater bulk of such effects would be concentrated either near Marsden Point – almost literally in the 'shadow' of the existing oil refinery and Northport facilities – or within the outer reaches of Whangarei Harbour and the more open expanse of Bream Bay, well away from most sensitive receiving environments and audiences.

Importantly, the effects identified would have a low to very low level of effect in relation to the areas of High Natural Character covering Calliope Bank, Mair Bank and the Home Point coastline, as well as the ONL that extends from Home Point to Ocean Beach. As a result, I am not concerned about the potential for the crude shipping project to adversely affect these sensitive environments in a cumulative fashion.

5.0 STATUTORY CONSIDERATIONS

The Crude Shipping Project would occupy part of the Coastal Marine Area that is subject to both regional and district provisions under the aegis of sections 6(a), 6(b), &(c) and 7(f) of the Resource Management Act, together with the NZ Coastal Policy Statement 2010 – specifically, Policies 13 and 15 in relation to landscape and natural character matters. As a result, the proposal is subject to assessment against relevant objectives and policies in the Northland Regional Coastal Plan (2004), the Northland Regional Policy Statement (2016) and the Whangarei District Plan (2004).

The **Northland Regional Coastal Plan** directly addresses structures, reclamation, dredging and other activities within the CMA. In relation to that operative document, the proposed channel formation and dredging proposed by Refining NZ would fall within the following Coastal Plan 'zones':

a. Marine 2 (Conservation) Management Area (or 'M2MA'); and

b. Marine 5 (Port Facilities) Management Area (or 'M5MA').

The proposed disposal of dredged material would occur in two areas: Disposal Area 1.2 and / or Disposal Area 3.2 – as described at Sections 4.2 and 4.5 of this report. Both of these disposal areas are also zoned M2MA. Importantly, none of the proposed works encroach into any area of the CMA that is zoned Marine 1 (Protection) Management Area (or 'M1MA'). Even so, a range of objectives and policies within the operative NRCP are directly pertinent to the current proposals and assessment of them as Discretionary Activities – including the following:

7.3 OBJECTIVE

The preservation of the natural character of Northland's coastal marine area, and the protection of it from inappropriate subdivision, use and development.

7.4 POLICIES

1. *In assessing the actual and potential effects of an activity to recognise that all parts of Northland's coastal marine area have some degree of natural character which requires protection from inappropriate subdivision, use and development.*

2. *As far as reasonably practicable to avoid the adverse environmental effects including cumulative effects of subdivision, use and development on those qualities which collectively make up the natural character of the coastal marine area including:*

   (a) *natural water and sediment movement patterns;*

   (b) *landscapes and associated natural features;*

   (c) *indigenous vegetation and the habitats of indigenous fauna;*

   (d) *water quality;*

   (e) *cultural heritage values, including historic places and sites of special significance to Maori; …………*

   and where avoidance is not practicable, to mitigate adverse effects and provide for remedying those effects to the extent practicable.

3. *Within Marine 1 and Marine 2 Management Areas and the rules that apply to each of those, identify what subdivision, uses and developments may be appropriate taking into consideration the actual or potential effects on natural character as required by, amongst others, Policy 1.1.1 of the New Zealand Coastal Policy Statement.*

4. *Subject to Policies 1 and 2 above, through the use of rules in this Plan, to provide for appropriate subdivision, use and development in areas where natural character has already been compromised, including within Marine 3, Marine 4, Marine 5, and Marine 6 Management Areas. ……..*

> 7. *To promote, where appropriate, the restoration and rehabilitation of the natural character of the coastal marine area where it has been significantly degraded.*

The **NRCP**'s Appendix 3 also identifies the following Outstanding Geological Features and Landforms' that are listed as being of international, national or regional significance in the NZ Geopreservation Inventory within and around Marsden Point:

> *Reserve Point nephelenite flow, garnet andesite and sedimentary rock;*
>
> *McLeod Bay unconformity;*
>
> *Taurikura natural jetty;*
>
> *Port Whangarei fossil beds;*
>
> *One Tree Point dunes; and*
>
> *Bream Head stratovolcano*

The assessments undertaken by MetOcean Solutions (*Predicted Physical Environmental Effects From Channel Deepening and Offshore Disposal)* and Tonkin & Taylor (*Coastal Processes Assessment*) provide no indication that these features and landforms would be adversely affected by the proposed channel dredging.

Turning to the **Northland Regional Policy Statement**, which became operative on 9th May 2016, Policy 4.5.2 addresses the location of particular parts of the coastal environment (including the CMA) and landscapes that are particularly sensitive to new development – stating as follows:

> *The Regional Policy Statement Maps of high and outstanding natural character and outstanding natural features and outstanding natural landscapes identify areas that are sensitive to subdivision, use and development. The maps of these areas identify where caution is required to ensure activities are appropriate.*

In my opinion those parts of the coastal environment around Marsden Point and Whangarei Heads appear to accord with the requirement [under sections 6(a) and (b) of the Resource Management Act] to identify and preserve / protect such areas from inappropriate subdivision, use and development. I have identified the Crude Shipping Project's effects on those areas accordingly. In a related vein, the following landscape and natural character provisions are relevant to the current proposals:

> ***3.14 Natural character, outstanding natural features, outstanding natural landscapes and historic heritage***
>
> *Identify and protect from inappropriate subdivision, use and development;*
>
> *(a) The qualities and characteristics that make up the natural character of the coastal environment, and the natural character of freshwater bodies and their margins;*
>
> *(b) The qualities and characteristics that make up the outstanding natural features and outstanding natural landscapes; …..*
>
> ***4.6.1 Policy – Managing effects on the characteristics and qualities natural character, natural features and landscapes***
>
> *(1) In the coastal environment:*
>
> *a) Avoid adverse effects of subdivision use, and development on the characteristics and qualities which make up the outstanding values of areas of outstanding natural character, outstanding natural features and outstanding natural landscapes.*
>
> *b) Where (a) does not apply, avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of subdivision, use and development on natural character, natural features and natural landscapes. Methods which may achieve this include:*

(i) Ensuring the location, intensity, scale and form of subdivision and built development is appropriate having regard to natural elements, landforms and processes, including vegetation patterns, ridgelines, headlands, peninsulas, dune systems, reefs and freshwater bodies and their margins; and

(ii) In areas of high natural character, minimising to the extent practicable indigenous vegetation clearance and modification (including earthworks / disturbance, structures, discharges and extraction of water) to natural wetlands, the beds of lakes, rivers and the coastal marine area and their margins; and

(iii) Encouraging any new subdivision and built development to consolidate within and around existing settlements or where natural character and landscape has already been compromised.

(2) Outside the coastal environment avoid significant adverse effects and avoid, remedy or mitigate other adverse effects (including cumulative adverse effects) of subdivision, use and development on the characteristics and qualities of outstanding natural features and outstanding natural landscapes and the natural character of freshwater bodies. Methods which may achieve this include:

a) In outstanding natural landscapes, requiring that the location and intensity of subdivision, use and built development is appropriate having regard to, natural elements, landforms and processes, including vegetation patterns, ridgelines and freshwater bodies and their margins;

b) In outstanding natural features, requiring that the scale and intensity of earthworks and built development is appropriate taking into account the scale, form and vulnerability to modification of the feature;

c) Minimising, indigenous vegetation clearance and modification (including earthworks / disturbance and structures) to natural wetlands, the beds of lakes, rivers and their margins.

(3) When considering whether there are any adverse effects on the characteristics and qualities 9 of the natural character, natural features and landscape values in terms of (1)(a), whether there are any significant adverse effects and the scale of any adverse effects in terms of (1)(b) and (2), and in determining the character, intensity and scale of the adverse effects:

a) Recognise that a minor or transitory effect may not be an adverse effect;

b) Recognise that many areas contain ongoing use and development that:

(i) Were present when the area was identified as high or outstanding or have subsequently been lawfully established

(ii) May be dynamic, diverse or seasonal;

c) Recognise that there may be more than minor cumulative adverse effects from minor or transitory adverse effects; and

d) Have regard to any restoration and enhancement on the characteristics and qualities of that area of natural character, natural features and/or natural landscape.

Finally, Section 10 ('The Coast') of the operative **Whangarei District Plan** contains objectives and policies that largely echo those outlined above:

10.3 Objectives 10.3.1

Preservation and protection of the natural character of the coastal environment from inappropriate subdivision, use or development.

10.3.2
The maintenance or, where appropriate, enhancement of the amenity, landscape, cultural, intrinsic and ecological values of the coastal environment by taking account of the cumulative effects of subdivision development.

10.3.3
Maintain and enhance public access, where appropriate, to and along coastal areas.

10.3.4
Recognise those activities which have locational requirements and/or effects on both sides of the Coastal Marine Area boundary.

10.4 Policies

10.4.1 Natural Character

To ensure that subdivision, use and development is managed in a manner that seeks to preserve, enhance and restore (where appropriate) the natural character of the coastal environment. Particular consideration should be given to:

- *Landscapes, seascapes and landforms;*
- *Significant indigenous vegetation and significant habitats of indigenous fauna;*
- *Intrinsic values of ecosystems;*
- *Sites of Significance to Maori;*
- *Significant places or areas of historic or cultural significance;*
- *Heritage values, including cultural, historical, spiritual and intrinsic values;*
- *Amenity values.*

10.4.2 Natural Character
To recognise, in assessing the actual and potential effects of an activity, that most parts of Whangarei District's coastal environment have some degree of character which requires protection from inappropriate subdivision, use and development.

10.4.3 Location of Activities
To ensure that, as far as practicable, subdivision, use and development is located in areas where the natural character has already been substantially modified.

10.4.4 Services and Infrastructure
To avoid adverse effects on the natural character, amenity, landscape, cultural, intrinsic and ecological values and functioning of an area by ensuring that subdivision, use and development occur where there is adequate infrastructure, services and on-site mitigation measures.

10.4.7 Future Development
To ensure that subdivision, use and development in the coastal environment for business and residential use is located within existing coastal settlements. Subdivision, use or development should only occur in other areas where there will be no more than minor adverse effects, taking into account:

- *The objectives and policies in this chapter (Chapter 10);*
- *Landscape values, landform and scenic values;*
- *Indigenous flora and habitats of indigenous fauna;*
- *Heritage values including archaeological sites and sites of significance to Maori;*
- *Amenity values;*
- *The degree of modification from the natural state; ………….*

10.6 Anticipated Environmental Results

The following results are expected to be achieved by the foregoing Objectives, Policies and Methods. The means of monitoring whether the Plan achieves the expected outcomes are set out in the Whangarei District Council Monitoring Strategy.

- *The preservation and/or enhancement of the natural character of the coastal environment, and its protection from inappropriate subdivision, inappropriate use and inappropriate development. Included here are landscapes, seascapes and landforms; significant indigenous vegetation and significant habitats of indigenous fauna; air, water and soil quality; the intrinsic values of ecosystems, including biodiversity along with other ecological values.*

- *The maintenance and/or enhancement of the historic and cultural heritage of the coastal environment, and the protection of it from inappropriate subdivision, use and development. Included here are cultural, historic and spiritual values; amenity values; places and areas of historic or cultural significance; and sites of significance to Maori.*

- *A settlement and development pattern in the coastal environment that does not adversely affect natural and cultural/historic heritage values, is able to be* *serviced efficiently, and does not result in sporadic, sprawling or ribbon development. Future intensive development is largely confined to existing settlements where the above values are already compromised.*

- *The maintenance and/or enhancement of public access, to and along the coastal marine area, except where it is desirable to restrict public access to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna, Maori cultural values, public health and safety; to ensure a level of security consistent with the purpose of a resource consent or a permitted activity; or in other exceptional circumstances.*

The Whangarei District Plan and the Northland Regional Policy Statement are responsible for management of the district and regional ONLs, and areas of high or outstanding natural character. The key issues identified in relation to these statutory documents are:

- The removal of dredged material from between Mair and Calliope Banks, which are identified as areas of Outstanding Natural Character – although not from the actual banks; and
- The location of a new navigation marker next to Home Point, within part of the coastline identified as being an HNC area.

The positioning of a new marker next to Home Point is considered likely to have a very low level of effect. It would sit, almost literally, in the shadow of Home Point itself, enclosed and backed by the rising mantle of rocks shelves, coastal scarp and pohutukawa lined slopes that flank the harbour mouth. The marker would be dwarfed by the adjoining landforms and its scale would be minimal even in relation to the buoys and other markers also on the margins of the new entry channel. It would become one of a chain of such navigation aids that line the harbour entrance and shipping route. Even its light would be of a low wattage. As a result, it would be difficult to distinguish and differentiate the marker from its Home Point backdrop other than when viewed from the shipping channel and surrounding harbour waters. It would have no effect in relation to nearby settlements, public beaches (within Urquharts Bay and elsewhere) or the Home Point reserve itself. It would have little, if any, impact on the dramatic interplay of volcanic landforms and harbour waters at the harbour entry and would not affect or erode the qualities of Home Point and adjoining reserve land.

Within the adjoining harbour, the dredging of material from the channel footprint would affect the topographic profile of the sea floor and erode material – mostly fine to medium grained sands and shell – from the harbour corridor between Mair Bank and Calliope Bank. Physically, this would change the profile of the sea floor near both banks, but would not significantly alter the composition of the material found on the sea floor. The new channel would have a more linear, geometric, profile than the natural harbour channel, but would not significantly alter the habitat values of the affected sea floor, its food gathering value or its materiality overall. The proposed changes proposed would also occur within part of the coastal environment that is highly dynamic and subject to on-going, natural change. Taking these various factors into account, it is considered that any effects in relation to the harbour floor would be of a low order, and any effects in relation to the Mair Bank and Calliope Bank HNC areas (and their natural character values) would be of a very low order overall.

In reaching these conclusions, I also note that Bioresearchers has identified the 'rocky reef and sponge garden' habitat near Home Point as being particularly susceptible to modification, which is relevant to assessment of the proposal against District Plan Policies 10.3.2, 10.4.1 and 10.6, together with RPS Policy 4.6.1 (1)(b)(i). However, any potential effects associated with changes to water turbidity near Home Point are to be managed to prevent such effects. Accordingly, it is my opinion, that the proposal is consistent with the management and protection of marine habitats in line with those policies.

These findings are also relevant to assessment of the project against Northland Regional Coastal Plan Policy 7.4 and its various sub-clauses, even though these have their genesis in the now superseded 2004 NZCPS. In particular, the greater bulk of proposed activities and modification would occur within that part of Whangarei Harbour and Bream Bay that is already subject to the regular movement of shipping, the positioning of channel buoys and other navigation markers, and activities associated with current refinery and Northport facilities – with reference to Policy 7.4(4). In my assessment, the crude shipping project is consistent with Policy 7.4.

6.0 CONSULTATION

Discussions with Nga Kaitiaki / Tangata Whenua o Whangarei Te Rerenga Paraoa, as the local representatives of mana whenua, have identified a number of potential issues in relation to the 'landscape' effects of the proposal, including:

- amenity effects associated with the operation of the dredge and associated vessels; and
- potential impacts on the form and seascape values of Mair Bank, Busby Head and other important landmarks that have cultural significance for iwi.

I have addressed these matters in detail within Sections 4.1 and 4.4 to 4.6 of this report. In particular, it is important to recognise that both Mair Bank and Calliope Bank are dynamic features that are continually shaped and reconfigured by tidal flows in and out of Whangarei Harbour and storm events. Both banks are capped by a mixture of medium to fine grained sands, gravels and shell fragments, and their physical equilibrium relies on a constant cycle of deposition and erosion. The proposed channel formation would affect the outer margins of both banks near the berth pocket, in particular. However, it would leave the main body of both banks intact, and the fundamental composition, character and extent of the banks would be unchanged from at present.

Although the proposed channel would extend to within 100m of the rocky margins of Home Point, it would not directly affect or modify that feature. I have described the effects of the proposed lateral navigation marker off Home Point at Section 4.3 of this report, and consider that it would have a negligible effect (if any at all) in relation to that key landmark. The proposed channel and its navigation markers would be much further separated from Busby Head and would have no impact on that feature or nearby Smugglers Bay.

Consequently, I remain of the opinion, that the proposed channel and its navigation markers would have a very low level of effect to no effect at all in relation to all of the coastal features and landmarks that line the Whangarei Heads coastline. Once the new channel is formed, it would be very difficult for those living around, or visiting, that coastline to identify any appreciable differences between Whangarei Harbour's 'pre-channel' and 'post channel' landscapes. The only new structure of any significance would be a new lead light off Taurikura, but its physical isolation within the harbour would result in it having much the same degree of visual presence as a yacht mast when viewed from most shoreline vantage points, including Taurikura Beach.

As a result, I have determined that the proposed channel and its navigation system would have no appreciable effect on the ONLs and areas of high to outstanding natural character that extend out from Mair Bank and Calliope Bank to Home Point and Busby Head, then along the dramatic volcanic coastline framed by Taurikura and Bream Head.

The issue of the dredging operations is also of concern to local iwi, in particular the activities of the dredging vessel within Whangarei Harbour. I have addressed this matter in some detail at Section 4.6 of this report. Even so, it is important to reiterate that the entrance to Whangarei Harbour already witnesses the passage of vessels that range from Suezmax tankers to timber carriers, tuna boats and wide range of recreational vessels heading in and of Whangarei Harbour and its town basin.

Any vessel undertaking dredging of the proposed navigation channel would be quite literally dwarfed by the vessels heading to and from Northport and Marsden Point's berthage dolphins, while much of the more intensive activity around the oil refinery's berthage area would take place almost literally in the shadow of that major industrial complex. Consequently, much as a dredging vessel would add to the catalogue of vessels found within the harbour and Bream Bay, it would have a limited visual presence in its own right. Any amenity effects associated with the operation of the vessel would be incremental and of a low order overall.

7.0 CONCLUSIONS

On the basis of this assessment, including evaluation of the proposal against relevant statutory provisions, it is considered that the Crude Shipping Project would have a typically low level of effect on the landscape, natural character and amenity values of Whangarei Harbour, Whangarei Heads and Bream Bay.

In effect, the current proposal would adhere to the maxim of concentrating new development and related effects within parts of the CMA and Coastal Environment that are already significantly modified. Consequently, the proposal would effectively avoid having an adverse effect on those parts of Whangarei Heads, Marsden Point and Bream Bay that are identified as having outstanding landscape or natural character values. It would also avoid having a significant effect in relation to the rest of the coastal environment and surrounding landscapes. Most components and activities associated with the project would have a quite limited impact on perceptions of the area's character, identity or sense of place.

Stephen Brown
BTP, DIP LA, Fellow NZILA, Affiliate NZPI

Annexure Two: Technical Reports

n) Whangarei Harbour Dredging: Archaeological Assessment. Clough and Associates. Dr Rod Clough and Simon Bickler. Dated July 2017.

MARSDEN REFINERY

WHANGAREI HARBOUR DREDGING: ARCHAEOLOGICAL ASSESSMENT

Report prepared for

The New Zealand Refining Company Limited

By

Simon Bickler (PhD)
Rod Clough (PhD)

July 2017

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INTRODUCTION

Project Background

Marsden Point Refinery is proposing to undertake dredging at the mouth of the Whangarei Harbour (Figure 1). The work will change the contour of the sea bed at the entrance to the Harbour between Marsden Point and the Whangarei Heads extending out into the open ocean, but only within the channel and turning basin and disposal area(s) (Figure 1). Two disposal areas in Bream Bay are proposed (Figure 2).

An archaeological assessment was commissioned by The New Zealand Refinery Company Limited to establish whether the proposed work is likely to impact on archaeological values. This report has been prepared as part of the required assessment of effects accompanying a resource consent application under the Resource Management Act 1991 (RMA) and to identify any requirements under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA). Recommendations are made in accordance with statutory requirements.

Methodology

The scope of the assessment includes:

- A review of known historic heritage within the immediate surrounds of the harbour (including any known wrecks);
- Review of relevant archaeological literature;
- A review of any statutory requirements relating to dredging work; and
- An analysis of any potential effects due to coastal erosion on sites around the Whangarei Heads as a result of changes to the currents in the Harbour resulting from the proposed work.

The New Zealand Archaeological Association's (NZAA) site record database (ArchSite), District Plan schedules and the Heritage New Zealand Pouhere Taonga (Heritage NZ) New Zealand Heritage List were searched to determine whether any archaeological sites had been recorded on or in the immediate vicinity of the proposed dredging area. Literature and archaeological reports relevant to the area were consulted (see Bibliography). Early plans held at Land Information New Zealand (LINZ) were checked for information relating to past use of the area.

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Methodology, *continued*

The project did not include any fieldwork as the proposed work is not land based. A number of archaeological projects have been undertaken by the authors and other colleagues on archaeological sites on the mainland near the project area which informed the assessment of effects on those sites. In addition, a study by the authors for the Department of Conservation (Bickler et al. 2013) relating to potential climate change effects on archaeological sites in the Whangarei District and a recent analysis of coastal heritage items in the Northland Region by Clough and Associates (Brown et al. 2015) were used in assessing the likelihood of heritage effects for the project.

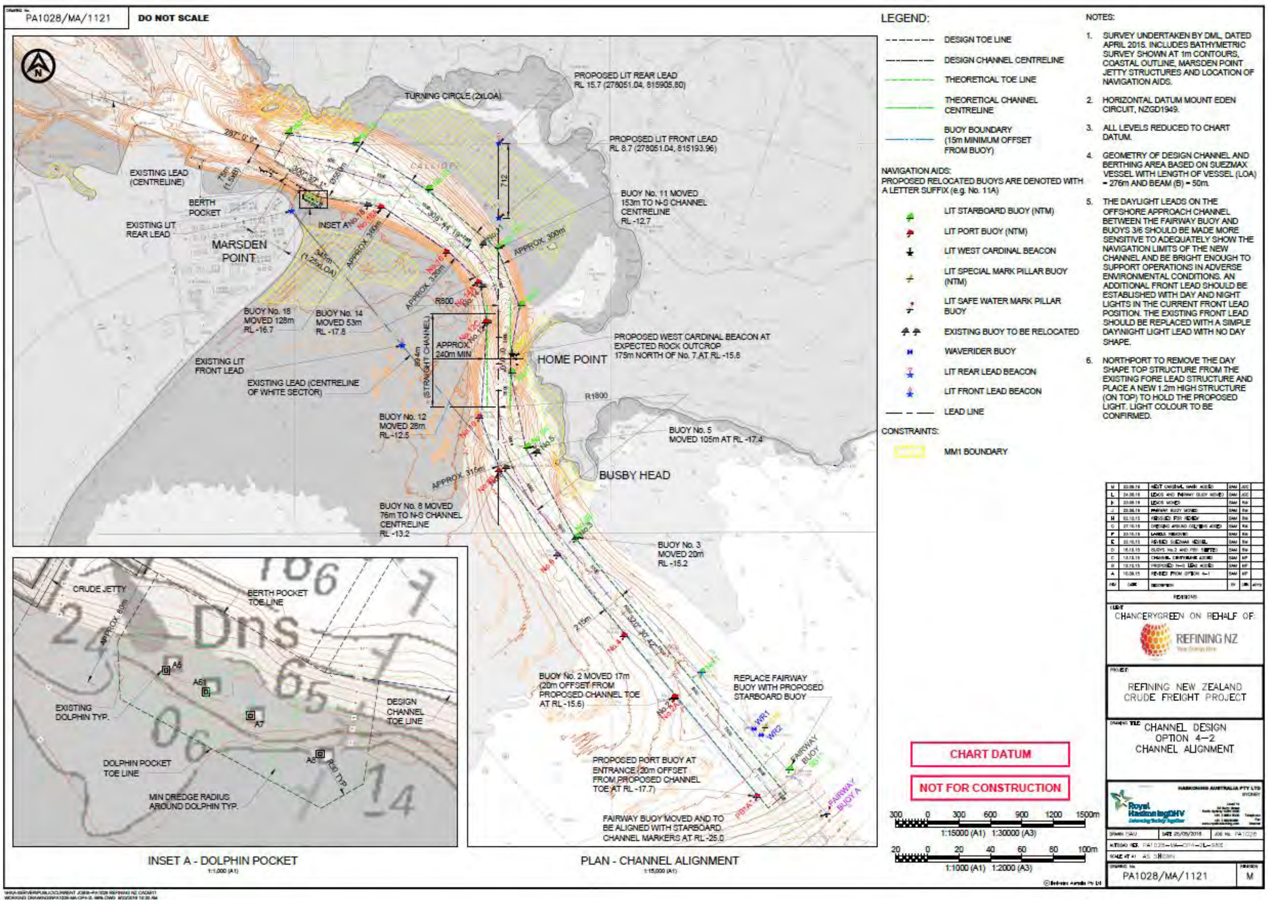

Figure 1. Proposed dredging plan

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INTRODUCTION, CONTINUED

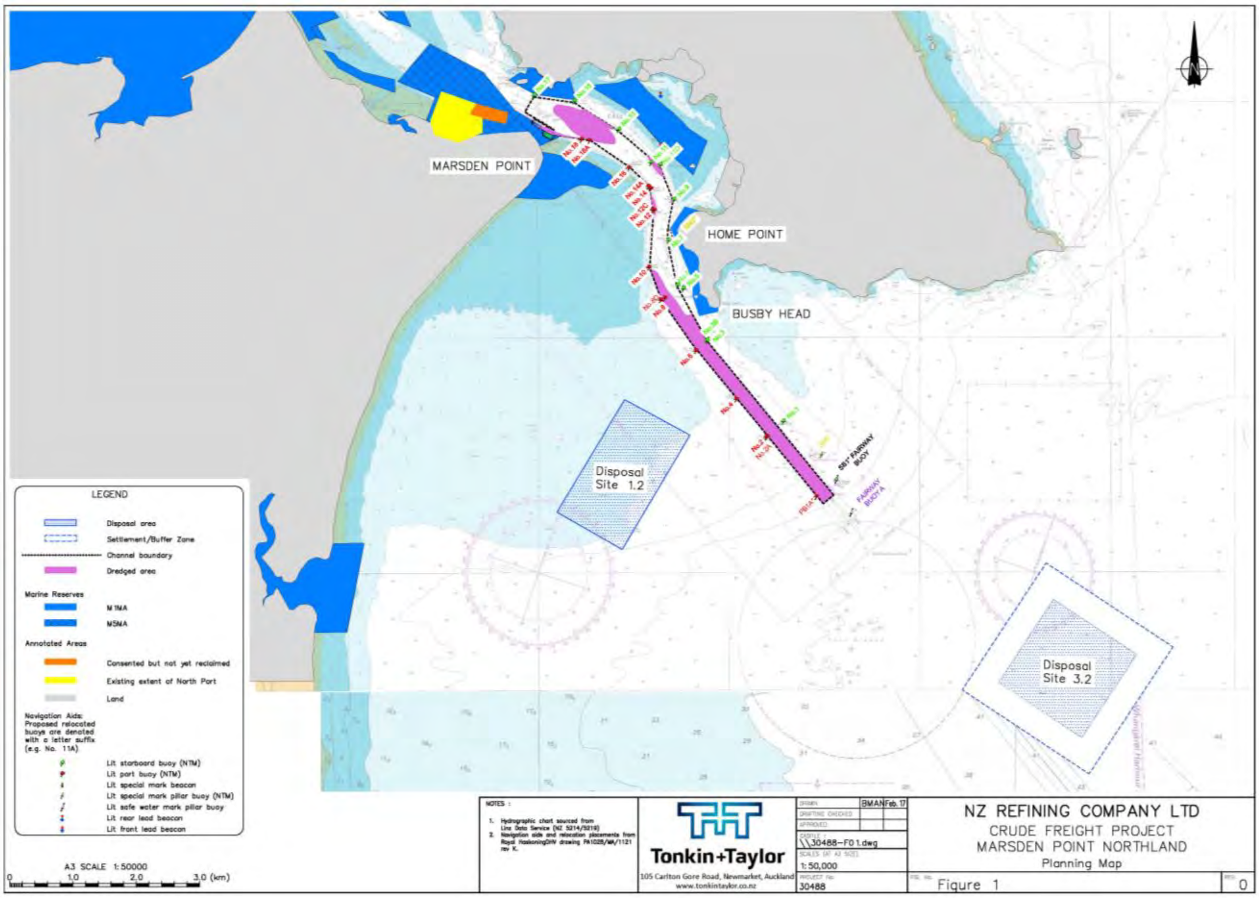

Figure 2. Proposed disposal sites (1.2 and 3.2)

RESULTS

Physical Environment

The project is located at the entrance to Whangarei Harbour. Detailed geological and environmental information is beyond the scope of the archaeological assessment and the brief summary here relates to the archaeological landscape at the Harbour's entrance. The Ferrar geological maps are shown here (although somewhat dated now) as they often contain information relating to earlier heritage items including the location of pa sites, Maori names and other historic information discussed below.

Whangarei Heads is an area of high relief on igneous rock (Figure 3). The interior coastline is marked by high promontories jutting out into the harbour with rocky shore beaches in the bays between.

Marsden Point is located on the western side of the entrance with an old prograding dune (see e.g., Osborne 1983) running from Ruakaka to the south and then turning west towards One Tree Point (Figure 4). The oil refinery is located at the Point with a wharf on the northern side of the Point. The area is relatively low-lying compared with the high relief at the Heads.

The other key features near the harbour entrance are the small islands in the bays, some of which were used in the past by Maori (e.g., McGregors Island), and historic use in the 19th and 20th centuries (e.g., the WWII gun emplacement on Bream Head, Q07/1264). There are also important sand banks which contain pipi and cockle (e.g., Snake Bank in the Harbour, Figure 5 and Mair Bank off Marsden Point) that were crucial to Maori in the pre-colonial period and continue to be an important resource through to the present (Williams et al. 2006).

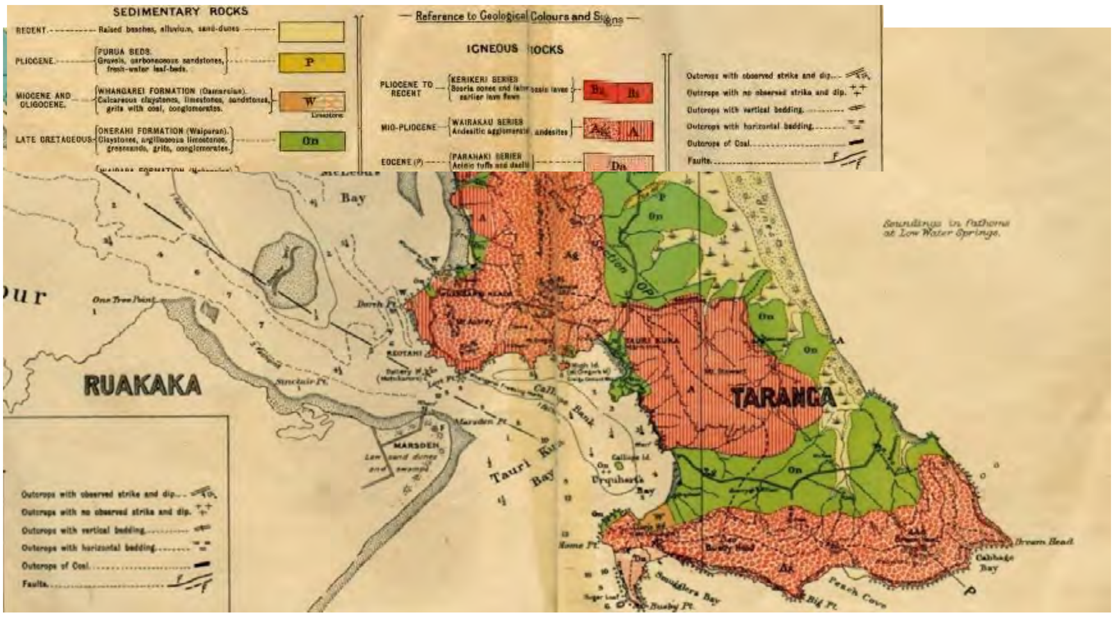

Figure 3. Geological plan of Taranga Survey District (Ferrar et al. 1934)

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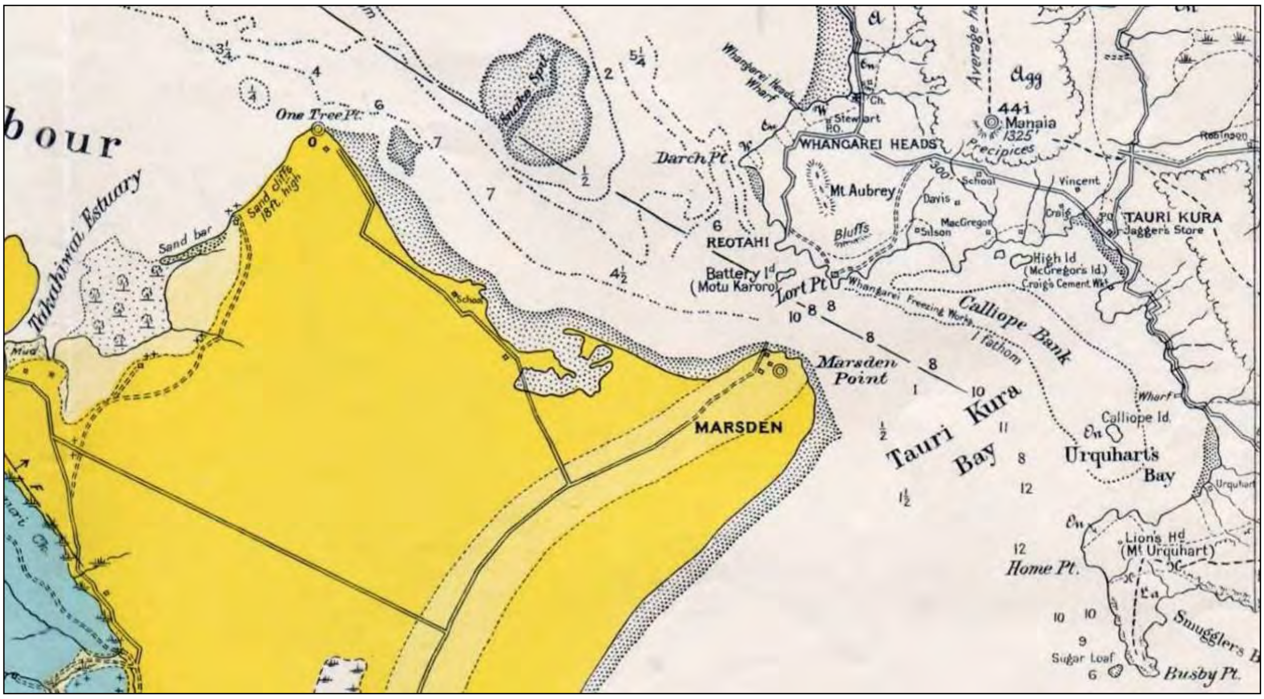

Figure 4. Geological Map of Ruakaka Survey District (Ferrar et al. 1934)

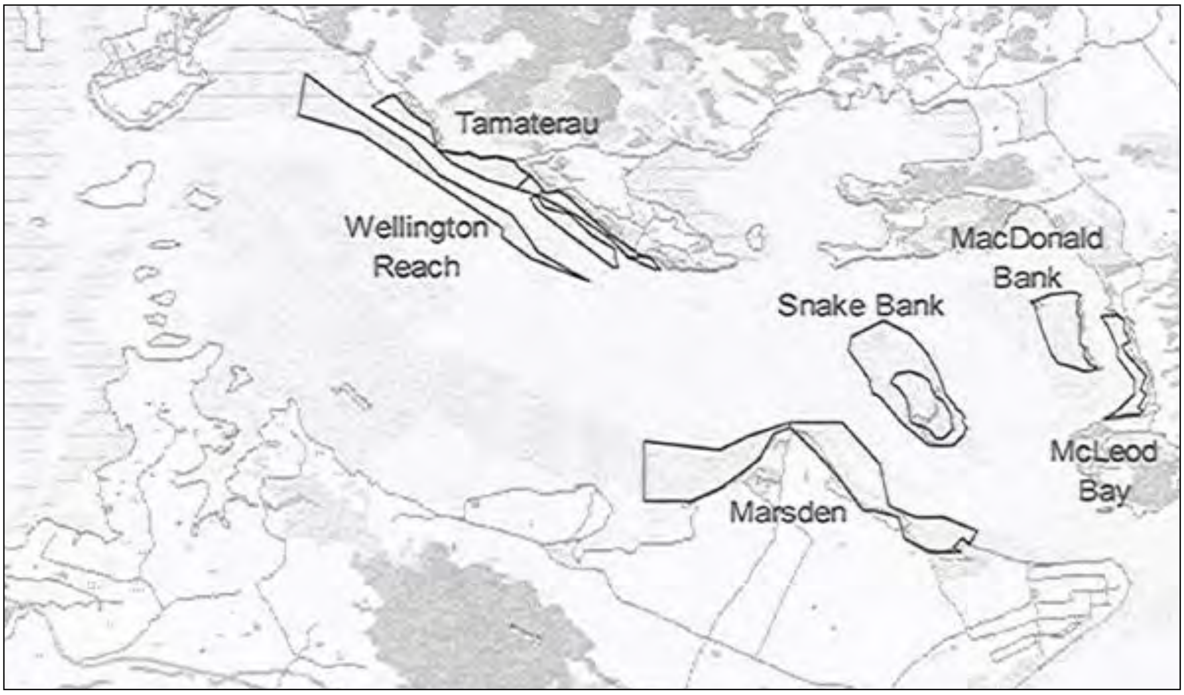

Figure 5. Beaches and banks in Whangarei Harbour that support appreciable numbers of cockles (at July 2002). From Williams et al. 2006: Figure 1

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History[1]

The traditional historical associations relating to the region reflect the migrations, conquests and occupations which have taken place over the centuries. It is a complex history and mana whenua today is based on the pattern which had emerged by the late 18th century.

The lands around Whangarei originally belonged to the Ngati Awa and subsequently the Ngaitahuhu people. In the mid-1700s, the Ngapuhi chief Te Ponaharakeke, living in the district, decided to conquer the One Tree Point area with the help of Ngarokiteuru. The land was divided between the conquerors. Te Ponaharakeke's son, Te Kahore, married Nga Pae, the daughter of the Ngaitahuhu chief Hikurangi. He also married Weku, the sister of the Hokianga chief, Te Raraku. The latter was given lands at One Tree Point and Ruakaka and invited to live there (Manihera et al. in Nevin 1984:6,9). In the early 1800s a war party of Ngatipukenga from Tauranga is said to have attacked the pa at Takahiwai, to the west of One Tree Point and been defeated by the Patuharakeke (Nevin 1984:11). The area around One Tree Point was known as Ara Kahika (Pickmere 1986:5).

In 1823 the missionary Samuel Leigh travelled through the district of Whangarei and found it desolate. He landed near One Tree Point with a mission group and spent the night at Takahiwai (Vallance 1964:30). The missionary Marsden had travelled through the area in 1815 and 1820 and eventually the influence of the visiting missionaries helped to abate the wars. Another missionary, Colenso, travelled the district between 1836 and 1842, accompanied by the British Resident James Busby in 1839, the latter buying the Ruakaka area from the Parawhau and Patuharakeke chiefs. The sale was supervised by the chiefs Te Tirarau III and Karekare (Nevin 1984:14). Busby also bought land in 1839 'on the south side of the harbour' from Patuharakeke (Pickmere 1986:27). In 1841 Colenso travelled from the Kaipara, and the first habitation the party came across was 'near the present settlement of Takahiwai', where they were welcomed by the Patuharakeke rangatira Pou and the hapu (Vallance 1964:34).

Early plans of the harbour date from 1827 (Figure 6) and show the main navigable channel into the Harbour, the high relief at the Heads, Marsden Point (Pte de Sables), and shallow waters associated with the various banks. A later sketch dated to 1842 also shows the entrance to Whangarei Harbour with silhouettes of the Heads ('Tewara') and a manned waka (Figure 7).

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[1] This history is derived from Bickler et al. (2008) and Turner et al. (2010). A more complete history is beyond the scope of this assessment but references in the bibliography provide additional information.

Figure 6. Whangarei Harbour in 1827 (Originally published by Dépôt-général de la Marine as chart 756 and also as carte 19, from D'Urville's Voyage de la Corvette l'Astrolabe, Atlas Hydrographique). Map of Whangarei Harbour, North Island, New Zealand. Relief shown by soundings and hachures. http://natlib.govt.nz/records/20425166)

Marsden Point – Pte des Sables (or Sandy Point)

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RESULTS, CONTINUED

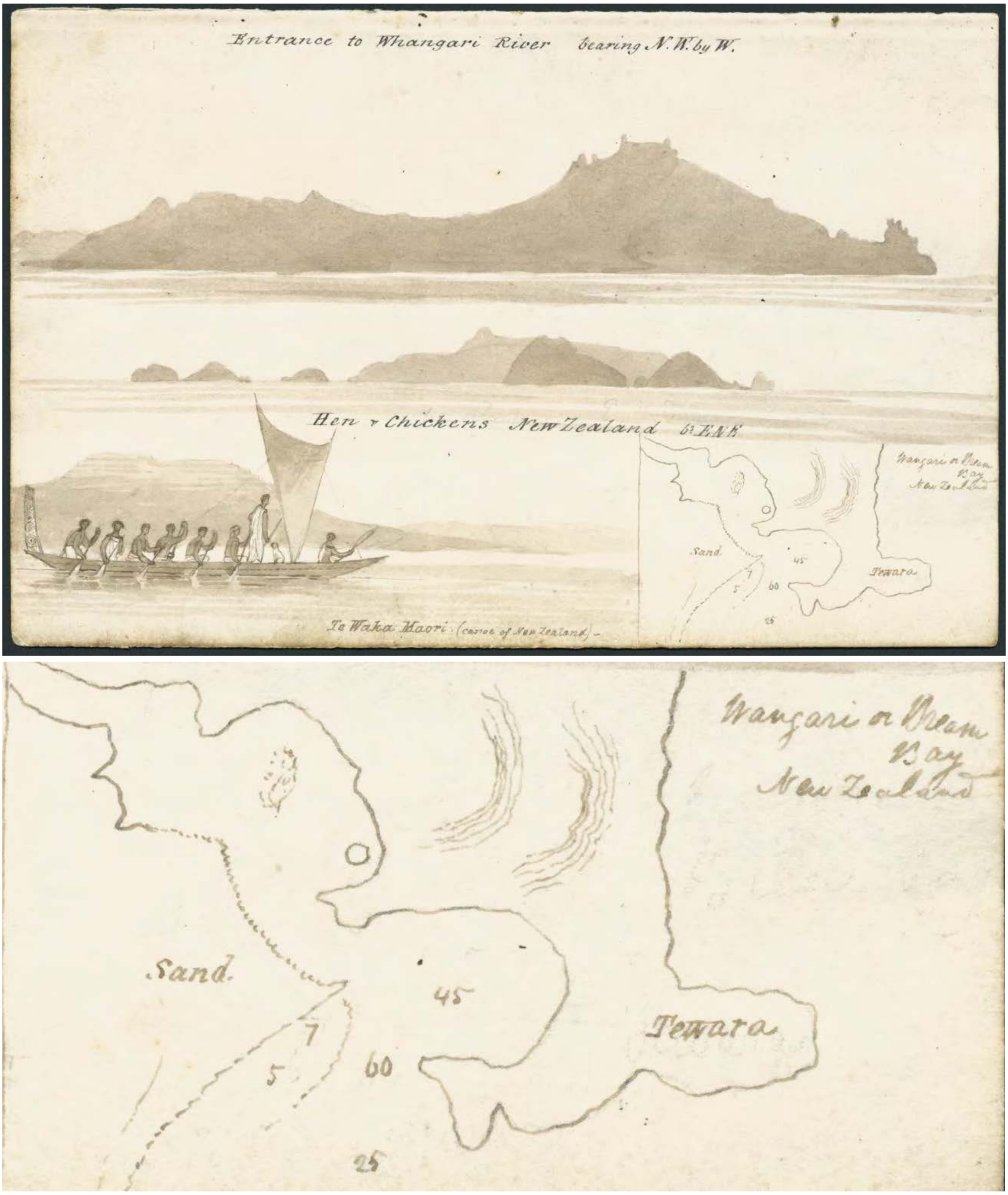

Figure 7. View of the Entrance to Whangarei Harbour (1842)

Entrance to Whangari River, bearing NW by W; Hen and Chickens, New Zealand..., Te Waka Maori (canoe of New Zealand); Wangari or Bream Bay, New Zealand.1842. Reference number: MS-0104-071 http://natlib.govt.nz/records/22741257

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History, *continued*

In February 1854 Maori again sold Ruakaka, this time to the Crown. It was a smaller block than previously, not including Marsden Point or One Tree Point, so they insisted on Busby being compensated. The excluded area was known as Poupouwhenua (Figure 8, Figure 9) and was sold to the Crown in July 1854 (Richards 1984:9-12).

In 1857, Donald McLean, Land Commissioner, wrote to the Governor describing the district of Whangarei: '... the low, sandy country around the town site of Marsden, ... on the banks of streams are some Native villages, ... here and there are occasional patches of poor white clay soil, which have been dug over for kauri gum' (Nevin 1984:5). It is highly likely that one of these 'Native villages' was along the banks of the Takahiwai Stream and possible that the Patuharakeke were busy in gum-digging activities for, as the trade developed, Maori became rapidly involved.

Nevin has attempted to trace the gumfields which were worked over around the Whangarei Harbour, showing likely activity in the One Tree Point and Marsden areas, although neither is listed as main gumfields in the district (Vallance 1964:84). For evidence, Nevin used local knowledge, field observations and typical soil types (Nevin 1984:16, 17). Small pieces of gum can be found today on the southeast side of the property in disturbed soil. The Takahiwai area supplied flax for mills in and around Whangarei in the early days of settlement. The chief of the Patuharakeke at the time was Te Ikanui Te Pirihi (Nevin 1984:15). Pickmere records that there was a Maori settlement at Takahiwai in the 1880s (1986:151) (see Figure 8).

Captain Duncan Mackenzie must have been an early purchaser of land in the area as he had a property and store at One Tree Point in 1854. It was here that ships' passengers were offloaded and taken in open boats along the coast to Waipu. The Captain, also known as 'Prince', was very active in the shipping business and had four sons who were all master mariners (Pickmere 1986:127).

A.M. Rust, born 1859, wrote in his reminiscences of Whangarei that, for Maori, fishing was a great pastime. They used to make raids on the sharks about One Tree Point, then clean the harvest and hang it out to dry in the sun (Rust 1936:125).

A number of shipwrecks around the Whangarei Harbour occurred during the 19th and 20th centuries (see Papers Past website for newspaper reports of a number of these occurrences). Diggle (2014) provides an overview of shipwrecks in the area, but no systematic survey has been undertaken in the Whangarei Harbour to determine the likely locations of all the possible wrecks in the area. Most appear to have occurred outside the mouth of the Harbour on the seaboard side of the Heads.

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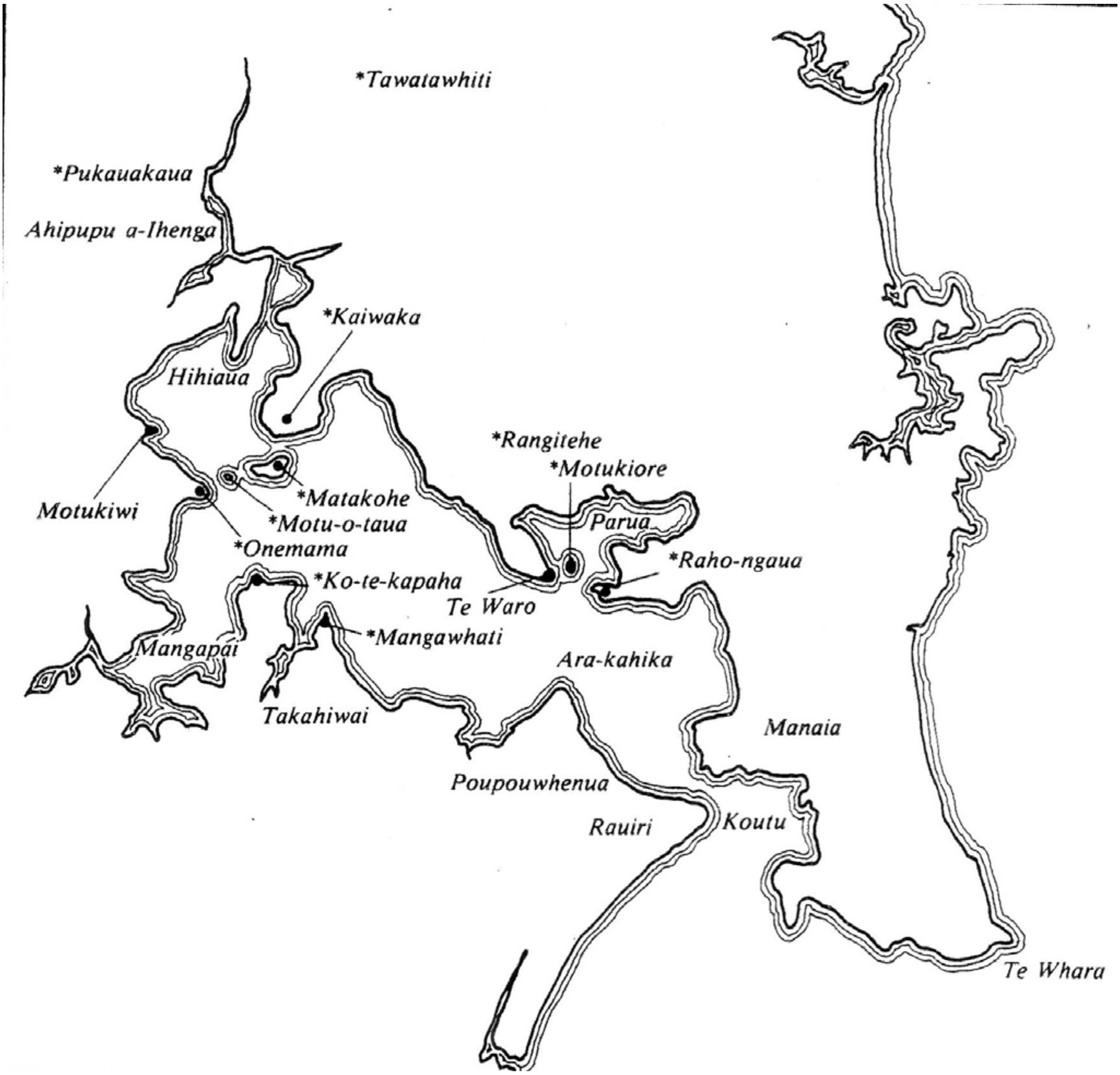

Figure 8. 'Pa sites and place names in use in the early nineteenth century' (Pickmere 1986:5)

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RESULTS, CONTINUED

Figure 9. Close-up of Roll 16 (LINZ) Date unknown

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Previous Archaeological Research

Excavations have been carried out around Whangarei Harbour since the 1960s. At Bream Head, for example, a large midden site produced evidence of significant shellfish cooking as well as seal, dog, bird, tuatara and fish bone, chert flakes, hangi stones and fishing equipment (Green & Davidson 1964 and NZAA Site Record Form Q07/103 cited by Phillips and Harlow 2001:14). More recent test excavations at Bream Head have been conducted, but little information is available regarding the results. Bickler et al. (2008) excavated midden sites in McGregors Bay, opposite the subject area on the north side of Whangarei Harbour, consisting of small to medium-sized middens, but these were relatively simple sites with no evidence of structures of significant complexity.

Nevin and Nevin (1981, G. Nevin [1984]) carried out the main surveys on the southern side of Whangarei Harbour and identified a large number of the sites which have been identified in the Ruakaka area. These were mostly midden near the coast. Farther inland, G. Nevin (1984) identified a large number of sites in the Takahiwai hills including pa, sites with pits and terraces, and evidence of gardening along with the ubiquitous midden sites.

In the inland areas around Takahiwai and near Ruakaka, the Maori settlement pattern appears to have been focussed around the higher ridges. Pa sites offered some defence from raiding parties travelling through the area. Gardening was carried out in this hinterland. Access to the rich marine resources would have been straightforward and during the seasonal cycle, family groups probably moved down to the dune lands to collect food for storage and perhaps exchange.

A small number of excavations have been carried out near Whangarei including investigation of the Ruarangi Pa (Q07/30). The excavations there created a picture of a site that had been occupied a number of times from the 1700s with evidence of houses and midden within the defences. Cockle was overwhelmingly the most common shellfish identified in the midden excavated at the pa (Hougaard 1971 cited in Phillips & Harlow 2001:12-13).

The large midden Q07/58 was excavated by Nichol and Walton in 1976 (Nichol 1988 cited in Phillips & Harlow 2001:13) and suggested extensive shellfish processing much like at the sites around One Tree Point.

Best (1999) excavated a small pit and terrace complex (Q07/897) in Ruakaka where a sequence of pollen data showed the environmental changes brought about by Maori and then Europeans in the area. The site included a cache of digging implements of relatively 'modern' age (i.e., 1800s onwards, where radiocarbon techniques become problematic) along with a radiocarbon date from a midden on the ridge above the cache of between 1640-1870 (at 2σ).

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Previous Archaeological Research, ***continued***

More extensive excavations were carried around One Tree Point, west of Marsden Point, and were reported by Phillips and Harlow (2001). A series of midden deposits were excavated which ranged from small concentrations of hangi/firescoops overlain with shells through to large complexes of firescoops, hangi, stake and post holes. The investigators concluded that the sites represented summer occupation of the One Tree Point area for large scale processing of shellfish from 1500 AD onwards. Most appeared to have only been used during a single season, but in at least one case there was evidence that Maori returned to one of the sites at least once.

Some late 19th century to early 20th century artefacts were also recovered during the investigation of the sites. They were considered to be chance finds relating to gum-digging activities and not linked with the earlier shellfish processing activities.

Subsequent investigations around One Tree Point (see e.g., Campbell 2005, 2006; Bickler et al. 2007) identified a large number of small midden sites ranging in age from 1500 AD to around 1850 AD scattered in the old dunes. These were smaller scale than the sites excavated by Phillips and Harlow (2001), but were probably small seasonal campsites.

There are no known archaeological sites at Marsden Point itself, although it seems likely that the original pre-European occupation there would have been similar to One Tree Point. While the earthworks around that area have probably destroyed most of the sites that may have been present, the possibility of some intact evidence being discovered in the future cannot be ruled out given the prograding shoreline and possible burial of some sites.

A number of investigations, generally of midden sites, have also been carried out on the Whangarei Heads. These include sites in Reotahi Bay (Campbell & Keith 2007) through to McGregors Bay where dates from the 15th to 17th centuries were obtained (see e.g., Bickler et al. 2008). Middens associated with pits and terraces were investigated at Tamaterau to the northwest (Judge & Clough 2008). The sites probably represented the living, gardening and storage areas that made up part of a relatively large settlement associated with a pa (Q07/673) in the 17th or 18th centuries. Recent infrastructure works undertaken by WDC have also exposed two complex multi-layered occupation sites at Taurikura and Urquharts Bays. Radiocarbon dates parallel the occupation at One Tree Point dating to 1500–1700AD (Judge et al. 2010). At Urquharts Bay, human remains, garden soils as well as food storage pits have been found with large middens and represent the range of occupation and activities around the northern harbour (Phillips 2006a,b; Phillips & Druskovich 2009; Judge & Clough 2006b).

Continued on next page

Previous Archaeological Research, *continued*

Carpenter (2012) has summarised the archaeological work around Bream Head and the neighbouring area while outlining a management structure for sites on the Department of Conservation Land there. Carpenter (2012: 26) argued that most of the sites 'represent an intensive occupation focussed on large-scale consumption of shellfish from nearby shell banks around the mouth of the Whangarei Harbour.'

There has been no major archaeological research undertaken on the sources of the shellfish, notably the cockle beds around Snake Bank and the pipi around Mair Bank off Marsden Point. However, the evidence from the archaeological sites suggest both areas have been used by Maori since at least 1500 AD and probably at least one or two centuries earlier.

Wider Landscapes

The scale of archaeological excavations in the Whangarei Harbour area has increased the information relating to the Maori occupation prior to European settlement. At Puwera, to the southwest of Whangarei city, an investigation of three archaeological sites in 2008 by Clough & Associates and the University of Auckland (Turner et al. 2010) provided evidence of inland settlement areas. The Puwera sites included remains of houses, extensive storage pits, cooking areas and stone working dating from the 16th-18th centuries. The storage facilities suggest that major gardens were located nearby, while the range of stone and obsidian tools demonstrated that the inhabitants had access to a range of materials sourced throughout the country. The results from Puwera contrast with those from other locations such as One Tree Point, but given the difference in environment (inland hills as opposed to coastal dunes), this is not surprising. It is likely the sites formed part of seasonal round of activities areas for populations in the area with seasonal encampments near the rich marine resources and more protected and good garden areas in the hinterland.

Around Kamo, north of Whangarei, volcanic soils provided similar conditions for gardening as the fertile soils of central Auckland for both Maori and early European settlers (Johnson 2002:60). Archaeological investigations at site Q06/486 included evidence of Maori occupation dating to the 17th century with nearby evidence of 19th century activities relating to the transformation of the landscape for farming.

Stone walls dating from the 19th century on are common across the District (see e.g., Prince 2009) and provide a visible symbol of the transformation of the Whangarei area into a pastoral landscape.

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Distribution of Sites

The current distribution of archaeological sites in the NZAA database is shown in Figure 10 and Figure 11. The majority of sites relate to pre-European Maori settlement with a few 19th and 20th century sites relating to European settlement. A more detailed discussion can be found in Bickler et al. (2013).

It should be noted that the NZAA site database shows all previously recorded sites including those that have been destroyed either by natural process or land development. This over-representation of sites is balanced in part by the likelihood of new sites that continue to be identified in the area. As a result, the data is a useful indicator of the general pattern of archaeological features in the Harbour.

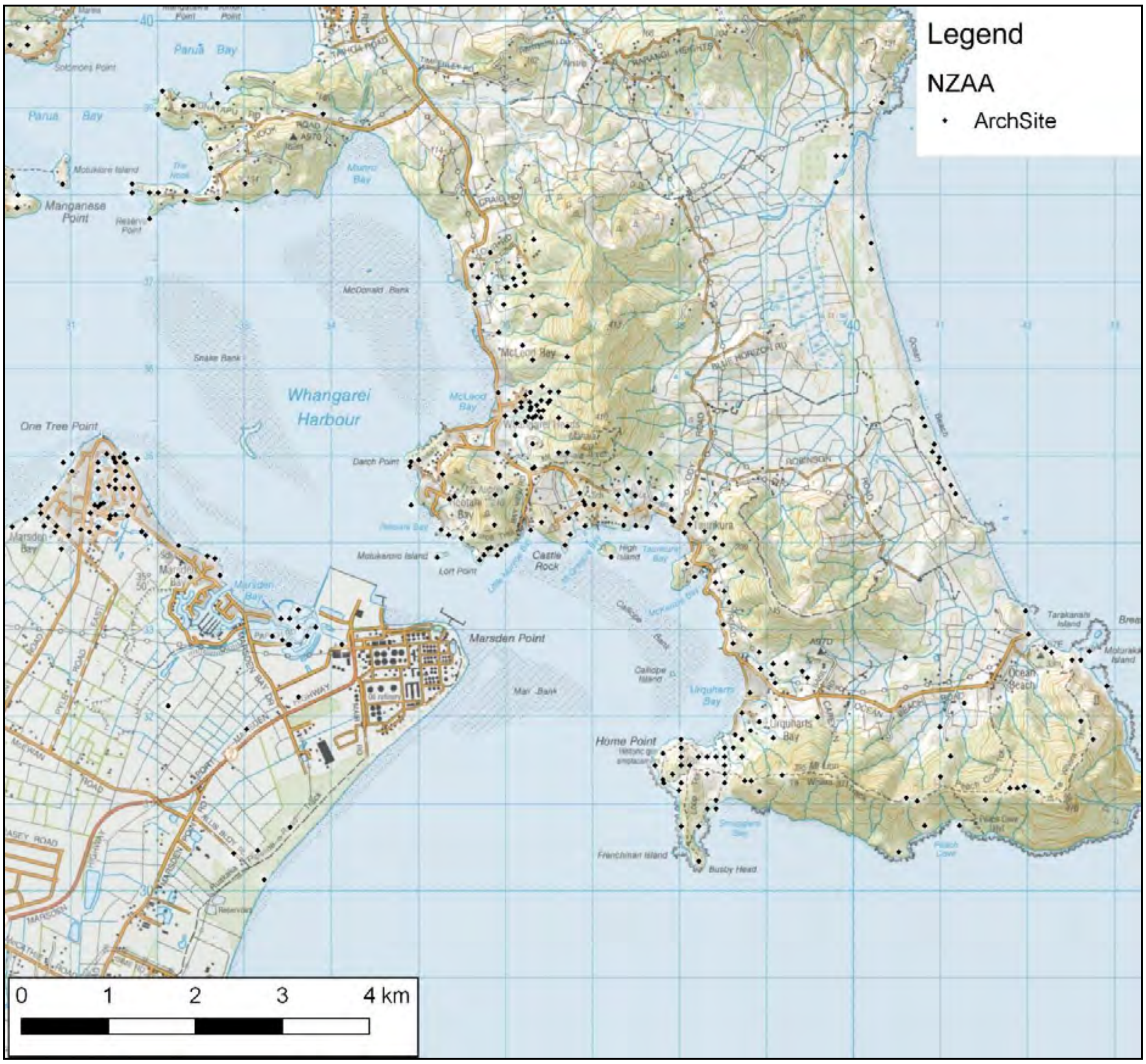

Figure 10. Distribution of archaeological sites (NZAA ArchSite database)

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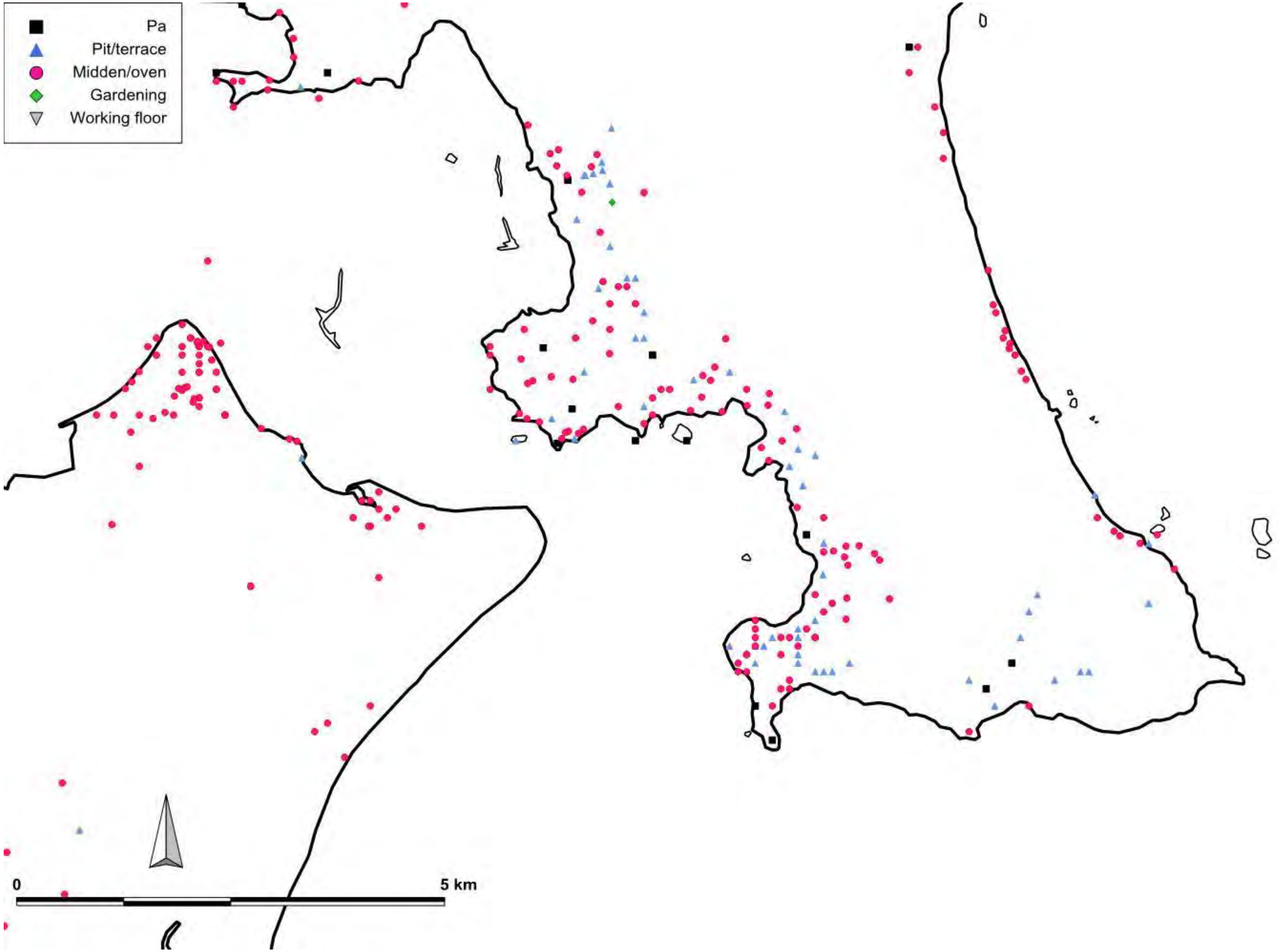
Figure 11. Distribution of archaeological sites by site type (NZAA ArchSite database)



DISCUSSION AND CONCLUSIONS

Summary of Results

The desktop analysis of the archaeological sites around the entrance to Whangarei Harbour shows the range of the features on both sides of the entrance. This includes midden, pit and terrace sites and pa sites dating back at least as far back as 1500AD with other sites likely to be older in the inner harbour. Sites relating to European settlement are recorded in the Harbour although none particularly near to the proposed dredging. The overwhelming majority of sites in the vicinity relate to earlier Maori settlement described in the oral and written histories and archaeological research of the region.

Maori Cultural Values

This is an assessment of effects on archaeological values and does not include an assessment of effects on Maori cultural values. Such assessments should only be made by the tangata whenua. Maori cultural concerns may encompass a wider range of values than those associated with archaeological sites. The historical association of the general area with the tangata whenua is evident from the recorded sites, traditional histories and known Maori place names. A Cultural Impact Assessment has been commissioned as part of the project.

Archaeological Value and Significance, *continued*

The archaeological value of sites relates mainly to their information potential, that is, the extent to which they can provide evidence relating to local, regional and national history through the use of archaeological investigation techniques, and the research questions to which the site could contribute. The surviving extent, complexity and condition of sites are the main factors in their ability to provide information through archaeological investigation. For example, generally pa are more complex sites and have higher information potential than small midden (unless of early date). Archaeological value also includes contextual (heritage landscape) value. Archaeological sites may also have other historic heritage values including historical, architectural, technological, cultural, aesthetic, scientific, social, spiritual, traditional and amenity values.

There are no known archaeological sites identified in the area of the dredging.

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The Heritage Landscape

A number of archaeological sites have been identified at the entrance to the Whangarei Harbour on both sides of the proposed dredging. These sites include evidence of both Maori and European settlement, agriculture and marine exploitation over the past few hundred years. A number of these sites have been investigated by past archaeological research with valuable results relating to Whangarei's history. The archaeological sites border the area of dredging on the nearby coastal areas (Figure 12).

The archaeological sites, as well as the later historical records, demonstrate that the pipi beds at Mair Bank and the cockle at Snake Bank around Whangarei Harbour, along with the other fishing resources, have been important to populations living around the Harbour for several hundred years.

Primary Effects of Proposal

As described in the report, the archaeological features and remains around the Whangarei Harbour can take the form of burnt and fire cracked stones, charcoal, rubbish heaps including shell, bone and/or 19th century glass and crockery, ditches, banks, pits, old building foundations, artefacts of Maori and early European origin or human burials. Shipwrecks around the Harbour are also possible, although there is no specific record of any in the dredging zone.

There are no known archaeological sites directly affected by the dredging or proposed marine disposal sites (Figure 12). Nor will any known sites be affected by the relocated or additional channel marker buoys, or other navigation aid structures (Figure 1).

It is possible that land based disposal sites may be required in the future, but would only be undertaken subject to the necessary consents being in place (Tonkin & Taylor 2016: 6). If land based disposal sites are proposed in the future they would require assessment from an archaeological perspective.

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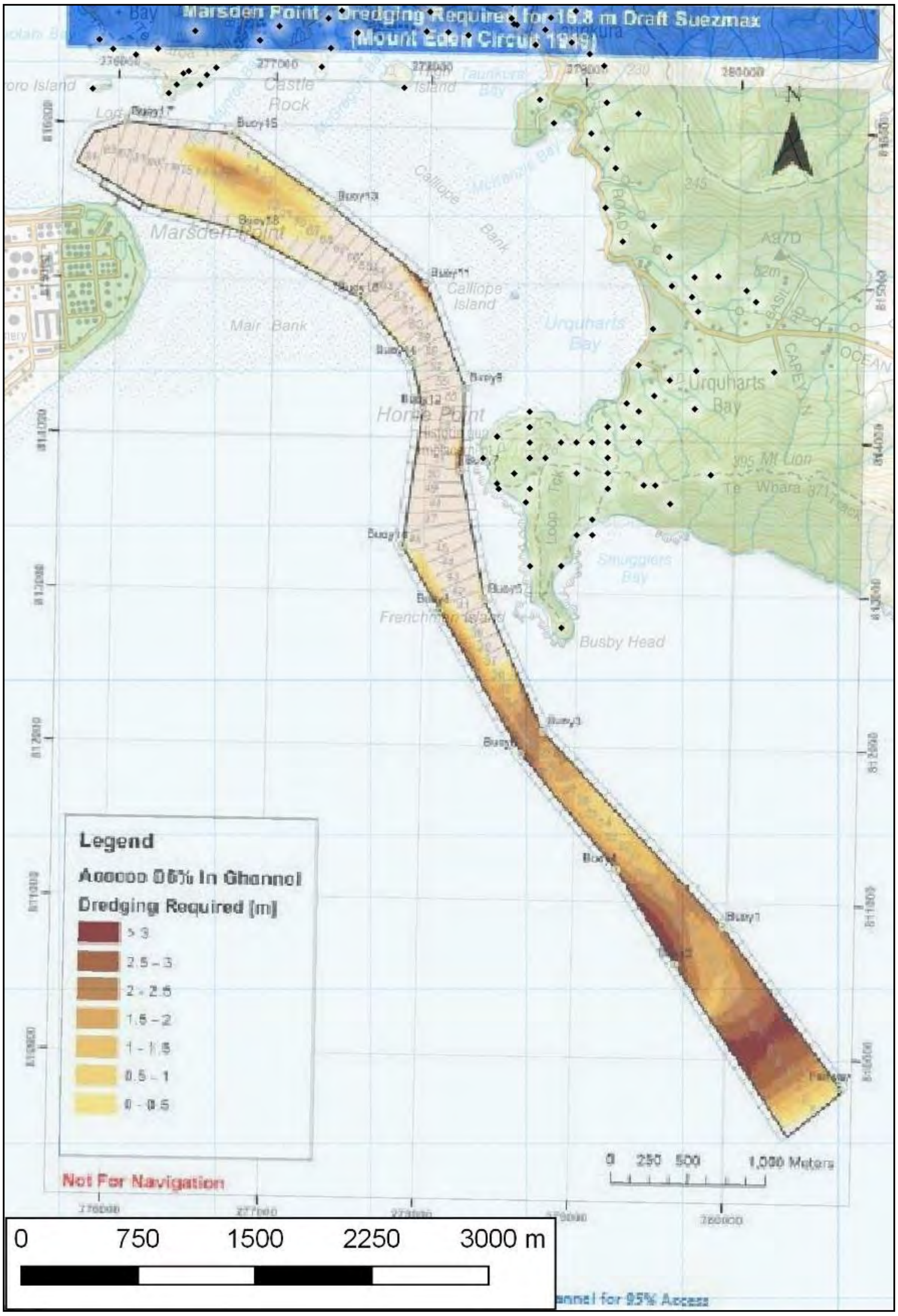

Figure 12. Distribution of archaeological sites (NZAA database) and proposed dredging plan

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Secondary Effects

The project brief included an assessment of possible effects on archaeological sites as a result of changes to the currents as a result of the dredging. This is also a concern raised in the Draft Cultural Effects Assessment,[2] which states 'Physical impacts that could increase secondary erosion effects along the northern shoreline, (ie. at Busby head) risk other important kaimoana gathering locations, our cultural landscapes and seascapes and undisclosed waahi tapu (burial caves) along this shoreline' (CEA, p.26). Of these potential effects, our report is only concerned with potential effects on the archaeological sites that contribute to cultural landscapes.

The Whangarei District Council (WDC GIS Dept)[3] has identified a number of hazard zones relating to:

1. Coastal erosion,
2. Flooding; and
3. Land stability.

A study of the potential effects of climate change on archaeological sites in the Whangarei District (Bickler et al. 2013), included the area of the Whangarei Harbour entrance as a case study. The analysis outlined there (Bickler et al. 2013:31ff) pointed to the possible influence on coastal erosion hazards and flooding hazard on the southern side of the harbour. Land to the west of Marsden Point towards One Tree Point is susceptible to flooding with coastal erosion significant to the south of Marsden Point.

On the Whangarei Heads land stability was considered to be the major natural factor as the higher relief made flooding less likely. However, while erosion was not specifically included in that area, the land stability is in part affected by the coastal erosion processes which exacerbate the land stability.

The distribution of archaeological sites and the WDC hazards identified in the earlier study is summarised in Figure 13. Overall, the case study showed how exposed midden on both sides of the harbour entrance were very likely to be destroyed by these hazards and this was likely to increase as a result of rising sea levels, increased storm events and erosion (Bickler et al. 2013: 34-36).

More recent data on the hazards available from the Northland Regional Council was examined in relation to the distribution of archaeological sites and shown in Figure 14.

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[2] Refining NZ Crude Freight Proposal – Tangata Whenua o Whangarei Te Rerenga Paraoa DRAFT Cultural Effects Assessment. 11 June 2017.
[3] Currently available at http://gis.wdc.govt.nz/intramaps80/?project=Whangarei&configId=0df84abb-1e1f-4b1c-a202-d198446d9c4e

Secondary Effects, ***continued***

The updated hazard information shows a wider area of land that is subject to erosion rather than the specific coastal fringe identified originally in the earlier analysis. This does, however, confirm the conclusions from Bickler et al. (2013), which identified the complex relationship between land stability and erosion as a significant factor in site destruction. However, many archaeological sites around the coastal fringe at the Harbour entrance are vulnerable to potential hazards, but assessing the vulnerability of any particular site to those hazards would require detailed site-specific analysis.

The broad scale nature of the analysis makes it difficult to provide specific data regarding site survivability as a result of changes to the currents that might occur as a result of the proposed dredging and disposal activities. The Tonkin & Taylor coastal processes assessment (2016) concludes that 'overall the changes to tidal flows and wave conditions resulting from the channel dredging and marine disposal are small and typically within the existing variability of tidal currents and wave energy. No changes to existing coastal processes are anticipated on the open coast from Marsden Point to Ruakaka River or along the rocky coast from Home Point to Smugglers Bay, on the ebb tide shoal and Mair Bank or within the inner harbour area.'

As a result, it is unlikely there will be any specific, identifiable or cumulative effects on archaeological sites around the coastline. Current erosion patterns are likely to continue to damage and destroy archaeological sites (Bickler et al. 2013: 36) regardless of proposed dredging. Here, as elsewhere, the more vulnerable components of cultural landscapes such as coastal midden will continue to erode away, but the most visible components, such as prominent coastal pa sites, would survive.

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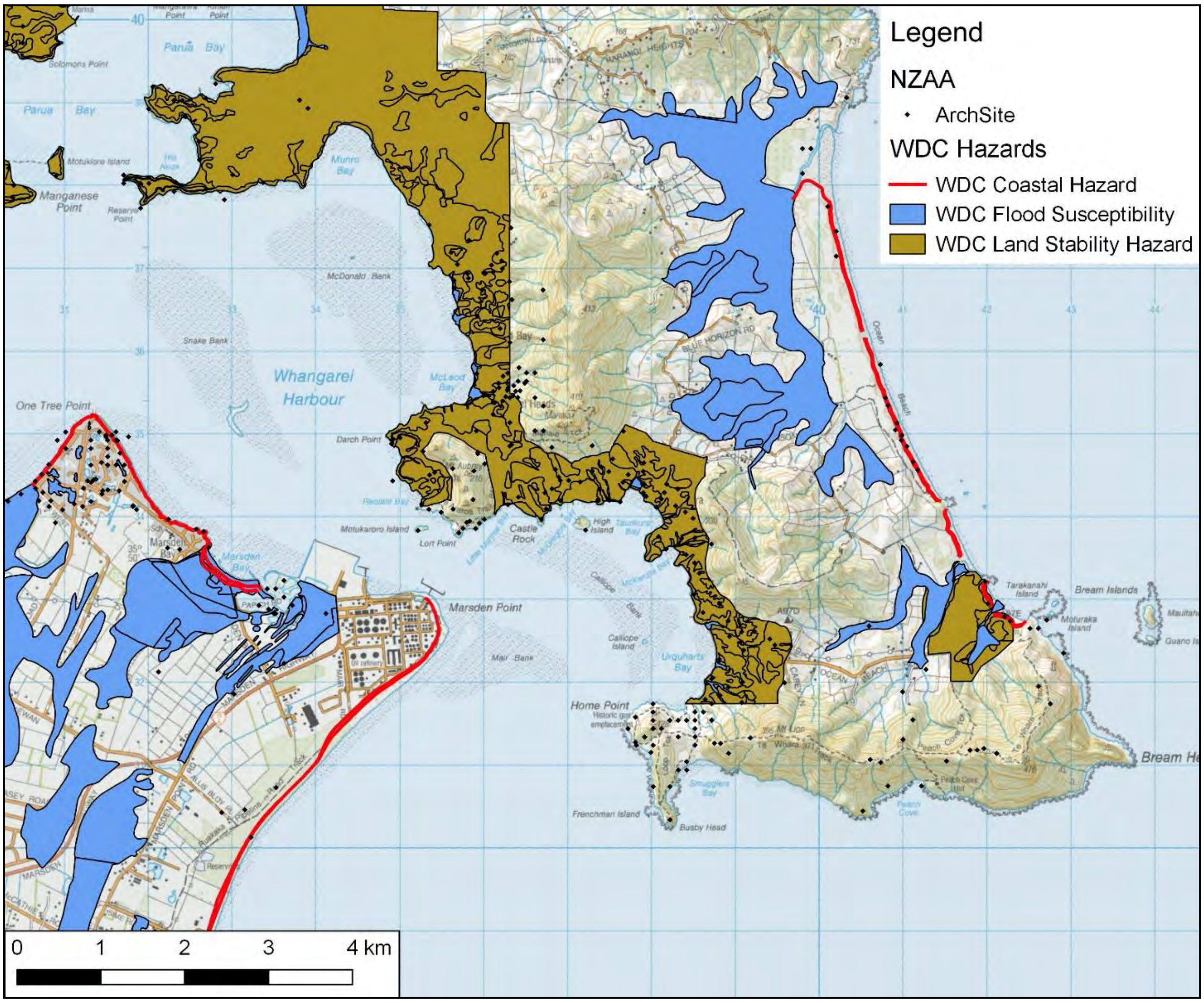

Figure 13. Distribution of archaeological sites (NZAA ArchSite) in relation to identified hazards in Whangarei District (WDC GIS Department 2008)

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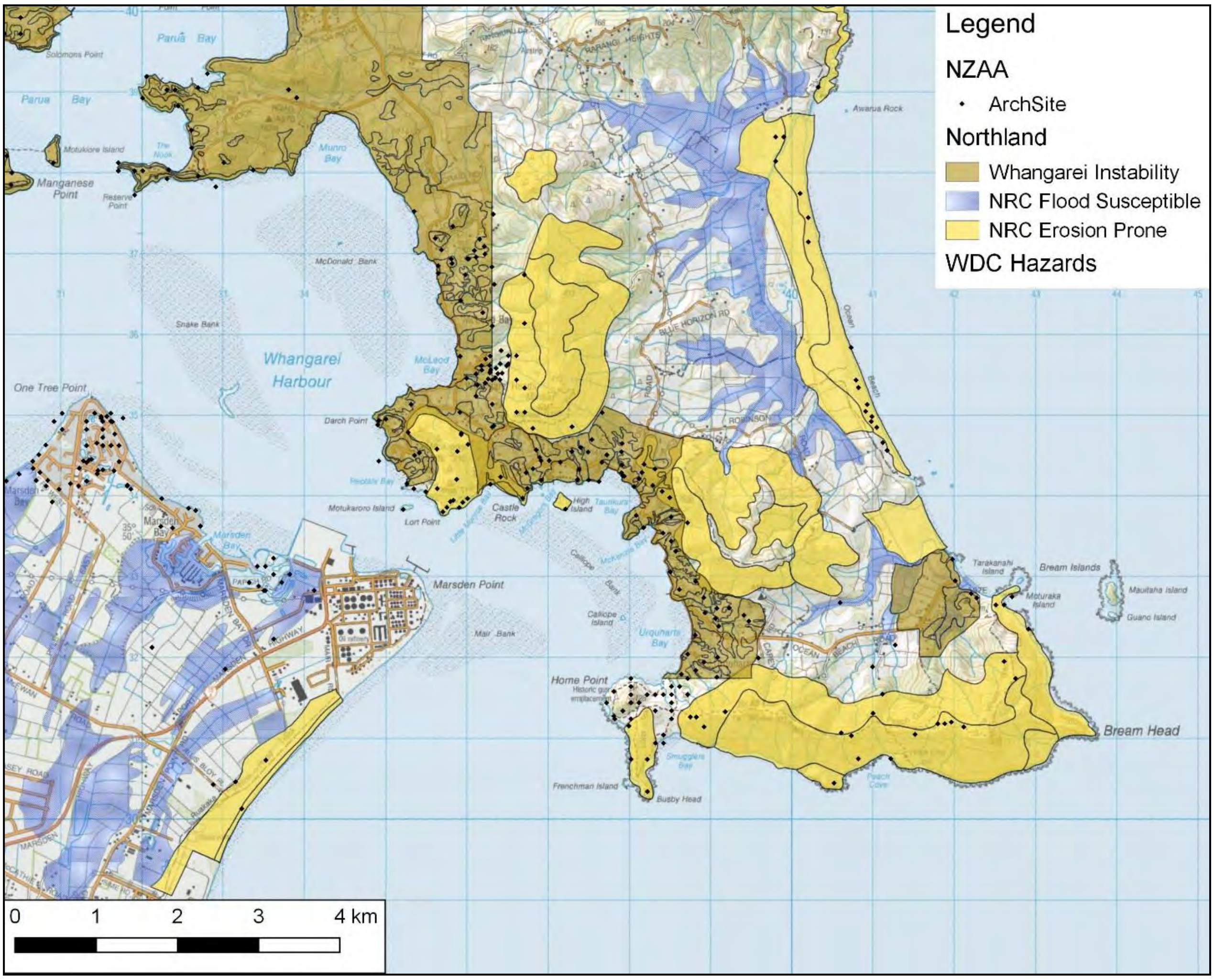

Figure 14. Distribution of recorded archaeological sites (NZAA ArchSite) and identified hazards (Northland Regional Council, data from Koordinates.com)

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Resource Management Act 1991 Requirements

Section 6 of the RMA recognises as matters of national importance: '*the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga*' (S6(e)); and '*the protection of historic heritage from inappropriate subdivision, use, and development*' (S6(f)).

All persons exercising functions and powers under the RMA are required under Section 6 to recognise and provide for these matters of national importance when '*managing the use, development and protection of natural and physical resources*'. Archaeological and other historic heritage sites are resources that should be sustainably managed by '*Avoiding, remedying, or mitigating any adverse effects of activities on the environment*' (Section 5(2)(c)).

Historic heritage is defined (S2) as '*those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, deriving from any of the following qualities: (i) archaeological; (ii) architectural; (iii) cultural; (iv) historic; (v) scientific; (vi) technological*'. Historic heritage includes: *'(i) historic sites, structures, places, and areas; (ii) archaeological sites; (iii) sites of significance to Maori, including wahi tapu; (iv) surroundings associated with the natural and physical resources*'.

Regional, district and local plans contain sections that help to identify, protect and manage archaeological and other heritage sites. The plans are prepared under the rules of the RMA. The Whangarei District Plan and Northland Regional Coastal Plan are relevant to the proposed activity, as is the New Zealand Coastal Policy Statement.

This assessment has established that the proposed activity will have no effect on any known archaeological or post-1900AD remains, and has little potential to affect unrecorded remains. If resource consent is granted, consent conditions relating to archaeological monitoring or protection would therefore not be required. A general condition relating to the accidental discovery of archaeological remains (i.e. as shipwrecks) could be included, requiring that if any archaeological remains are exposed during development, work should cease in the immediate vicinity and the Council and Heritage NZ should be informed.

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Heritage New Zealand Pouhere Taonga Act 2014 Requirements

In addition to any requirements under the RMA, the HNZPTA protects all archaeological sites whether recorded or not, and they may not be damaged or destroyed unless an Authority to modify an archaeological site has been issued by Heritage NZ (Section 42).

An archaeological site is defined by the HNZPTA Section 6 as follows:

> ***'archaeological site** means, subject to section 42(3), –*
>
> *(a) any place in New Zealand, including any building or structure (or part of a building or structure) that –*
>
> > *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and*
> >
> > *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and*
>
> *(b) includes a site for which a declaration is made under section 43(1)*'

Under Section 42(3) an Authority is not required to permit work on a pre-1900 building unless the building is to be demolished.

Under Section 43(1) a place post-dating 1900 (including the site of a wreck that occurred after 1900) that could provide '*significant evidence relating to the historical and cultural heritage of New Zealand*' can be declared by Heritage NZ to be an archaeological site.

Authorities to modify archaeological sites can be applied for either in respect to archaeological sites within a specified area of land (Section 44(a)), or to modify a specific archaeological site where the effects will be no more than minor (Section 44(b)), or for the purpose of conducting a scientific investigation (Section 44(c)). Applications that relate to sites of Maori interest require consultation with (and in the case of scientific investigations the consent of) the appropriate iwi or hapu and are subject to the recommendations of the Maori Heritage Council of Heritage NZ. In addition, an application may be made to carry out an exploratory investigation of any site or locality under Section 56, to confirm the presence, extent and nature of a site or suspected site.

An archaeological authority will not be required for the project as no known sites will be affected, and it is unlikely that any undetected sites are present. However, should any sites (e.g. shipwreck remains) be exposed during development the provisions of the HNZPTA must be complied with.

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Conclusions

This desktop assessment has examined the archaeological data relating to the land-based settlement around the Whangarei Harbour. That information, along with previous research on possible environmental hazards around the Whangarei Harbour (Bickler et al. 2013) and the coastal processes assessment for the current proposal (Tonkin & Taylor 2016), suggests that while many sites may be vulnerable to future erosion, it is unlikely that there is any overall increased risk to archaeological features as a result of the project.

If any land based disposal areas are proposed in the future, these would need to be assessed to establish whether they have the potential to impact on archaeology.

RECOMMENDATIONS

It is Recommended:

- That there should be no constraints on the proposed dredging project on archaeological grounds, since no archaeological sites are known to be present and it is considered unlikely that any will be exposed during development.
- That if archaeological evidence should be unearthed during the work (e.g., evidence of early shipwrecks), work should cease in the immediate vicinity of the remains and the Council, project archaeologist and/or Heritage NZ should be notified.
- That if modification of an archaeological site does become necessary, an Authority must be applied for under Section 44(a) of the HNZPTA and granted prior to any further work being carried out that will affect the site. (*Note that this is a legal requirement*).
- That in the event of koiwi tangata (human remains) being uncovered, work should cease immediately in the vicinity of the remains and the tangata whenua, Heritage NZ, NZ Police and Council should be contacted so that appropriate arrangements can be made.
- That since archaeological survey cannot always detect sites of traditional significance to Maori, such as wahi tapu, the tangata whenua should be consulted regarding the possible existence of such sites associated with the project area. A cultural impact assessment is in preparation.
- That if land based disposal is proposed in the future, the disposal areas should be assessed for potential effects on archaeological values.

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Annexure Two: Technical Reports

o) **Crude Shipping Project – Economic Assessment of Channel Deepening at the Marsden Point Refinery. New Zealand Institute of Economic Research. Peter Clough and Mike Hensen. Dated 02 August 2017**

Crude shipping project

Economic assessment of channel deepening at the Marsden Point Refinery

NZIER report to Refining New Zealand

2 August 2017

About NZIER

NZIER is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice to clients in the public and private sectors, throughout New Zealand and Australia, and further afield.

NZIER is also known for its long-established Quarterly Survey of Business Opinion and Quarterly Predictions.

Our aim is to be the premier centre of applied economic research in New Zealand. We pride ourselves on our reputation for independence and delivering quality analysis in the right form, and at the right time, for our clients. We ensure quality through teamwork on individual projects, critical review at internal seminars, and by peer review at various stages through a project by a senior staff member otherwise not involved in the project.

Each year NZIER devotes resources to undertake and make freely available economic research and thinking aimed at promoting a better understanding of New Zealand's important economic challenges.

NZIER was established in 1958.

Authorship

This paper was prepared at NZIER by Peter Clough & Mike Hensen

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Tel +64 4 472 1880 | econ@nzier.org.nz

Key points

This report sets out a framework for economic assessment of the proposal for deepening the channel for Marsden Point Refinery. It proposes a cost benefit approach that has been used in the Environment Court, supplemented by considerations of economic impact of the refinery's spending and employment in the region.

The cost benefit framework identifies the economic surplus from channel deepening, taking account of the externalities that may be created by it.

The cost of the channel deepening project is currently estimated at around $37 million for dredging and a further $20 million for additional tank storage to handle larger deliveries. This will have limited impact on the local economy if much of the inputs are imported, but will have greater economic consequence for the region and New Zealand in enabling the continuation of refinery operations.

The potential benefit from accessing larger loads in deeper draught ships is in cost savings in the order of $12-17 million a year on current prices, depending on the size of heavier delivered cargoes enabled by channel deepening. These savings are largely captured by Refining NZ and its customers as developers of the project, which as New Zealand domiciled companies also provide a national benefit.

These potential cost savings also help to maintain the international competitiveness of the Marsden Point refinery and prolong its operation and contribution to the economy in Northland. This includes annual payments that are currently around $68 million a year to its 500 employees and contractors, and additional payments are made on periodic maintenance shut-downs and investment projects additional to routine operations, which have flow on effects in stimulating other expenditure in the local economy.

RNZ faces increasing competition from larger refineries in Asia, which has been attributed with the closure of several Australian refineries of similar scale to Marsden Point. In the absence of channel deepening it will be more difficult to maintain competitiveness and continue to operate at its current level.

Marsden Point is New Zealand's only refinery, capable of refining oil products from both indigenous and imported crudes. The continuity of operation of the refinery has a particular significance for the Northland economy, given its low rating on a number of economic and social measures. Premature closure of the refinery, given its contribution to general business expenditures and wages paid in the region, would have a significant negative impact on regional economic activity and well-being.

By improving the competitive position of RNZ, channel deepening will confer years of extra refinery operation. It would also reduce the present value of these costs of refinery closure and site remediation, which are estimated at $300 million, by deferring them indefinitely into the future when their present value cost will be lower.

There are also a number of external benefits for the wider community, such as fewer vessel movements around the refinery and reduced greenhouse gas emissions[1] from

[1] These reductions in greenhouse gas emissions contribute to but are not counted against greenhouse gas emission goals, because of the current exclusion of international shipping in international agreements

fewer crude deliveries. The proposed realignment of the channel also provides a benefit for other shipping in the approach to Whangarei Harbour.

Other external effects on the environment, such as on the seabed and reclamation areas, affect a small proportion of the marine and coastal area and do not appear to have significant scarcity or distinctiveness to warrant incurring high expenditure or opportunity cost to their protection.

If the refinery were to close it would probably convert to an oil terminal handling imported oil products for dispatch by pipeline to Auckland. That would reduce the overall number of shipping movements around Marsden Point, as crude carriers and coastal tankers were discontinued and replaced by tankers importing refined oil products. The environmental effects of such changes would need to be weighed against the loss of economic contribution from the refinery's probable contraction to an oil terminal, with much lower economic impact than the refinery in operation.

From the analysis in this report the channel deepening is likely to enable benefits that are larger than the costs incurred by the project, indicating it is an efficient use of resources, in line with the Resource Management Act's section 7(b). By assisting the refinery to continue its current operations and supply of economic surplus to the region and New Zealand at large, it also enables communities to provide for their economic well-being in line with the Act's section 5.

Summary of economic effects of channel deepening

Item	Unit	Value
Cost of channel deepening	$ m	37
Cost of extra tank storage	$ m	20
Combined cost of project	**$ m**	**57**
Cost annualised over 15 years at 8%	$m/year	6.7
Benefit in lower delivered costs	**$m/year**	**12 - 17**
Present value (at 8%) of deferring refinery decommissioning/remediation		
From 10 years to 20 years	PV $ m	75
From 10 years to 35 years	PV $ m	119
Unquantified benefits		
Strategic advantage in widening the choice of available crudes and timeliness of shipping		
Benefit for all shipping from channel alignment reducing risk of navigational error		
Reduced greenhouse gas emissions per unit of delivered crude		

Source: NZIER

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1. Introduction

This report provides economic advice and evidence to support resource consent applications for changes in the sea approaches to Marsden Point wharf. The principal activity for which consent will be sought is dredging of the channel, primarily at the outer channel towards Fairway Shoal and at the Marsden Point Jetty. This will enable Suezmax ships with heavier loads than are currently possible to dock at the jetty which will improve the efficiency of deliveries of crude oil into the Marsden Point refinery.

1.1. Economics in the Resource Management Act

Economics in its broadest sense can be described as the study of how limited resources are used in satisfaction of potentially unlimited needs and wants. This is relevant to many of the operational and regulatory powers under the RMA, such as allocating land space and water to different activities, and allocating discharge capacity into different environmental media of air, soil and water. Economics can both indicate the likely consequences on economic activity of proposals and inform the choices made under the Act.

The purpose of the RMA is the sustainable management of natural and physical resources. Section 5 defines this as enabling people and communities to provide for their well-being while sustaining natural and physical resources to meet foreseeable needs, safeguarding life-supporting capacities of environmental media, and avoiding, remedying or mitigating adverse effects of activities on the environment. The Act defines environment broadly to include social, economic and cultural conditions.

Explicit economic considerations under the Act include section 5's references to enabling communities to provide for their economic well-being, and section 7(b)'s requirement to have regard to efficient use and development of natural and physical resources. Section 32 requires consideration of alternatives, benefits and costs before a proposed planning measure is put into effect, including after recent amendments how a proposal would affect opportunities for employment and economic growth. However, section 32 is not a specific requirement under the Act when considering resource consent applications, although it may influence how economics is considered. More relevantly, Schedule 4 to the Act requires an applicant for resource consent to include an assessment of:

- the actual or potential effect on the environment (which, as noted above, includes economic conditions) of the activity;[2] and
- any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects.[3]

Further, section 104 of the Act requires a consent authority, when considering an application for resource consent to have regard to any effects (positive or adverse) on

[2] Clause 6 of Schedule 4.

[3] Clause 7 of Schedule 4.

the environment of allowing the activity. As noted above, the definition of environment includes economic considerations.

Well-being can be regarded as equivalent to economic welfare, the conceptual measure of the amount of consumption that can be enjoyed by people in the economy, where consumption includes both that of market goods and non-market conditions such as the state of the environment. In practice non-market conditions are difficult to value in monetary terms so often decisions on their level are determined by political or judicial systems in which economic value is implicit (rather than explicit) in the decisions.[4]

A proxy for market-based consumption is income generated by the refinery's continued operation, as this enables consumption by people in Northland and New Zealand at large. The efficient use of resources can be inferred from the contribution of channel deepening to accessibility of ships with larger cargoes that lower crude delivery costs to the refinery below what they would be without the deeper channel.

Applications for resource consent are usually taken as evidence that a proposal benefits the applicant, so the RMA focus is on external "spillover effects" that might arise. That includes external effects on natural and physical resources and also on the economic conditions within the environment.

1.2. Methods of economic analysis

Although the RMA does not specify a method for economic assessment when considering consents, a useful approach is **cost benefit analysis (CBA)**, the standard economic method for determining whether a project or proposal is worthwhile. It compares the economic value of the project against the costs of implementing it, not just for the company but for the wider economy. NZIER have adopted the CBA approach in undertaking this assessment.

Such analyses are used in consent applications. For instance, in seeking consent for extending its runway, Wellington International Airport Limited has submitted a CBA following the approach set out by the Environment Court (*Port Gore Marine Farms v Marlborough District Council)* for assessing economic effects (the sum of net addition to producer surplus, consumer surplus, and positive externalities less negative externalities). Cost benefit analysis directly addresses the issue of efficiency of resource use, and even if not fully quantified applies a logical framework for comparing outcomes with and without a proposed change.

Another common approach is **economic impact analysis (EIA)**, which shows how a project impacts on aggregate measures of the economy such as spending, contribution to GDP, incomes and employment. EIA often uses economic multipliers which show how the direct spending and job creation by the project stimulates indirect spending and job creation in other local sectors which either supply inputs to, or use the outputs from the project. But multipliers are confined to impacts on "the economy" and cannot account for external effects on the environment. They can exaggerate impacts of changes in the economy, as being derived from a static model of inter-industry transactions they do not allow for new demands changing prices and re-allocating

[4] For instance, if a planning rule upheld by legal process determines that a given area should be set aside for conservation, it implies the area is worth to the public at least as much as the highest value alternative use for the area. Such considerations are not often explicit in such decisions, raising the risk that value can be very variable across different decisions.

resources across the economy.[5] Multipliers do exist, but their quantification is difficult and prone to misplaced precisions and overstated by multiplier analysis. Because of these limitations such analysis is not used here.[6]

1.3. Economic outline of Marsden Point channel deepening

Economic value from channel deepening at Marsden Point could arise from:

- Producer surplus from efficiencies in cargo handling that improve profitability for the oil supply industry, both RNZ and its customers
- Consumer surplus would arise if New Zealand consumers obtained lower prices, new products or improved security of products; but in practice the landed cost of imported refined product sets the price across the market so such consumer benefits are extremely limited for refined oil products
- Externalities include positive environmental effects e.g. a safer channel due to realignment with reduced environmental spill risk, or fewer ship movements enabled by deeper draught vessels and larger loads, with less disruption for other activity around the shipping channels; or negative effects, such as any residual unmitigated adverse environmental effects.

Beyond RNZ's private interest in improving its operational efficiencies by accessing the services of larger ships and cargoes, there is wider economic case to be made around effects external to RNZ:

- Direct economic benefit of more heavily loaded ships – cost savings for the refinery and its NZ customers relevant to s7b efficiency and s5 wellbeing – a private benefit except to the extent it keeps the refinery in operation
- Strategic interest in increased competitiveness and longevity of the refinery – relevant to s5 wellbeing and to efficiency through improved security of supply, avoidance of business disruption from RNZ losing competitiveness, lowering New Zealanders' disposable income
- Additional work done, employment and spending associated with the dredging operation – fits with s5 wellbeing to the extent it provides a share of income to people and businesses in the region, but such impacts of shipping channel deepening may be quite small if much of the dredging equipment or labour is specialised and imported
- Continued refinery operation – fits with wellbeing to the extent that it provides spending and jobs in a region with limited alternatives for work.

Making the case for channel deepening in a CBA framework requires:

- Identifying the counter-factual or base case that would prevail in the absence of channel deepening

[5] A better tool is General Equilibrium (CGE) Analysis, which does account for resource constraints and price effects, but is rather more complex than the commonly encountered multiplier analysis.

[6] Multipliers' methodological weaknesses are recognised in the government sector and rarely taken seriously by decision-makers For an overview of these weaknesses, see publications by the Australian Productivity Commission, the New Zealand Treasury and MBIE. All three clearly state that multipliers over-state economic impacts and thus lack credibility for policy analysis.

- This involves outlining the refinery's role in the current supply of refined oil products in New Zealand and how that might evolve given influences on the wider economy and on future oil demand and supply
  - It identifies the value at risk should the absence of channel deepening constrain the company's ability to adapt to new conditions and remain competitive with other suppliers to fulfil that role
- Identifying, quantifying and valuing to the extent possible the incremental changes in continued operation of the refinery with channel deepening
- Estimating effects over a long time period, to compare costs and benefits and see which is the larger over the period in present value terms
- Testing robustness of results to changes in inputs and assumptions.

In this report estimates of annualised capital costs are presented for two timeframes: the maximum consenting period of 35 years, and a shorter timeframe of 15 years to reflect more commercial considerations of quicker expected payback where the investment is likely not to last as long because of risk or the need for future upgrade. The results are intended to illustrate return in the long term over the full consenting period and against more stringent short term criteria.

2. Prospects without channel deepening

2.1. The issue facing Refining NZ

RNZ operates in a highly competitive market for refined oil products, where addition of new capacity, new technology, greater refinery scale and access to very large crude carriers has lowered the supply cost curve for crude oil in the Asia-Pacific region. New ways of improving operating margins at Marsden Point are needed to remain competitive with much larger refineries in Singapore, Korea, India and the Middle East. Reducing costs of delivery is one such option for protecting margins at Marsden Point to support long term sustainability of the refinery.

Suezmax tankers (120-180,000 deadweight tonnes (dwt) with cargo capacity up to around 1.05 million bbl) offer operational cost advantages over more common Aframax tankers (80-120,000 dwt, 700 kbbl). The increase in US fracking production has reduced demand for Suezmax on the Trans-Atlantic trade, freeing Suezmax vessels to ply for business on other long haul routes.

Increasing accessibility of Suezmax to Marsden Point would enable greater access to West African crudes, which tend to be sold in large parcel sizes. That could also enable Refining NZ's customers to adjust their slate of crudes from different source regions and take advantage of crude sourcing and trading benefits that may accrue from access to more commonly traded larger parcel sizes.

The channel approach to Marsden Point Wharf currently has a draught limit of 14.7m, which limits the use of Suezmax vessels to around 900 kbbl laden capacity. Relieving these constraints would increase the availability of vessels carrying heavier loads of 1.05 mbbls to service the refinery and reduce the likelihood of costs being incurred from periodic unavailability of the most economic vessels.

Currently Marsden Point receives 4 deliveries a year in not-fully-laden Suezmax vessels and 55 deliveries in Aframax vessels, with an average load across all vessels of around 700kbbl. With channel deepening that could shift to 25 Suezmax and 23 Aframax deliveries a year with average load of 850 kbbl, with continued Aframax deliveries comprising shipments from Asian ports that have constraints on larger vessels.

There are various options for channel deepening and disposal of spoil, with capital costs that currently are indicatively estimated to be NZ$37 million [Royal Haskoning DHV]. If undertaken by a national dredge operator, this will represent a significant investment within the national economy. However, it appears likely that – due to availability of the specialised equipment required – much of this may accrue to overseas firms if the services are imported. In that situation, the direct impact on the regional or local economies in Whangarei and Northland is likely to be reduced.

2.2. Current supply of oil products in New Zealand

2.2.1. Refining NZ in national oil supply

Since the building of the Marsden Point refinery in the 1960s, New Zealand's oil supply has relied upon a mixed system, in which the bulk of oil is imported as crude feedstocks and refined into products at the refinery, with a smaller proportion of refined oil products imported from sources in Australia and Asia. The refinery's products are distributed across New Zealand via the Refinery-Auckland Pipeline (RAP), by road tanker around Northland, and by coastal tankers to oil depots at other ports around New Zealand.

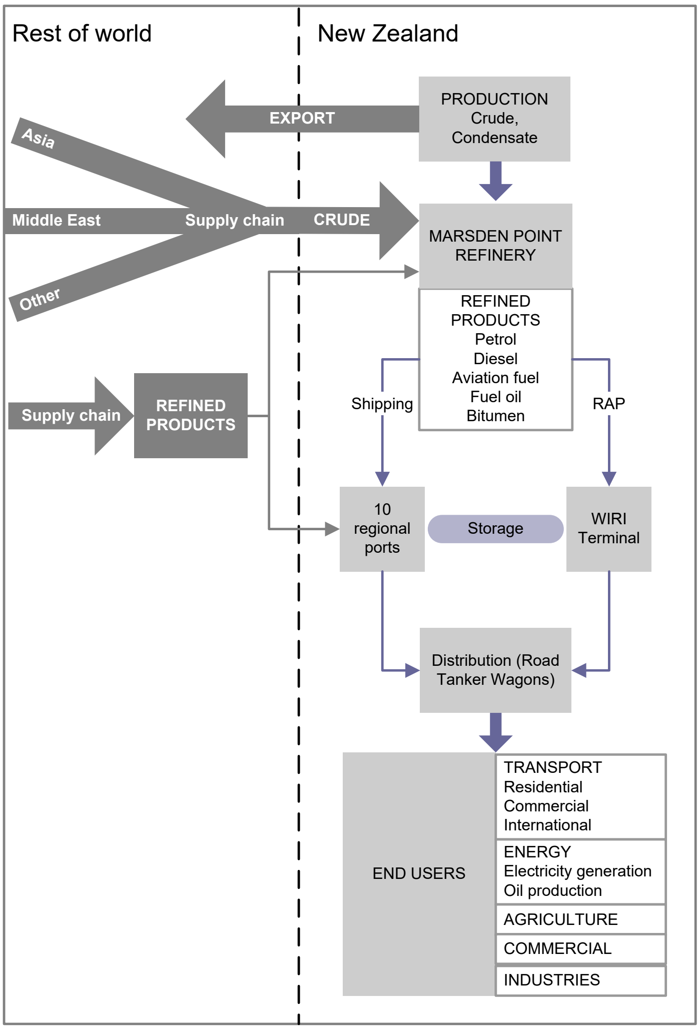
Refining NZ currently supplies:

- all of New Zealand's fuel oil for ships
- around 86% of the country's jet fuel
- 67% of its diesel
- 63% of its petrol
- between 60% and 75% of all bitumen for roading.

It also produces sulphur that is used in fertiliser manufacture, and carbon dioxide that is used in the food and beverage industries.

Refining NZ's refinery processes crude oil for its customers, and it charges a tolling fee for its refinery services. Refining NZ's customers, the major oil product wholesalers in New Zealand, bear the costs and associated risks of crude purchasing, shipping and maintaining crude, feedstock and product inventories. But the tolling fee charged by the refinery for processing is calculated as if the refinery bears these costs (using international market assessments and freight rate benchmarks) to calculate a notional margin, of which 70% is ascribed to the refinery fee (subject to a fee floor and margin cap) and 30% to the oil companies.

Figure 1 RNZ in **New Zealand's Oil Supply**



Source: NZIER

Reducing shipping cost and improving efficiency will be reflected in an improved notional margin shared between RNZ and its customers. Regardless of this margin split, the whole reduction in transport cost enabled by larger shipping can be regarded as a benefit to New Zealand as it accrues to New Zealand domiciled companies.

2.2.2. Current oil demand and supply security

According to the Ministry of Business Innovation and Employment's *Energy in New Zealand*, in 2015, oil was the source of 31% of the primary energy used in New Zealand. From a high of 50% in 1975 that share dropped to 27% in 1993 then recovered to the mid 30%-40% range in the 2000's where it has fluctuated since then. Despite that apparent decline oil still accounted for 44% of total consumer energy in 2015, and 99% of all energy used in transport. Transport accounts for about 81% of all oil and oil product consumption in New Zealand, and other major users are the primary industries of agriculture (5.8%), forestry (1.1%) and fishing (1.6%), other industry (7.4%), commercial (2.3) and residential users (1.2%).

Oil and oil products remain of critical importance to New Zealand, and for many of their uses (particularly transport) there currently are no large scale practical or cost effective substitutes available in the short to medium term, making security of supply of oil products an international issue. In 1974 the International Energy Agency (IEA) was set up by the OECD in response to major oil market disruptions, requiring that member countries like New Zealand hold supply in hand for at least 90 days of their previous year's consumption.

2.3. Influences on future oil demand

The latest Energy Supply and Demand Forecasts from the Ministry of Business Innovation and Employment were prepared in 2011 and provide forecasts for the period 2011-2040. These show New Zealand's primary energy growing at 1% per annum on average over that period, with oil growing at 0.6% per annum so that its share of primary energy slips from 33% to 29%. Most energy sources show a similar decline in share of primary energy, with the principal exception of geothermal energy which forecasts suggest will have a share rising from 21% to 35% over the period.

Oil is forecast to hold up better as a share of total, consumer energy, remaining at 44% over most of the forecast period. Its annual average growth rate is 0.8% over the period. Most oil products also record positive growth throughout the forecasts, with the exception of gasoline that declines by 0.2% per annum on average.

There are many influences on oil demand and fuel efficiency. Change in car ownership patterns, climate change policy and the emergence of alternative fuels and electric cars have all been suggested as factors that moderate future demand for oil. Their influence may be observed in forecast oil demand growing slower than general economic growth, but not markedly so in the next few decades.

Internationally oil production has run ahead of demand in recent years reducing oil prices. We assume oil's predominant share of transport fuels market will continue into the foreseeable future with only marginal shifts into new technologies, as while oil remains cheap there is less incentive to bring alternative energy into use.

2.4. Regional implications of RNZ operation

Northland is a region that has been struggling in comparison to its resource base and other regions for several decades.[7] It has a higher share of employment in the primary sector, a sector in which employment has been falling. It also has the highest age dependence ratio (proportion of people under 15 and over 65) of any New Zealand region, and this is forecast to significantly increase as the able bodied move to other regions in search of jobs. It has the second-lowest labour force participation and second-lowest-employment rate of all New Zealand regions. Median household income in the region is approximately 20 percent lower than median household income in New Zealand.

[7] MBIE Regional Economic Activity Report 2015

As a substantial employer in the Whangarei District, offering relatively highly–skilled and highly paid job opportunities[8] the continued operation of the refinery is a significant driver of economic activity for the region. Our estimate of the size of the contribution over the past five years based on economic data for the region[9] and Refining NZ annual reports is included in the following table (Table 1).

Table 1 Economic contribution of Refining NZ

Contribution to economic activity and employment

Contribution	2011	2012	2013	2014	2015
Gross Domestic Product[1] ($million)					
Petroleum Manufacturing[2]	432	400	463	519	542
Northland Region Total	5,336	5,410	5,524	5,681	5,940
Refining NZ share of Northland GDP	**8.1%**	**7.4%**	**8.4%**	**9.1%**	**9.1%**
Employment (number of people)					
Refining NZ employees	310	320	341	355	355
Refining NZ contractors[3]	*130*	*125*	*116*	*118*	*149*
Refining NZ jobs	*440*	*445*	*457*	*473*	*504*
Whangarei [4] jobs (estimated)	34,700	34,800	35,600	35,800	36,900
Northland Region jobs	77,854	77,642	77,739	78,339	80,199

Notes:

1. GDP is stated in 2010 prices.
2. Refining NZ is assumed to be the only enterprise recorded in the category
3. NZIER estimate from Refining NZ payments to contractors, assuming similar payments per worker as for company employees
4. Whangarei District (Territorial Local Authority)

Source: NZIER analysis of regional reports prepared by Infometrics

8 Based on data from Refining NZ annual report and Infometrics we estimate that average annual earnings per employee/ contractor working at Refining NZ in 2015 was in excess of $120,000 compared with an average of $50,000 across the region.

9 These statistics are taken from the Infometrics database of regional economic activity available at http://ecoprofile.infometrics.co.nz/Northland%2bRegion/Gdp/Structure. The estimates prepared by Infometrics are based on regional GDP and income and employment data by Statistics New Zealand

Refining NZ's contribution to economic activity has increased more quickly than the growth in the Northland economy over the past five years. Employment growth at Refining NZ has kept pace with growth in employment in Northland.

Refining NZ currently pays about $68 million per year to people working for the refinery. The Refining NZ annual report for the year ended 31 December 2015 reported wage and salary payments to employees of $48 million and payments to contractors of $20 million. We understand from Refining NZ that almost all of these payments (94 percent) are made to employees and/or contractors' businesses residing in the region. Refining NZ jobs are more highly paid than the average for the region and we estimate that wage, salary and contractor payments account for over 2 percent of the payments for the region and just over 3.5 percent of the payments made in the Whangarei territorial local authority.

In addition to the 'steady' annual employment described above, Refining NZ also employs additional staff for annual shutdowns. These vary in size and duration each year but can offer work for around 500 people for a period of 3 to 4 weeks.[10]

Refining is a capital intensive business with a long history of periodic investment in capital renewal and upgrading projects which inject substantial funds into the regional economy. Over the past 11 years RNZ has invested around $735 million to produce low sulphur diesel, remove benzene from petrol and improve energy intensity and reduce carbon emissions profile.[11] The refinery's substantial links to other industries and contractors in the region were illustrated in the economic assessment of the CCR project (NorthTec 2012). That project involved total expenditure of $365m, of which $147m was spent in Northland, $27m in the rest of New Zealand and $191m overseas, with estimated employment up to 350 in construction and a further 657 jobs stimulated in industries supplying the project, as summarised in Table 2.

Table 2 Summary impacts from the CCR project

NorthTec Impact Report CCR project	Direct $m	Indirect $m	Total $m	Multiplier
Total spending $m	365			
Imported $m	191			
Northland source $m	147	100.0	247.0	1.7
Rest of New Zealand $m	27	40.5	67.5	2.5
Employees (number)	350	657	1007	2.8

Source: NorthTec

10 The expenditure on shutdowns is capitalized in the Balance Sheet of the Refining NZ Annual Report rather than being recorded as an expense in the Income Statement (in the year in which it was incurred). Employment created by such shutdowns is unlikely to be attributed to the 'Petroleum Manufacturing' industry in the economic data we have summarised in Table 1, which hence understates the full impact of RNZ in the region.[2]

11 These investments included the $180 million Future Fuels Project in 2005, the $190 million Point Forward Project in 2009 and the $365 million Continuous Catalyst Regeneration Platformer (CCR) project completed in 2015.

The incomes earned by Refining NZ staff and contractors directly help retain nearly 500 households in the region and their consumption of goods and services generates income and employment for local businesses in Whangarei. Periodic shutdowns and investments provide additional incomes in the region, and expenditure by the company and its employees has flow on effects in stimulating other business in the economy. As these investments are capitalised into the company's balance sheet they are additional to the income and expenditure due to the company's routine operation.

2.5. Potential savings from heavier loaded vessels

There are realisable economies of scale in receiving deliveries in larger cargoes. Compared to Aframax tankers with 700 kbbl load, transport cost would be lowered by about US$0.15 per bbl (NZ$0.21/bbl) in a Suezmax with 950kbbl, a further US$0.15 per bbl with a 1Mbbl load and further US$0.14 per bbl with 1.05Mbbl load. At July 2016 exchange rates (0.70), in New Zealand dollars these savings would translate to $0.21, $0.42 and $0.61 per bbl respectively on successively larger loads; with a longer term exchange rate (0.65) the corresponding New Zealand dollar savings per bbl would be 0.23, 0.46 and 0.67 respectively.

Currently the refinery receives about 40.7 mbbl per year, in cargoes on average just under 700 kbbl per delivery. Deliveries from Asia tend to be in slightly smaller loads (650 kbbl) than those from the Middle East and West Africa (723 kbbl) or from the Russian terminal at Kozmino (740 kbbl).

Assuming that the 37% of shipments from Asia that arrive in smaller loads are less likely to change (in the short term) because of constraints on the ports in Asia, the saving in delivery cost for the remaining 63% would on current prices be about $11.8 million per year if delivered in 1 Mbbl loads or about NZ$17.3 million per year if delivered in 1.05 Mbbl loads.[12] That is a saving to the refinery and its customers, and also to New Zealand.

If increasing dredging depth also enabled *all* deliveries to move to 1 Mbbl cargoes at some point in the future where Far East port draught constraints were alleviated, there would be a saving in delivery cost of about NZ$16.8 million per year. This would increase to $24.7 million if all deliveries were of 1.05 Mbbl cargoes. Delivery cost savings, would be only about $9 million if all shipments were of 950 kbbl, but these are unlikely to be common as the refinery's customers would aim to get the greatest economic gains, which come from the largest possible shipments. These estimates are illustrative of the incremental costs of different load sizes, but we expect savings are most likely in the middle of the range, around $17 million.

In summary, the projected cost savings in transport of crude associated with the Crude Shipping Project are around NZ$17 million per year at current prices and sourcing patterns, but could be about NZ$25 million per year in future if Asian ports are able to despatch heavier laden vessels.

[12] This assumes NZ$/US$ exchange rate of 0.65, the long term average exchange rate over the past 22 years. In recent years the NZ$ has risen to over 0.70 against the US$ which would lower the savings, other things held constant. At 0.70 the potential savings would be $11M/year from 1Mbbl cargoes and $16M/year from 1.05Mbbl cargoes.

2.6. The future without channel deepening

Without channel deepening, RNZ would be unable to access the heavier loaded ships in which the cost of transport per barrel is lower than in the smaller Aframax or underloaded Suezmax ships. We have estimated potential savings for RNZ of NZ$17 million for delivery of the current slate of annual crude requirements in loads up to 1.05 Mbbl, compared to delivery as at present in loads averaging around 700 kbbl.

Without access to larger cargoes RNZ's margins will be squeezed by competition from more scale efficient refineries in Asia. A number of refineries in Australia have recently closed or been converted to refined product import terminals (with a workforce of about a tenth of that of the refinery operation), including Shell Clyde (Sydney 2015), Caltex Kurnell (Sydney 2012) and BP Bulwar Island (Brisbane 2015). All closures have been attributed to competition from more modern, larger and efficient refineries in the Asian region driving structural change on the supply chain.[13]

Tighter competition from larger refineries offshore exerts continuous pressure on refinery margins which at some point could cause production to no longer be worthwhile. In that case the refinery could shut down and New Zealand would move to importing all its refined oil products. RNZ's expenditures and employment in Northland would cease except to the extent it retained some oil terminal operations to receive imported products and feed them into the Refinery-Auckland Pipeline.

This implies the choice between channel deepening and not deepening can be summarised as three potential outcomes:

- With channel deepening, there would be a saving in the cost of deliveries of crude oil, some operational efficiencies for RNZ and its customers in availability of ships and consignments, and improvement in the refinery's competitiveness sustaining spending and employment to the Northland regional economy
- Without channel deepening,
  - in the short term the refinery would continue to operate but without the savings and operational efficiencies provided by larger cargoes, losing competitiveness against larger refineries overseas
  - In the long term, the refinery could not compete with imported refined product and would close its refining operations and likely convert to an import terminal and distribution point, with reduction in spending and employment in the region and in New Zealand at large.

The consequences of these different outcomes with and without channel deepening are summarised in Table 3 below. We use an extreme scenario of the refinery closing and converting to an oil terminal at some indeterminate point in the future as an illustrative example, not as a prediction.

Expectations behind this table include:

13 See http://www.smh.com.au/business/shell-shelves-refining-at-clyde-20110412-1dbxn.html
http://www.bp.com/en_au/australia/media/media-releases/bulwer-island-refinery-processing-halt.html
http://uk.reuters.com/article/uk-australia-bp-refinery-idUKKBN0OJ0PX20150603

- Closure of the refinery would also lead to discontinuation of coastal tanker distribution, as Marsden Point becomes a terminal serving only Auckland, via the RAP, and Northland via road tanker wagons
- Refined product imports would arrive in vessels that are of 55 kilo-tonnes capacity (requiring 47 shipments per year into Marsden Point and 36 to other New Zealand ports) or in 80 kilo-tonne vessels (requiring 32 shipments to Marsden Point and 24 to other ports); and in addition, imports of black products (bitumen and heavy fuel oil) in 20 kilo-tonne vessels (requiring 9 shipments into Marsden Point and 19 to other ports)

Table 3 Summary of channel deepening and alternatives

Item	With channel deepening	Without channel deepening (short term)	Without channel deepening (long term)
Refinery operation	Continued operation	Continued operation	Closed
Oil terminal & tank farm	Continued operation	Continued operation	Continued operation
Refinery-Auckland pipeline	Continued operation	Continued operation	Continued operation
Crude delivery savings $m/yr	17	0	
Crude tanker deliveries	48	59	Discontinued
Coastal tankers (50kt)	Ca 46 voyages a year	Ca 46 voyages a year	Discontinued
Number of Product import vessels @55-80 kt (additional to current shipments)			32-47 into Marsden Point + 9 for bitumen & fuel oil; +24-36 to other New Zealand ports + 19 for bitumen & fuel oil
Channel dredging $m	37 + periodic maintenance		
Additional storage tank $m	20		
Site remediation $m			300
Employment #	355	355	35
Employment wages $m/yr	48	48	5
Contractors #	148	148	15
Contractors $m/yr	20	20	2
Local employment $m/yr	45	45	4
Local contractors $m/yr	18	18	2

Source: NZIER

- Employment at the terminal is approximately 10% of that at the refinery, and there would be a similar proportionate drop in contractor use
- Local impact of employment and contracting (i.e. that accruing to Whangarei and Northland) is 94% of total spending on these categories.

The timing of refinery closure is indeterminate but Table 4 illustrates how the remediation costs avoided (or deferred) by pushing back the date of refinery closure, reduce in present value terms when discounted at Treasury's public sector discount rate of 8%. A higher discount rate reduces the present value of cost and increases the saving still further. Similarly, the further into the future the cost is avoided, the smaller its present value and bigger the saving compared to earlier closure. This table is illustrative only and not a prediction of expected continuation of the refinery.

Table 4 Value in extending refinery operation

New Zealand millions dollars converted to present values at 8% discount rate

Years hence	10	15	20	35
Remediation cost	139	95	64	20
Saving in cost	-161	-205	-236	-280

Source: NZIER

If the refinery were to close imminently, RNZ may be liable for site remediation costs.[14] This report does not make substantive comment on contamination at the site, recognises the historical land use as a refinery and is likely to require remediation of the site. The site remediation cost could be in the order of $300 million, but the present value of that cost declines the further into the future it is deferred. Assuming the remediation cost remains the same in real terms (i.e. not adjusted for general inflation) if closure were deferred 10 years the present value would be $139 million, after 20 years it would be $64 million and after 35 years, $20 million. If, for example, closure would occur in 10 years without channel deepening but is deferred a further 10 years by channel deepening, the benefit (avoided cost) gained would be $75 million ($236 million - $161 million). If the technology of site remediation improves in the future, the cost of remediation may even decrease over time, adding another benefit to deferring the risk of refinery closure through the channel deepening project.

14 This is not intended as a substantive comment on contamination at the site, or the dredging project but simply recognises the historical land use as a refinery and the likelihood of remediation cost associated with the site.

3. Economic consequences of channel deepening

The consequences of channel deepening depend on establishing the counterfactual that would prevail if the deepening project did not proceed. We assume this is continuing supply by Aframax and partially loaded Suezmax vessels, which would involve more frequent sailings and higher cost deliveries than is possible with more fully laden Suezmax vessels. The refinery needs to invest to maintain its competitiveness as the supply-cost curve continues to be squeezed.

3.1. Components of an economic assessment for consenting purposes

Components of economic assessment for a consenting assessment are summarised in Table 5 below.

Table 5 Components of an economic assessment

Item	Comment	Without channel deepening	With channel deepening
Price of refined oil products	Determined by the landed price of refined product imports	Market determined	Market determined
Refined oil product consumers	Facing the price of refined product delivered to retail outlets or other sources (bulk deliveries)	Small consignment size in limited New Zealand market may affect some product availability	No change in price or consumer surplus; small improvement in availability
Refinery margin	Notional difference between product value and (delivered) feedstock value	A producer surplus declining as squeezed by competitive imports; declining activity to future non-viability	Producer surplus maintained by lower costs of delivery - $17m a year deferment of non-viability
Owners' margin	Share of the notional margin on refining	A producer surplus in decline	Producer surplus maintained
Wider economy	Macro-economic effects on balance of payments and exchange rates - significance and direction of impact indeterminate	Risk of stranded assets if rising imports change distribution routes for refined products	Producer surplus maintained from distributional assets (RAP, coastal tankers) utilisation

Environmental effects	Risk of vessel grounding	Unchanged	Lowered by deeper straighter channel
	Risk of vessel collisions	Unchanged	Lowered, but if it happens, spill impact could be greater
	Risk of channel congestion	Unchanged	Lowered, but not currently an issue
	Seabed disturbance	Unchanged	Raised along the channel, but a small proportion of harbour area
	Spoil deposition	Unchanged	Raised, but the two offshore deposition areas occupy a small proportion of Whangarei Harbour/Bream Bay (being 5.75 km^2 and 2.5km^2 respectively, including buffer zone)
	Greenhouse gas emissions	Smaller ships have higher cost and emissions per tonne	Larger ships have lower cost and emissions per tonne, but may cover longer distances
Local market stimulation	Regional impact of channel deepening works	Unchanged	Dredging works of $37m plus $20m share of installing new tanks
	Regional impact of continued operation	Depends on rate of decline due to loss of competitiveness	Arrested decline due to loss of competitiveness

Source: NZIER

3.1.1. Effects on oil product consumers

The price of refined oil product is driven by the cost of importing into the country, so there is little price advantage to the consumer in local production. This is explicit in MBIE's Review of Oil Security in New Zealand (2012) which found the principal advantage of security was the avoidance of disruption costs (such as extra costs and time in finding alternative transport methods). When international prices for oil and oil products move, domestic prices move with them.

This means there is little likelihood of channel deepening conferring any price advantage giving rise to consumers' surplus in New Zealand.[15] There is a possibility of consumer gain if channel deepening improves the availability of vessels and regularity of refinery operation and supply, but the value of this is probably very small.

3.1.2. Effects on oil product suppliers

The suppliers of oil products in this case are RNZ and its customers (oil product wholesalers), both of whom stand to protect producer surplus should the dredging project proceed relative to the counterfactual under which competitive pressure from non-New Zealand suppliers will squeeze margins and surpluses.

As indicated above, the potential savings in delivering feedstock to Marsden Refinery can be regarded as producer surplus from the channel deepening. We estimate that for 1.05 Mbbl loads the saving could be around NZ$17 million per year. RNZ will bear the costs of channel deepening, which in broad indicative terms have been estimated at $37 million, depending on the disposal method for sediment. It will also incur costs for additional tank capacity to handle the larger volumes being landed, the cost of which has been estimated at $20s million. Combined with the dredging the total project initial cost would be $57 million.

In broad terms the Net Present Value of costs is compared against a stream of annual surpluses over a period of years to give the net present value of producer surpluses from the project. For this estimate environmental costs are not included because of practical difficulties in establishing the value of such environmental attributes as ecological integrity and cultural preference. Annualising $57 million at 8% discount rate over the 35 year maximum consenting period s amounts to $4.9 million cost per year. With a shorter payback period of 15 years the annualised cost would be $6.2 million. Both these estimates are well below the potential savings from larger loads in shipments of either 1 Mbbl ($12 million) or 1.05 Mbbl ($17 million).[16]

So the net benefit of each larger load configuration appears to be positive on an annualised basis assuming constant prices over time. But the net present value over the full consenting period would vary according to future movements in the delivery cost per barrel.

3.1.3. Effects on the local economy

The direct impact of the channel deepening project involves a capital expenditure of $37 million on dredging operations and $20 million on installing further tank capacity at the refinery. Of this $57 million, much of it will not be spent in the local economy if dredging contractors, materials for tank expansion are obtained from suppliers outside the region, but a proportion of labour on tank installation is likely to be sourced locally and support incomes in the region. There may also be periodic maintenance spending

[15] In other products and markets, it is possible for transport costs to create a wedge between the international price and price in the domestic market, creating a domestic glut which keeps prices low, but this is unlikely for oil products.

[16] This result also holds with shorter payback periods: e.g. at 7 years the annualised cost would be about 10 million, still net beneficial if maintenance dredging has annual cost of less than $1 million.

but these are unlikely to exceed $1 million a year. The direct impact, and any indirect impact from flow on expenditure, are likely to be small.

The main effect on the local economy is derived from the improvement in the refinery's competitiveness and its effect of increasing the probability of continuation of current operations. This will prolong the period over which the refinery can deliver the economic contribution outlined in section 2.4 above.

3.1.4. Effects on the wider economy

A principal difference between the outcome with and without the channel deepening is that an increase in imports of refined products can be avoided or deferred by retaining the viability of the refinery. In principle, increasing imports can have impacts on balance of payments and pressure on the exchange rate. In practice this is unlikely to be significant, as the refinery's customers import crude to which the refinery adds value through refining, rather than importing refined product. As the difference between imported crude and imported refined product is a small proportion of the cost of supplying oil products to New Zealand, macro-economic effects such as pressure on balance of payments or exchange rates can be ignored in this case.[17]

The counter-factual also includes risk of stranded assets if rising refined imports change the distribution network within New Zealand. The principal asset potentially at risk is the Refinery to Auckland Pipeline (RAP), which handles direct transport into Auckland, and the RNZ refinery terminal infrastructure. As the RAP would continue to be the least costly way of transporting product into Auckland if RNZ converts to importing refined product, the risk of asset stranding is not significant.

Refined products would most likely be imported directly into other coastal terminals in New Zealand to avoid the double handling of imported products, so the distribution of refined product through coastal shipping would cease.

3.2. Effects on the natural environment

Effects on the natural environment fall into three broad categories: effects on other vessels and activities sharing the harbour entrance, effects of seabed disturbance and effects of emissions into the environment. Economic valuations of environmental protection are rarely explicitly used in RMA settings because of practical difficulties in estimation, but economic principles still apply to the consideration of environmental effects. We note that separate assessments relating to effects on a range of environmental disciplines have been commissioned from other consultants as part of the Crude Shipping Project.

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[17] Section 2.4 above describes the regional implications of Refining NZ's operations (Table 1) and its proportionate share of national economic activity will be small (around 0.2%). Any reduction in refinery activity is likely to be met by increases in refined product imports. The refinery adds value through its refining margin on processing imported crude, whereas importers add rather less value through their procurement processes, the difference between New Zealand refined and imported oil products that switch at the margin will be smaller still and have little effect on the total economy.

Vessel movements

Relative to the counterfactual, larger cargoes reduce the number of vessel trips required to deliver the refinery's feedstock. RNZ advise this could reduce the number of deliveries for current yearly volumes from 59 to 48, a reduction of about 19%.

While the current harbour channel may not be congested at present, reduction in vessel movements will have a positive effect in reducing the likelihood of vessel encounters and the already low possibilities of collision or running aground. The proposed channel realignment will improve navigational safety for all shipping, not just crude tankers.

If the refinery were to close, vessel movements would reduce as crude carriers and coastal tanker trips are discontinued and replaced by fewer deliveries of refined oil products. There might be implications for vessel movements around other ports in New Zealand, but as shipments for refined product into other ports are driven by demand, and the average size of refined product tankers could be higher than that of the current coastal tankers, it is unlikely that there would be an increase in shipping movements in aggregate.

Seabed disturbance

Seabed disturbance may be viewed as an adverse effect on the environment and will certainly be increased, at least temporarily, along the channel. While other experts will assess the extent and severity of disturbance, the very low proportion of sea bed within the harbour entrance directly affected, and the frequency of shipping using the channel, suggests that in economic terms protecting it in its current state would not warrant incurring high expenditure or opportunity cost. Doing so would be inefficient as the marginal cost would be high while the marginal benefit would be low. In the environment, as in other resources, scarcity and authenticity confer economic value and neither of those is significant in this case.

Emissions

Another consequence of channel deepening is that with larger loads and fewer ships the volume of greenhouse gas emissions from crude deliveries should decline relative to the counterfactual.[18] With or without the channel deepening project, change in the sources of crude due to regional pricing dynamics could lead to switching sources to longer routes with higher emissions (eg. substituting supplies from West Africa or Middle East for those from Asia), but other things held constant, larger loads reduce the emissions per barrel transported.

The RMA's s104E appears to preclude consideration of climate change except for energy efficiency and renewable generation, but wider government policy on climate change still allows councils to consider emission-related measures that are not covered by existing policy instruments. As international shipping is outside the coverage of Kyoto Protocol and subsequent international agreements, it is an external effect on

18 Currently the crudes imported at Marsden Point come from Middle East (48%), Far East/Asia 38%, Siberia 13% and West Africa (2%). If those proportions remain the same, larger cargoes and fewer trips should lower the fuel use and greenhouse gas emissions on supply relative to the current situation, but some significant shifts in sourcing – e.g. less from Asia, more from West Africa – could increase the distance shipped and counteract that reduction in emissions.

environment whose benefit can be considered, although difficult to quantify to the extent it depends on future changes in shipping patterns.

There may be other environmental effects which are less amenable to quantification. But beyond the obvious impacts on dredging and deposition, the reduction in vessel movements and opportunities for reclamation are potentially positive for the environment and reduce costs for people in it, even if they cannot all be quantified.

3.3. Sensitivity of estimates

All numerical estimates depend on the assumptions and inputs on which they are based. This report refers in various places to the effect of variations in inputs used in the calculations, including the New Zealand and US dollar exchange rates, variations in load size and use of different discount rates (see section 2.5 above). The size of the cargo has the most significant impact on the results of the comparison of costs and benefits from the proposed project.

3.4. Summary of quantified estimates

Table 6 shows the annual avoided costs of larger shipments enabled by channel deepening. The left centre column shows the effect if 63% of refinery feedstock is delivered in loads larger than 700 kbbl (principally those from Middle East and West Africa); the right-centre column shows all deliveries (including those from Asia) moving to larger cargoes if current load constraints at Asian ports were to be remedied at some point in the future.[19] The outcome may be higher or lower than $17 million per year, depending on the size of the delivered cargoes.

Table 6 Benefit (avoided costs) of larger loads delivered

Average nominal cargo size	25.6mbbl in larger loads	40.7mbbl in larger loads
	$m/year	*$m/year*
950 kbbl	5.8	8.1
1000 kbbl	11.8	16.8
1050 kbbl	17.2	24.7

Source: NZIER[20]

With the costs of deepening and associated tank capacity expansion estimated at $57 million, the annualised cost over 15 years at a risk adjusted discount rate of 8% would be $6.2 million.[21] With operating costs assumed to be less than $1 million, all the

[19] There is no immediate prospect of all Asian ports removing their depth constraints, but they may do in the future

[20] Red cells indicate annualised cost exceeding benefit, amber cells indicate low net benefit and green cells indicate strong net benefits

[21] We use the short 15-year timeframe as it is more stringent than the costs annualised over the full 35-year consent period.

estimates above except for the current import slate in 950 kbbl loads would produce net benefit over deepening costs, indicating an efficient use of resources.

Unquantified benefits come from a reduction in shipping movements around the harbour mouth and reduction in greenhouse gas emissions on shipping. Adverse effects on an already modified environment are unlikely to have high dollar cost.

There is strategic benefit in prolonging the refinery's operation against foreign competition. This defers the date at which refinery closure would incur site remediation costs of $300 million, the present value of which would be in the 10s to 100s of millions of dollars depending on how long channel deepening extends operation. Closure would also lead to 85% reduction in employees, contractors and above-average wages paid in Northland, as summarised in Table 7. The reduction in employees would have a negative impact on community well-being, so its deferment is beneficial.

Table 7 Impact of prolonging refinery operation

	Employees	Contractors	Combined
Staff numbers	-270	-79	-349
Wages $m/year	-57	-17	-74
Northland $m/year	-54	-15	-69

Source: NZIER

4. Conclusions

This report has set out a framework for economic assessment of the proposal for deepening the channel for Marsden Point Refinery. It proposes a cost benefit approach that has been used in the Environment Court, supplemented by considerations of economic impact of the refinery's spending and employment in the region.

The cost benefit framework identifies the economic surplus from channel deepening, taking account of the externalities that may be created by it.

The potential cost savings from accessing larger loads in deeper draught ships are a clear example of enhanced producer surplus from the proposal. These are largely captured by Refining NZ and its customers as developers of the project, but are also a benefit to the nation as they accrue to New Zealand domiciled companies.

Another element of surplus comes from the deferment of costs of closure of the refinery should it be unable to access the larger cargoes to remain competitive with overseas refineries. One such cost is the remediation of the refinery site after closure, which could be worth more than annual savings in delivery costs, depending on how many years of extra competitive operation would be conferred by channel deepening.

We estimate these annual savings in delivery costs to be around $12-17 million a year, depending on the average size of landed cargoes enabled by the deeper channel. This range is well above the annualised cost of deepening of around $6 million a year. This would improve the competitive position of the refinery against foreign supplies and sustain the operation of the refinery into the future.

A number of external effects can also be considered beneficial for the wider community. Larger cargoes would mean fewer vessel movements around the refinery of benefit to all users of the harbour entrance, compared to current operations without channel deepening. Fewer vessels would also reduce greenhouse gas emissions from crude deliveries, which would be a measurable benefit should international shipping come under an emissions pricing scheme.

Other external effects on the environment, such as the seabed and reclamation areas, do not appear to be affecting elements of scarcity or high value for natural character. Such effects would not warrant incurring high economic cost to avert them and retain the environment in its current condition.

Aside from these cost benefit considerations, the continuity of operation of the refinery has a particular significance for the Northland economy, given its low rating on a number of economic and social measures, such as high unemployment, low household income, higher dependency ratio than the corresponding New Zealand averages.

Closure of the refinery, with its well-paid workforce and its contribution to business expenditures in the region, would have a significant negative impact on regional economic activity which may take some time to recovery.

If the refinery were to close, then the overall number of shipping movements would reduce as crude carriers and coastal tankers were discontinued and replaced by imports of refined product. While some might consider that beneficial, it would not be economically significant given the low incidence and risk of adverse effects of vessel movements in the harbour entrance.

That effect would need to be weighed against the loss of economic contribution from closure of the refinery and its probable contraction to an oil terminal, providing only a tenth of the employment and reduction of the economic impact of the refinery in operation.

Appendix A Response to Cultural Effects Assessment

In June 2017, the Tangata Whenua o Whangarei Te Rerenga Paraeroa Draft Cultural Effects Assessment (CEA) of the Refining NZ Crude Freight Proposal was circulated for comment. It concluded that the economic benefits of the proposal would not outweigh the potentially adverse ecological and cultural effects. In particular, it concluded:

- Positive social and economic effects on Tangata whenua as a result of the Crude Freight Project were likely to be negligible as more jobs for locals are unlikely to arise
- They had concerns about the potential future constraints to their economic aspirations, in the areas of aquaculture, commercial fishing and ecotourism
- The health and welfare of Tangata whenua would be affected by their inability to gather kai and feed their whanau or manuhiri at the marae.

We respond to these to the extent that they relate to the NZIER *Economic assessment of channel deepening at the Marsden Point Refinery*.

A.1 Positive social and economic effects

The CEA sees little employment benefit for local tangata whenua from current refinery operations. Compared to around 350 employees and150 contractors identified in the NZIER report, it identifies 32 employees who identify as Māori or part Māori, and it is unknown how many of the employees are local tangata whenua.

The NZIER report agrees (page 5) with the CEA that if the dredging activity involves specialised equipment provided by overseas firms, the direct impact on the regional or local economies is likely to be limited. The dredging and consenting process is only short term and forms a small part of the economic impact of the Crude Freight Project. More significant are the long term improvements in competitiveness that prolong the refinery's operation and its role as a source of incomes and spending in the region.

While the refinery may employ few Māori directly or via consultants' services, the positive social and economic effects of the refinery are not confined to the direct effects on Māori employment. The refinery also supports indirectly other businesses that employ Māori through its purchases of services and through the spending of its employees on their consumption goods.

The NZIER report was not tasked with identifying the effects on Māori specifically and there are practical challenges in accurately doing so. While that impact is unknown, if the channel deepening improves the competitiveness, market share and longevity of the refinery operation it will benefit all those who receive income directly and indirectly from that continued operation in the region, Māori and non-Māori alike.

The CEA also notes that the NZIER report does not elaborate on when the refinery would close or how much longer it could stay open with channel deepening. That is a forecasting issue depending on many factors of technological and market development which was beyond the scope of the NZIER report. The CEA considers the oil industry to have a limited lifespan in the future anyway, which may be true in view of development of new technologies like electric vehicles and concerns over continued use of fossil fuels. However, there is a lead time in new technologies becoming commercially competitive and also in transforming the stock of equipment (especially in transport) from oil-based to other technologies, so it is not unreasonable to seek consent for further refining operations over the full 35 year consenting period.

A.2 Potential constraints on future economic aspirations

Noting that a draft AEE report (Boyd 2017) concludes that dredging and spoil disposal would have negligible effects on commercial fishing in the area the CEA expresses concern about losing future potential economic opportunities. It cites commercial cockle and pipi fisheries on the Snake and Mair Bank, that were closed in 2012 due to low biomass but could recover and enable future commercial fishing to resume. Māori own 50% of New Zealand's fishing quota and are involved in aquaculture, with entitlement to 20% of any new aquaculture space allocated in future.

Fishing, aquaculture and seafood processing may provide scope for expansion into sustainable long term business in Northland. Typically, most of the jobs are in seafood processing which is lower paid than fishing or aquaculture which use more specialised qualified labour. At present, neither fishing and aquaculture nor seafood processing make significant contribution to Northland's GDP, each accounting for about 0.2% of total regional GDP in 2015 (compared to the refinery's 9%). The significance of a recovered Snake and Mair Bank to the potential for growth is not evident from the CEA but is unlikely to be large relative to the benefit of continued refinery operation.

CEA notes that impact on Māori customary and recreational fishing has the potential to affect local tangata whenua who collect kaimoana to supplement low incomes. Changes in recreational opportunity can affect economic well-being if it changes the cost of exercising that opportunity or, in this case, the cost of obtaining the gathered food to supplement other income. That economic effect depends on the scale of area affected, the number of people affected and the availability of substitutes (e.g. access to other fishing areas) and there is nothing to suggest this effect would be significant.

A.3 Other matters

The CEA queries the NZIER report about how channel deepening allows the cost of site remediation at refinery closure to be deferred to an unspecified date in future. It notes that tangata whenua are uncomfortable with the idea of passing on the costs and burden of site remediation to future generations to deal with.

The NZIER report's discussion on this is about the economic cost of site remediation, not about who pays or bears the cost of remediation. The cost today of deferring remediation is lower the further in the future it falls because of the effect of discounting the future costs. One way to think of this is that if a sinking fund were set up putting an amount aside each year to pay for the future remediation, the amount set aside each year would be smaller the longer the period before remediation is required, because of the cumulative effect of set asides and compound interest.

There are numerous financial mechanisms that could be used to ensure remediation of the site is paid for by those who enjoy the use of the site in its lifetime rather than people in the future, including RMA financial contributions, bonds and depreciation allowances used by the company. These were outside the scope of the NZIER report.

Annexure Two: Technical Reports

p) Commercial Fishing in Whangarei Harbour and Bream Bay. Boyd Fisheries Consultants Ltd. Rick Boyd. Dated 11 August 2017

Commercial Fishing in Whangarei Harbour and Bream Bay

Prepared for Refining NZ
11 August 2017

Rick Boyd
Boyd Fisheries Consultants Ltd
Wanaka

Table of contents

1.0 Introduction

1.1 Refining NZ's Crude Project

Refining NZ is proposing changes to the approaches to Whangarei Harbour to allow bigger cargoes of crude oil to be brought to the refinery (Tonkin & Taylor 2016). Bigger cargoes would reduce the cost of transporting crude oil to the refinery and allow it to better compete with much larger Asian refineries.

Refining NZ's proposed project has a number of components listed below. Each of these is further described in the following paragraphs.

- Capital and ongoing maintenance dredging to first increase and then maintain the shipping channel at a depth that would allow safe passage for ships with 16.6m draft,
- Partially realigning the shipping channel to provide safe navigational access for fully laden 'Suezmax' ships
- Changes to navigational aids along the new shipping channel, including removal, replacement and relocation of these aids
- Disposal of the dredged material from both capital and ongoing maintenance dredging at sea at two sites in Bream Bay.

Figure 1 shows the area to be dredged and the proposed disposal sites.

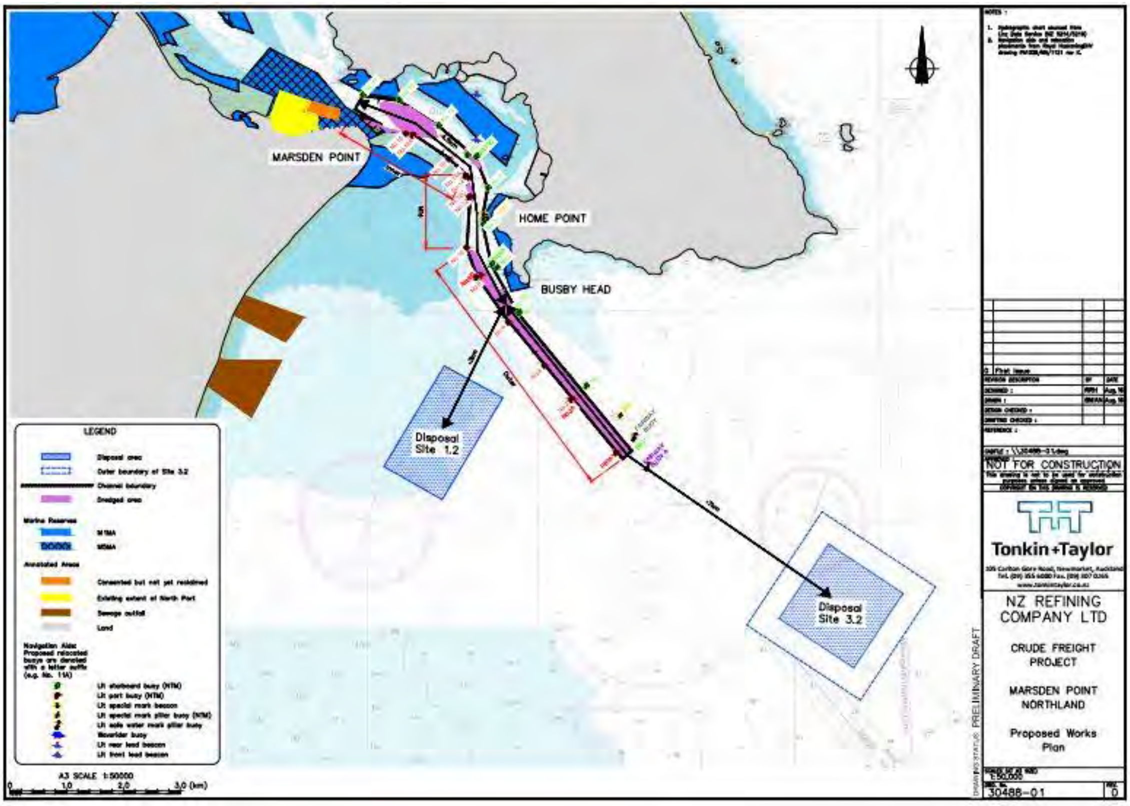

Figure 1: Proposed dredging and disposal sites (from Tonkin & Taylor 2016).

Tonkin & Taylor (2016) gives a description of the project including the physical characteristics of the dredge and disposal areas, and the equipment proposed for the work. To deepen the approach channel to the Refinery, 3.7Mm^3 of fine and medium sand will be dredged (capital dredging), most of this from the outer channel. The material to be dredged is predominantly medium sand with small fractions of silts and clays, fine and coarse sand and some gravel-like coarse shell. The total area to be dredged is 1.95km^2. In future years some ongoing maintenance dredging is likely to be required at periodic intervals to maintain the depth of the deepened channel.

It is likely that a Trailing Suction Hopper Dredger (TSHD) will undertake most of the capital dredging and that it would be completed within a period of six months or less depending on the size of the dredge. A number of smaller support vessels would support the TSHD. Periodic maintenance dredging is expected to be required at intervals of 2-20 years depending on location and rates of deposition in the berthing and channel areas.

The approach channel will be slightly re-aligned to improve safety for tanker ships delivering crude oil to the Refinery. This will require installing new additional navigational aids for the re-aligned shipping channel, and the relocation of some existing aids.

Most of the dredged material would be relocated to the seabed at a depth of 45 metres south east of Whangarei Harbour and east of 3 Mile Reef (Figure 1, Site 3-2). The dredged material would be spread evenly to cover all of Site 3-2.

A small quantity (2.5-5% of the total dredged material from the capital dredging) would be deposited on the south-eastern side of Mair Bank (Figure 1, Site 1-2) at depths of 7 to 15 metres, with the aim of helping to slowly replenish sand that is gradually being lost from the harbour's ebb-tide delta. At Site 1-2, it is likely that smaller areas will be targeted for deposits rather than the material being spread uniformly over the site and the location. The quantity and placement of these targeted deposits may vary according to how they perform as replenishment sources for the ebb-tide delta.

Following the proposed work to deepen the approach channel to Whangarei Harbour, the dredged material from periodic maintenance dredging would use the same disposal sites as the capital dredging.

Both proposed disposal sites are 2.5km^2 and the existing seabed is comprised of sandy sediments very similar to the material to be dredged from the harbour channel. At Site 3-2 there is a maximum area of 5.75km^2 around the disposal site where the sediment may disperse over time. No similar area is calculated for Disposal Site 1-2 as the intended purpose is for material to move shoreward over time as a result of natural coastal processes. At both disposal sites the deposited material will soon compact to a similar density as the surrounding area. At Site 3-2 which is deeper, little dispersal is expected over time. At Site 1-2 which is shallower, targeted disposal of small quantities of dredged material over part of the site (10% of the total area) is designed to provide a source of material to replenish the adjacent areas and some dispersal will occur.

1.2 Interaction of Commercial Fishing with Refining NZ's Crude Project

The primary purpose of this report is to examine commercial fishing in relation to Refining NZ's proposed Crude Project in order to identify the potential impacts of the proposal.

Commercial fishing is extensive throughout the northern Hauraki Gulf and Northland coast. The remaining sections of this report commence with a brief background to the inshore commercial fisheries found in the region. It then describes commercial fishing activity in Whangarei Harbour and

Bream Bay focusing on areas where there is interaction between the proposed dredging and disposal, and commercial fishing. The final section of the report examines potential impacts of Refining NZ's project on commercial fishing in Whangarei Harbour and Bream Bay.

2.0 The Commercial Fish and Shellfish Fauna

2.1 Background

Fishes and shellfish are amongst the most important components of marine ecosystems. The distribution of each species is strongly influenced by the presence of its preferred habitat. Some species such as flatfish predominantly occupy shallow harbours. Coastal species such as snapper, gurnard and John dory are found on the open coast from very shallow waters to at least 100m depth but are most abundant in waters shallower than 50m. Shellfish species such as pipi and scallops are generally sessile or less mobile although most shellfish species release their eggs and larvae into the sea where they can be transported over considerable distances.

Comprehensive information on commercial fish and shellfish species, including the most recent stock assessments, can be found in Ministry for Primary Industries' annual Fisheries Assessment Plenary reports (Ministry for Primary Industries 2016a, 2016b). Most of the commercially important fish species found in Whangarei Harbour and Bream Bay are both highly mobile and widely distributed around northern and central New Zealand.

Many fish species exhibit seasonal movements for feeding or spawning. There are also considerable natural fluctuations in the abundance of many fish populations over time due to the effect of changes in environmental conditions that drive variations in survival and recruitment of juveniles into the adult population.

2.2 Bream Bay Fish and Shellfish Fauna

Research trawl surveys undertaken over a 34 year period in the greater Hauraki Gulf area as far north as Bream Head were analysed by Kendrick and Francis (2002). More than fifty species or species groups exceeded a 1% threshold of occurrence in the combined research tows (Table 1). The trawl survey results illustrate the diversity of the demersal (bottom dwelling) fish fauna of the area. All of these species are widely distributed throughout northern New Zealand. Most are vulnerable to commercial fishing and many are commercially valuable although only a handful is of commercial significance.

Table 1: Fish and squid species or species groups occurring in more than 1% of Kaharoa trawl tows, sorted by percentage occurrence in Kaharoa tows. (source: Table 3 in Kendrick & Francis 2002)

		Occurrence (%)	
Species	Latin name	Kaharoa tows	Ikatere tows
Snapper	*Pagrus auratus*	97.40	99.05
Jack mackerels	*Trachurus novaezelandia & T. declivis*	85.97	76.13
John dory	*Zeus faber*	84.62	77.33
Gurnard (Red gurnard)	*Chelidonichthys kumu*	76.82	74.94

Sand flounder	*Rhombosolea plebeian*	41.16	37.71
Leatherjacket	*Parika scaber*	31.60	29.59
Arrow squid	*Nototodarus sloani and N. gouldi*	27.34	8.83
Spotted stargazer	*Genyagnus monopterygius*	26.09	7.88
Broad squid	*Sepioteuthis australis*	24.84	3.82
Rig	*Mustelus lenticulatus*	23.39	63.25
Eagle ray	*Myliobatis tenuicaudatus*	22.25	48.21
Barracouta	*Thyrsites atun*	20.89	14.56
Lemon sole	*Pelotretis flavilatus*	19.96	35.32
Spotty	*Notolabrus celidotus*	19.85	11.46
Trevally	*Pseudocaranx dentex*	19.65	39.62
Blue mackerel	*Scomber australasicus*	18.71	16.47
Ray	*Dasyatis brevicaudata and D. thetidis*	15.70	32.94
Yellow-belly flounder	*Rhombosolea leporina*	14.45	13.13
Opalfish	*Hemerocoetes monopterygius*	14.03	2.63
Red mullet	*Upeneichthys lineatus*	13.72	17.42
Kahawai	*Arripis trutta*	13.41	12.41
Scaly gurnard	*Lepidotrigla brachyoptera*	13.41	6.92
Skates	*Dipturus nasutus and D. innominatus*	12.27	13.13
Pilchard	*Sardinops neopilchardus*	9.56	6.92
Soles	*Peltorhamphus novaezeelandiae and P. latus*	7.38	13.60
Crested flounder	*Lophonectes gallus*	7.17	12.89
Porcupinefish	*Allomycterus jaculiferus*	7.07	7.88
Yellow-eyed mullet	*Aldrichettaforsteri*	7.07	6.92
Blue cod	*Parapercis colias*	6.86	7.40
Witch	*Arnoglossus scapha*	6.55	4.54
Tarakihi	*Nemadactylus macropterus*	6.13	10.26
School shark	*Galeorhinus galeus*	5.51	21.48
Parore	*Girella tricuspidate*	4.99	2.63
Anchovy	*Engraulis australis*	4.57	4.54
Sea perch	*Helicolenus percoids*	4.57	1.43
Spotted gurnard	*Pterygotrigla picta*	4.37	1.19
Carpet shark	*Cephaloscyllium isabellum*	4.16	4.30
Frostfish	*Lepidopus caudatus*	3.95	0.72
Silverside	*Argentina elongata*	3.53	0.48
Kingfish	*Seriola lalandi*	3.12	5.25
Cucumberfish	*Chlorophthalmus nigripinnis*	2.81	0.48
Hammerhead shark	*Sphyrna zygaena*	2.70	9.31
Electric ray	*Torpedo fairchildi*	2.39	8.35
Snipefish	*Macrorhamphosus scolopax*	1.77	0.48
Conger eels	*Conger verreauxi and C. wilsoni*	1.66	1.67
Northern spiny dogfish	*Squalus mitsukurii*	1.56	1.67
Capro dory	*Capromimus abbreviatus*	1.56	0.24
Mirror dory	*Zenopsis nebulosus*	1.46	0.72
Red cod	*Pseudophycis bachus*	1.25	3.82
Gemfish	*Rexea solandri*	1.14	0.48

West & Don (2015) provide a literature review of fishes known from the Bream Bay area, most of which are associated with reef habitats not sampled by research trawls. Although the fishes identified in West & Don's (2015) literature review include some of the above species, many of the reef fishes they identify as known from the area are small and cryptic and not vulnerable to commercial fishing or to research trawls. The species identified in Table 1 are therefore additional to those in West & Don (2015)

Figures 2, 3 and 4 show the relative abundance of snapper, gurnard and John dory from the combined Kaharoa and Ikatere trawl surveys summarised in Table 1. These three species form the mainstay of much of the inshore commercial finfish fishery throughout the region, including Bream Bay. All the other species in Table 1 are relatively common. Many but not all are commercially valuable and form part of the overall commercial finfish catch. (*Note that the catch rate scale differs in each of these three figures.*)

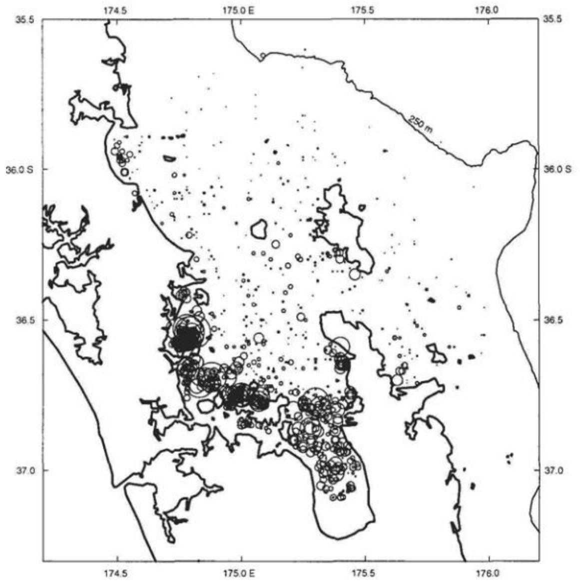

Figure 2: Catch rate of snapper (*Pagrus auratus*) at RV Kaharoa trawl stations. Circle diameter is proportional to catch rate (max catch rate 56 441 kg km^{-2}). (Figure 7 from Kendrick & Francis 2002)

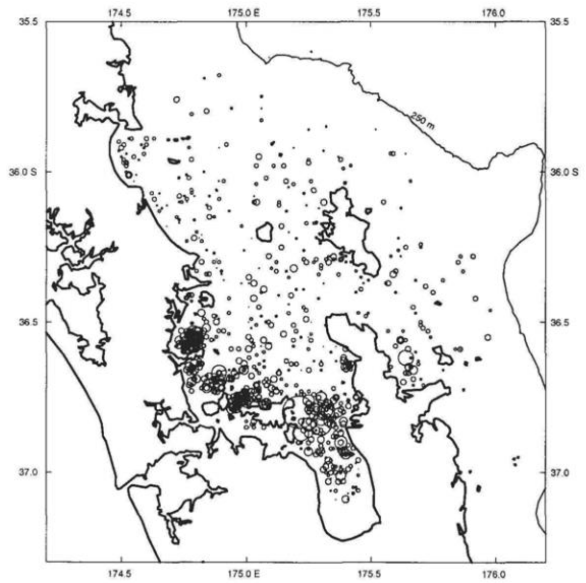

Figure 3: Catch rate of John dory (*Zeus faber)* at RV Kaharoa trawl stations. Circle diameter is proportional to catch rate (max catch rate 2 613 kg km^{-2}). (Figure 8 from Kendrick & Francis 2002)

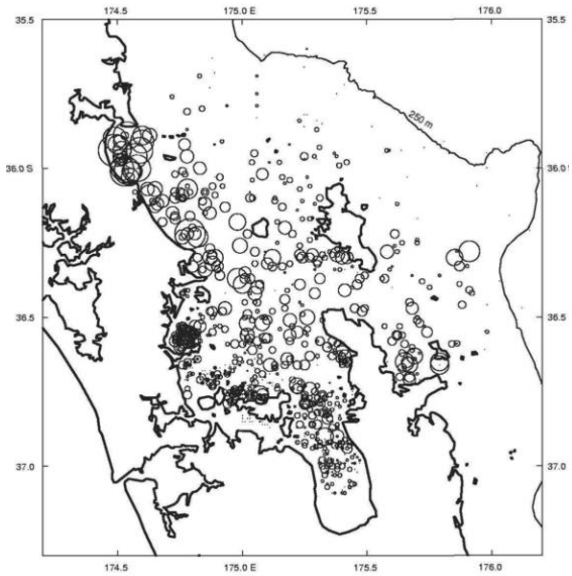

Figure 4: Catch rate of gurnard (*Chelidonichthys kumu*) at RV Kaharoa trawl stations. Circle diameter is proportional to catch rate (max catch rate 782 kg km^{-2}). (Figure 9 from Kendrick & Francis 2002)

Many common intertidal and shellfish species are also present in Whangarei Harbour and Bream Bay. A number of these also support commercial fisheries or have done so in the recent past. Commercial shellfish species occurring in the Whangarei Harbour and Bream Bay area include rock lobsters, scallops, paddle crabs, whelks, cockles and pipi. West and Don (2015) summarise the literature on the invertebrate/shellfish fauna of the area. Additional literature on the commercial shellfish species can be found in Ministry for Primary Industries' annual Fisheries Assessment Plenary reports (Ministry for Primary Industries 2016a, 2016b).

3.0 Commercial Fisheries of Whangarei Harbour and Bream Bay

3.1 Information sources

Commercial fishing catch and effort data is collected by Ministry for Primary Industries (MPI) using different templates or returns for each fishing method. Catch and effort data for some fishing methods (e.g., trawl, longline, set net) is reported by latitude and longitude. For other methods, it is reported only by 'fisheries statistical area' with unique reporting areas used for different species (e.g., rock lobster, scallop). The MPI statistical areas that commercial fishers use to record catch and effort also generally incorporate much larger areas of the coast than Bream Bay. This complicates compiling an overall data set of catch and effort for all species for the area. Therefore, examination of commercial catch and effort data reported by MPI statistical area has been combined with information provided by commercial fishers to provide a much more comprehensive understanding of commercial fishing in Whangarei Harbour and Bream Bay.

The commercial catch and effort data by latitude and longitude that is collected by MPI from trawl, longline and some set net fishing is available in the form of downloadable maps on MPI's website at http://fs.fish.govt.nz/Page.aspx?pk=91. These maps show the distribution of total commercial catch and effort for all species combined. Additional information on catch by method by species by MPI fisheries statistical area is available from the National Aquatic Biodiversity Index System (NABIS) website at http://www.nabis.govt.nz/. Both sources have been used in the preparation of this report.

The finest-scale geographic subdivision of catch and effort data available for most individual species and commercial fishing methods is for MPI's Fisheries Statistical Area 003 (FSA003) which incorporates the coastline from Karangi, near the west end of Taupo Bay, south about 200km to Waipu Cove (Figure 5). Whangarei Harbour and Bream Bay lie within FSA003.

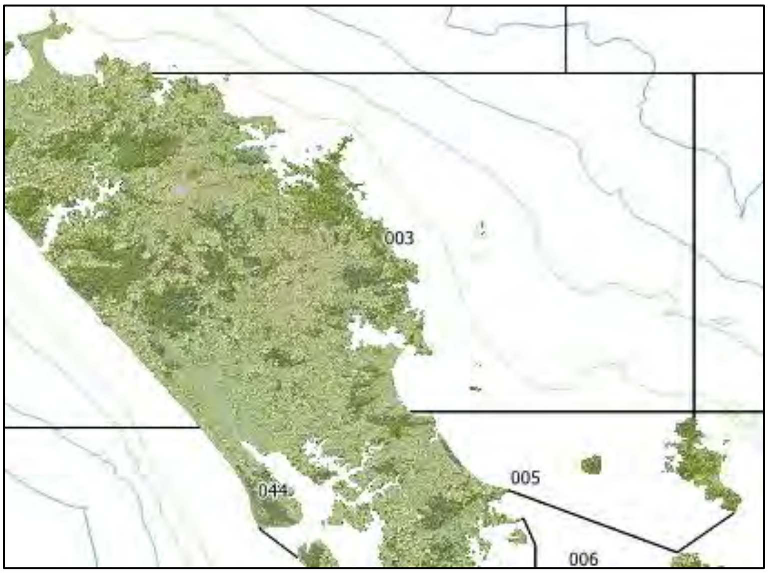

Figure 5: Map of MPI Fisheries Statistical Area 003

Different reporting areas are used for scallops (Figure 6) and rock lobster (Figure 7).

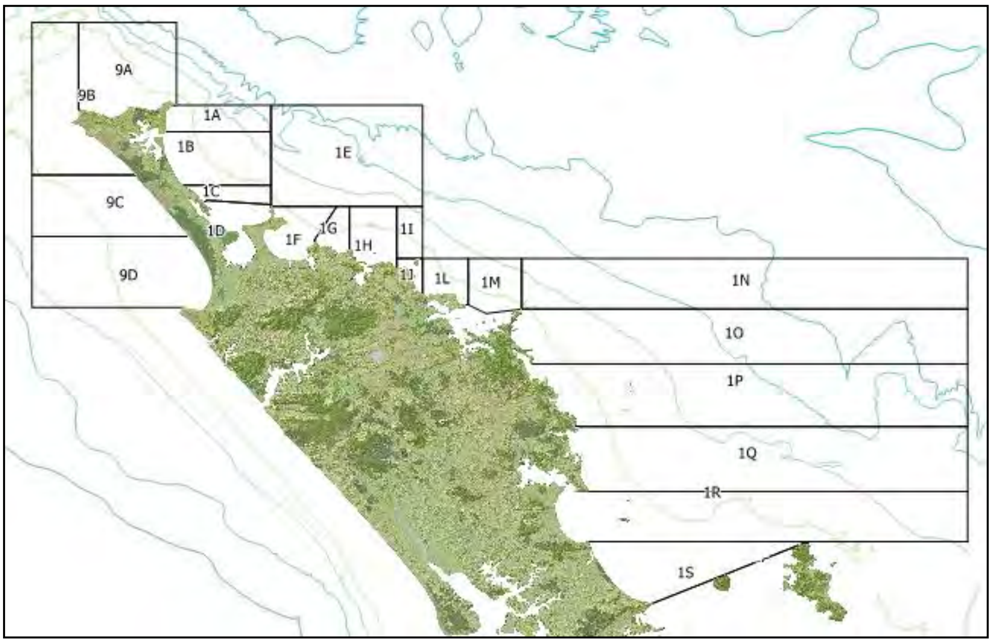

Figure 6: Map of MPI Scallop Statistical Areas for the SCA1 (Northland) scallop fishery. Bream Bay lies in Scallop Statistical Area 1R.

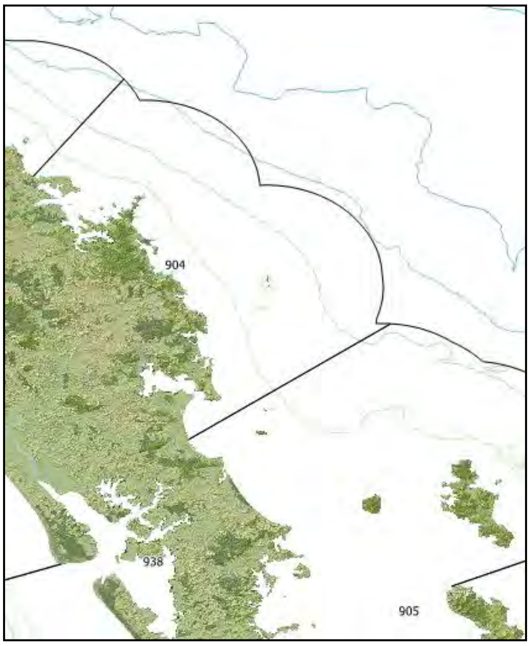

Figure 7: Map of MPI Rock Lobster Statistical Areas 904 and 905.

Scallop Statistical Area 1R incorporates all of Bream Bay. Rock Lobster Area 904 includes the coast from Bay of Islands to Waipu Cove.

To supplement official MPI catch and effort information and published research, local commercial fishers have been consulted to obtain local information on the distribution of commercial fishing activities in the area of interest around Bream Bay and Whangarei Harbour. This has been combined with official MPI catch and effort data (where appropriate data exists). Information available in the fisheries literature and in Ministry for Primary Industries' (2016a, 2016b) Annual Plenary Reports also provides some descriptions of commercial fisheries in the area.

3.2 Commercial Fishing Closures and Prohibitions

Some areas in Whangarei Harbour and Bream Bay are closed to commercial fishing entirely or to commercial fishing by certain methods.

Whangarei Harbour Marine Reserve incorporates two areas – one around Motukaroro Island and Lort Point and a second at Waikaraka – within which all fishing (including commercial fishing) is prohibited.

Under the Fisheries (Auckland and Kermadec Areas Commercial Fishing) Regulations 1986 certain commercial fishing is prohibited in defined areas of Bream Bay and Whangarei Harbour and these prohibitions are summarised below.

i. Trawling and Danish seining is prohibited inside a straight line drawn from the southernmost extremity of Busby Head to the shore on the southern end of Bream Bay (Figure 8).

ii. Fishing with a box or teichi net, purse seine net, Danish seine net, trawl net, or lampara net, or set nets of a total length exceeding 1 000 metres is prohibited in the waters of Whangarei Harbour lying inside a straight line drawn from the south-western extremity of Busby Head to the northern chimney of the Marsden Point power station. (Figure 9). (This prohibition duplicates part of the closure in i. above).

iii. Drag netting is prohibited in Whangarei Harbour lying inside a straight line drawn from Marsden Point to Lort Point except in certain waters around Snake Bank (Figure 10).

iv. Commercial scallop fishing is prohibited from the waters of Whangarei Harbour lying inside a straight line drawn from the southern westernmost extremity of Peach Cove to the southernmost extremity of Busby Head to the northern chimney of the Marsden Power Station (Figure 11):

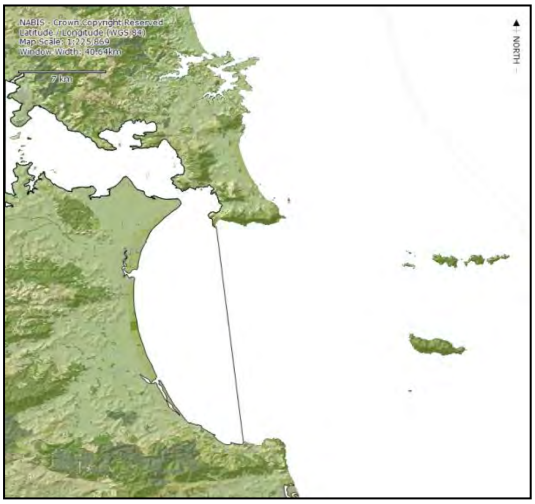

Figure 8: Trawl and Danish seine closed area, Bream Bay and Whangarei Harbour (area inshore of the line).

Figure 9: Fishing prohibited with a box or teichi net, purse seine net, Danish seine net, trawl net, or lampara net, or set nets of a total length exceeding 1 000 metres (Whangarei Harbour inshore of the line).

Figure 10: Areas closed to drag nets or beach seine (areas shoreward of the lines).

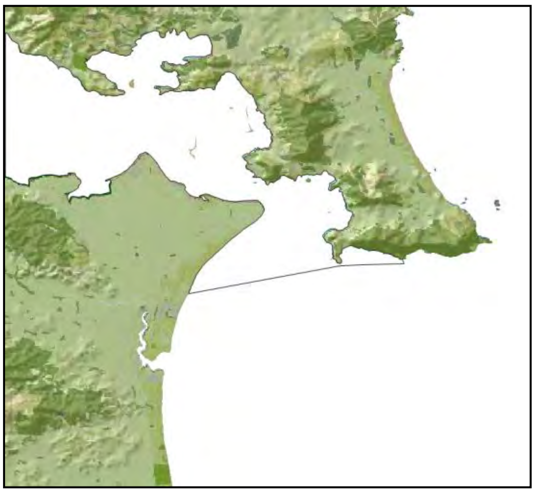

Figure 11: Areas closed to scallop fishing in Bream Bay (areas north of the lines)

Additional species prohibitions and method restrictions apply to commercial fishing under the Fisheries (Auckland and Kermadec Areas Commercial Fishing) Regulations 1986 but none of these close any additional areas. Froude & Smith (2004) provide a comprehensive list and maps of all area-based restrictions in the New Zealand marine environment, including all current commercial fishing restrictions in Whangarei Harbour and Bream Bay except the Whangarei Harbour Marine Reserve which was established in 2006.

3.3 Overview of Commercial Fishing

Inshore commercial fishing in Whangarei Harbour and Bream Bay includes several fishing methods targeting different species. There are no contemporary publications describing inshore commercial fishing activities in the area. MPI's fisheries research is primarily targeted at understanding individual species and the level of harvest they can sustain. MPI publications provide no documentation of the overall fishery, the fishing fleet or the industry's structure. As noted in section 3.1, MPI commercial fishery statistics for most species cover wide areas of the coast and most of these areas do not separate out local coastal areas at the scale of Bream Bay and Whangarei Harbour. Paul (2014) provides a comprehensive and useful overview of the history of the inshore commercial finfish fishery in the wider Hauraki Gulf (including Whangarei/Bream Bay) and how it has developed until the present time. The snapper (*Pagrus auratus*) has been the mainstay of the inshore commercial finfish fishery throughout its development over the past century or more. However, flounders and grey mullet have been the principal commercial species fisheries targeted within shallow northern harbours such as Whangarei Harbour.

Table 2 gives estimated commercial catches of the main inshore commercial finfish species taken by fishing method reported from FSA003 (see Figure 5) from 1 Oct 2008 to 20 March 2003. Catches of species not generally taken in waters less than 50m depth or by commercial methods not used in the inshore areas of the fishery are not included.

Table 2: Estimated commercial catch (t) of the principal finfish species caught in waters less than 50m deep in MPI's FSA003 by method from 1 Oct 2008 to 20 March 2013. (catch data from Booth 2013). Species listed in order of highest to lowest all methods total catch.

Species	**Bottom longline**	**Bottom trawl**	**Danish seine**	**Set net**	**Beach seine**	**Other methods**	**All methods total catch**	**% of total catch**
Snapper	929.1	630.6	498.3	11.1	0.3	48.6	2,118.0	64.2%
Gurnard	76.3	53.5	118.6	2		4.2	254.6	7.7%
John dory		123.9	24.3	0.7		5.4	154.3	4.7%
Grey mullet				110.1		3.2	113.3	3.4%
School shark	66.1	31.5		10.7		1.4	109.7	3.3%
Flounders	0	0	0.9	106.3		0.2	107.4	3.3%
Trevally	8.9	74.1	1.5	10.4	2.4	4.0	101.3	3.1%
Leatherjacket		56.6	2.9			4.1	63.6	1.9%
Parore				55.4	1.6	0.4	57.4	1.7%
Rig	4.2	1.9		37		1.3	44.4	1.3%
Kingfish	12.9	4.9	0.5	2.1		5.2	25.6	0.8%
Kahawai	4.7	0.6		19.2		0.0	24.5	0.7%
Porae	7.5	3.7	0.1	6.9		0.4	18.6	0.6%
Garfish				12.4	4.4	0.2	17.0	0.5%
Yellow-eyed mullet				14.7		0.9	15.6	0.5%
Jack mackerel		12.6				0.0	12.6	0.4%
Red snapper	10.2	0.6				0.6	11.4	0.3%
Blue cod	2.3					1.0	3.3	0.1%
Total	**1,122.2**	**994.5**	**647.1**	**399**	**8.7**	**81.1**	**3,252.6**	

Although catch data for MPI's FSA003 includes a much larger area, both the methods used and species caught are representative of commercial fishing for finfish in Whangarei Harbour and Bream Bay.

Overall, Table 2 indicates that snapper dominates the catch of longline, trawl and Danish seine methods, all of which operate on the open coast of FSA003. Gurnard and John dory are the second and third most important finfish species overall. The set net fishery principally takes flounders and grey mullet in the shallower waters of enclosed harbours, with parore, garfish and yellow-eyed mullet also important. Some set netting occurs outside harbours, predominantly for sharks, snapper, kahawai and trevally.

The catch of shellfish species is not included in Table 2. Scallops and paddle crabs support the main commercial shellfisheries south of Bream Head. Until relatively recently there were also significant commercial fisheries for cockles at Snake Bank in Whangarei Harbour and pipi at Mair Bank. Some rock lobster potting occurs along the northern rocky shores from the harbour entrance out to Bream Head.

Each of the finfish and shellfish fisheries is described in more detail the following sections of the report. The finfish fishery is broken down by fishing method as each fishing method operates in different areas. The shellfish fisheries are broken down by individual species.

There is an extensive fisheries literature on all the individual commercial species available in Ministry for Primary Industries (2016a, 2016b)

3.4 Trawl and Danish Seine Fishery

3.4.1 Target Species

The bottom trawl and Danish seine fisheries in waters less than 50m depth principally target snapper but also catch much smaller quantities of a wide range of other mobile fish species; in particular John dory and gurnard (see Table 1). As noted in the previous section, the inner part of Bream Bay is closed to trawling and Danish seining (Figure 8).

3.4.2 Trawl and Danish Seine Methods

Both bottom trawl and Danish seine methods involve fishing gear that maintains contact with the seabed as it is being fished.

Trawl nets generally have a weighted ground rope or chain at the bottom of the net to maintain contact with the seafloor (Figure 12). Wire sweeps join the wings of the net to trawl doors that keep the trawl net mouth spread open. The trawl doors are weighted and also maintain contact with the seabed as the net is towed. A typical inshore trawl vessel will have a swept door to door path of 50 to 90 metres in width, depending on the size of the vessel. The duration and speed of trawl tows varies, but typical inshore vessels may tow for 2-3 hours at a speed of around 3 knots. Baird et al. (2015) found the average trawl tow length for an inshore trawl targeting snapper to be in the range of 6.6- 8.1 nautical miles (12-15 km).

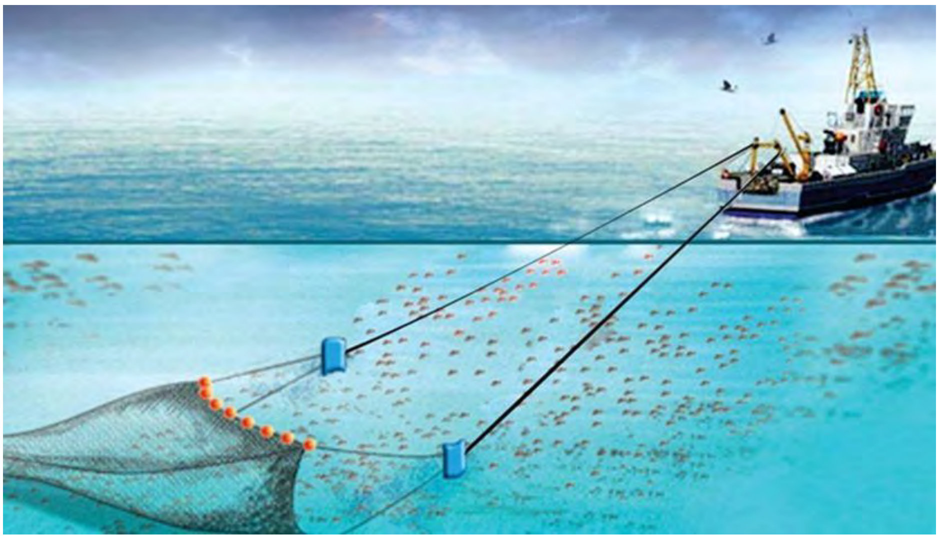

Figure 12: Image depicting typical bottom trawl net, sweeps and trawl doors being towed on the seabed.

Danish seine fishing involves the use of a net that is similar to a bottom trawl net. Instead of the net being towed over the seabed with wire sweeps and trawl doors to keep the net open, the wings of a Danish seine net are attached to very long weighted ropes that are winched back over the seabed toward the net. As the mouth of the net starts to close, the vessel steams slowly to capture the fish in the net. This method progressively encloses an area and herds bottom dwelling fish toward the net before it is brought back to the vessel. An area of several square kilometres may be swept in a typical Danish seine shot. Figure 13 shows a schematic diagram of a Danish seine net and how it is deployed.

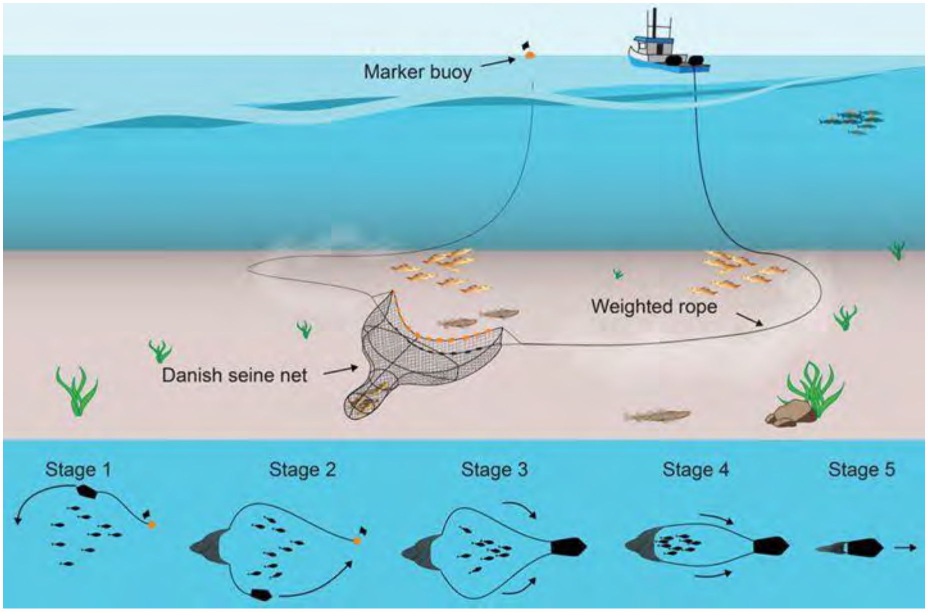

Figure 13: Depiction of Danish seine fishing and how the net and ropes are deployed

In summary, both bottom trawl and Danish seine gear is in continuous contact with the seafloor as it is towed or winched. This means both methods can only be used in areas with soft and relatively smooth seabeds – such as muds, sands and fine gravels. Sometimes trawling is conducted using ‘bobbins’ on the ground rope to roll over rougher areas.

3.4.3 Where Trawling and Danish Seining Occurs in Bream Bay

The sandy substrate that is found in most of Bream Bay is ideally suited to both trawling and Danish seine methods. Areas with rocky seabed or ‘foul ground’ such as Three Mile Reef or rocky seabeds or shoals are unable to be fished by either of these methods. Any contact with reefs or large rocks may damage the gear or pose risks to the vessel if the gear becomes snagged. Other seabed obstructions such as the presence of a vessel wreck or lost anchors can also prevent trawling and Danish seining. Modern navigational equipment allows vessels to accurately plot the position of these so called ‘fasteners’ and avoid them.

MPI maps in Figures 14a and 14b, show the spatial distribution of trawl fishing effort and catch respectively plotted in 1 nautical mile (nm) square grids over a five-year period from 1 October 2008 to 30 September 2013. The data plotted is the starting point of each trawl that may be several nautical miles in length. Trawls may be in any direction from their starting point.

TRAWL PLOT NOTES: Care is needed in interpreting these plots. The following notes are provided to assist in correctly interpreting the information presented in the figures.

<u>Intensity Scale</u>: The legend (top right corner on Figures13a and 13b) indicates the effort and catch range for each colour. Without the use of the legend, the colour density scale can be potentially visually deceptive. On face value, it looks to be a simple progressive linear increase from light to dark (representing light to heavy fishing effort). However, the effort scale in Figure13a is highly skewed. The legend indicates the four lowest effort categories are all very low – an average of 5 or fewer 'events' or trawls per year per $1nm^2$ grid. The highest (darkest) category is anything above 5 trawls per year up to a maximum of 120 trawls. This maximum of 120 trawls may be in a single grid and may located anywhere around New Zealand. It is apparent that MPI have compressed most of the real range in the number of trawls per grid into this single highest category of >5 to 120. For this reason, only limited conclusions can be reached about the importance of specific areas to trawling from the MPI plots. A similar skewed scale has been used by MPI for the plots of average annual catch (see the legend top right, Figure 13b).

Therefore, using Figures 13a and 13b it is only possible to draw limited conclusions about trawling such as:

- where trawling occurs and where it does not occur at all.
- where average trawl effort is very low to low (an average of >0 to 5 trawls per $1nm^2$ grid per year) and where it is higher than an average of 5 per year but may be up to 120 trawls per year.
- information on average annual catch of all species combined.

<u>Effect of Trawl Length</u>: An additional point to be considered when interpreting the MPI trawl plots is that they are based on the grid where trawls commenced. Most inshore trawls in northern New Zealand target snapper. The average length of a snapper trawl is between 6.6 – 8.1 nautical miles (nm) although some trawlers may tow for much shorter distances. Thus, the MPI trawl plot distribution in Figures 13a and 13b is highly biased toward where trawlers prefer to start their fishing. A trawl may head in any direction from its starting point.

<u>Overall</u>: The MPI trawl plots in Figure 13 are most meaningful when viewed on a wide scale – to show broad areas of the coast where trawling occurs or does not take place, and where there is the most trawl effort and average catch. Clusters of grids all with more than 5 trawls per year will be the areas most intensively fished.

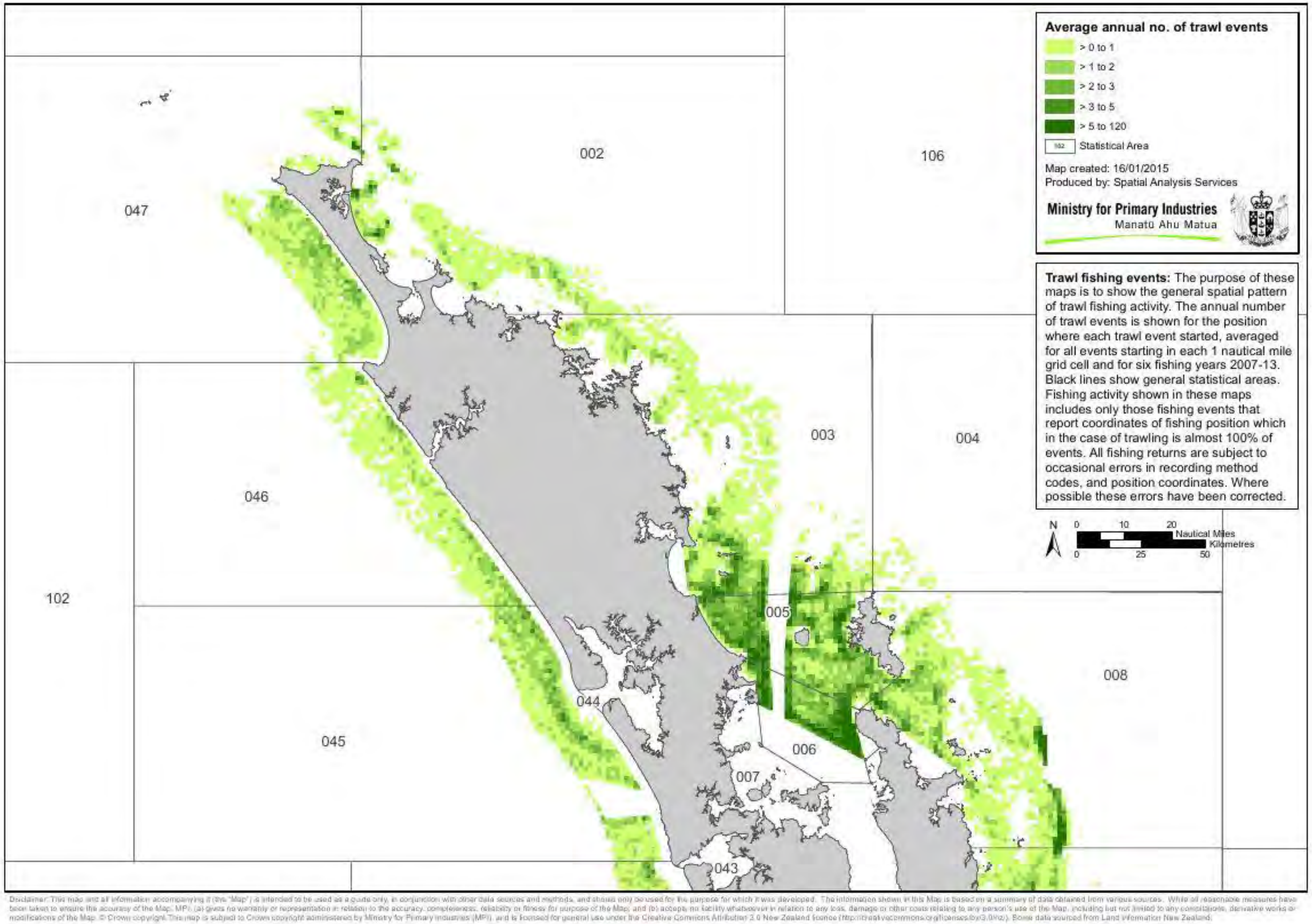

Figure 14a: Annual average no. of trawl tows (events). See insets for legend and other important details.

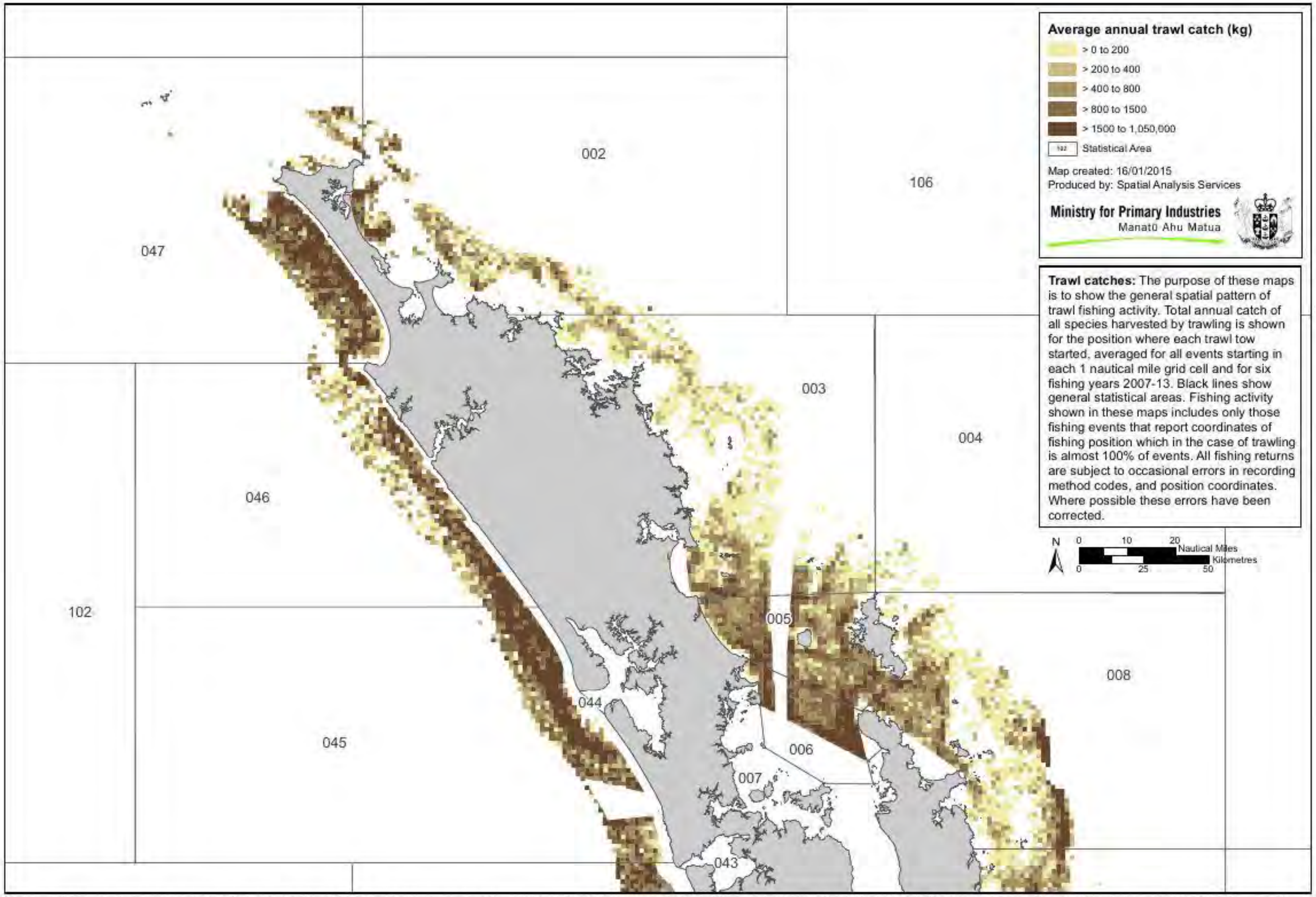

Figure 14b: Average annual trawl catch (all species combined). See inset for legend and other important details.

The plots in Figure 14a show is that trawling is very widespread along the east and west coasts of northern New Zealand. The inshore areas along the Northland coast from Bream Head to Houhora are relatively lightly trawled due to the predominantly rocky inshore seabed. Both effort and catch (Figures 14a and 14b respectively) appear to be highest in the Hauraki Gulf and south of Bream Bay.

The location of the proposed disposal site 3-2 is indicated in Figures 15a and 15b which are magnified images of trawl effort and catch in Bream Bay. Note again that the plots are of the starting position of trawls that may head in any direction from the start point and they may extend for distances of more than 6 nm.

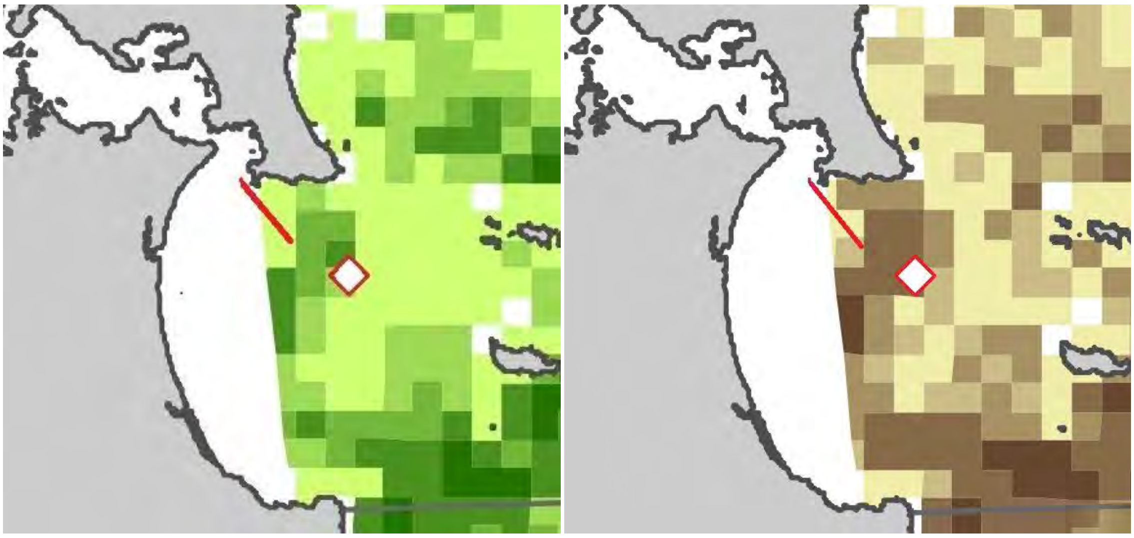

Figure 15a, 15b: Location of proposed outer dredging footprint (solid red line) and proposed Disposal Site 3-2 (red and white diamond) in relation to spatial distribution (1 nm grid) of the average annual trawl events and average annual catch respectively in Bream Bay (magnified images from Figures 14a and 14b). The plots are based on an average of 6 fishing years 2007-2013. Effort and average catch categories are described in the legend insets in Figures 14a and 14b. The advisory notes on interpretation of the MPI trawl plots provided earlier need to be kept in mind.

Figure 15a shows that some trawling occurs throughout Bream Bay (based on starting position). This is consistent with the wide distribution of snapper and the sandy seabed that is suitable for trawling in most of Bream Bay. There is no single $1nm^2$ grid in Bream Bay where there was an average effort of more than 5 trawls commencing per year. Most areas in Bream Bay received low to moderate fishing effort. There is a concentration of slightly higher trawl effort along the trawl limit line and in a single $1nm^2$ grid overlapping proposed Site 3-2. Average annual catches in Bream Bay (Figure 15b) were highest for trawls commencing along the trawl limit line.

Overall, Figures 14a and 15a show that commercial bottom trawling (trawling) is extensive on the northeast coast wherever there is soft seabed, including in Bream Bay. Trawl effort in Bream Bay is generally low to moderate between >1 to 5 trawl events commencing per $1nm^2$ grid per year.

However, this larger perspective of the distribution of trawling risks masking how individual trawl vessels operate. Individual commercial fishers tend to operate in different areas based on their base port and local knowledge. Whangarei based trawlers spend more time operating in Bream Bay. Nonetheless, Figure 15a clearly indicates a relatively low average number of trawls commence annually in most areas of Bream Bay and there is no evidence that Bream Bay is a hotspot for commercial trawling.

There are no similar maps available from MPI showing the spatial distribution of Danish seine fishing. Individual Danish seine shots can encompass several km^2. However the areas where bottom trawling takes place are generally also suited to Danish seining which generally operates in the same inshore areas as trawling, especially in depths <50m. Like inshore trawling, Danish seining also predominantly targets snapper.

MPI commercial catch data (www.nabis.govt.nz) indicates that trawlers take about 25% of the total snapper catch in MPI's Fisheries Statistical Area 003 (Figure 5) and Danish seiners take about 15%.

In summary, Whangarei based trawl and Danish seine fishers indicate that they fish throughout Bream Bay wherever the seabed does not prevent their gear from being used. The area to the east of 3 Mile Reef is actively fished by both methods, principally targeting snapper but there is no evidence that it is a trawling hotspot. Trawlers and Danish seiners based in Auckland also fish Bream Bay from time to time as part of their overall fishing activity.

3.4.4 Trawling and Danish Seining in or near Proposed Dredging and Disposal Sites

Figure 16 shows the main areas of commercial fishing activity by trawlers in Bream Bay (>3-5 trawls commencing annually per 1 nm^2), interpolated from the MPI plots in Figures 14 and 15 and discussions with fishers. Danish seine vessels also operate in similar areas as trawlers including part of proposed Disposal Site 3-2.

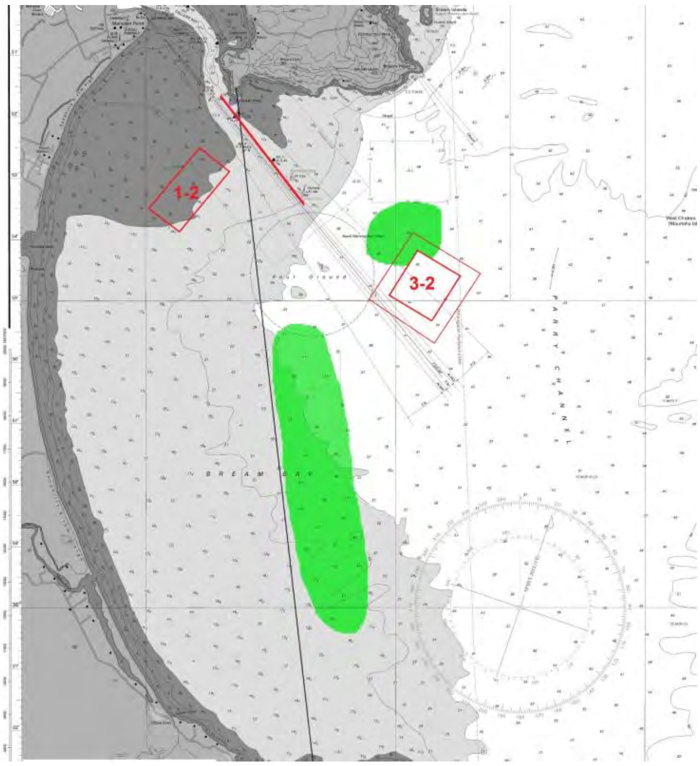

Figure 16: Main areas of bottom trawl fishing activity in Bream Bay.

The area with the most trawl fishing effort and that also has the highest catches in Bream Bay appears to lie along the trawl limit line. Another area with higher trawl effort overlaps proposed Disposal Site 3-2. Less information is available on the distribution of Danish seining which is not included in Figure 16.

3.5 Bottom Longline Fishery

3.5.1 Target Species

The bottom longline fishery predominantly targets snapper with gurnard an important bycatch.

3.5.2 Longline Method

Bottom longlines for snapper fishing have a mainline up to several kilometres in length anchored on the seafloor at either end with buoy lines marked by flags (Figure 17). Baited traces are clipped to the main line. Once on the seabed, the longline is stationary.

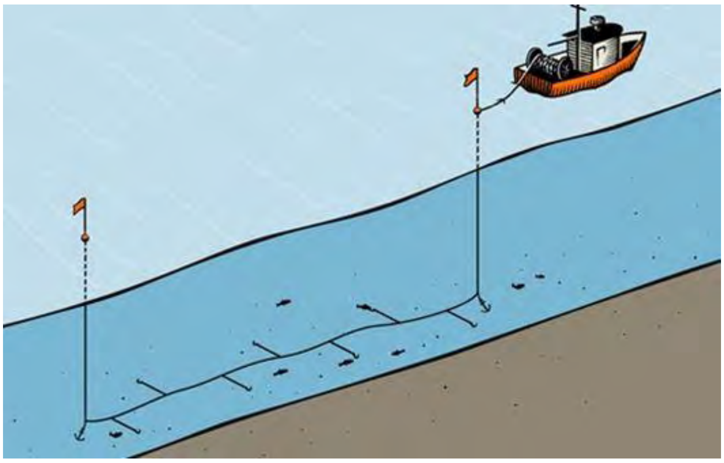

Figure 17: Image of a typical bottom longline.

Bottom longlining can take place over both soft and hard seabeds and is therefore more spatially extensive along the coast than trawling or Danish seining. There are also no areas closed to bottom longlining in Bream Bay or Whangarei Harbour. Bottom longline fishing takes nearly 60% of the total snapper catch in MPI's FSA 003.

3.5.3 Where Longline Fishing Takes Place in Bream Bay

MPI maps in Figures 18a and 18b show the spatial distribution of the starting positions of longline fishing effort and catch respectively plotted in 1 nm grid over a five-year period from 1 October 2008 to 30 September 2013. Longline gear may be set in any direction from the start point and may extend for up to several kilometres. However, as the grid cells in Figure 18 are 1nm^2 (1 nm = 1.85 km) the plots provide a reasonable picture of the true distribution of catch and effort along the coast. Note that the insets in Figures 18a and 18b indicate that only about 70% of all longline fishing sets or events is incorporated in these figures. Therefore these figures slightly underestimate the average annual effort in each grid cell although the degree of underestimation may vary from 1 nm^2 grid to grid.

LONGLINE PLOT NOTES: Care is needed in interpreting these plots. The following notes are provided to assist in correctly interpreting the information presented in the MPI longline plots.

Intensity Scale: The legend (top right corner on Figures16a and 16b) indicates the effort and catch range for each colour. As with the trawl effort and catch plots, the plots are skewed and the same caveats apply as for the trawl plots. Most of the effort range is compressed into the top effort category of >5 to 30. However the top longline category is narrower than the top trawl category so there appears to be less skew than in the trawl plots.

Effect of Longline Length: Longline gear is stationary. The plots of longline effort are based on the starting position of the longline. The length of longlines may exceed 1nm but often not much more than that. Therefore, the grid plots of longline effort give a reasonable picture of the vicinities where the greatest fishing effort occurs.

Overall: The MPI longline trawl plots in Figures 16a and 16b provide a reasonable picture of the distribution of longline effort and where the greatest catches are made. However, Figure16a will slightly underestimate the true average annual effort because only about 70% of all longline fishing is reported by latitude and longitude.

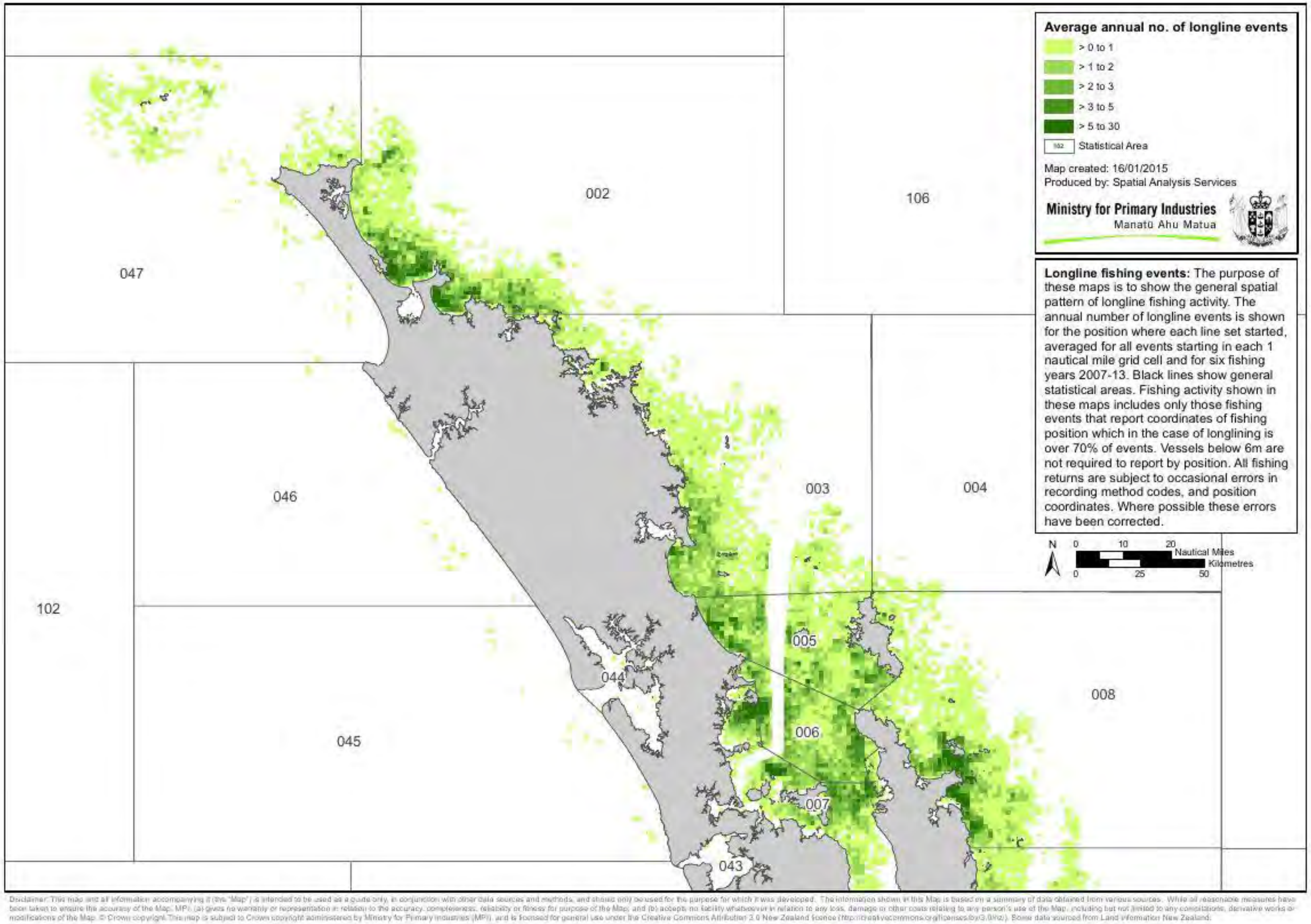

Figure 18a: Annual average no. of longline events or sets. See inset for legend and other details

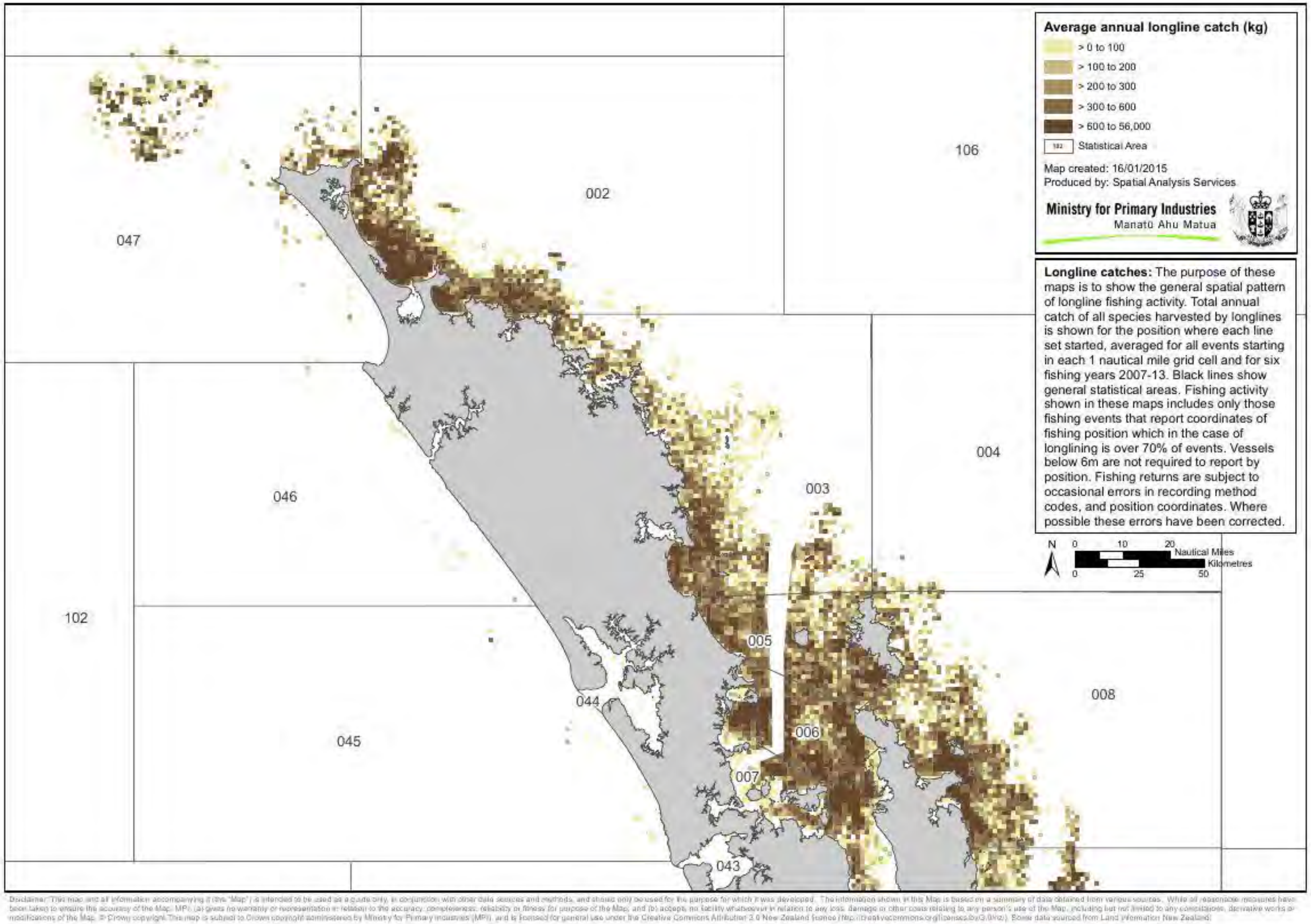

Figure 18b: Annual average annual longline catch, all species combined. See inset for legend and other details.

3.5.4 Longlining in or near Proposed Dredging and Disposal Sites

Figures 19a and 19b below are magnified images of longline effort and catch in Bream Bay plotted in 1nm^2 grid cells taken from Figure 18. The plots are based on the starting position of longline sets.

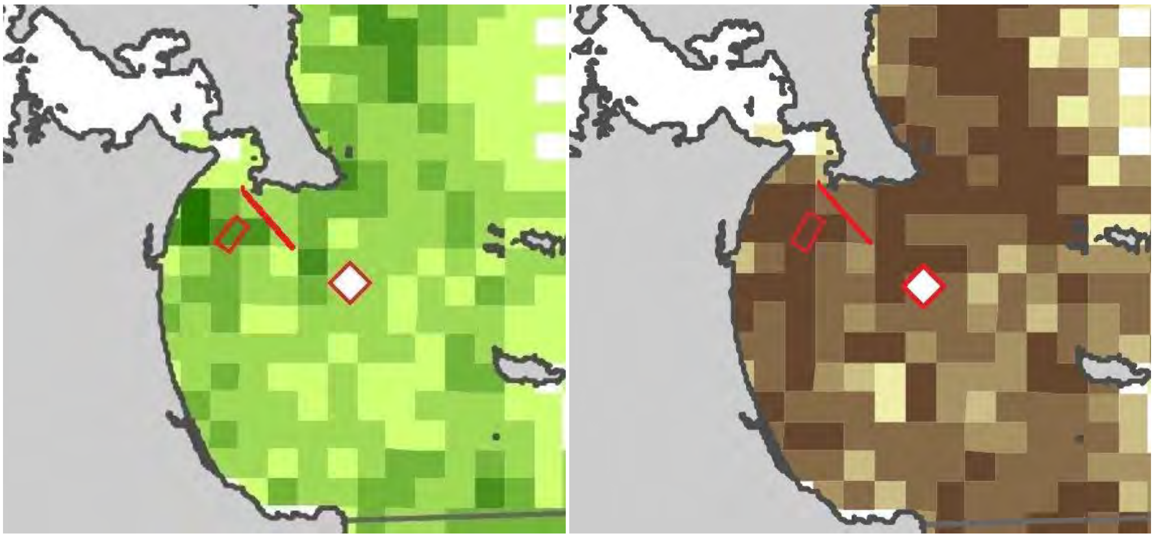

Figure 19a, 19b: Location of proposed outer dredging footprint (solid red line) and Disposal Sites 1-2 (red rectangle) and 3-2 (red and white diamond) in relation to spatial distribution (1nm^2 grid) of the average annual number of longline sets and average annual catch respectively in Bream Bay (magnified images from Figures 18a and 18b). The plots are based on an average of 6 fishing years 2007-2013. Refer to insets in Figure 18 for the legend and other information. The advisory notes on interpretation of the MPI longline plots provided earlier need to be kept in mind.

Figure 19a indicates that commercial longline fishing occurs throughout Bream Bay. The MPI plots show that the average annual number of longline sets in each 1nm^2 grid is low to moderate (>0-5) in most of Bream Bay. Effort is highest at grids adjacent to the coast south of Marsden Point. Catch is high in a number of areas but there appears to be little correlation between the distribution of longline effort and the distribution of catch. Because the MPI plots only account for 70% of all longline events the figures may slightly underestimate longline effort in Bream Bay.

Fishers indicate that they fish throughout Bream Bay targeting different depths and locations according to the time of year and fish movements.

Figure19a indicates that the highest longline effort in Bream Bay lies inshore of proposed disposal Site 1-2 and generally longline effort is highest in Bream Bay around and near Site 1-2. Effort was low (>1-2 longline sets annually) at Site 3-2. There is little if any longlining in the channel dredging footprint.

3.5.6 Longline Fishing in or near Proposed Dredging and Disposal Sites

Figure 20 shows the main area of commercial longline effort in Bream Bay interpolated from discussions with fishers and the MPI longline plots.

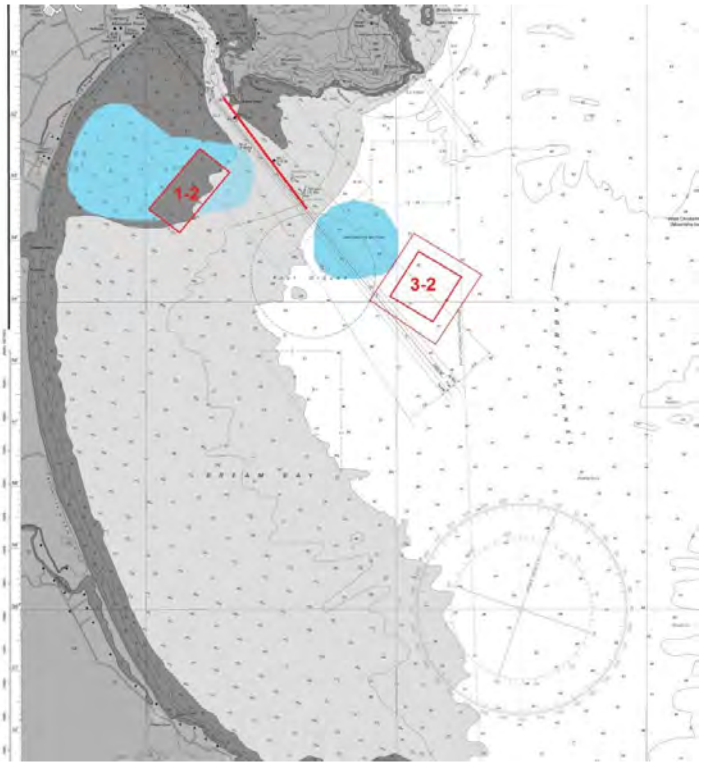

Figure 20: Main areas of longline fishing activity in Bream Bay

The commercial longline fishing areas with the most fishing effort lie over the shoals along the coast south of Mair Bank and north east of Three Mile Reef. Proposed Disposal Site 1-2 lines in one of the areas where longline effort in Bream Bay is more concentrated.

3.6 Set Net Fishery

3.6.1 Target Species

There are essentially two distinct set net fisheries targeting different species and using different types of set nets.

In the upper harbour the set net fishery principally targets flatfish and grey mullet in very shallow water. This inner harbour set net fishery extends into and up the upper harbour channels and intertidal flats. The nets used in this fishery are typically no more than a few hundred metres in length and often much shorter than that.

In the harbour mouth, outside the harbour entrance and throughout the shallower waters of Bream Bay, gill nets or set nets are used to catch coastal species including sharks, snapper, trevally, and kahawai. The set nets used in this fishery may be up to 1,000m or more in length.

3.6.2 Set Net Method

Set nets are anchored to the seabed with floats along the top of the net (Figure 21). They are usually marked with floats or buoys at each end. Set nets can be used over soft and rocky seabed.

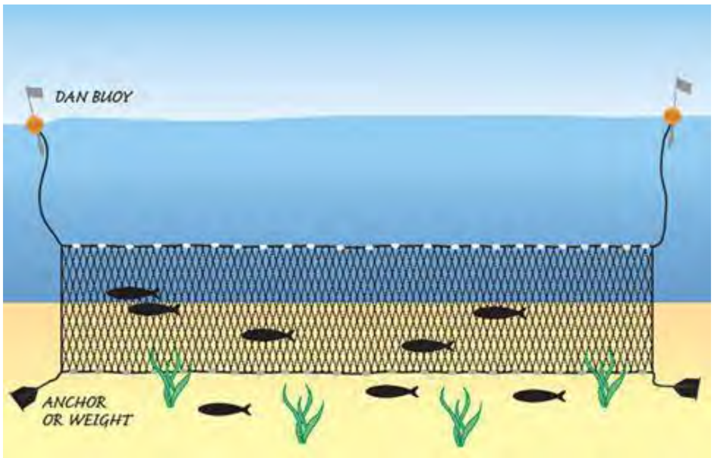

Figure 21: Image of a typical set net.

3.6.3 Where Set Net Fishing Takes Place in Whangarei Harbour and Bream Bay

MPI maps in Figures 22a and 22b show the spatial distribution of the starting positions of set net events or sets and catch respectively plotted in a 1nm^2 grid over a five-year period from 1 October 2008 to 30 September 2013. As the length of set nets are relatively short compared to the 1 nm grids, the plots provide a reasonably accurate picture of the distribution of the fishery. However as noted above, the insets in Figures 22a and 22b indicate that only about 33% of all set netting is reported by latitude and longitude. This means that these figures may considerably understate the average annual numbers of sets and may not give an accurate estimate of average annual catch.

The underestimate of set net effort may vary from location to location around the country depending on what proportion of set net vessels operating in an area report their latitude and longitude coordinates. Vessels that do not provide coordinates report their effort and catch by Fisheries Statistical Area only.

SET NET PLOT NOTES: Care is needed in interpreting these plots. The following notes are provided to assist in correctly interpreting the information presented in the MPI set net plots.

Intensity Scale: The legend (top right corner on Figures19a and 19b) indicates the effort and catch range for each colour. As with the previous MPI plots the scale is highly skewed. The same caveats apply to their interpretation. Most of the effort range is compressed into the top effort category which for set netting is an average of >5 to 210 sets annually.

Effect of Longline Length: Set net is stationary. In harbours nets are rarely more than 100-200m long. Outside of harbours they may be up to 1000m. Therefore, the grid plots of set net effort give a reasonably accurate picture of where the greatest fishing effort occurs.

Incomplete Data: The legend on the MPI set net plots indicates that only about 33% of all set net events are incorporated in these figures. Therefore total effort will therefore be much higher than the set net plots indicate. Catch rates may not be representative.

Overall: Because only 33% of set net events are included in these figures, plots in Figures 19a and 19b will provide only an approximate picture of the intensity of average set net effort and average catch.

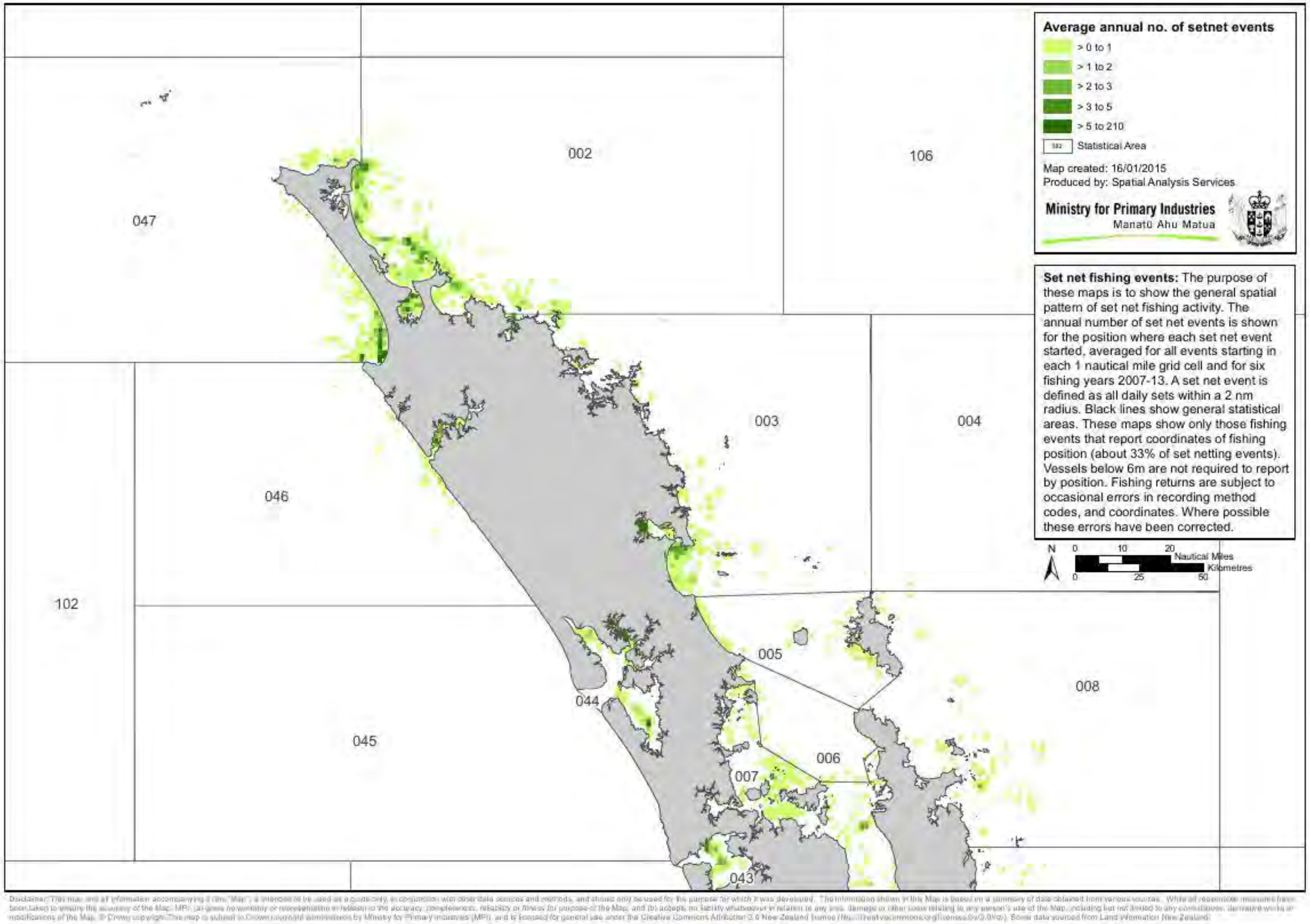

Figure 22a: Annual average annual number of set net events or sets. See inset for legend and other details.

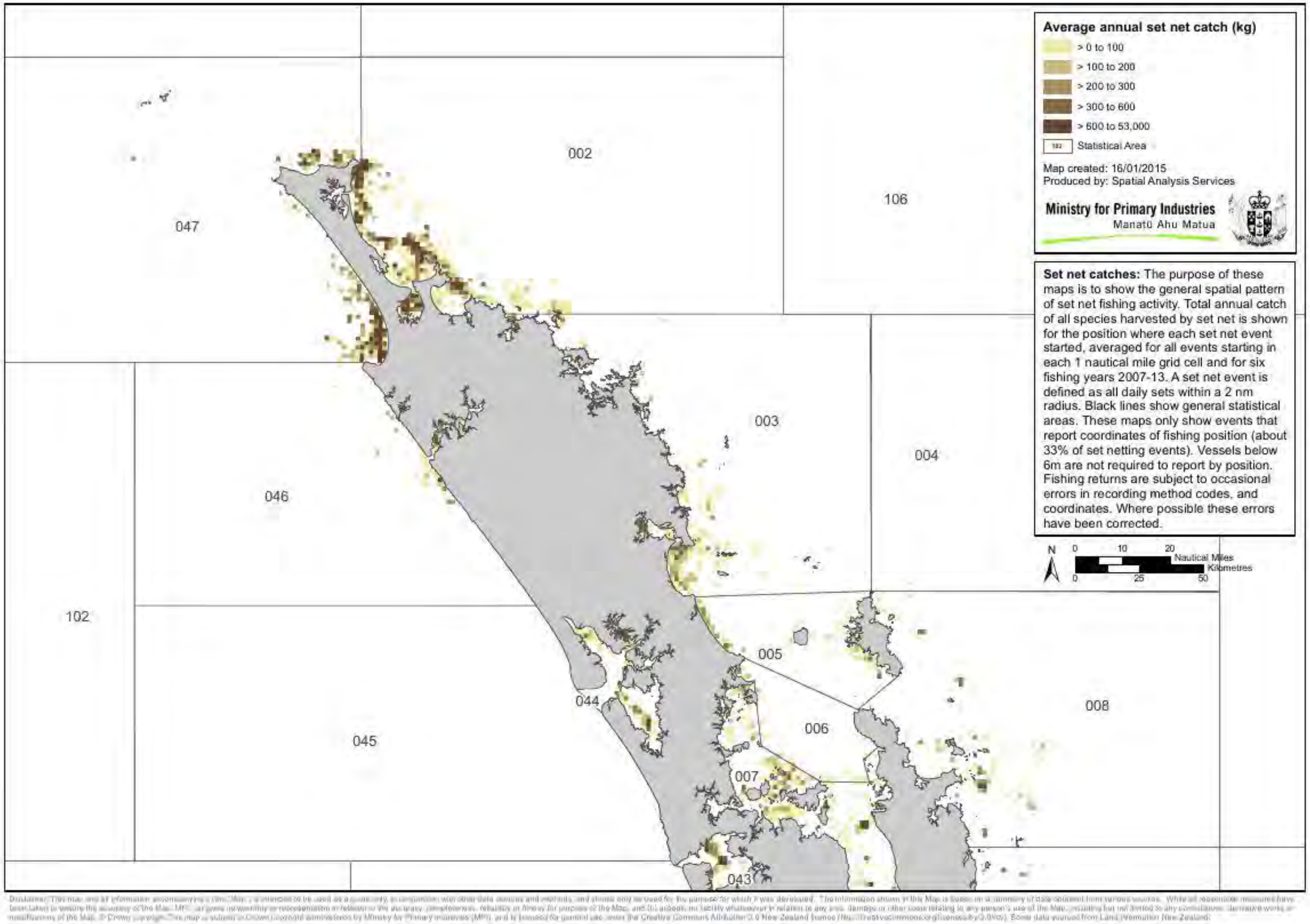

Figure 22b: Annual average annual catch by set net, all species combined. See inset for legend and other details.

Figures 23a and 23b below are magnified images of set net effort and catch in Bream Bay in nm^2 grid cells taken from Figure 22. As the length of a set net is generally not more than 1,000m, the images provide a relatively good picture of where set netting occurs. However, note again that only about 33% of all set netting is captured in the MPI plots in Figure 22.

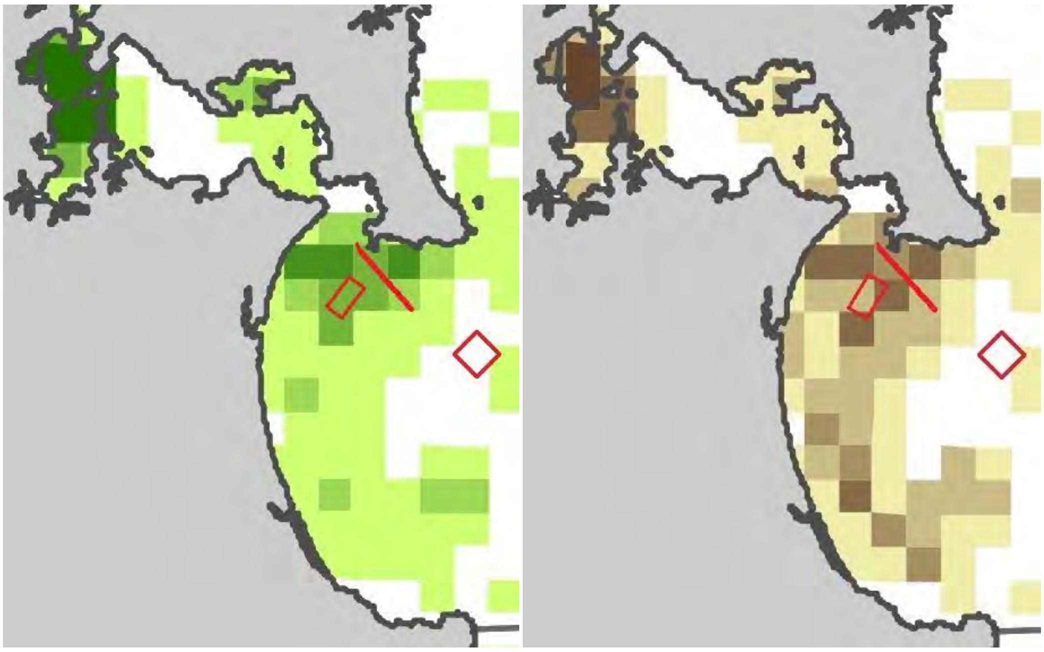

Figure 23a, 23b: Location of proposed outer dredging footprint (solid red line) and Disposal Sites 1-2 (red rectangle) and 3-2 (red and white diamond) in relation to spatial distribution (1nm^{2}grid) of the average annual number of set net sets and average annual catch respectively in Bream Bay (magnified images from Figures 22a and 22b). The plots are based on an average of 6 fishing years 2007-2013. Refer to insets in Figure 22 for the legend and other information. The advisory notes on interpretation of the MPI set net plots provided earlier need to be kept in mind.

The most concentrated set netting occurs in the upper reaches of Whangarei Harbour. Set netting also occurs around the outer entrance to the Harbour, including the area south of Mair Bank and the coast from Smugglers Cove to Peach Cove.

Figure 22a suggests that set net effort tends to be higher on either side of the shipping channel and proposed dredging footprint and not within it.

Outside the Harbour entrance and within Bream Bay, most set net effort is concentrated on the shoals in the northwest of Bream Bay and around the vicinity of proposed Disposal Site 1-2.

Because only 33% of all set net effort is included in the MPI plots it is difficult to reach any firm conclusions about the true importance of the area to set netters. However the plots are consistent with information provided by fishers, which provides some additional confidence to the data available. In addition, catch data presented earlier in Table 2 indicates that set net catches of coastal open water species in MPI's FSA003 (which includes Bream Bay) are very modest.

Figures 21 and 22 indicate that no set net activity occurs at or around proposed Disposal Site 3-2.

3.6.4 Set Net Fishing in or near Proposed Dredging and Disposal Sites

Figure 24 highlights where there is the most commercial set net fishing activity in Whangarei Harbour and Bream Bay interpolated from MPI plots and discussion with fishers.

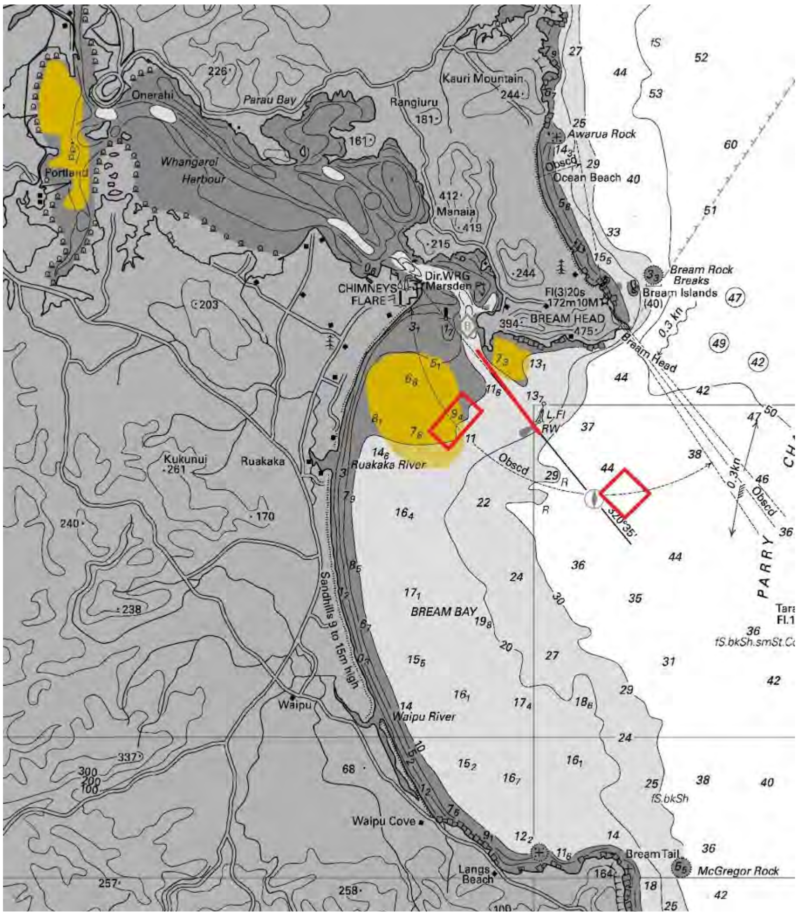

Figure 24: Main areas of commercial set net activity in Whangarei Harbour and Bream Bay.

Proposed Disposal Site 1-2 overlaps one of the main set net fishing areas at the entrance to Whangarei Harbour. There is little or no set netting around the proposed dredging footprint and proposed Disposal Site 3-2.

3.7 Paddle Crab and Whelk Fisheries

3.7.1 Paddle Crabs

The paddle crab *Ovalipes catharus* is found off sandy beaches, and in harbours and estuaries throughout New Zealand. It is most abundant from the lower intertidal zone to at least 10m depth although it is known to occur down to 100m (Ministry for Primary Industries 2016a). Diet studies from central and northern New Zealand indicate that *O. catharus* is an opportunistic, versatile and generalist predator and scavenger feeding on molluscs or crustaceans including tuatua, pipi, burrowing ghost shrimp, isopods and amphipods (Wear & Haddon 1987). The diet varies with location around New Zealand indicating that it adapts its diet according to the available prey. Although paddle crabs sometimes prey on adult shellfish, they more commonly prey on shellfish spat which are found in abundance on many sandy shores.

Mating generally occurs during winter and spring (May to November) in sheltered inshore waters when female paddle crabs are soft-shelled (Armstrong 1988). Female crabs are thought to migrate to deeper water to spawn over the warmer months (September to March). After spawning the eggs are incubated until they hatch and then have an extended larval life. The larvae are thought to live offshore before migrating inshore where the megalopa settle in the summer and autumn (Ministry for Primary Industries 2016a).

3.7.2 Paddle Crab Traps

Paddle crabs are targeted in Bream Bay using baited crab traps (Figure 25) set to lie on the seabed and marked with a rope connected to a float at the surface. The traps are usually set to fish overnight.

Figure 25: Image depicting a typical type trap used for paddle crabs

3.7.3 Paddle Crab and Whelk Fisheries in Bream Bay

The Bream Bay paddle crab fishery is regionally significant and in most recent years has generated between two thirds and 100% of all commercial catches of this species throughout the country (www.nabis.govt.nz). Whelks are not targeted but attracted to the bait in the traps and are a saleable minor bycatch.

All the annual paddle crab catch from MPI's Fisheries Statistical Area 003 is taken in Bream Bay and the area around the entrance to Whangarei Harbour. Table 3 gives recent annual catches. Official landings data (www.nabis.govt.nz) shows that paddle crabs are caught throughout the year with no clear seasonal peak. There are no currently available statistics for the catch of whelks but based on information from local fishers the total catch is possibly in the order of 1-2 tonnes annually.

In 2010-11 and 2011-12 paddle crabs were not present in commercial quantities in Whangarei Harbour/Bream Bay and commercial catches fell to negligible amounts. The reason for their reduced abundance in these years is not known but may be related to variable reproductive success or larval survival. Commercial fishers report that in recent months, paddle crabs have again become less abundant.

Table 3: Annual catches of PAD1 (paddle crab) in MPI's FSA 003 (source www.nabis.govt.nz)

PAD1	FSA 003 annual catch (kg)
2006-07	20,660
2007-08	66,958
2008-09	45,979
2009-10	19.291
2010-11	Data withheld by MPI

2011-12	362
2012-13	<500
2013-14	1,987
2014-15	54,058
2015-16	68,614
2016-17 (6 months 1 Oct to 31 Mar)	29,252

There are no MPI maps showing the distribution of the paddle crab fishery. Discussions with paddle crab fishers indicate that they fish throughout Bream Bay from shallow water to at least 15m depth. Their area of operation includes Calliope Bank and Urquhart's Bay, Lort Point to Home Point, the shoals to the southeast of Mair Bank, and all of Bream Bay south to Bream Tail. About five Whangarei commercial fishers are believed to operate in the crab and whelk fisheries.

A typical crab fisher deploys about 40 baited traps set at about 50m apart. Fishing locations in Bream Bay vary according to the movements and distribution of the crabs which move about throughout the year. Whelks that are attracted to the bait in the crab traps are also caught as a bycatch and are sold primarily in Auckland markets.

As well as being a bycatch of the paddle crab fishery, whelks are also targeted on their own, especially when there are few crabs present. Prevailing weather conditions often confine whelk fishing activity to northern Bream Bay, from Ruakaka north, inshore of proposed Disposal Site 1-2 around the fringes of the 5m depth contour. In these circumstances, especially when crabs are not present, some commercial crab fishers advise that their ability to catch whelks in this area is critical to their livelihood.

3.7.4 Paddle Crab and Whelk Fishing at or near Proposed Dredging and Disposal Sites

Figure 26 shows the distribution of the paddle crab fishery in Bream Bay and the entrance to Whangarei Harbour based on discussions with fishers. Crab fishers operate around proposed Disposal Site 1-2 as well as throughout Bream Bay.

Whelk fishers also operate throughout the same waters. The shoals inshore of Disposal Site 1-2 around the 5m depth contour are particularly important to whelk fishers, especially when weather and sea conditions constrain where they can safely operate. There is insufficient information to definitively show the areas receiving the most fishing effort overall.

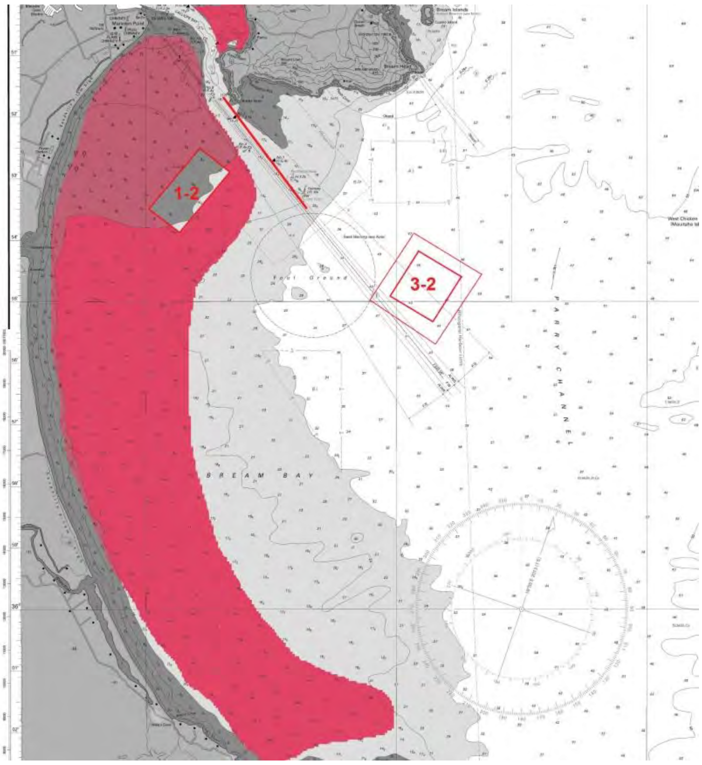

Figure 26: Area of paddle crab and whelk fishing activity in northern Bream Bay.

3.8 Scallop Fishery

3.8.1 Scallops

The scallop (*Pecten novaezelandiae*) is most common in depths from 10-60m on sand, shell and gravel substrates and occurs all around New Zealand. Scallops tend to be patchily distributed in small and large beds, some of which are persistent and others ephemeral (Hartill & Williams 2014). Whilst considered to be a sessile species, it is capable of rapid short distance movement i by clapping its shells to jet water that propels it over the seabed. Scallops tend to be present in enclosed and semi-enclosed harbours and bays where it is thought that circulating currents tend to retain larvae. Larvae remain pelagic for about three weeks and in Northland the main spat settlement occurs in January (Ministry for Primary Industries 2014).

3.8.2 Bream Bay Scallop Fishery

All commercial scallop fishing is by dredge, with most fishers in Northland using self-tipping box dredges (Ministry for Primary Industries, 2014). The legal fishing year is from 1 April to the following 31 March but the Northland commercial scallop season runs from 15 July to 14 February. The minimum legal size (MLS) is 100 mm and the base-level total allowable commercial catch (TACC) for the entire Northland fishery is 40 tonnes meatweight. This is the smallest scallop fishery in New Zealand. When it appears that abundance may support larger catches, scallop biomass surveys are undertaken to provide the data required to support an increase in the annual catch limit for the fishery (Cryer & Parkinson 2006).

Hartill & Williams (2014) provide a detailed characterisation of the Northland scallop fishery from 1989 to 2011. This includes the fishery in Bream Bay. Relatively high catches in the Northland scallop fishery occurred from its inception in the 1970s until the early 1990s. Since then scallop catches throughout Northland have been very much smaller and sporadic.

In the Bream Bay fishery, the scallop population has only supported a fishery lasting one or two years at about 10 year intervals with no fishery in the intervening years. Scallops can usually be found in low densities throughout Bream Bay from shallow waters to depths of 50m. In recent years commercial fishing for scallops has only occurred in an area south of the Ruakaka River mouth.

Reported catches from Scallop Statistical Area 1R from 2002-03 to the present are given in Table 4. The Bream Bay scallop fishery has supported commercial catches greater than minor amounts in just five of the past 15 years. Bream Bay scallops tend to grow more slowly and be in poor condition compared to scallops from Rangaunu and Spirits Bays. Many Bream Bay scallops never reach the 100mm minimum legal size. The environmental factors causing this are not known.

Table 4: Annual catches of scallops from MPI's Scallop Statistical Area 1R (Bream Bay) (source: www.nabis.govt.nz).

Fishing year	Area 1R reported scallop catch (kg meatweight)
2002-03	9,013
2003-04	0
2004-05	99,362
2005-06	174,421
2006-07	72,433
2007-08	<1
2008-09	0
2009-10	0
2010-11	0
2011-12	0
2012-13	0
2013-14	<1
2014-15	68,585
2015-16	46,459
2016-17	1,480

Issues faced by scallop fishers in Bream Bay are low scallop densities in most of the area with only small patches of higher density worth fishing, poor condition, and a high proportion of the population falling below the minimum legal size of 100mm, requiring considerable sorting at sea (Hollings pers. comm.). Overall, operating costs are high and returns from the scallop fishery are modest even though scallops are a high value product. In recent years 6 or fewer vessels have actively fished for scallops throughout Northland even in those years when stocks are abundant enough to support a fishery.

3.8.3 Scallop Fishery at or near Proposed Dredging and Disposal Sites

Figure 27 shows the main areas of scallop dredging activity in Bream Bay based on discussion with the scallop industry. Scallop beds can develop in different areas from year to year but generally commercially viable beds are found in patches in a band along the coast from Ruakaka south to Bream Tail.

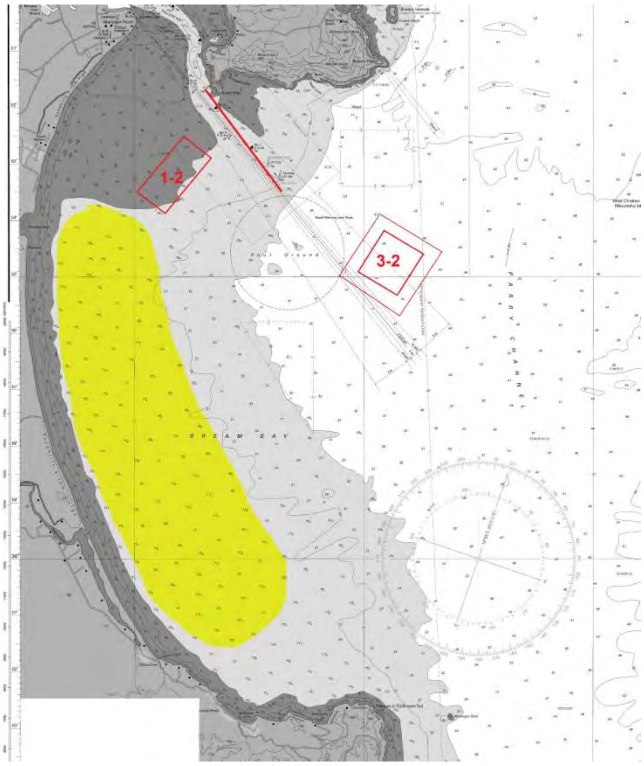

Figure 26: Main area of commercial scallop dredging in Bream Bay.

3.9 Commercial Cockle and Pipi Fisheries

3.9.1 Snake Bank Cockle Fishery

Snake Bank supported a commercial cockle fishery from the early 1980s until 2012 when the fishery was closed. It was the only cockle bed open to commercial fishing in Whangarei Harbour. Catches exceeded 500 t in the early years of the fishery but dropped progressively to less than 50 t in the year before its closure in 2012 due to low biomass (Ministry for Primary Industries 2016a).

Although the Snake Bank cockle fishery is currently closed, there is the potential for the fishery to resume in the future depending on a recovery in the stock biomass.

3.9.2 Mair Bank Pipi Fishery

A commercial fishery for pipi took place on Mair Bank for at least five decades until the fishery was closed on 1 October 2012 due to low biomass levels. Catches exceeded 250 t annually in some years but fell to very low levels after 2010 (Ministry for Primary Industries 2016a).

Although the Mair Bank pipi fishery is currently closed, there is potential for the commercial fishery to resume in the future if biomass levels recover.

3.10 Rock Lobster Fishery

Rock lobster are taken by potting on or near rocky shores or rocky reefs and seabed from the shallows and out to at least 100m depth on suitable substrates (Ministry for Primary Industries 2016b). Rock lobsters occur along the northern shores of Bream Bay from the entrance to Whangarei Harbour to Bream Head. Kerr & Moretti (2015) found sub-legal rock lobsters in the Motukororo Marine Reserve.

The northern shore of Bream Bay lies at the southern end of MPI Rock Lobster Area 904 (RLA 904) as shown in Figure 7. RLA 904 includes the coast from Waipu to the Bay of Islands. Most of the rocky habitats and reefs suitable for rock lobster in this area lie north of Bream Head. Recent annual catches in the whole of RLA 904 are modest at about 10t annually (www.nabis.govt.nz). It is likely that the commercial catch of rock lobster taken from along the northern coastline of Bream Bay is very small. Because rock lobsters are mainly found on subtidal rocky habitat most of the commercial catch in this area is taken very close to the coast. Rock lobsters are known to move onto sandy seabeds adjacent to rocky reefs to feed on shellfish (Kelly et al. 1999, Langlois et al. 2005) but the distances involved are small.

4.0 Discussion and Assessment of Potential Impacts of Refining NZ's Proposed Crude Project on Commercial Fishing

4.1 Overall Factors to Consider

Finfish are highly mobile. As noted in Section 2.1 the species of most significance to commercial fishing in Bream Bay are very widely distributed along the coast. Commercial fishing for snapper and associated species is also widespread as shown in the MPI plots of trawling, longlining and set netting.

On a coastwide basis, the wide distribution of commercial fishing effort indicated in the MPI plots shown in Figures 14a, 18a and 22a is reflective of both the mobility of fishes and commercial fishers that catch them. The MPI plots and information provided by commercial fishers also indicate that commercial fishing by trawl, longline and set net occurs throughout most of Bream Bay, including in and around proposed Disposal Sites 1-2 and 3-2.

Whilst commercial fishing is widespread in Bream Bay, the MPI plots and MPI Nabis data also indicate that Bream Bay is not amongst the most important and intensively fished areas in the wider coastal fishery. Any potential impacts of the Project on commercial fishing in Whangarei Harbour or Bream Bay will primarily be local rather than being of regional or national significance.

Overall, the commercial fishery in Whangarei Harbour and Bream Bay is comprised of several essentially discrete and unrelated fisheries using different methods or targeting different species and each may be impacted differently.

4.2 Impacts Relevant to Commercial Fishing

There are a number of project impacts that may potentially affect commercial fishing and need to be evaluated. These include the following:

i. Direct mortality of commercial fish and shellfish species.
ii. Loss of or ecological changes to habitats that fish use that may result in loss of commercial fishing opportunities.
iii. Physical changes to habitats that may affect the operation of fishing methods or gear and/or prevent fishing.
iv. The availability of alternative locations for commercial fishing.
v. Whether any of the impacts are permanent or temporary, and if temporary the duration of recovery of any ecological or physical changes to habitat.

Each of these potential impacts is briefly considered below, prior to an overall assessment of impacts on each of the individual commercial fisheries described earlier in section 3.0 of the report.

4.2.1 Direct Mortality of Commercial Fish and Shellfish Species

Finfish are highly mobile and commercial species such as snapper, gurnard and John dory are able to avoid the disturbance caused by active dredging and disposal activity. These species will be able to move to undisturbed nearby areas. Paddle crabs are also very mobile. Both finfish and paddle crabs may be attracted to areas that are disturbed during dredging and disposal to scavenge for benthic organisms exposed during the works. Both the dredging activity and disposal of dredged material is highly unlikely to result in mortality of mobile fish species which naturally avoid physical disturbance (Coffey 2017).

Sessile bottom dwelling species such as scallops are unlikely to survive either dredging or being buried by dredged sediments at the disposal sites (Coffey 2017). Except for whelks, commercial densities of sessile bottom dwelling species are not known to occur within the dredging and disposal footprints. Whelks are present at both the dredge and disposal sites (West & Don 2016a, 2016b, Coffey 2017) and would be unlikely to survive burial.

Overall, there is expected to be no mortality of mobile commercial fish species as a consequence of the dredging or disposal. Some whelks at Site 1-2 may be buried and not survive but the any temporary effect on their reduced availability to the commercial whelk fishery in Bream Bay is expected to be negligible. They are part of the benthic faunal community that will re-establish within 6-12 months.

4.2.3 Loss of or Ecological Changes to Fisheries Habitat

In the assessment of ecological effects, Coffey (2017a,b) indicates that the combined capital dredging and disposal would impact benthic communities from a total area of 4.37km^2 for a period of 6-24 months. However, ecologically constructive benthic communities are expected to progressively re-establish within a period of not more than 12 months. There will be no permanent loss of fish feeding habitat. Any reduction in availability of benthic fauna that fish feed on will be temporary and confined to the dredging and disposal sites.

4.2.4 Physical Changes to Habitat

Both bottom trawling and Danish seining can only occur on ‘soft’ seabeds – such as mud, sand or gravels. There could be longer term impacts on bottom trawl and Danish seine methods if any long term or permanent changes to the seabed were to occur at proposed Disposal Site 3-2. This disposal site lies within an area where both methods operate from time to time. For example, a reduction in the density of the seabed and/or large mounds of dredged material could make it more difficult or impossible for these methods to operate at the disposal site in the future.

A review of the likely surface elevation and contours by Tonkin & Taylor (2017) considered both numerical modelling and information from the completed dredging and disposal at the Port of Tauranga. This indicates that expected changes in average depth at Disposal Site 3-2 will be in the order of 0.5m with an initial maximum height of 2.8m and maximum slopes of around 1:40 (V:H) but more typically 1:120 (V:H). Large mounds will not develop at the disposal site and these slopes are very gentle. Based on the experience at Tauranga and the modelling at Site 3-2 the seabed surface will progressively smooth over time as a result of storm wave activity. The review indicated that densification of the deposited sand is likely to occur quickly, matching that of the adjacent seabed density within weeks, with no significant lowering.

In summary, the review indicates that once disposal at the site finishes, the seabed form and density at Site 3-2 will have physical characteristics similar to its present state and like adjacent areas where trawling occurs. Therefore the disposal is not expected to materially affect the continued use of Site 3-2 for trawling and Danish seining. Other methods are much less dependent on seabed form and density. Overall, any effects on the future use of Site 3-2 for commercial fishing will be negligible.

4.2.4 Availability of Alternative Sites for Commercial Fishing

The MPI plots of commercial fishing activity and average catches show that commercial finfish fishing is very widespread. The total area impacted by dredging and disposal is very small in comparison to the total area where commercial fishing activity takes place. Individual fishers may operate anywhere throughout Bream Bay and the wider region subject only to having the right to commercially harvest the particular species they target.

4.2.5 Duration of Impacts – Permanent and Temporary

The proposed project will result in a number of permanent changes to the environment in which commercial fishing takes place. These include:

- A deeper and re-aligned shipping channel into Marsden Point.
- Altered navigational aids.
- Shallower seabed depth within proposed Disposal Site 3-2.
- Areas of shallower depths where dredged material is deposited within proposed Disposal Site 1-2.

Neither the deeper and realigned shipping channel nor the altered navigational aids are expected to have any adverse impacts on commercial fishing. They are more likely to be beneficial, both in terms of reducing risk to the fisheries environment from oil tankers visiting the port and aiding fishing vessels entering and departing Whangarei Harbour.

A shallower seabed depth at proposed Disposal Site 3-2 is unlikely to adversely affect commercial fishing provided its density, sediment type and slope remain such that commercial trawl and Danish seine vessels are able to continue to fish the area in the future. Density, texture and slope have been addressed in section 4.2.4. The reduction in depth by 4m at this site is not significant in a commercial fishing context. Inshore commercial trawl and Danish seine vessels operate their gear at a range of depths from very shallow water to more than 100m depth. Other fishing methods that use static fishing gear (longline, set net, pots) are unlikely to be affected in any way by reduced seabed depth as they also operate over a wide range of depths.

At proposed Disposal Site 1.2, only 10% of the area (0.25km^2) is expected to be used for disposal of capital dredging. The small area impacted here is unlikely to result in measurable impacts to commercial fishing when compared to the very wide area where commercial vessels now operate in this part of Bream Bay.

Coffey (2017) concludes that all of the adverse ecological and environmental effects of the capital and maintenance dredging work, such as the reduced food supply for fishes, will be localised and temporary. The affected areas are expected to progressively recover within a relatively short time frame, with ecologically constructive benthic communities able to provide feeding grounds for fish occurring in all affected areas within 12 months. The volumes from maintenance dredging are about 5% of the capital dredging and the impacts correspondingly less.

4.3 Impacts on Commercial Trawl and Danish Seine Fishing

There are two potential adverse impacts on bottom trawl and Danish seine fishing. Both are temporary. One is the loss of access to all or part of the area of proposed Disposal Site 3-2 during the period of active disposal from both capital and periodic dredging work. This impact arises from the change to the physical seabed which may make trawling or Danish seining activity impossible or result in loss or danger to fishing gear. Based on the Tonkin and Taylor (2017) assessment, the physical attributes of the seabed will recover. The recovery of the seabed to pre-disposal conditions is expected to be rapid – in the order of weeks. However, as disposal activity from capital dredging will be continuous and spread systematically throughout the full area of the disposal site, a very conservative assessment is that trawling and Danish seining may not be physically possible at Site 3-2 for the full duration of the capital dredging programme plus a few weeks.

The second potential adverse impact is the displacement of commercial fishes at Disposal Site 3-2 as a result of both physical disturbance and the loss of benthic fauna on which fishes feed. This adverse effect is temporary and may last for a period of 6-12 months (Coffey 2017). How far fish will be displaced is uncertain but a literature review of fish behaviour in response to dredging and disposal found that fish tend to exhibit avoidance behaviour for about two to three hours after dredged material placement and fish community densities generally return to pre-disposal levels after about three hours (ECORP Consulting Inc. 2009). The degree of displacement of benthic commercial fish species from the temporary loss of benthic food items is likely to last longer. However the progressive nature of disposal means than only small areas of Disposal Site 3-2 will be affected at any one time. Adopting the assumption that once disposal commences fish will be instantaneously displaced from the entire area of Site 3-2 for a period of 6-12 months would be extremely conservative. Although this entire area will be progressively affected over a period of up to 6 months, the immediate impacts will be over a smaller area at any one time and thus spread out over the duration of capital dredging.

Based on MPI data, the average number of trawls commencing in the area of the dredging footprint is very low (>0-1 per 1nm^2 grid or 3.43km^2) annually. The average number of trawls commencing in the immediate vicinity of Site 3-2 is higher but still no higher than >3-5 per 1nm^2 grid annually. At 2.5 km^2, Site 3-2 is smaller than a single 1nm^2 grid. Any fish temporarily displaced will still be available to catch outside of the affected areas. Overall, any adverse effect on trawling and Danish seining can be expected to be negligible.

4.4 Impacts on Longline Fishing

Commercial fish species that longliners target will be displaced as a result of both physical disturbance and the temporary loss of benthic fauna on which fishes feed. This potential adverse effect arises at both Sites 1-2 and 3-2. Little longline fishing takes place around the dredge footprint. The adverse effects on longlining from displacement of fishes at both disposal sites can be expected to be very small, if any, for the same reasons as given above for trawling and Danish seining. Additionally, although Site 1-2 lies within or near the area of greatest longline activity (Figure 20), placement of dredged material there will be localised. Overall, any adverse effects of dredging and disposal on commercial longline fishing can be expected to be negligible.

4.5 Impacts on Set Net Fishing

Adverse effects on set net fishing at Site 1-2 are the same as for longline fishing and are expected to be negligible for the same reasons.

4.6 Impacts on Paddle Crab and Whelk Fishing

Paddle crabs are mobile and can also swim, but are not able to move as fast as fishes and may be unable to avoid dredged material when it is deposited. Some individuals are likely to be buried by the disposal of dredged material as they normally reside on the seabed. Disposal Site 3-2 does not lie within the area where paddle crab fishers indicate they fish but Site 1-2 is within the area most actively fished. Commercial fishers report that the paddle crabs they fish for appear to regularly move or migrate to different areas in Bream Bay over the course of the year. At other times they are not abundant at Site 1-2. Whelks move very slowly over the seabed and some will be buried by the disposal of dredged material at Site 1-2.

Both paddle crabs and whelks are predators and scavengers. They may initially be attracted to the benthic fauna exposed in the dredge deposits and this may make them more vulnerable to repeated deposition. Disposal at Site 1-2 is proposed to be distributed in relatively small amounts at a number of different sites throughout the overall area over a relatively short period of time to facilitate a range of wave conditions gradually moving sediment. Under this scenarioany such attraction is unlikely to be significant.

Overall, adverse effects of the disposal of dredged material at Site 1-2 on paddle crab fishing is expected to be negligible. They are very mobile and the impacted area at Site 1-2 is very small (0.25km^2) when compared with the area where paddle crab fishing takes place in Bream Bay.

Some loss of whelks will occur within proposed Disposal Site 1-2 as they have a limited capacity to escape and survive burial. The area most important to whelk fishers when weather and sea conditions constrain where they operate lies inshore of Site 1-2 around the fringes of the 5m depth contour. This is more than 1km from proposed disposal Site 1-2. As the disposal at Site 1-2 will be localised and of relatively small amounts, any effect on whelk fishing is expected to be negligible.

4.7 Impacts on Scallop Fishing

Although low densities of scallops occur throughout Bream Bay, in recent years commercial densities of scallops have only ever been present south of Ruakaka. No adverse effects on commercial scallop fishing are expected from the proposed dredging or disposal.

4.8 Impacts on Other Commercial Fishing.

As noted earlier in the report, significant commercial cockle and pipi fisheries occurred at Snake Bank and Mair Bank in the recent past. Both are now closed to commercial fishing due to declines in biomass. Neither of these areas lies within the dredging footprint although Mair Bank lies relatively near the inner harbour channel where capital dredging will take place. Coffey (2017) discusses the recent decline in the pipi population at Mair Bank. No adverse effects on commercial fishing for cockle or pipi are likely.

Limited commercial rock lobster fishing occurs along the rocky northern shores of Bream Bay. The distance between the proposed dredging footprint and Disposal Site 3-2 means that no adverse impacts on the rock lobster fishery are likely.

4.9 Maori Commercial Fishing

Maori have extensive commercial fishing interests arising from the settlement of Treaty of Waitangi fisheries claims. To provide further context, these Maori commercial fishing interests include:

- Ownership interests in the fishing company Moana New Zealand that many Whangarei-based commercial fishers fish for or supply fish to.
- Direct ownership of commercial fisheries quota, including inshore quota stocks, by local Iwi.

The shellfish resources at Snake Bank (cockle) and Mair Bank (pipi) have particularly significant customary and commercial fishery values. In relation to commercial fishing, both areas are currently closed to all harvesting due to low biomass. Recovery of the biomass of both the cockle and pipi populations and future commercial shellfish harvesting will depend on how the populations respond to natural environmental conditions. The current shellfish closures are aimed at assisting in this recovery.

No capital dredging or disposal will occur at either Snake Bank or Mair Bank. There is no contaminated sediment to be dredged or disposed of. In the assessment of the Crude Shipping Project's ecological effects, Coffey (2017) concludes that there will be no ecological issues associated with sediments being placed at Disposal Site 1-2. Adverse effects on plankton are predicted to be negligible. Both cockles and pipi are very tolerant of higher turbidity that may be generated for short periods during dredging and disposal. Neither species is likely to be negatively impacted in any way, including recovery of biomass, by the relatively short duration of dredging or disposal activity. In summary, it is expected that there will be no short or long effects of the proposal on the Snake Bank cockle population or the Mair Bank Pipi population.

In the wider commercial fishing sector, Maori commercial fishing interests include both inshore and offshore species. The commercial harvesting rights held by local Iwi are mostly made available to Maori fishing companies such as Moana New Zealand which operates throughout Northland waters. There may be some short-term displacement of commercial fishing activity at the two disposal sites but this will be temporary and is expected to have a negligible effect, if any, on commercial fishing. Overall, the proposal will not inhibit or preclude commercial fishing within Bream Bay – including by Maori –in the future.

4.10 Marine Farming

One existing oyster farm is present just east of Kirikiri Point in Parua Bay. No other consented marine farms are present elsewhere in Whangarei Harbour or Bream Bay. At the time of the preparation of this report, Northland Regional Council advise that they have received no applications for any new marine farms in Whangarei Harbour or Bream Bay.

Based on its distance from the proposed work associated with Refining NZ's proposed dredging and disposal, it is expected that there will be no effects of the proposal on the oyster farm at Parua Bay.

5.0 Summary and Conclusions

Commercial fishing by a variety of methods and for many different target species is widespread in Bream Bay and near the entrance to Whangarei Harbour. MPI data and commercial fishers indicate that both proposed disposal sites lie within or near areas most actively fished by some methods and/or some species.

Trawling and Danish seining methods involve towing their fishing gear over the seabed. Both methods are actively used at Site 3-2 although it does not appear to lie completely within the area most actively fished by these methods. Long term impediments to continued bottom trawling or Danish seining at Site 3-2 post-disposal as a consequence of physical changes to seabed density or form appear to be very unlikely. Adverse effects on trawling and Danish seining from temporary displacement are expected to be negligible.

Disposal Site 1-2 lies near and partly within the areas of most active fishing by both longlining and set netting. However, due to the localised nature of proposed disposal at Site 1-2 and the temporary effects of the displacement of mobile fishes, any adverse effects on fishing by both methods are expected to be negligible.

There is a regionally significant paddle crab fishery throughout Bream Bay on the outer edges of Mair Bank and around the entrance to Whangarei Harbour. Potting for paddle crabs takes place year-round. Commercial fishers move around the area to fish in a range of depths over the course of the year depending on where they find the crabs are most abundant. Given the wide distribution of the fishery and the localised disposal proposed at Site 1-2, any adverse effects on paddle crab and whelk fishing are expected to be negligible.

In some years when scallop abundance and density are high enough a small commercial scallop dredge fishery takes place as far north as Ruakaka in central and southern Bream Bay. Commercial fishing for scallops occurs well away from the influence of both dredging and disposal. No adverse effects on commercial scallop fishing are expected.

There will be no adverse effects on commercial fishing for other species and no impact on the oyster farm in Parua Bay.

Commercial fishers navigate and fish throughout the area where the proposed dredging and disposal will occur. It is recommended that they be kept advised of all operations throughout the project, especially disposal activity at both the proposed disposal sites.

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Annexure Two: Technical Reports

q) **Peer Review Report of Refining NZ Crude Freight Proposal – Tangata Whenua o Whangarei Te Rerenga Paraoa DRAFT Cultural Effects Assessment. Te Onewa Consultants. Antoine Coffin. Dated 21 July 2017**

Refining NZ Crude Shipping Project

Peer Review Report of

Refining NZ Crude Freight Proposal – Tangata Whenua o Whangarei Te Rerenga Paraoa DRAFT Cultural Effects Assessment (11 June 2017)

Prepared by Antoine Coffin, Te Onewa Consultants

For Refining NZ

21 July 2017

TE ONEWA
CONSULTANTS

Peer Review Report July 2017

1. Introduction

1.1. This review has been commissioned by Refining NZ (RNZ) and relates to the Refining NZ Crude Shipping Project.

1.2. This is a review of a draft cultural effects assessment (CEA) prepared by Te Patuharakeke Te Iwi Trust Board. The draft CEA is called *Refining NZ Crude Freight Proposal – Tangata Whenua o Whangarei Te Rerenga Paraoa DRAFT Cultural Effects Assessment* (11 June 2017) and referred in this review in full or as the 'draft *CEA'*. This review also identifies potential measures that could avoid, mitigate or remedy effects identified in the cultural effects assessment and advice to the client regarding further work.

1.3. A draft cultural effects assessment dated 11 June 2017 was provided to the author (Antoine Coffin) around 19 June 2017 along with various discussions and correspondence with other tangata whenua representatives. Antoine Coffin met with the author of the draft CEA on the 23rd June 2017 and a site visit to Urquarts Bay and Marsden Point Oil Refinery was conducted on the same day. This review was conducted in June and July 2017.

1.4. The Refining NZ Crude Shipping project involves partially realigning the Whangarei Harbour access channel to provide safe navigational access for fully loaded "Suezmax" ships, to remove / replace / relocate / add to navigational aids along the new channel alignment, for targeted capital and maintenance dredging to achieve and maintain a minimum, depth to support 16.6m ship draught in the access channel, and to dispose of dredged materials. The project seeks the granting of resource consents for the dredging, disposal, and ancillary activities.

1.5. The draft CEA has been commissioned by Refining NZ and undertaken by Patuharakeke Te Iwi Trust Board on behalf of Nga Kaitiaki/Tangata Whenua o Whangarei Te Rerenga Paraoa as part of the Tangata Whenua engagement process in relation to an application proposal being investigated and prepared by Refining NZ to make modifications to the Whangarei Harbour to allow existing oil tankers to enter the harbour fully loaded. The draft CEA follows an earlier cultural values assessment (CVA) prepared by Te Patuharakeke Te Iwi Trust Board to assist RNZ and its expert consultants identify and assess the effects on the environment.

1.6. Whilst no author is identified in the draft CEA, the author of the report is Julianne Chetham. Ms Chetham is a trustee and secretary of Te Patuharakeke Te Iwi Trust Board and a consultant employed by Te Patuharakeke Te Iwi Trust Board to manage the Resource Management and Customary Fisheries Portfolio's on behalf of the Trust Board.

1.7. Patuharakeke Te Iwi Trust Board has a Memorandum of Understanding with RNZ, and it is understood that Te Patuharakeke Iwi has a close relationship with the Marsden Point Refinery (i.e. the land-based site). It is understood that tangata whenua representatives supported Julianne Chetham preparing the cultural values assessment and the cultural impact assessment.[1]

2. Author

2.1. My name is Antoine Coffin. I am a professional consultant and director of Te Onewa Consultants Limited. I have twenty years' experience in Māori resource management, cultural heritage planning, community engagement and facilitation.

2.2. I have held positions at Ngati Kahu Resource Centre as a planner and researcher, Auckland Regional Council as Team Leader Iwi Relations, New Zealand Historic Places Trust as heritage advisor, University of Auckland as a lecturer, Boffa Miskell as principal, Auckland War Memorial Museum as Maori Partnerships and Business Director and have held more than 20 governance roles in community organisations and iwi rūnanga.

2.3. In 2013, I was awarded NZ Planning Institute's 'Nancy Northcroft Planning Practice Award', the Institute's supreme award for excellence in planning practice for project managing and writing the Ngāti Rangitihi Environmental Management Plan.

2.4. I have worked in a range of roles on major infrastructure and water-related projects in Auckland, Waikato, Wellington, Taranaki and the Bay of Plenty including re-consenting of the Tauranga wastewater network and major interceptor project involving 7 cultural impact assessments; Matauranga Maori Technical Leader for Healthy Rivers Waiora Plan Change; technical advisor to the Rotorua Wastewater Project Cultural Assessment Committee involving 13 iwi representatives; strategic advisor to the applicant in the MV Rena environment court proceedings, my role was to review all cultural evidence and identify the key issues that needed to be addressed. I also presented evidence to the Court focussing on my review of the draft conditions. My evidence recommended a number of changes to clarify and give meaningful expression of cultural matters in the implementation of the consents.

2.5. I currently provide training and professional development in Māori resource management and Māori engagement for staff at New Zealand Transport Agency, members of the New Zealand Planning Institute and a number of iwi and hapu representative groups.

2.6. I am also an independent hearing commissioner specialising in Maori matters of consultation, heritage, cultural values and effects.

[1] Pers. Comment Julian Chetham, 23 June 2017

3. Cultural Impact/Effects Assessment

3.1. A Cultural Impact Assessment or Cultural Effects Assessment is a report documenting Māori cultural values, interests and associations with an area or a resource, and the potential impacts of a proposed activity on these. CIA/CEAs are a tool to facilitate meaningful and effective participation of Māori in impact assessment. Some iwi/hapū use the terms 'Tangata Whenua Impact Assessment', or 'Tangata Whenua Effects Assessment', to describe the impact assessment process and report.[2] The report being reviewed has been termed a Cultural Effects Assessment.

3.2. There is no statutory requirement for applicants or a territorial/regional council to prepare or commission a CEA. However, an assessment of impacts on cultural values and interests can assist both applicants and the council to meet statutory obligations in a number of ways, including:

- preparation of an AEE in accordance with section 882B including matters in schedule 4 of the Resource Management Act 1991 ('the RMA')
- requests for further information under s92 of the RMA in order to assess the consent application
- providing information to assist the council in determining notification status under ss95 to 95F of the RMA
- providing information to enable appropriate consideration of the relevant Part 2 matters when making a decision on a resource consent under s104 of the RMA
- consideration of appropriate conditions of a resource consent under s108 of the RMA.

3.3. CEAs are often prepared to articulate the effects of a proposal or activity and are framed in response to Part 2 matters under the RMA, usually as part of a consent or requirement for a designation process. In particular, CEAs address:

- Recognising and providing for the relationship of tangata whenua with their ancestral lands, waters, forests, wāhi tapu and other taonga
- Having particular regard for Kaitiakitanga
- Having particular regard for historic heritage; and
- Taking into account the principles of the Treaty of Waitangi.

3.4. The draft CEA being reviewed is some 36 pages long and includes appendices. The following comments outline the content of the CEA. An introduction on pages 3 and 4 of the draft CEA provide a short summary of the proposal, an acknowledgement of engagement with Tangata Whenua since 2014 and the production of a cultural values assessment as well as an independent technical review.

3.5. In Section 2 of the draft CEA the report provides a summary of the engagement conducted by RNZ in collaboration with Patuharakeke Iwi Trust Board with a range of

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[2] www.qualityplanning.org.nz (what is a cultural impact assessment)

Tangata Whenua groups. At page 5 the draft CEA describes the four-step engagement and cultural affects assessment road map which was agreed to by Tangata Whenua. Minutes and notes of the various meetings, hui and workshops is included in Appendix 1.

3.6. Section 3 of the draft CEA describes the process followed to complete a cultural values assessment in January 2015. A list of Tangata Whenua of Whangarei Te Rerenga Paraoa (15 groups) is also provided along with the key themes or matters of significance to Tangata Whenua at that time. The draft CEA confirms that technical studies related to mahinga mataitai taonga species and other sites of significance should be commissioned and a Tangata Whenua working party have a continuing role to provide input into the project. The CVA prepared in 2014 also recommended that an independent technical advisor review the studies.

3.7. At Section 4 the draft CEA sets out the RNZ considerations of alternatives.

3.8. At Section 5 the draft CEA gives a very brief summary of the independent technical review and the information that was provided to Tangata Whenua, including five key areas of concern.

3.9. At Section 6 the draft CEA sets out the assessment framework and later identifies relevant provisions of two iwi planning documents. The draft CEA concludes that the RNZ dredging proposal is not consistent with the relevant provisions in those iwi planning documents. With regard to Kaitiakitanga the draft CEA identifies that potential diminishing of the role of kaitiaki is a result of the dredging. Regarding the Treaty of Waitangi principles, the draft CEA focuses on governance of Whangarei Harbour, the legal recognition of customary rights (MACA 2011), commercial and customary fishing rights and iwi future aspirations for commercial development. The draft CEA identifies (not in order of priority) several key areas of concern, these being:

- Historic ecological effects of the North Port development (1998)
- Noise effects and vessel strike of marine mammals
- Potential risk of murky water, lighting and noise effects on Korora (penguins) Oi (petrels)
- Potential sedimentation of benthic invertebrates
- Potential changes to beach profiles
- Erosion destabilisation of Mair Bank as a result of climate change/ sea level rise
- Oil spill risk as a result of more ships
- Advocating a low carbon economy and the relationship with climate change.

3.10. The draft CEA concludes that the potential environmental effects or rather the cumulative environmental effects will contribute to a decline in ecosystem health. Whilst the draft CEA acknowledges that these environmental effects would have a low probability of occurring, the potentially high impact of these potential effects are unacceptable and not supported by Tangata Whenua.

3.11. The draft CEA at pages 28 and 29 identifies three cultural effects, these being,

- temporary effects on the form of Mair Bank, Busby Head and other cultural markers as a result of dredging.
- effects on Mauri articulated as a broad and general ecosystem context with no time dependence.
- the lack of participation of Tangata Whenua in decision making processes and as a consequence a loss of Mana. The CEA concludes that cumulative cultural effects from the past, present and the future are considered at significant adverse effects that cannot be mitigated.

3.12. The draft CEA at pages 29 to 32 sets out the social and economic effects of the proposal. The social effects appear to be focused on noise effects of the dredging and the industrialisation of the Whangarei Harbour and the consequential impacts on harvesting kai. With regard to economic effects the CEA questions the economic benefit of the existing plant (Maori staff and management) and the limited life span of the refinery. The draft CEA also raises the concern regarding re-mediation costs of the site post closure. The draft CEA takes a view that the proposal will constrain and have a negative impact on current pipi and cockle bio-mass and the opportunity for commercial fishing and aquaculture. The draft CEA concludes that any positive social and economic effects are negligible and that effects on mahinga kai and future commercial fishing/ aquaculture would be potentially adverse.

3.13. At Section 6 of the draft CEA under the heading 'Measure to Avoid, Remedy or Mitigate' the report confirms that potential mitigation measures were briefly discussed at a 12 May 2017 hui and that the consensus of the participants considered the proposal to have unacceptable adverse effects and the effects could not be mitigated. The CEA states "mitigation measures have not been recommended in this CIA report and Tangata Whenua seek that proposal in its entirety be avoided, i.e should not proceed".

3.14. The last section of the draft CEA on page 33 includes three recommendations to the applicant and consent authority. The first of these related to the report being received and considered; the second recommendation encourages RNZ to continue dialogue with Tangata Whenua on all aspects of the application and the third recommendation that RNZ work with Tangata Whenua on the restoration of mahinga kai and customary resources.

4. General Observations

4.1. I have sighted a significant body of technical work that has been conducted to support the applications for resource consent. This work appears to identify in whole or part the physical effects identified by tangata whenua; these being, ecology (marine mammals, birds, benthic fauna), coastal processes, climate change (sea level rise), and oil spill risk.[3] It appears that some of this work has been commissioned in response to concerns from tangata whenua.

4.2. The commissioning of both a cultural values assessment and a cultural effects assessment, supported by several years of meaningful consultation is a solid foundation for identifying and addressing concerns and effects identified by tangata whenua. It is understood that the draft CEA has been developed in consultation with tangata whenua, written by a person of their choosing, with assistance / input from technical experts of tangata whenua choosing and will shortly be formally endorsed by tangata whenua. The independent technical review prepared by Newell and Nuttall sets out further matters that should be considered by tangata whenua. A comprehensive response to the concerns and issues was prepared by Refining NZ, however, this does not appear to have been reflected or included in the draft CEA.

4.3. There appears to be a positive relationship between RNZ (the applicant) and tangata whenua representatives. This is evidenced by well-attended meetings, the longevity of consultation, the commissioning and production of both a cultural values assessment and a cultural effects assessment and the existing MoU. A good relationship with tangata whenua is often challenging to establish and maintain. It is suggested that a balancing act needs to be performed that fine tunes technical support to the applications and addresses the concerns and aspirations of tangata whenua.

4.4. There appears to be an obvious opportunity to formalise the working relationship with the establishment of a kaitiaki group made up of appropriate representatives and technical expertise to manage and give advice to the implementation of the consents including conditions. This is a matter that can be imposed by a decision-maker, however, it is preferable to have something already scoped and agreed to by all or most parties before a hearing. The development of a draft terms of reference may be a place to start as well as commissioning some work identifying and assessing the feasibility of using existing forums or committees.

4.5. The applicant should turn some attention now to addressing the 'concerns' of tangata whenua. As mentioned above significant technical expertise and assessment has been commissioned. I believe in this instance there can be a discrete but important difference between the <u>concerns</u> of tangata whenua and the <u>effects</u> of the proposal including those identified by tangata whenua. An effect as you know can include the actual and potential positive or adverse, temporary or permanent, past, present or future; and cumulative **effects on the environment** or **change as a result or consequence of an action**, in this case the proposal. A concern is a cause of anxiety, worry or a matter of interest or

[3] Draft Cultural Effects Assessment. 2017. pp21-27

importance to someone.[4] In this context the concerns and anxiety of tangata whenua can include the:

- Concern for the impact on natural processes
- Strong concerns about traditional kai and taonga species (stingray and penguin)
- ..risks of oil spill…This is a serious concern…
- Generations of harvesting kai but today concern for making sure there are safe and healthy pipi for future generations
- Being involved in a meaningful way in expressing kaitiakitanga.

5. Consultation with tangata whenua

5.1. Whilst there is no duty to consult on resource consent applications, it is good practise to consult with tangata whenua to identify any relevant RMA matters that should be considered and accounted for in the preparation of the applications.

5.2. A summary record of consultation will be important for the hearings panel to account for the various parties involved and who has or hasn't submitted. This could be included in the CEA or in the applicant's evidence. Furthermore, the panel will likely want to know from the applicant that iwi/cultural concerns have been well canvassed and addressed in some part in the application. I will comment on this later in my report.

5.3. It is understood that consultation for this proposal was initiated in October 2013 and has been undertaken with a wide range of groups and the public generally since that time, and continues at the present. My assessment of the application documents and cultural impact assessment suggests that some 10 meetings/hui have been conducted over a 4 year period. Meetings appear to have been well-attended by tangata whenua representatives and supported by senior RNZ representatives and technical experts. Consultation draft reports were provided to tangata whenua ahead of their release to the public and independent technical reviewers of tangata whenua choosing were commissioned to read/interpret those reports. As I have mentioned earlier, the commissioning of a CVA and a CEA together with the large body of technical work illustrates the commitment of the applicant to understand and acknowledge the concerns of tangata whenua.

5.4. The draft cultural effects assessment sets out 5 separate lists of tangata whenua of Whangarei Te Rerenga Paraoa. These are set out in:

- Page 4 - section 2 (paragraph 2)
- Page 8 - section 3 (paragraph 3)
- Appendix 1 – Request for Iwi Contacts from NRC, prepared by Rachel Ropiha
- Appendix 1 – meeting held 15 August 2014
- Appendix 2 – CVA, section 5 (paragraph 3).

[4] Oxford Dictionary.

5.5. On the face of it, these lists appear to be slightly different and the draft CEA does not articulate why they are different. It is likely that the tangata whenua groups are dynamic and known by a range of names and the list reflects this, and also, the tangata whenua group and its representative body may have different names. These matters should be clarified. A simple table may assist, either included in the CEA or in evidence provided to the hearing. This table would include the tangata whenua group, its type of interest or relationship with Whangarei Te Rerenga Paraoa, the representative body(s) and whether they have taken part in the CEA/consultation.

5.6. The draft CEA does not presently articulate the discrete and special relationships of each group with Te Rerenga Paraoa, rather it provides a 'sum' of the issues, concerns and opportunities. These comments are not a criticism per se, rather an observation. The cultural effects assessment could be enhanced by describing the relationships of the various groups in more detail (if they want to), thus giving weight to the values, concerns and effects articulated later in the draft CEA.

6. Specific Comments

6.1. This section sets out my comments regarding specific matters in the draft CEA not already covered above.

Iwi Management Plans

6.2. The draft CEA identifies two relevant iwi management plans; the Patuharakeke Hapu Environmental Management Plan 2014 and the Te Iwi o Ngatiwai Iwi Environmental Policy Document 2015. The conclusions of the draft CEA on page 18, state that the application is inconsistent with the iwi management plans. This does not appear to be supported by a thorough assessment of each provision in the plans. It could well be that some provisions are not relevant, some are inconsistent, some are consistent and others are uncertain.

6.3. For the purposes of a notification for requirement at Waikeria Prison the following assessment included in the cultural impact assessment was used by Antoine Coffin for assessing each provision of three iwi management plans. A similar approach would be appropriate for this application before making a conclusion that the application is inconsistent with the iwi management plans. Furthermore, there should be a recommended response or action that would address the issue or opportunity.

Extracted from Cultural Impact Assessment for Waikeria Prison, 2017[5]

[5] Coffin, Antoine. Cultural Impact Assessment of the Proposed Waikeria Prison Expansion, March 2017, Pg 75.

Subject	Ref	Page	Issue, Opportunity or statement	Current Response / Action	Future/Proposed Response / Action
Interconnectedness	M22	57	Collaborate with RCT on identifying internship and training program opportunities at all levels	Meeting with RCT on 7 December 2016	Keep RCT updated with NoR and Regional Consent progress (ongoing communication) Work with RCT to identify opportunities for RCT to be involved in training programs that are run for prisoners

Key Concerns

6.4. Much of the draft CEA is devoted to articulating the concerns of tangata whenua. Throughout the draft CEA relevant quotes from the hui/meetings are added to emphasise the importance and sincerity of their concerns. Many of the concerns identified in the draft CEA are broad, general and contextual. The draft CEA in my view blurs the line between concerns and effects. This does not appear to be intentional, however, makes addressing both concerns and effects in the application challenging.

6.5. These concerns include:

6.5.1. Maintaining tangata whenua relationships with Whangarei Te Rerenga Paraoa;

6.5.2. Providing for meaningful participation in decision-making;

6.5.3. The protection and enhancement of mahinga kai (pipi, tuangi);

6.5.4. Concern for birds, fish, shellfish, marine mammals and the ecosystem;

6.5.5. Issues related to major infrastructure and industrialisation of the harbour and land-use past, present and future;

6.5.6. Risk of oil spill;

6.5.7. Climatic changes;

6.5.8. Protecting the potential for realising commercial fishing/aquaculture;

6.5.9. Economic benefits of the refinery among local Maori; and

6.5.10. Protection and enhancement of the harbour generally.

6.6. An exercise should be undertaken to <u>correlate the specific responses of the application to the above concerns </u>and should be the topic of ongoing discussions with tangata whenua.

Key Effects

6.7. The draft CEA has identified a small number of environmental, social/economic and cultural effects. These are:

- Kaitiakitanga - The enduring, systematic and systemic loss of knowledge that has occurred post colonisation and may continue to be affected as a result of the proposal, through loss of access to sites and mahinga kai, loss of original placenames, reduced abundance of mahinga kai[6]
- Treaty of Waitangi - The potential impact on tangata whenua customary and commercial rights and interests now and in the future[7]
- Ecological – the potential effects of marine mammal collision and entanglement with dredging operation[8]
- Ecological – cumulative significant effects of turbidity, lighting and noise effects of dredging on Mair Bank and Reotahi Bay shorebirds[9]
- Ecological – loss of benthic Fauna within dredging footprint[10]
- Coastal processes – secondary effects of shoreline erosion as a result of higher intensity storm events and surges (caused by climate change)[11]
- Oil spill risk[12]
- Climate change – cumulative effects of climate change on coastal processes, geomorphology, and extreme weather events[13]
- Mauri – removal of sand out of the system, loss of benthic community, sediment plumes, any impacts on whales[14]
- Mana – constraints on participation in decision-making, past, present and future[15]
- Socio-economic effects – noise, loss of amenity, industrialisation of harbour[16]
- Socio-economic effects – no positive effects for local community, future remediation costs, dredge footprint and loss of pipi and cockle, constraints on commercial and future aquaculture opportunities.[17]

6.8. My area of expertise is in the assessment of cultural effects. I turn my attention to those matters of a Maori cultural nature; Kaitiakitanga, Treaty of Waitangi, Mauri, and Mana.

6.9. As noted above under Key Effects, the draft CEA identifies a loss of knowledge may continue as a result of the loss of access to sites and mahinga kai, loss of original placenames, reduced abundance of mahinga kai. The draft CEA does not spell out the

[6] CEA. pp18-19
[7] CEA. pp19-21
[8] CEA. p22
[9] CEA. p23
[10] CEA. pp24-25
[11] CEA. pp25-26
[12] CEA. pp26-27
[13] CEA. p27
[14] CEA. p28
[15] CEA. p29
[16] CEA. p29-30
[17] CEA. p31

extent to which this may occur and the length of time (if relevant) this would apply. It is presumed that there may be some restrictions of access during dredging operations and if dredging occurs on pipi and cockle beds there would a loss of abundance at those places. Dredging is a temporary activity and only applicable to the area being dredged. It is unclear if tangata whenua access the areas to be dredged, the frequency of visits and to what degree access and loss of mahinga kai may be experienced. This would assist in determining the degree of effects on Kaitiakitanga. On the face of it this has the potential to be a minor to moderate effect of a temporary nature. Kaitiakitanga can be enhanced by ensuring tangata whenua appointed representatives are provided with a role to participate in the implementation of consents and having a role in projects and activities that will enhance environmental outcomes.

6.10. The draft CEA identifies an effect on Treaty rights, viz a viz, commercial rights and interests now and in the future. The draft CEA has identified tangata whenua rights in fishing quota as well as aquaculture space as an issue. Fishing quota can be sought from a fishing management area that includes a very large area of the coastline. Inshore and deepsea fish quota is unlikely to be affected. The draft CEA suggests there may be local impacts on commercial species of shellfish, crabs, crayfish and other crustaceans that are commercially harvested within the dredging and spoil area. The effects on crabs, scallops, and other mobile species are wide spread and distributed. Any effects are expected to be negligible. The Treaty of Waitangi Settlement Aquaculture rights of Mandated Iwi Organisations can be realised for <u>new</u> aquaculture space. These Aquaculture rights are likely to be exercised in large scale operations land-based or at coastal locations some distance from Port and shipping facilities and recreational boating activities. There do not appear to be any identified at the present time. These potential effects are regarded as less than minor.

6.11. The draft CEA identified effects as a result of the removal of sand out of the system, loss of benthic community, sediment plumes, any impacts on whales. These are described as effects on mauri. The matter of mauri is a rather personal and perceptive concept. It means many things to many people. Specific species and groups of those species can be a representation of the mauri of a place, their presence giving sense to the life essence of a place. Mauri can also be considered an overall value of a place and its resources, its life-giving qualities as a whole rather than its constituent parts. The concept that mauri is tapu, and tapu is mauri denotes the spiritual or unseen forces of mauri. These mauri can be attributed to the Atua - realms of the environment and imbued in physical objects. Whatever the view of mauri is in this case, it is one of the most important principles to Maori. I am of the opinion that the matter of mauri could be explored and interrogated more in the context of the draft CEA. For that reason, I believe the draft CEA is not determinative on discussion and assessment of effects on mauri as a result of the proposal. The matters of removing sand out of the system, loss of benthic community, sediment plumes and any impact on whales as they relate to mauri are important and more discussion in the CEA may better support their conclusions.

6.12. The draft CEA identified effects on Mana through constraints on participation in decision-making, past, present and future. Refining NZ has actively sought to include tangata whenua throughout scoping and refining its proposal and in doing so has exceeded the requirements of the current RMA legislation. The applicant has agreed to and resourced the production of cultural and technical inputs into the application process, however, the applicant has no mandate or control over past and future legislative provisions on Maori input into the decision-making process. The engagement undertaken to date with tangata whenua is in my opinion appropriate, meaningful and conducted in good faith.

6.13. I am of the view that the social, economic, and environmental effects have been addressed in the technical reports for the most part. Some of these 'effects' could be regarded as concerns or issues. Nonetheless, an exercise should be undertaken to correlate the specific responses in technical reports and the AEE to the effects identified in the draft CEA.

Independent Technical Review

6.14. As already mentioned an Independent Technical Review was undertaken by Alison Newell (Ecologist) and Dr Peter Nuttall of University of South Pacific. This was recommended by the tangata whenua working party due to the large number and complexity of background and AEE reports. The independent review is attached to the draft CEA. The CEA draws on many of the comments of the independent review and includes these as concerns and effects in the body of the report.

6.15. The Newell and Nuttall independent technical review report identifies five areas of concern. These are:

- The economic analysis provided by NZIER, including the overall viability of the refinery in the long term.
- Related to this is the relationship of the proposed application within the context of climate change and New Zealand's current and future policy over the lifetime of the consents sought.
- **The overall health of the harbour and the role of Refining NZ as a key stakeholder.**
- **The practical implementation of the responsibility of kaitiakitanga by Patuharakeke in relation to the harbour**.
- The potential impacts of dredging, including disposal of dredgings.[18]

6.16. Refining NZ responded to the technical review in a comprehensive and detailed manner in April 2017. The response acknowledged the concern that hapu and iwi have for the overall health of the harbour and supported the important role of Tangata Whenua in the

[18] Alison Newell and Dr Peter Nuttall. Hui Outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping project. April 2017. p1

harbour and surrounds.[19] The Refining NZ response set out the undertaking and efforts to keep Tangata Whenua informed, involved and resourced opportunities to input. At page 9, Refining NZ confirms their willingness to discuss practical and technical application of Kaitiakitanga. The responses to these matters from Refining NZ have not been included in the draft CEA. This matter could be rectified easily by including the Refining NZ response in the appendix following the independent review and/or summarising the responses in section 5 of the CEA.

Conclusions / Recommendations

6.17. There is a contrast between the body content of the draft CEA and its conclusions. The conclusions appear to be absolute but often do not have factual or evidence to support an actual effect. The conclusions appear to signal strong opposition to the proposal and a decision sought to decline the application. This conclusion is made in the absence of any proposed or suggested mitigation measures. For example, on page 29, a quote from a meeting held on 29 May 2017;

> Does the project allow us to provide for the cultural and spiritual protection of the harbour?: the resounding answer was "no"…
>
> …These cumulative effects span the past, present and future and are considered significant adverse effects that cannot be mitigated. As such they should be avoided.

6.18. This opposition could reflect either an iwi consensus view of the application at the time of the hui, which favours the loudest and most ardent opposition, or a holding position until the next phase of the process; this being, submission and pre-hearing. The recommendations on page 33 relating to ongoing dialogue and working together would support this view that mitigation and agreements are the topic of the next phase of engagement.

6.19. The recommendations on page 33 of the draft CEA appear to be out of step with the strong opposition in the conclusions of the report. The recommendations request that the report be received and considered. The draft CEA goes on to recommend ongoing dialogue on all aspects of the application, including face to face reports to marae communities, and regardless of application work together on restoration of the mauri of Whangarei Te Rerenga Paraoa. It is unclear whether, as I have suggested above, this is a holding position or a reflection of different voices in the draft CEA.

7. Potential measures to avoid, mitigate or remedy effects

[19] Refining NZ response to "Hui Outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project", April 2017. pp8-9

7.1. This section sets out the types of measures that could be employed in this project.

7.2. As mentioned earlier, the draft CEA does not provide any measures to mitigate or remedy effects, rather states that the proposal should be avoided in its entirety. It is understood that there may be an appetite among tangata whenua to discuss and establish a range of measures that could enhance the environment, provide positive effects and give tangata whenua confidence that the project could be acceptable.

7.3. In New Zealand there is now a range of common measures that are used to recognise and provide for relevant Part 2 matters to Maori and address issues of concern to Maori. Notwithstanding a proposal will be modified during its development in consultation with tangata whenua to respond to concerns, the following is a supplementary list of methods. These include the establishment of management and technical forums, investment in environmental enhancement programmes and projects (offset mitigation), research on understanding natural processes and consequences/effects of development, implementation and monitoring plans that include tangata whenua participation and input, and periodic reviews of latest technology and techniques.

7.4. I have included below a series of examples and included thoughts on whether these may be applicable to the Refining NZ Crude Shipping Project.

7.4.1. A **Kaitiaki/tangata whenua forum** is a matter that has been raised by tangata whenua in the CEA and during consultation. It is understood that there may be at least one existing Kaitiaki Group conducting projects or programmes of enhancing the general well-being of the harbour environment and undertaking or commissioning of research.[20] A kaitiaki group of some form to provide advice on matters of tikanga, have input into various management plans and the implementation of conditions of consent, recommending environmental enhancement projects would go some way to ensuring meaningful participation of iwi in the outcomes of decision-making including an ongoing role in projects that enhance the natural harbour environment. In projects where there are a number of tangata whenua groups, a Kaitiaki Forum has an advantage of providing for a one-stop place to engage for a specific reason. It is suggested that a Kaitiaki Forum would be appropriate for the Crude Shipping Project to serve as a conduit for information relating to the monitoring of the consents, a forum to seek advice on matters of tikanga and kawa, and facilitate/oversee enhancement projects. The purpose and role of the Kaitiaki Group should be developed, perhaps as part of a draft terms of reference. The representatives of the group should be progressed once the purpose and role have been confirmed but it is likely that an extension of the existing tangata whenua working group would be a good place to start.

[20] Whangarei Harbour Kaitiaki Roopu mentioned at 5.2.7 of the CVA

7.4.2. **Technical advisory groups** exist for a range of wastewater treatment projects and large infrastructure projects around the country and usually have roles and responsibilities related to the pre-application consideration of options and alternatives, and then sometimes post-application implementation of conditions related to preparing management plans and reviewing technical information. Some technical advisory groups have matauranga Maori expertise and provide for a role of tangata whenua in the selection of technical people. The technical expertise is related to the matters of relevance to the consent. For activities in a coastal environment such as Whangarei Harbour with high levels of interest of tangata whenua I would expect a technical advisory group to include a Matauranga Maori expert. A technical advisory group could provide independent technical support for a Kaitiaki Forum and/or the consent holder in the implementation of consents. I do not have a strong view on whether there should be a technical advisory group with Matauranga Maori expertise, post-consent. My recommendation is that suitable expertise can be sought as and when required during implementation of the consent.

7.4.3. Programmes and/or projects that enhance the environment and the relationship of tangata whenua with sites and water can address or offset effects of an activity. Some projects being implemented elsewhere in New Zealand include seeding shellfish, riparian planting, weed and pest control, assisting breeding of key species, repairing existing or construction of new access, establishment of artworks and memorials, oral research projects that focus on tikanga and kawa, sand replenishment, interpretation (signage, displays, banners), etc. These projects are normally identified by tangata whenua and agreed to as part of the development of the application or during the submission and hearing process. Leaving the provision of programmes and projects to the imposition of a hearing panel is not considered good practise. As already mentioned the draft CEA does not identify appropriate enhancement programmes, however, it would be suggested that any such programmes should have an obvious and direct relationship with the Whangarei harbour and immediate surrounds. Refining NZ has some experience in this area as over the last 18 months Te Patuharakeke Trust Board members have been actively engaged in environmental monitoring at the refinery, relating to the restoration of a sand dune on the refinery boundary, and dredging activity at a dolphin (mooring aid) adjacent to the refinery jetties. The applicant has also sought advice on appropriate mitigation measures and ecological enhancement activities. These include support of existing catchment management projects, establishing a Stream care Group, fencing native bird habitat at Blacksmith’s Creek, interpretation, riparian planting, seagrass planting, doubling penguin nest boxes numbers and the like.

7.4.4. Research is often put up as a mitigation measure but seldom delivers or responds to the original concern raised by tangata whenua. Large sums of money and time have been spent on desktop research and modelling that delivers little in increasing and sharing knowledge, answering community questions and is often self-perpetuating e.g.

research that recommends more research. For this application, it is suggested that local community participatory science research will be appropriate where building capability and capacity locally among community is a priority.

7.4.5. Monitoring plan(s) – Many projects around New Zealand involve tangata whenua in the preparation of monitoring plans, overseeing their implementation and in some instances conducting the monitoring. In the case of the MV Rena wreck, Maori expert divers were used to monitor the health of the wreck and Astrolabe Reef. In the case of the Auckland Harbour channel dredging an Iwi representative was on board the barge during daylight hours overseeing the digger and application of GIS tracking. In this project I would recommend that tangata whenua be given an opportunity to have input into monitoring plans and potentially have a role in their implementation.

7.4.6. Periodic review of new technology and techniques. Some consent conditions, particularly those related to wastewater treatment have review clauses for periodic review of international literature on technology and process advances. It is not clear what may be applicable in this project but there may be some merit in investigating this further. For example this could apply to the on-going maintenance dredging.

7.4.7. Environmental enhancement packages and mitigation. Various applications around New Zealand have involved the implementation of mitigation measures and enhancement packages. Each project has its own merits, capital and operational costs and benefits, varying degrees of tangata whenua involvement, priority and interest, and the relationships between applicant and tangata whenua can have a vastly different influence on mitigation. In my experience, there is some difficulty in providing a consistent scale of costs that might apply mitigation packages from one project to another. In saying that, an appropriate level of mitigation and enhancement packages should be consistent to the scale of the projects and its effects. In this instance, the Refining NZ Crude Shipping project should have some measure of mitigation/enhancement package that is of a scale that has a measurable and direct positive benefit and is reasonable and in scale to the proposal. The package could comprise:

- The establishment and maintenance of a Kaitiaki/tangata whenua forum;
- The establishment of a technical advisory group;
- local community participatory science research projects;
- risk mitigation activities;
- environmental enhancement projects that could include seeding shellfish, riparian planting, repairing existing or construction of new access, establishment of artworks and memorials, oral research projects that focus on tikanga and kawa, sand replenishment, interpretation;
- ecological mitigation projects; and/or
- programmes identified in discussions with tangata whenua.

8. Overview

8.1. I have considered the cultural effects and concerns of tangata whenua that have been raised in the CEA as these relate to the Refining NZ Crude Shipping Project resource consent applications. I have also considered how the proposal sits with Part 2 of the RMA.

8.2. I am of the opinion that measures can be developed in consultation and agreed with tangata whenua that will ensure that any adverse cultural effects (including cumulative cultural effects) are appropriately avoided, remedied and mitigated. I have set out at section 7 of this review the types of measures that may be appropriate.

8.3. The cultural well-being of tangata whenua as it relates to Whangarei Te Rerenga Paraoa has been well articulated in the cultural values assessment and emphasised during consultation. The application has been developed to minimise as far as possible the dredging requirements balance this with the needs of foreseeable generations. A range of measures can be applied to avoid, remedy and mitigate any adverse effects on the environment.

8.4. The application affects an important part of the ancestral landscape, water and sites, namely, Whangarei Te Rerenga Paraoa. These important matters are identified and understood by the applicant through consultation, the CVA, CEA and independent technical review. The applicant has taken time and resources to respond in a proactive and constructive manner to recognise and provide for these matters.

8.5. The application does not affect any known or identified wahi tapu as such, however, important mahinga kai or harvesting areas are potentially affected. The concern of tangata whenua is acknowledged and further work is undertaken to understand and response accordingly to the many influences on mahinga kai.

8.6. The applicant is aware of aquaculture and fisheries rights held by Iwi, and that in the future there may be further customary rights and interests that may be protected in the coastal area.

8.7. The proposal will give particular regard to kaitiakitanga by continuing to engage with tangata whenua representation to ensure Kaitiaki responsibilities are being discharged appropriately. The proposal can include meaningful participation of tangata whenua in the implementation of the project and the measures that I have set out at section 7.

8.8. I am of the opinion that the relevant principles of the Treaty of Waitangi in this project are; the duty to act in good faith, duty to make informed decision through consultation and the principle of mutual benefit. The proposal has involved consultation with tangata whenua since 2013, the development of the proposal as I understand has been modified as a result of that consultation. Considerable work has been commissioned to respond to matters raised by tangata whenua and their has been a two-way flow of information. The principle of mutual benefit is yet to be realised but could be through the application of a number of methods and measures that will ensure tangata whenua participation in the development of, oversight, and implementation of measures that will benefit the harbour as a whole.

8.9. The applicant has commissioned a cultural values assessment early in the development of the applications, has conducted consultation with a broad number of tangata whenua groups over several years and in a way recommended by tangata whenua. A draft cultural effects assessment has been commissioned and it reflects both the journey of engagement and the views of tangata whenua. This provides a good framework for both tangata whenua and the applicant RNZ to move forward and have further discussions regarding a range of measures that would make the proposal acceptable. I have concluded that the cultural effects and concerns can be appropriately and effectively addressed if the parties continue to work proactively together, and as such I am confident that the relevant Part 2 matters can be accounted for.

9. Further work that could be done

9.1. There is an opportunity to formalise the working relationship with the establishment of a kaitiaki group made up of appropriate representatives and technical expertise. The development of draft terms of reference may be a place to start as well as commissioning some work identifying and assessing the feasibility of using existing forums or committees.

9.2. I have earlier in this review recommended an exercise that correlates technical reports and AEE to the range of 'concerns' and 'effects' identified in the draft CEA and technical review.

9.3. Section 5 of the draft CEA gives a very brief summary of the independent technical review including five key areas of concern. These can be found at page 1 of the Newell and Nuttall report under the heading 'Overview'. A detailed and comprehensive response from RNZ has been prepared and given to the tangata whenua working party regarding those concerns. This response should be included in the CEA or included in evidence for the hearing.

9.4. The adoption or endorsement of the draft CEA by the various tangata whenua groups is an important milestone for the application. This both confirms the process of engagement undertaken by the applicant and articulates the matters of concern. It is understood that the author wishes to finalise the CEA as soon as possible; thus, completing a long process started in 2013. The draft CEA conclusions strongly oppose the application. Whilst this is not unusual of cultural impact assessments prepared by tangata whenua in NZ, it can seem quite daunting and off-putting in the context of long and intense engagement.

There is a small window of opportunity to have some matters clarified, important gaps filled and content corrected if necessary before the draft CEA is finalised.

9.5. Matters that can be addressed 'in' the draft CEA are as follows:

9.5.1. The addition of the CEA author would be helpful. An author gives the CEA further legitimacy.

9.5.2. The CEA does not presently include a narrative of previous responses to harbour developments. This might be helpful to illustrate the participation (or lack of), in decision-making regarding Whangarei Te Rerenga Paraoa.

9.5.3. There are some 5 lists of tangata whenua groups throughout the draft CEA and its appendices. It would be helpful to have a table of tangata whenua that sets out the; name of the tangata whenua group; the representative body(s) for that group; the key representatives; the nature of their relationship with the application area; and whether the representative body/reps have been involved in the engagement process and CEA, and if not, reasons why.

9.5.4. An assessment of the provisions of the two iwi management plans could be undertaken either as part of the CEA, as part of a peer review of the AEE, or as part of evidence presented at the hearing.

9.5.5. The responses from the various RNZ expert consultants and the response to the Independent technical review could be included or recorded in the CEA.

9.5.6. The concept of mauri has not in my opinion received much discussion within the context of the draft CEA. Mauri is a very important Maori principle and should be afforded some further consideration to assist interpreting the potential effects on mauri and how they may be avoided, mitigated or remediated.

9.5.7. The conclusions of the draft CEA reflect a strong opposition to the proposal whilst the recommendations suggest that matters can be worked through. The subtleties of opposition, neutrality and support are not canvassed in the draft CEA. Clarification should be sought regarding the appetite of tangata whenua to work with RNZ to identify appropriate package of environmental enhancement programmes.

END

Annexure Three: Key Resource Consents granted by Northland Regional Council for the operation of:

a) Refining NZ
b) NorthPort Limited
c) Marsden Cove Limited
d) NIWA
e) Whangarei District Council
f) Department of Conservation

1.1 Refining NZ's Existing Resource Consents

The continued existence, maintenance and operation of the RNZ's existing operations are governed by a suite of existing resource consents that have been granted by both the District and the Regional Council's. As the Proposal only seeks to undertake works within the CMA, being an area governed by the Regional Council Plans, we have endeavoured to only set out the existing environment as it relates to the CMA.

The full suite of Regional Council resource consents is contained in **Table 1** below, with the following providing a summary of the key consents granted by the Regional Council required for the current operations of the Refinery. It is considered that the Company's existing resource consents can be broadly split into two activities that are of relevance to the Proposal, as follows:

1. Consents authorising discharges from the Refinery into Whangarei Harbour; and
2. Consents authorising the use and maintenance of structures in Whangarei Harbour.

1.1.1 RNZ Consents authorising discharges from the Refinery into the Whangarei Harbour

Those consents held by Refining NZ to authorise discharges from the Refinery into the Whangarei Harbour include consents; AUT.008319.01.03, CON20080831913 13, AUT.008319.14.01 and AUT.008319.16.01.

The maximum discharges under AUT.008319.01.03 include; up to 8000m^3 per 'dry weather discharge' day of treated processed wastewater and groundwater, and 8,400m^3 per day of ballast water. In addition, this consent allows the intermittent discharge of stormwater, combined with the treated process wastewater, groundwater and ballast water, up to a total discharge flow of not more than 2,000m^3 per hour. Consent CON20080831913 13 is only exercised when water overtops the Refining NZ Stormwater Basin. AUT.008319.14.01 authorises a stormwater outlet pipe to discharge stormwater within the CMA and to use and occupy space in the CMA. The discharge through this outlet should only occur due to the overtopping of the Stormwater Basin. The total quantity of stormwater discharged from the outlet together with consent CON20050831902 shall not exceed 3,200m^3 per hour. In addition to the above discharges, AUT.008319.16.01, authorises the discharge of stormwater, groundwater, ballast water and process wastewater into the Whangarei Harbour via an overflow spillway from the stormwater basin. This consent is only exercised during an extreme rain event once all other authorised discharges from the stormwater basin are being exercised to their maximum capacity.

1.1.2 RNZ Consents authorising structures within the Whangarei Harbour

Those consents held by RNZ to authorise structures, their use, and maintenance within the Whangarei Harbour include consents AUT.008319.17.01, AUT.008319.06.01, AUT.006372.01.01, AUT.008319.07.01 and AUT.008319.12.02.

Consent AUT.008319.17.01 authorises RNZ's overflow spillway structure which occupies the CMA. This consent requires the consent holder to keep the CMA within 100m of the overflow spillway structure free of debris. The consent holder is to notify the Regional Council a day before maintenance or repair work is to be undertaken, and repairs/maintenance should only occur between the hours 0700 to 1900 Monday to Saturday. Consent AUT.008319.06.01 authorises the occupation and use of the CMA for the Refinery wharf and associated structures, including toilets and sewerage holding tanks, fire pump diesel tanks, slops tanks, dolphins and breastings and a wastewater diffuser outfall structure.

Consent AUT.006372.01.01 allows the use of a concrete Boat Ramp at Marsden Point, while consent AUT.008319.07.01 authorises the use of the Refining NZ tug berth jetty and associated gangway and protective piles. Lastly, consent AUT.008319.12.02 authorises the use of the Company's barge jetty.

Consent Number	Summary	Expiration Date
AUT.008319.01.03	Stormwater outlet pipe for emergency discharge at Marsden Point Refinery	31st of May 2022
AUT.008319.02.02	To discharge contaminants into the air from all site activities at the Refinery	31st of May 2022
AUT.008319.03.01	To discharge uncontaminated seawater from the Refinery fire-fighting water supply to Whangarei Harbour	31st of May 2022
AUT.008319.04.01	To discharge contaminants to ground as a result of activities associated with the normal operations of the Refinery	31st of May 2022
AUT.008319.05.01	To take groundwater from bores, in the catchments of Whangarei Harbour and Bream Bay for water table depression purposes and supply of refining processes on that property	31st of May 2022
AUT.008319.06.01	To occupy and use the CMA with the Refinery wharf and associated structures, including toilets and sewerage holding tanks, fire pump diesel tanks, slops tanks, dolphins and breastings and a wastewater diffuser outfall structure	31st of May 2022
CON20060831911	To discharge contaminants into the air from dry abrasive blasting and spray painting operations conducted at Marsden Point	31st of May 2022
CON20080831913 13	To discharge stormwater within the CMA	31st of May 2022
CON20080831913 14	To use and occupy space in the CMA with a stormwater outlet pipe	31st of May 2022
AUT.008319.16.01	To discharge stormwater, groundwater, ballast water and process wastewater into Whangarei Harbour via an overflow spillway, from the stormwater basin.	31st of May 2022
AUT.008319.17.01	To use and occupy the costal marine area with part of a stormwater basin overflow spillway structure	31st of May 2022
AUT.008319.18.01	To disturb the foreshore and CMA during maintenance and repair of a stormwater basin overflow spillway structure.	31st of May 2022
AUT.008319.19.01	To erect and place a stormwater basin spillway within the CMA and associated disturbance of the seabed	31st of May 2018
AUT.008319.20.01	To discharge treated stormwater from the construction area into the CMA during construction of a stormwater basin spillway	31st of May 2018
AUT.008319.21.01	To discharge contaminants into air, namely dust, associated with construction of a stormwater basin spillway within the CMA.	31st of May 2018
AUT.008319.22.01	To divert stormwater around and away from a construction area during construction of a stormwater basin spillway	31st of May 2018
AUT.008319.23.01	To divert stormwater during construction activities, within the Riparian Management Zone	31st of May 2018
AUT.008319.24.01	To dewater groundwater from a construction area during construction activities	31st of May 2018
AUT.008319.25.01	To discharge treated stormwater to land from a construction area during land disturbance activities	31st of May 2018
AUT.008319.26.01	To clear vegetation within the Riparian Management Zone during construction activities	31st of May 2018
AUT.008319.27.01	To undertake earthworks within the Riparian Management Zone during construction activities	31st of May 2018
AUT.006372.01.01	Use and occupy a boat ramp	31st of May 2022
AUT.008319.12.02	Fuel barge extension to "Product Jetty" at Marsden Point, Whangarei	31st of May 2022
AUT.008319.14.01	Stormwater outlet pipe for emergency discharge at Marsden Point Refinery Jetty	31st of May 2022
AUT.008319.07.01	Occupation of the CMA for tug berth jetty and associated gangway and protective piles at Marsden Point	31st of May 2022

Table 1: Existing Resource Consents held by Refining NZ

1.2 Resource Consents Held by NorthPort Limited

The following summarises the key resource consents (but not all) granted by the Regional Council for the operation of the NorthPort facilities adjacent to the Refinery. The full suite of Regional Council resource consents is contained in **Table 2**. It is considered that NorthPort's existing resource consents can be broadly split into three activities that are of relevance to the Proposal, as follows:

1. Consents authorising dredging within the CMA;
2. Consents authorising the use and maintenance of structures in the CMA; and
3. Consents authorising discharges to the CMA.

1.2.1 NorthPort Consents authorising dredging within the CMA

Those consents held by NorthPort to authorise dredging and reclamation in the CMA include consents AUT.005055.04.01, AUT.005055.23.01, AUT.005055.26.01 and AUT.011809.01.01.

Consent AUT.005055.04.01 provides NorthPort with a coastal permit for the port operations, including commercial vessels and other vessels berthed at port wharves, jetties and barge berths. This consent includes the reclamation of 32ha of foreshore, which includes the deposition of dredged material, disturbance to foreshore and seabed, and building of retaining walls (including any diversion of seawater as a consequence of these works) on the foreshore and seabed of Whangarei Harbour. This consent also authorises the operation of piles and a wharf structure on the foreshore and seabed of the Whangarei Harbour. Lastly, this consent authorises maintenance dredging of the turning basin on the foreshore and seabed of Whangarei Harbour, expiring in 2034.

Consent AUT.005055.23.01 involves reclamation of 5.2ha of foreshore and seabed at Marsden Point. This consent also authorises the use of a rock retaining wall. All works in connection with the construction of the reclamation under this consent is to minimise adverse effects on RNZ's jetties.

Consent AUT.005055.26.01 allows the disturbance of the seabed for maintenance dredging of the turning basin, and removal of associated san, shingle and other material. All material dredged will be deposited on land at Marsden Point or Northland Port Corporation (NZ) Ltd (now known as Marsden Maritime Holdings Limited). Any dredged material that is not required by the Consent Holder for reclamation will be stockpiled and made available for beach nourishment in the Whangarei Harbour and Bream Bay. This consent expires on the 21 December 2039. This consent also authorises the occupation of the CMA for wharves, related structures for berths 3 and 4, and for barge berths, tug berths and water taxi services, and for the discharge of stormwater from the reclamation and associated structures, after being treated, to the Whangarei Harbour at Marsden Bay during the operation of the port extension.

Consent AUT.011809.01.01 provides NorthPort with a consent for maintenance dredging at the oil tanker berths and fire pump intake location at the Refinery jetties at Marsden Point. The solid volume of seabed material disturbed is not to exceed 50,000m^3 or a length of 1000m. The dredging will be used for nourishment of dunes or beach systems within the Whangarei Harbour and or Bream Bay area. This consent expires on the 31 May 2032.

1.2.2 NorthPort Consents authorising structures within the CMA

Those consents held by NorthPort to authorise structures, their use and maintenance within the CMA include consents AUT.005055.17.01, AUT.0050055.07.02, AUT.011811.01.01, AUT.005055.24.01, AUT.005055.23.01 and AUT.013187.01.01. It is noted that some of the consents held by NorthPort in relation to structures are covered in the above section 1.2.1.

Consent AUT.005055.17.01 authorises the placement and use of a jetty in the CMA, and expires on the 30 November 2034. In relation to this consent is consent AUT.0050055.07.02, which authorises the extension to the existing jetty for a dry bulk cargo pier. This consent was transferred to Northport on the 28th of May 2002 and expires on the 19th of April 2037. Further, consent AUT.011811.01.01 is for undertaking remedial measures associated with structure maintenance, required as a result of seabed scouring due to coastal processes, at the Refinery jetties at Marsden Point. Remedial measures under this consent can take place if there is evidence that there has been a significant change to the recorded seabed levels at the jetties, such that lateral or vertical capacity of jetty piles and/or dolphins are affected. Refining NZ must provide their written agreement that the remedial measures are necessary. This consent expires on the 31 May 2032.

NorthPort hold consent AUT.005055.24.01, which authorises the use of wharves at Marsden Point, Whangarei Harbour, and to use these wharves for port related purposes. Further, consent AUT.005055.23.01 is held by NorthPort, which authorises the use of a rock retaining wall and the reclamation of 5.2ha of foreshore and seabed at Marsden Point. This consent expires on the 17th of November 2039.

Lastly, consent AUT.013187.01.01 authorises the use of a tide monitoring gauge in the CMA at Frenchman Island, which expires on the 31 March 2030.

1.2.3 NorthPort Consents authorising discharges into the CMA

NorthPort hold consent AUT.010723.04.02, which authorises activities associated with the operation of an industrial park at Marsden Point. These activities include:

1. Discharging treated stormwater to Whangarei Harbour via an existing outlet structure at the port terminal berthface;
2. Discharging treated stormwater to the Blacksmiths Creek;
3. A structure on the bed of Blacksmiths Creek;
4. Stormwater discharged from the communal treatment pond to Whangarei Harbour, which shall not cause the water quality of the receiving waters immediately outside of the mixing zone to fall below acceptable standards;
5. Stormwater discharged from the communal treatment pond (retention basin) to Blacksmiths Creek, shall not cause the water quality of the receiving waters as measured 20m from the discharge point fall below water quality standards; and
6. The median concentration of total suspended solids in the stormwater, as measured in a manhole shall not exceed 50 grams per m^3.

Consent Number	Summary	Expiration Date
AUT.010723.04.02	Industrial Park at Marsden Point	2nd of December 2034
AUT.005055.04.01	Wharf and piles used for port operations (Environment Court Decision #4)	35 years from 4th of November 1999
AUT.005055.17.01	Fishing jetty at West Wall, Marsden Point	30th of November 2034
AUT.0050055.07.02	Extend existing jetty and use for a dry bulk cargo pier	19th of April 2037
AUT.011811.01.01	Remedial scour protection works at NZ Refining Co Ltd jetties at Marsden Point	31st of May 2032
AUT.013187.01.01	Tide monitoring gauge, Frenchman Island	31st of March 2030
AUT.005055.26.01	To occupy the seabed and water space for new wharves and related structures for berth	21st of December 2039
AUT.005055.23.01	To reclaim approximately 5.2 ha of seabed	17th of November 2019
AUT.005055.24.01	To erect and place new wharves and related structures for new berths in the CMA.	17 November 2039
AUT.011809.01.01	Maintenance dredging at the NZ Refining Co Ltd jetties at Marsden Point	31st of May 2032

Table 2: NorthPort Limited Existing Resource Consents

1.3 Resource Consents Held by Marsden Cove Limited

The following summarises the key consents (but not all) granted by the Regional Council for the operation of Marsden Cove. The full list of resource consents held by Marsden Cove are contained in **Table 3**. It is considered that the Marsden Cove's existing resource consents can be broadly split into two activities that are of relevance to the Proposal, as follows:

1. Consents authorising dredging and discharges in the CMA; and
2. Consents authorising the use and maintenance of structures in the CMA.

1.3.1 Marsden Cove Consents authorising dredging and discharges in the CMA

Those consents held by Marsden Cove Limited to authorise dredging and discharges in the CMA include consents AUT.009796.37.01, AUT.009796.38.01 and AUT.009796.01.01.

Consent AUT.009796.37.01 and AUT.009796.38.01 authorise maintenance dredging, the deposit of dredged spoil onto the foreshore and to use heavy machinery on the foreshore. Maintenance dredging of an access channel held by Marsden Cove Limited, occurs adjacent to the Marsden Cove access channel through Marsden Bay, only between 01 of April and 30 September in any year. This consent expires on the 31st of May 2039.

Marsden Cove Limited hold a number of consents to undertake activities associated with the maintenance of a marina and waterways housing development on One Tree Point Road, One Tree Point, Ruakakai (AUT.009796.01.01), which include:

1. Discharge into the CMA, and the deposition of sand from maintenance dredging of the Access Channel and Blind Channel for beach replenishment in Marsden Bay and east of One Tree Point;
2. Under RC 9796(15), to use and maintain entrance channel training walls and associated navigational aids;
3. Under RC 9796(19), to carry out maintenance dredging of an Access Channel, undertaken between 1 April and 30 September in any year;
4. Under RC9796(22), to use and maintain a tidal lock to dissipate the energy of tidal currents to prevent scouring of channels and foreshore seabed on either end of those structures;
5. Under RC9796(24) to use and maintain piles and pontoons in the canals for jetties and private ramps;
6. Under RC9796(26), to use and maintain piles and pontoons in a marina;
7. Under RC9796(30), to use and maintain a haulout, five jetties (associated with the principle multilane boatramp, vessel refuelling and effluent pump-out facilities, haulout and land based vessel storage and maintenance), and a secondary boatramp;
8. To use and maintain canal seawalls; and
9. Under RC9796(32), to use and maintain canal revetment walls

1.3.2 Marsden Cove Consents authorising structures within the CMA

Consents held by Marsden Cove to authorise structures, their use and maintenance within the CMA include consent AUT.037637.01.02. It is noted that some of the consents held by Marsden Cover, in relation to structures in the CMA, are covered in the above section 1.3.1.

Consent AUT.037637.01.02 authorises the use and maintenance of a boat ramp, retaining walls and jetty, at Marsden Cove Marina. This consent expires on the 31st of May 2039. This consent is part of a suit of consents for a boat maintenance yard located south of the Marsden Cove Marina alone Rauiri Drive. Culvert structures provide access from the marina into the maintenance boat yard.

Consent Number	Summary	Expiration Date
AUT.009796.37.01	Capital and maintenance dredging associated with the diversion of Blacksmiths Creek	31st of May 2039
AUT.009796.38.01	Deposit dredged spoil onto the foreshore associated with the diversion of Blacksmiths Creek	31st of May 2039

AUT.009796.01.01	Maintenance of a marina and waterways housing development on One Tree Point Road.	31st of May 2038
AUT.037637.01.02	To use and maintain a boat ramp, retaining walls and jetty.	31st of May 2039

Table 3: Marsden Cove Limited Existing Resource Consents

1.4 Resource Consents Held by NIWA

The following summarises the key consents that are held by NIWA and are considered to be of relevance to this Proposal and have been granted by the Regional Council. The full list of resource consents held by NIWA are contained in **Table 4**.

NIWA's consent AUT.001346.02.01, is considered relevant as it authorises the discharge of stormwater and cooling water to Bream Bay from Marsden A power station site catchment, and from the Marsden B power station site. This consent contains a condition to ensure that no more than 4.0m^3/s of seawater from Bream Bay is taken for the cooling generator units at Marsden A power station. This consent also authorises structures in the CMA, including navigational buoys.

Consent Number	Summary	Expiration Date
AUT.001346.02.01	Pipelines & outlet structures	31st of May 2034

Table 4: NIWA Existing Resource Consents

1.5 Resource Consents Held by Whangarei District Council

The following summarises the key consents that have been granted by the Regional Council to the District Council, which are considered to be of relevance to this Proposal. The full list of resource consents held by the District Council is contained in **Table 5**.

We have split the relevant consents held by the District Council into the following general locations:

1. One Tree Point to Paradise Point;
2. Marsden Point;
3. Urquharts Bay;
4. McLeod Bay;
5. Taurikura Bay;
6. Ruakaka Estuary;
7. Reotahi; and
8. McKenzie Bay.

1.5.1 Consents in and around One Tree Point to Paradise Point held by the District Council

The majority of resource consents held by the District Council are for activities located at One Tree Point. This includes consent numbers; AUT.008596.07.01, AUT.013131.01.01, AUT.023487.11.01, AUT.023487.04.01, AUT.023487.01.01, AUT.006252.03.02, AUT.008596.10.02, AUT.006390.08.01, AUT.003671.07.01 and AUT.009941.01.01.

Consent AUT.008596.07.01 authorises a rock-training wall, rock revetment, a rock artificial island reclamation area, two groynes, a dinghy-launching ramp and beach nourishment between One Tree Point and Paradise Point (total volume up to 20,000m^3 and maintenance volume up to 5,000m^3 per year). Consent AUT.013131.01.01, AUT.023487.11.01, AUT.023487.04.01, and AUT.023487.01.01 is for the use and to occupy space in the CMA with rock revetments at One Tree Point, Whangarei. The District Council also holds consent AUT.006252.03.02 to use a wooden seawall and rock revetments in the CMA between Pile Road West and the One Tree Point.

Consent AUT.008596.10.02 authorises beach nourishment between One Tree Point and Paradise Point (total volume up to 50,000m^3 and maintenance volume up to 10,000m^3 per year), and to carry out beach nourishment and channel infilling at Marsden Bay (total volume up to 20,000m^3 and maintenance volume up to 5,000m^3 per annum. The District Council also holds consent AUT.006390.08.01, which allows for the reclamation of 230m^2 at Paradise Point.

Consent AUT.003671.07.01 authorises the discharge of stormwater into the CMA, discharge of stormwater into Blacksmiths Creek and onto land that enters coastal waters of Whangarei Harbour. This consent is also to occupy and use the CMA for stormwater discharge structures and associated erosion protection works. Lastly, Whangarei District Council holds consent AUT.009941.01.01, to occupy the CMA for a boat ramp at One Tree Point.

1.5.2 Consents in and around Marsden Point held by the District Council

Those consents held by WDC at Marsden Point include consents AUT.018204.02.02, AUT.009942.01.01, AUT.008596.14.01, AUT.008596.19.01 and AUT.003671.07.01.

Those activities consented at Marsden Point include consent AUT.018204.02.02, to occupy space in the CMA with a revetment wall. Consent AUT.009942.01.01 is to occupy space in the CMA for a boat ramp at Marsden Point. Consent AUT.008596.14.01 is for a dinghy ramp in the CMA. Consent AUT.008596.19.01 is to place and occupy space in the CMA with a stormwater pipeline extension at Marsden Point.

WDC also hold consent AUT.003671.07.01 which authorises the discharge of stormwater into the CMA of Whangarei Harbour, discharge stormwater into an unnamed tributary of Marsden Bay (locally known as Blacksmiths Creek) and onto land that enters coastal waters of Whangarei Harbour. This consent is also to occupy and use the CMA for stormwater discharge structures and associated erosion protection works.

1.5.3 Consents in and around Urquharts Bay held by the District Council

The District Council hold three consents to use and occupy space in the CMA for a boat ramp at Urquharts Bay including consents AUT.009953.01.01, AUT.009951.01.01 and AUT.009952.01.01. The District Council also hold consent AUT.006393.02.01 to use and occupy space in the CMA with a jetty and associated stone groyne. This consent expires on the 31 March 2032.

1.5.4 McLeod Bay Consents in and around McLeod Bay held by the District Council

The District Council hold three consents considered to be of relevance to the Proposal, including consent AUT.038317.03.01, to maintain a boat ramp. Consent AUT.038317.01.01 authorises the maintenance of seawalls and revetments. WDC also hold consent AUT.038317.02.01, which authorises the maintenance of a timber groyne at McLeod Bay. These consents expire on the 30 April 2050.

1.5.5 Consents in and around Taurikura Bay held by the District Council

Two consents considered to be of relevance to the Proposal, held by the District Council in Taurikura Bay include consent AUT.024052.01.01 and consent AUT.010017.01.02. Consent AUT.024052.01.01 is to occupy space in the CMA with a road culvert and rock wing walls. Consent AUT.010017.01.02 allows the use of a boat ramp in the CMA.

1.5.6 Consents in and around Ruakaka held by the District Council

Both consents AUT.008043.03.01, AUT.000902.01.01 and AUT.031053.04.01 are held by the District Council to use and occupy space within the CMA with two sea walls, to discharge stormwater at three locations, and to use and occupy space with three stormwater culverts.

1.5.7 Consents in and around Reotahi held by the District Council

The District Council hold a consent AUT.009948.01.01, to occupy space in the CMA for a boat ramp. Consent AUT.004959.02.02 allows the discharge of stormwater into the CMA and to maintain a stormwater outlet structure. This consent expires on the 31 May 2041.

Council also hold consent AUT.009964.01.01 for a historical wharf and fender piles at Reotahi. In relation to this consent is consent AUT.009747.01.01, to occupy the CMA with 32 structures including wharfs, a seawall, culverts, a bridge, boat ramps, jetties and a historical wharf and fender piles.

1.5.8 Consents in and around McKenzie Bay held by the District Council

Consent AUT.036103.01.01 is the single consent held by the District Council considered of relevance to the Proposal in McKenzie Bay, which authorises the use of a seawall in the CMA. This consent expires on the 31 March 2048.

Consent Number	Summary	Expiration Date
AUT.006390.02.04	Use and occupy space in CMA	31st of May 2034
AUT.006390.08.01	Reclaim up to 650 square metres of CMA at One Tree Point	31st of May 2034
AUT.008596.07.01	Dredge new channel	31st of May 2034
AUT.003671.07.01	Stormwater management at One Tree Point	31st of May 2034
AUT.009747.01.01	Use and occupy space in CMA with 32 structures, including historical wharf.	31st of December 2022
AUT.024052.01.01	Culvert in Taurikura Bay, Whangarei Harbour	31st March 2044
AUT.023487.01.01	Rock revetment up to 295m long at One Tree Point Road, One Tree Point	31st of March 2042
AUT.009953.01.01	Boat ramp at Urquharts Bay.	31st of December 2022
AUT.018204.02.02	Rock revetment at Paradise Point, Marsden Point	31st of December 2043
AUT.008596.10.02	Use and occupy space in the CMA with two timber groynes at One Tree Point, Marsden Bay	31st of May 2034
AUT.004959.02.02	Stormwater outlet structures within the CMA	31st of March 2044
AUT.006390.08.01	Reclaim up to 650 square metres of CMA at One Tree Point	Unknown
AUT.008043.03.01	Three culverts in the Ruakaka Estuary, Whangarei Harbour	28th of February 2029
AUT.006393.02.01	Jetty at Urquharts Bay, Whangarei Harbour	31st Match 2032
AUT.008596.14.01	Dinghy Launching ramp at Marsden Bay	31st of May 2034
AUT.031053.04.01	Maintenance of rock seawall	31st of May 2047
AUT.008596.19.01	Stormwater pipeline extension at Marsden Bay	31st of March 2042
AUT.006252.03.02	3 rock revetments at One Tree Point	31st of March 2044
AUT.009951.01.01	Boat ramp at Urquharts Bay	31st of December 2022
AUT.010017.01.02	Taurikura Beach Association Incorporation Boat ramp at Taurikura	1st of July 2020
AUT.008579.05.03	Dredging of main channel	31st March 2050
AUT.008579.11.02	Maintenance dredging of the Portland Reach shipping channel	31st of March 2050
AUT.008596.06.01	8 stormwater pipes	31st of May 2034
AUT.009964.01.01	Historical wharf and fender piles at Reotahi	31st of December 2022

AUT.013131.01.01	Use and occupy space in the CMA with a rock revetment at One Tree Point	31st of March 2042
AUT.023487.11.01	Use and occupy space in the CMA with a 130m long rock revetment at One Tree Point	31st of March 2042
AUT.010362.01.02	Boat ramp in the CMA at Blacksmiths Creek	31st of March 2018
AUT.009952.01.01	Boat ramp at Urquharts Bay	31st of December 2022
AUT.023487.04.01	Use and occupy space in the CMA with a rock revetment	31st of March 2042
AUT.009941.01.01	Boat ramp at One Tree Point	31st of December 2022
AUT.009948.01.01	Boat ramp at Reotahi	31st of December 2022
AUT.038317.03.01	Boat ramp at McLeod Bay	30th of April 2050
AUT.038317.01.01	Maintain seawalls and revetments in CMA at McLeod Bay.	30th of April 2050
AUT.038317.02.01	Maintain a timber groyne at McLeod Bay.	30th of April 2050
AUT.031461.01.01	Use and occupy space in the CMA with a rock revetment	31st of March 2048
AUT.031461.02.01	Occupy space in the CMA with reclamation	31st of March 2048
AUT.009942.01.01	Occupy space in the CMA for a boat ramp at Marsden Point	31st December 2022
AUT.000902.01.01	Discharge stormwater to the Ruakaka River and onto land that enters coastal waters of Bream Bay	31st of May 2039
AUT.031053.01.01	Use and occupy space in the CMA with a rock sea wall and 3 stormwater pipes	31st of May 2039
AUT.036103.01.01	Seawalls at McKenzie Bay	31st of March 2048

Table 5: Whangarei District Council Existing Resource Consents

1.6 Resource Consents Held by the Department of Conservation

The following summarises the key consent that has been granted by the Regional Council to DoC, which is considered to be of relevance to this Proposal. The full list of resource consents held by DoC is contained in **Table 6**.

DoC's single consent which is considered of relevance to the proposal is consent AUT.015324.01.02. This consent authorises the use of navigational buoys in the CMA. The consent expires on the 31st of March 2031. The six navigational buoys and their approximate locations are listed below:

1. Buoy A (MNZ 1329): 1735299E 6033945N;
2. Buoy B (MNZ 1330): 1735209E 6033984N;
3. Buoy C (MNZ 1331): 1735034E 6033857N;
4. Buoy F (MNZ 1772): 1735397E 6033647N;
5. Buoy G (MNZ 1771): 1735950E 6033509N; and
6. Buoy H (MNZ 1770): 1735994E 6033553N.

Consent Number	Summary	Expiration Date
AUT.015324.01.02	Navigational aids in Whangarei Harbour	31st of March 2031

Table 6: DoC Existing Resource Consent

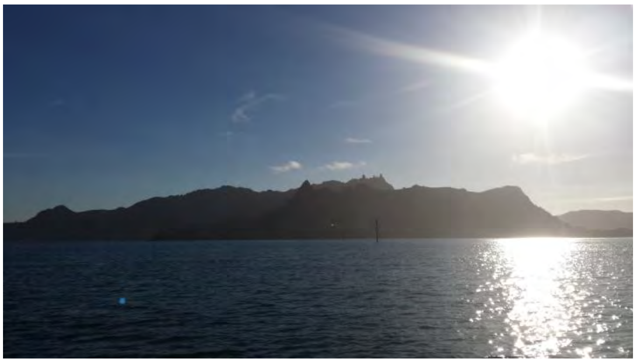
Annexure Four: Environmental Management Plans

a) Ngātiwai Trust Board, Ngātiwai Iwi Environmental Policy Document 2015
b) Patuharakeke Te Iwi Trust Board, Hapū Environmental Management Plan 2015

Annexure Four: Environmental Management Plans

a) Ngātiwai Trust Board, Ngātiwai Iwi Environmental Policy Document 2015

Ngātiwai
Iwi Environmental Policy Document
2015



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He mihi hoki ki ngā kaumatua, ngā kuia, me ngā tāngata i awhi, i tautoko mai hoki i tēnei pepa whai mana.

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Cover page photos: Dane Karapu & Clive Stone

1. Whakatauki (Proverb)

Ka tangi a Tukaiaia kei te moana,
E haere ana a Ngatiwai ki tae.....

Ka tangi a Tukaiaia kei te whenua,
E haere ana a Ngatiwai ki uta.....

When the Tukaiaia cries at sea,
Ngatiwai are on the move at sea.....

When the Tukaiaia cries on land,
Ngatiwai are on the move on land.....

Photo: Clive Stone

2. Rarangi Upoko (Contents)

3. Tauaki o Mana Motuhake (Statement of Identity)

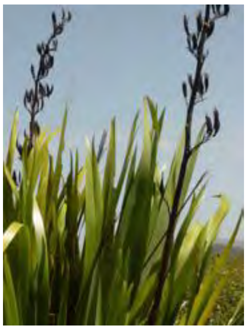
The Ngatiwai Trust Board, based in Whangarei, is the mandated authority for Te Iwi o Ngatiwai. Te Iwi o Ngatiwai exercises mana whenua and mana moana over its rohe or region of responsibility, which extends from Tapeka Point in the Bay of Islands to Takatu Point, south Omaha and encompasses the eastern seaboard and all off-shore islands, including Tawhiti Rahi and Aorangi (Poor Knights), Taranga and Marotere (Hen and Chickens Islands), Aotea (Great Barrier Island) and Hauturu (Little Barrier Island).

Ngatiwai are unified by their descent from Maui-Tikitiki, Toi te Huatahi and Manaia. Five generations after the second Manaia, came Te Rangi Hokaia who lived approximately twelve generations ago. Te Rangi Hokaia begat Rehua, Repo, Te Ao o te Rangi, Haua, and Hikihiki. His children's names became the names of the hapu. These hapu combined make up Ngatiwai.

The rohe of Te Iwi o Ngatiwai encompasses part of the jurisdictional area of four district councils (Far North, Whangarei, Kaipara and Auckland) and the Northland Regional Council.

Rohe picture: Dane Karapu

4. Whakaaro o tenei Tuhinga (Purpose of this Document)



Unuhia te rito o te harakeke,
kei hea te kōmako e kō
whakataerangitia rere ki uta, rere ki tai
Uia mai kī ahau
he aha te mea nui?
māku e kī atu
he tangata, he tangata, he tangata.....

The purpose of this document is to state the core values of Te Iwi o Ngatiwai, from an iwi perspective, around generic environmental issues. This document is also to assist Ngatiwai hapu and whanau to produce documents that identify and state their own specific local environmental issues.

This document is specifically focussed on the responsibilities that district and regional councils have under a range of legislation, primarily the Resource Management Act 1991. This document is designed for any parties proposing development within Ngatiwai territory. It shows procedures for developers and consent authorities. Ngatiwai Resource Management Unit must be the first place that all parties approach at their project design stage. This document does not specifically focus on matters dealt with by our Treaty partners, such as the Department of Conservation. Such policies will be produced in the near future.

In 2003 the Resource Management Act went through a major amendment process. Today, Sections 66 and 74 of the Act states that district and regional councils must "take into account any relevant planning document recognised by an iwi authority and lodged with the council" in the preparation of their own planning documents. Taking into account means that the iwi or hapu documents must be shown to have influenced the planning process and to have been incorporated into the council's decision making.

Ngatiwai Resource Management Unit has produced guidelines for an open, transparent, accountable and collectively agreed upon process for District and Regional Council's to take into account the iwi and hapu documents lodged with them. These guidelines were developed with Whangarei District Council, Auckland Council and other local Tāngata Whenua environmental practitioners.

The guidelines were given to the Whangarei District Council's Maori Liaison Subcommittee for their comment and then to the Whangarei councillors for their consideration and response. One reason Whangarei District Council was chosen first is because the majority of Ngatiwai marae are within the Whangarei District Council area. The other councils will be approached to adopt the same guidelines once the Whangarei District Council process is complete. These Guidelines can be found at Appendix 11.1.

Photo: Tui Shortland

5. Hoahoa Kaupapahere (Policy Design)

This environmental policy document has been set out according to the genealogical sequences of Ngatiwai.

The sections have been positioned into the stages of creation:

- **Te Unaunahi Tuatahi** are the minerals and substances with make up the earth and sky
- **Te Unaunahi Tuarua** are the flora and fauna which cloak the earth
- **Te Unaunahi Tuatoru** are those of the animal kingdom
- **Te Unaunahi Tuawha** are the human related elements

In its draft form this policy document was given to Ngatiwai kaumatua and kuia, Ngatiwai Trust Board trustees and Ngatiwai hapu for comment and feedback. It has also gone out to various key district and regional council staff, to the project funder, and the Ministry for the Environment in 2007.

A lot of positive and informed feedback has been obtained. All feedback has been considered and has contributed to this document.

Photos: Tui Shortland

6. Kaupapahere Whakaaetanga (Policy Recognition)

This document has been formally recognised as the Ngatiwai iwi environmental policy by the Ngatiwai Trust Board trustees at their Board Meeting of April 2007 in the first instance. It has since then undertaken a revision process by the Ngatiwai Resource Management Unit in 2014/2015 whereby the Ngatwai Trust Board trustees have formally accepted it at their Board Meeting of August 2015.

7. Arotake o tenei Tuhinga (Review of this Document)

The Ngatiwai Resource Management Unit will facilitate the review of this policy document on an “as needed basis” in collaboration with the hapu, marae and whanau of Ngatiwai by resolution of the Board.

Photo: Tui Shortland

8. Te Whakahaere Rauemi o Ngatiwai (Ngatiwai Resource Management Unit)

The Resource Management Unit is the environmental department of the Ngatiwai Trust Board. The Unit's role is to develop the resource management capacity of Te Iwi o Ngatiwai whilst ensuring the sustainable management of the natural, physical and cultural resources of the iwi.

Fulfilling that kaitiaki responsibility means seeing that any human interaction with the environment is managed in a sustainable way and that protection of the mauri of the natural, physical and cultural resources occurs.

The Resource Management Unit has been operational since the late 1980s. The Unit has developed knowledge, skills and expertise in a wide range of contemporary kaitiakitanga skills.

Some of these include:

- Ngatiwai archaeological assessments
- Ngatiwai Impact Assessments
- Biosecurity surveillance
- Fresh waterways health profiling using the Macroinvertebrate Community Index
- Wetland restoration
- Oil spill response representation, in association with Northland and Auckland Regional Councils.
- Recovering resources from dead stranded marine mammals for customary and scientific purposes
- Ngatiwai offshore islands management
- Endangered species recovery programmes
- Native bird island surveys and transfers
- Kiore, kuri *(Canis familiaris)* and ti pore *(Cordyline fructicosa)* mitrochondrial DNA research
- Recovering resources from dead native birds for customary and scientific purposes
- Maintaining a Ngatiwai storehouse of customary resources
- Inshore fisheries research projects
- Managing kiore populations on offshore Ngatiwai islands

Iwi resource management for Ngatiwai is about maintaining the cultural and spiritual integrity of Te Whakaputanga o nga Rangatira o Niu Tireni (The Declaration of Independence) and Te Tiriti o Waitangi as the founding political documents for governance in Aotearoa New Zealand.

It is about weighing up the principles and values of Ngatiwai for the environment with those of the Crown in a meaningful and positive way to ensure the sustainability of its resources for future generations.

9. Te Unaunahi i whakapiripiri kit e Ika nui a Mauitikitiki-a-Taranga

9.1 Te Unaunahi Tuatahi

9.1.1 Mineral Issues for the Ngatiwai rohe

- The use of minerals or geothermal resources under the Crown Minerals Act 1991 gives precedence to economic factors and does not assess the environmental, cultural or social impacts when permitting mining related activities. As a result the mauri of mineral and geothermal resources contained within the rohe of Ngatiwai is being destroyed or lost and there is potential for detrimental environmental, cultural and social effects.

  Explanation
  The rohe of Ngatiwai is rich in extractable mineral resources such as sand (both onshore and offshore), scoria, gold, mercury, limestone, clays and gravels. Geothermal areas also exist throughout the rohe, particularly on Aotea (Great Barrier Island).

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their ancestral taonga, mineral and geothermal resources.

Photo: Celia Witehira

Minerals Objectives for the Ngatiwai rohe

- The sustainable extraction and management of mineral and geothermal resources without adverse impacts upon the earth.

- The mauri of mineral and geothermal resources is protected and enhanced in ways that enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.

- Tāngata Whenua are acknowledged as the kaitiaki of mineral and geothermal resources within their rohe.

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral taonga, mineral and geothermal resources, is recognised and provided for as a matter of national importance by councils.

- There is an increased Tāngata Whenua involvement in the management and monitoring of mineral and geothermal resources.

- Tāngata Whenua traditional environmental knowledge in relation to mineral and geothermal resources is appropriately acknowledged and utilised.

Minerals Policies for the Ngatiwai rohe

1. Prospecting, exploration and mining activities under the Crown Minerals Act are not permitted in areas significant to Tāngata Whenua. Areas significant to Tāngata Whenua include wāhi tapu, fresh waterways, mahinga kai and other places, as identified by Tāngata Whenua.

   Explanation
   Some quarries were created more than 150 years ago when there was no legislation to protect sensitive sites. One such quarry within Ngatiwai territory is on what is known today as Tutukaka hill. Its name is Pukearanga a sacred maunga to local Tāngata Whenua who cite the pepeha, .Ko Pukearanga te maunga, ko Ngunguru te awa, ko Ngatitakapari te hapu, ko Paratene te Manu te marae..

2. Tāngata Whenua promote innovative, sustainable management practices concerning mining, including restoration and rehabilitation programmes.

3. Tāngata Whenua are the kaitiaki of mineral and geothermal resources in their rohe.

4. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting mineral or geothermal resources, including applications for sand relocation for beach renourishment, because of their special relationship with these taonga.

5. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around mineral and geothermal resources.

6. Whenever Tāngata Whenua are involved in setting conditions for consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

Photo: Celia Witehira

Minerals Methods for the Ngatiwai rohe

1. The review of the Crown Minerals Act to include factors of environmental, cultural and social effects.

2. The review of the Crown Minerals Act to ensure that permit applications are sent to the relevant councils to ensure that they are aware of upcoming resource consent applications.

3. Restoration and rehabilitation programmes will be planned and initiated by both Tāngata Whenua and permit holders, with the costs being met by permit holders.

4. Permits for mining activities must not include areas identified as significant by Tāngata Whenua.

5. Councils will require permit holders to prepare and implement a mining or quarrying closure management plan.

6. Tāngata whenua will be notified by the relevant council of any resource consent application concerning or potentially affecting mineral or geothermal resources.

7. Councils will actively promote to consent applicants pre-application engagement with Tāngata Whenua as being best practice.

8. All resource consent applications concerning or potentially affecting mineral or geothermal resources will be lodged with an impact assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

9. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

10. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge throughout their strategies and plans.

11. Where there is agreement from Tāngata Whenua that a mineral resource can be extracted, a benefit back to them (in the form of a royalty) will be payable.

9.1.2 Air Quality Issues for the Ngatiwai rohe

Mā te hā o Tāwhirimātea i ora ai te ao

- The mauri of air within the territory of Ngatiwai is being destroyed or lost through ignorance, oversight, misuse, exploitation, contamination and abuse.

  Explanation
  Pepeha: Tihei mauri ora!
  To hongi is to impart your breath of life to someone else.

  The quality of the air within the rohe of Ngatiwai, and thus the wellbeing of tāngata whenua and the surrounding environment, is being negatively impacted upon by emissions of contaminants from vehicles, industrial processes and procedures (sandblasting, spray painting, smoke emissions), pollen drift from pine plantations, agricultural and horticultural spraying and spray drift, smoke from large burn-offs, noise pollution from industrial areas (fork hoist backing beepers), dust (unsealed roads, quarrying activities, earthworks, woodchips), smoke from home fires in winter and flue stack emissions from the Marsden Point Oil Refinery.

  Motor vehicles and domestic fires, particularly open fires, are two larger sources of air pollution within Ngatiwai territory. These activities have cumulative adverse effects on air quality and respiratory wellness.

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their ancestral taonga, air.

Photo: Tui Shortland

Air Quality Objectives for the Ngatiwai rohe

- The mauri of air is protected and enhanced in ways which enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.

- The life supporting capacity of air enables optimum health and wellness for all Tāngata Whenua; those they host within their rohe; their plants, animals and other whanaunga; and their waterways and moana.

- Tāngata Whenua are acknowledged as the kaitiaki of air within their rohe.

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral taonga, air, is recognised and provided for as a matter of national importance by councils.

- There is an increased Tāngata Whenua involvement in the management and monitoring of air quality.

- Tāngata Whenua traditional environmental knowledge in relation to air is appropriately acknowledged and utilised.

Air Quality Policies for the Ngatiwai rohe

1. Air is a sacred resource to Tāngata Whenua, to be given the highest level of protection.

2. Tāngata Whenua promote innovative, sustainable management practices concerning air quality.

3. The discharge of contaminants into the air will be progressively reduced by the active promotion and adoption of energy efficient methods.

4. Tāngata Whenua are the kaitiaki of air in their rohe.

5. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting air quality, because of their special relationship with this taonga.

6. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around air.

7. Whenever Tāngata Whenua are involved in setting conditions for consent, they then are responsible or jointly responsible for monitoring compliance with those conditions.

Photo: Celia Witehira

Air Quality Methods for the Ngatiwai rohe

1. New or retro fitted domestic solid fuel burning fire emissions in urban areas will achieve a particulate emission rate of 4.0 g/kg of fuel burned for appliances without catalytic combustors and 2.25 g/kg for appliances with catalytic combustors.

2. Vehicles with clean fuel-efficient technology, that are appropriately maintained, will be actively promoted.

3. Energy efficient public transport systems will be promoted to reduce private vehicle use.

4. Used imported vehicles and vehicles currently in use will have emission control equipment fitted.

5. Alternative forms of heating houses, such as solar power, will be promoted, through education, subsidies and or environmental benefits.

6. Spray free zones will be actively promoted near schools, kohanga reo, public gathering places, marae, and public halls.

7. Tāngata Whenua will be notified by the relevant council of any resource consent application concerning or potentially affecting air quality.

8. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

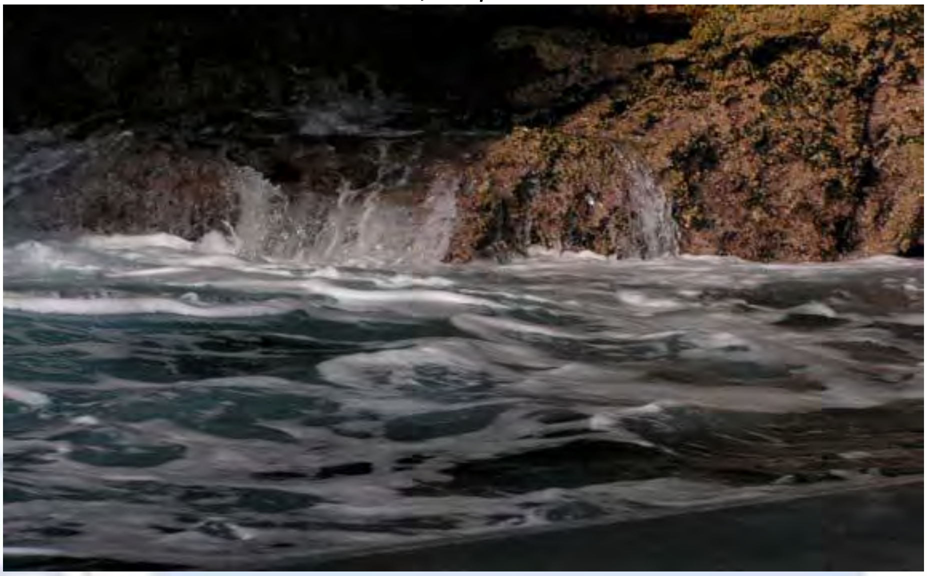
9. All resource consent applications concerning or potentially affecting air quality must be lodged with an impact assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

10. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

11. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

9.1.3 Water Issues for the Ngatiwai rohe

Mā te waiora ā Tāne, i tupu ait e mauri o te ora



- The mauri of water (creeks, streams, water bodies, wet areas, wetlands, swamps, springs, dune lakes, aquifers, thermal waters, estuarine waters and coastal waters) and soil and their associated ecosystems within the rohe of Ngatiwai is being destroyed or lost through ignorance, oversight, misuse, exploitation, contamination and abuse.

  Explanation
  The rohe of Ngatiwai is located on part of the eastern coast of what is known today as Te Tai Tokerau. The majority of water catchments within the rohe flow out to the eastern seaboard, are small and steep in area, and have rivers and streams which are short in length, in comparison to other areas within New Zealand. A lot of rain within a very short space of time, sometimes over a localised area, is a reasonably frequent event.

  An example of the damage to the mauri of water within the rohe of Ngatiwai is Whangarei Terenga Paraoa Harbour. Prior to European contact the harbour boasted numerous annual visits of marine mammals. Now it has been turned into a dumping ground for fertilizer run-off, stock wastes and sediment coming from farming operations; sediment from forestry activities and subdivision development; city storm water run off; and raw sewage from non-functioning pumping stations, and broken down and out of date pipe lines. The Whangarei Town Basin - within the central city area of the harbour - requires regular dredging to maintain depth for visiting yachts. The dredged spoil then requires disposal. This is another concern to Tāngata Whenua.

  The ability to put kaimoana on the table for manuhiri and whanau at tangi, hui and other events on Ngatiwai marae, and to feed Ngatiwai whanau and hapu on a regular, sustained basis, is being increasingly compromised by damage to the mauri of water.

Photo: Tui Shortland

Water Issues for the Ngatiwai rohe continued

- Impacts on the mauri of a resource create negative flow-on impacts on other resources, and cause opportunity losses for Ngatiwai people.

  Explanation
  To Ngatiwai water, soil and air are all integral elements of the life-supporting nature of the natural and physical environment. Water, soil and air must be considered in conjunction with all living things, as everything is interconnected. Tāngata whenua recognise that the quality of the water, soil and air is the fundamental basis for the quality of the environment; therefore it is imperative that these elements are sustainably managed. It is important to reiterate that water, soil and air must be seen in the context of the whole environment, not just as separate elements.

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their ancestral taonga, water.

  Explanation
  Ngatiwai are of people of the water (wai). We are a coastal people who live close to water and have a special relationship with water. Ngatiwai history, strength and mana stems from water – water is a sacred resource and a taonga.

- The use, allocation, flow, and quantity management of water within Ngatiwai territory has had negative impacts of those waters and their related ecosystems.

Water Objectives for the Ngatiwai rohe

- The mauri of water and soil is protected and enhanced in ways which enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.
- The life-supporting capacity of creeks, streams, water bodies, wetlands, swamps, springs, aquifers, thermal waters, estuarine waters and coastal waters enables optimum health and wellness for all Tāngata Whenua; those they host within their rohe; their plants, animals and other whanaunga.
- The sustainable management of water, soil and air in a collaborative manner considering all flow on effects.
- The relationship of Tāngata Whenua and their culture and traditions with their ancestral waters is recognised and provided for as a matter of national importance by councils.
- Tāngata Whenua are acknowledged as the kaitiaki of creeks, streams, water bodies, wetlands, swamps, springs, aquifers, thermal waters, estuarine waters and coastal waters within their rohe.
- There is an increased Tāngata Whenua involvement in the management and monitoring of water.
- Tāngata Whenua traditional environmental knowledge in relation to water resources is appropriately acknowledged and utilised.
- Water use, allocation, and flow will be sustainably managed within Ngatiwai territory.
- Water use, allocation, and flow management will enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.
- Tāngata Whenua, because of their special relationship with their waters, will be involved in water allocation planning for consumption from their streams, rivers and groundwater resources.

Photo: Celia Witehira

Water Policies for the Ngatiwai rohe

1. Tāngata Whenua promote innovative, sustainable management practices concerning water. All natural water has value and sustains some form of natural life in the environment. Water is a sacred resource to Tāngata Whenua, to be given the highest level of protection.

2. No hierarchical values will be placed on water bodies within any council.s planning documents to decide differing levels of protection.

3. All regional councils will have an integrated catchment riparian management and implementation strategy.

4. All aquifers will be protected from salt water and nitrate / nitrite intrusion, limited replenishment, and sewage contamination.

   Explanation
   Aquifers are the last bastion especially for communities or off-shore islands where there are no running streams. Many of the aquifers in Ngatiwai coastal community areas have become polluted from septic tanks, and nitrates and nitrites from non-point source pollution, while others have started to fill with salt water, making them brackish.

5. All puna will be protected from inappropriate use and development.

   Explanation
   Most of the puna or springs today have dried up because of the removal of the forest and draining of the land for farms. Significant puna were named, some were tapu, some were associated with pa, and some were associated with gardens.

6. Earthworks provided for as a permitted activity in council plans will be subject to stringent environmental performance standards.

7. Integrated earthworks management plans (detailing how erosion, sediment control, possible archaeological sites and revegetation are to be managed, and how risks will be identified and minimised) are mandatory for any type of consent involving an earthworks component.

8. The application or removal of anti-fouling to vessels will occur in a designated contained place on a hard surface away from a waterway, so anti-fouling and unwanted exotic marine organisms are not permitted to enter waterways. Anti-fouling scrapings will be gathered up and disposed of at an appropriate land site.

   Explanation
   To date around 148 exotic marine organisms have been introduced accidentally to New Zealand. 70 % of which probably arrived as fouling.

Water Policies for the Ngatiwai rohe continued

9. Water must be seen and managed in an integrated, holistic way as per its cycle, and as an element of the life supporting the natural and physical environment. Water should not be viewed just as a running stream, a lake, or an aquifer, with no relationship to the other resources within its environment.

10. All activities concerning or potentially affecting creeks, streams, water bodies, wetlands, swamps, springs, aquifers, thermal waters, estuarine waters and coastal waters within a water catchment will be managed in an integrated way on a catchment basis.

11. Regional and district plans and strategies will promote and provide incentives for the planting of riparian margins from the headwaters of a catchment through to its outfall into the moana.

Photo: Celia Witehira

Water Policies for the Ngatiwai rohe continued

12. Regional and district plans and strategies will promote and provide incentives for the rehabilitation, enhancement and protection of existing river banks and riparian margins, and their further extension along the margins and beds of water bodies.

    Explanation
    The key to improving water quality and restoring ecological diversity is connectedness. *Rehabilitation of waterways is most successful when planting of riparian margins begins from the headwaters and progresses through the catchment to produce a long, continuous buffer.*

    Riparian margins control non-point source discharges (microbial and fertilizer-enriched water runoff from land or leachate), erosion, stop sediment reaching streams and waterways, filter agrochemicals, maintain and improve water quality and provide habitats for native fauna.

13. Tāngata Whenua are the kaitiaki of water in their rohe.

14. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting water use, allocation, flow, quality, or quantity because of their special relationship with this taonga.

15. Use will be made of all relevant forms of knowledge and practises, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around water.

16. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

17. Minimum flows will be set for all watercourses.

18. Maximum water take will be dependent on the baseline (minimum) flow, rather than on a predetermined set amount.

19. Councils and Tāngata Whenua will together jointly develop mechanisms for the allocation of rights to water.

Water Methods for the Ngatiwai rohe

1. Payment of a bond is mandatory for all types of consent, large or small, which involve earthworks.

2. Repo (swamps) of any size will not be transformed into wetland sewage systems. There is no objection to such uses for man-made wetlands however, as long as they are sited appropriately.

   Explanation
   The mauri of the repo is a very special mauri. The repo has a very special spiritual quality as well as its cultural and traditional significance. The ancestral links of Tāngata Whenua with repo vary. Such links could be an abode of a taniwha, a burial place, or a place utilised for its resources.

   Swamps and wetlands contain kai (tuna, kewai, taro, watercress), dyes (paru . black mud which is fed decaying leaves for dying flax fibre) and weaving materials (raupo, harakeke, kōrari, kuta).

3. Drainage of natural wet areas or wetlands of any size is prohibited, unless decided otherwise by Tāngata Whenua. This includes by directly draining the wetland itself, or by nearby land drainage activities, which then impact the wetland.

4. The deliberate introduction of exotic species to creeks, streams, water bodies, wetlands, springs, aquifers, thermal waters, estuarine waters and coastal waters, without prior effective engagement with affected Tāngata Whenua, is prohibited, unless decided otherwise by Tāngata Whenua.

5. The use of chemical pesticides, fertilisers or any other contaminant in a manner where they can enter, affect or potentially affect any waterway is prohibited, unless decided otherwise by Tāngata Whenua.

6. Discharges from hospitals and funeral parlours, or discharges of human body fluids will not be combined with other wastes such as stormwater, and treated together.

7. Consent conditions which allow any possible emergency discharge (if the discharge is unforseen, intermittent, infrequent, or from a technical failure) of untreated sewage from sewage pumping stations into creeks, streams, water bodies, wetlands, waters, estuarine waters and coastal waters are prohibited, unless decided otherwise by Tāngata Whenua.

Photo: Tui Shortland

Water Methods for the Ngatiwai rohe continued

8. No liquid waste will be discharged directly, or indirectly (through stormwater drains, artificial watercourses, subsurface field drainage or open drains), to creeks, streams, water bodies, springs, thermal waters, estuarine waters or coastal waters. Instead it will be diverted back onto land for treatment that removes all bacteria, viruses and protozoa dangerous to health. Only then will it be permitted to enter receiving waters. This includes stormwater, sewage, farm dairy waste, effluent, contaminants, animal effluent and non-point source discharges.

   Explanation
   The word "waste" is used here and in other places within this document solely for clarity by the reading audience. However to Ngatiwai, waste is a material or substance that can be used for some other purpose. It would be more proper to see it as a resource and to treat it accordingly, rather than to call it waste.

9. Different types of liquid wastes (eg sewage and stormwater) will not be combined and treated together.

   Explanation
   The mixing of different mauri by human intervention is offensive to Tāngata Whenua.

10. Artificially injecting freshwater into thermal waters is prohibited, unless decided otherwise by Tāngata Whenua.

11. Manmade waterways or structures will not be constructed through or alongside tapu areas.

12. Siting a landfill over an aquifer or near any water supply, or near a Wāhi tapu area is prohibited, unless decided otherwise by Tāngata Whenua.

13. Small rural coastal communities will have communal land based treatment facilities that remove all bacteria, viruses and protozoa dangerous to health before discharge to receiving waters.

14. All new septic tank installations will treat sewage to a very advanced standard (remove all bacteria, viruses and protozoa dangerous to health) before discharge to a soakage field.

15. Unrestricted stock access to the sides, the beds or the banks of natural creeks, streams, water bodies, wetlands, springs, and estuarine waters is prohibited, unless decided otherwise by Tāngata Whenua.

16. Stock bridges will be constructed over creeks, streams or waterways that are used as stock crossing areas and effluent deposited on the bridge will be channelled to land for disposal.

Water Methods for the Ngatiwai rohe continued

17. Councils will impose nitrogen caps on farm properties. Stock loading rates per hectare will be capped to reduce nitrogen loss to waterways.

    Explanation
    A big issue facing dairy farmers particularly is nitrogen loss and nitrate leaching into waterways as a result of herd intensification, or a switch to dairying from other types of farming.

18. Marine farming equipment is prohibited from being transferred from one marine area to another without thorough cleaning. Cleaning will occur in a designated contained place on a hard surface away from a waterway, so unwanted exotic marine organisms are not permitted to enter new areas of water. Cleaned off material will be gathered up and disposed of at an appropriate land site.

19. New urban roading stormwater systems will be connected to rain gardens so stormwater is filtered prior to entering a waterway.

    Explanation
    Rain gardens contain sand, crushed shell and gravel which act as filters during rain. Certain species of plants also have a cleansing role. Rain gardens have been installed by Mark Cromie Holden Whangarei and the Whangarei Aquatic Centre, in both cases to filter car park run-off.

Photo: Tui Shortland

Water Methods for the Ngatiwai rohe continued

20. All proposed consent works in or within the riparian margin alongside creeks, streams, water bodies, wet areas, wetlands, swamps, springs, dune lakes, thermal waters, estuarine waters and coastal waters will be preceded by a comprehensive biological audit to identify indigenous animal and plant species in that area, as well as a Tāngata Whenua Impact Assessment to assess the mauri of the resource / area, prior to development commencing. Consent conditions will stipulate continued regular assessment of the cultural health of the resource / area, and Macroinvertebrate testing and monitoring. If it is noted that Macroinvertebrate numbers fall below 100 then activities must cease.

21. Earthworks activities will be limited to the summer months (1 October . 30 April) to protect the environment from sediment run-off and erosion. Stabilisation must have occurred by 30 April.

22. Earthworks provided for as a permitted activity in council plans (with certain exceptions) will still be required to notify the appropriate council and Tāngata Whenua.

23. Erosion and sediment control measures will be implemented and maintained while soil is exposed, and revegetation must be completed (to an 80% ground cover) within a three month period. Where the operation is not finished but will need to stop for a period of time (such as in the winter), any bare area must be sown over with a temporary cover to stabilise the area.

Photo: Celia Witehira

Water Methods for the Ngatiwai rohe continued

24. All vessels (regardless of size or carrying capacity) within the Ngatiwai territory, from the land to Hawaiki, are banned from discharging ballast water and engine cooling water or other possible contaminated substances directly into the sea.

    Explanation
    A bulk cargo carrier can deliver products to Japan and Korea and return with 50,000 tonnes of ballast water used for stability. This water is taken aboard while ships are in port before departure. This ballast water can contain harbour sediment and any organisms, particularly from shallow water or water disturbed by dredging or bad weather.

25. All vessels (including small vessels) will have mandatory waste holding facilities on board and their disposal must be more proactively managed by councils. Marinas must hold contained reception facilities for oil wastes, sewage, rubbish and ballast water. Contained reception facilities must also be installed at all other ports, wharves and jetties. These reception facilities must be monitored by councils.

26. Riparian margin size will be as wide as possible - its width is determined by the amount of slope to the stream, the type and size of diffuse discharge in the area, and the predominant land use.

27. When manmade structures are placed in creeks, streams, water bodies, wetlands, estuarine waters or coastal waters, the loss of in-stream aquatic habitats will be addressed, and appropriate provision will be made for indigenous migratory species, for example, tuna passage to their spawning areas.

    Explanation
    Until recently, culverts were simply concrete pipes that replaced in-stream habitats. They also presented challenges for native fish to swim through. New, innovative fish passage solutions consist of custom-made baffles designed as moulded plastic sheets that are bolted to the culvert floor. To recreate aquatic habitats inside culverts, every fourth baffle sheet is used to create a rock weir. The baffles are filled with rock, rubble, and sand and stream mud, causing pools to form behind and creating riffles by the stream flowing over the stones. These techniques are currently being trailed on four culverts under the ALPURT B2 alignment (SH1 Northern motorway extension).

28. All creeks, streams, water bodies, wetlands, swamps, springs, estuarine and coastal waters will have fenced or hotwired riparian margins planted in locally sourced indigenous plants.

29. Esplanade reserves or esplanade strips are required for every new subdivision or boundary adjustment adjacent to creeks, streams, water bodies, wet areas, wetlands, swamps, springs, dune lakes, thermal waters, estuarine waters and coastal waters.

Water Methods for the Ngatiwai rohe continued

30. Councils will offer information, educational material, technical advice, incentives (such as rates rebates), and the preparation of individual riparian management plans to promote the creation, rehabilitation, enhancement and protection of riparian margins.

31. Regional councils will provide individual riparian management plans for farms as a free service, and the provision of suitable native plants and trees, at cost.

Explanation
This is being done in Taranaki as a geographical extension to the Dairying and Clean Streams Accord signed in May 2003. The Taranaki District Council contracts with local nurseries to supply in bulk suitable indigenous plants and passes on the savings to landowners implementing their riparian management plans. As of June 2005 in Taranaki around 50% of dairy farms have riparian management plans. Around 55% of stream banks covered by management plans are fenced (or hotwired as necessary) and 39% of stream banks have vegetation present (not all of it has been planted).

32. Councils and Tāngata Whenua will together jointly develop catchment management strategies for all creeks, streams, water bodies, wetlands, swamps, springs, aquifers, thermal waters, estuarine waters and coastal waters.

33. Councils will actively promote to consent applicants pre-application engagement with Tāngata Whenua as being best practice.

34. All resource consent applications concerning or potentially affecting water quality must be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

35. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

36. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

37. All water abstractions (both permitted abstractions and those for which consent must be applied) must allow 100 % of the 1 in 5 year low flow to remain in streams and waterways, to ensure that there is no possibility of extra concentration of effluent or pollution.

38. Tāngata Whenua will be notified of any resource consent application concerning or potentially affecting water use, allocation, flow, level, and quantity.

39. All resource consent applications concerning or potentially affecting water use, allocation, flow, level, or quantity must be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

9.2 Te Unaunahi Tuarua

9.2.1 Indigenous Flora Issues for the Ngatiwai rohe

- Within the rohe of Ngatiwai the life-supporting capacity of indigenous flora is being negatively impacted by farming, subdivision, forestry practices and development. This can lead to biodiversity losses.

  Explanation
  Te Tai Tokerau has the highest number of threatened indigenous plant and animal species in Aotearoa New Zealand (more than 100 according to the Northland Regional Council's 2002 State of the Environment Report).

  High percentages of our indigenous species are endemic; they are found nowhere else on earth.

  To Ngatiwai, indigenous plants are whanau and taonga, to be looked after for future generations.

  Indigenous plants have positive effects on the environment. These include cleansing the air of pollutants and returning oxygen to it; acting as weather shields and noise buffers; acting as environmental indicators; providing kai and other resources for birds and other animals; reducing erosion, water run-off and instability; providing a recreational and tourism role, and having customary, historic, landscape and visual amenity values to communities.

- Bioprospecting or the taking of natural resources to derive products from them that might be of potential commercial use is intensifying worldwide.

  Explanation
  Bioprospecting is not regulated or managed in a truly sustainable way, the end result may be the loss of that species. A classic example is the huia.

Photo: Tui Shortland

Indigenous Flora Objectives for the Ngatiwai rohe

- The maintenance and restoration of natural species, habitats and ecosystems.
- The enhancement of endemic and endangered indigenous species and habitat.
- The mauri of indigenous ecosystems is protected and enhanced in ways which enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.
- The life-supporting capacity of indigenous ecosystems enables optimum health and wellness for all Tāngata Whenua; those they host within their rohe; their plants, animals and other whanaunga; and their waterways and moana.
- Tāngata Whenua are acknowledged as the kaitiaki of all indigenous flora and their associated ecosystems within their rohe.
- There is an increased Tāngata Whenua involvement in the management of their indigenous flora.
- Tāngata Whenua traditional environmental knowledge in relation to indigenous flora is appropriately acknowledged and utilised.
- Bioprospecting within Ngatiwai territory is managed appropriately.

Photo: Tui Shortland

Indigenous Flora Policies for the Ngatiwai rohe

1. All proposed land based activities which result in the modification of existing trees and vegetation will be preceded by a comprehensive biological audit to identify indigenous plant species in that area. This includes permitted activities for which certificates of compliance have been applied for.

2. No hierarchical values will be placed on indigenous flora within any council.s planning documents to decide differing levels of protection.

3. All councils will adhere to the 1992 United Nations Convention on Biological Diversity (CBD) adopted at the Earth Summit in Rio de Janeiro and ratified by the New Zealand Government.

4. All councils will adhere to and implement the New Zealand Biodiversity Strategy.

   Explanation
   The New Zealand Biodiversity Strategy was written to implement the Convention on Biological Diversity within Aotearoa New Zealand.

5. Indigenous flora are taonga tuku iho to Tāngata Whenua.

6. Tāngata Whenua are the kaitiaki of their indigenous flora.

7. Ngatiwai kaitiakitanga will be recognised as a viable management approach with respect to its indigenous flora.

8. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially impacting indigenous biodiversity, because of their special relationship with these taonga.

9. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around indigenous flora.

10. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

11. Only after appropriate effective engagement and adequate remediation or mitigation, or safety or security reasons, will Tāngata Whenua support any negative or destructive impacts on their indigenous flora.

12. Bioprospecting will only be carried out within Ngatiwai territory with the appropriate agreement from Tāngata Whenua.

13. Government regulation of bioprospecting is reviewed and increased.

Indigenous Flora Methods for the Ngatiwai rohe

1. No cats, dogs or mustelids will be permitted on subdivided properties zoned or partially zoned Outstanding or Notable Landscape areas, or directly abutting those zones.

   Explanation
   This is consistent with the resource consent decision by Whangarei District Council on the Neverlands Investments Ltd.

2. Councils and Tāngata Whenua will promote the use of locally sourced seeds and plants for revegetation landscaping projects.

3. Rates relief will be offered by councils as an incentive and a method of compensation for those land owners who covenant land with indigenous fauna and flora on it meeting covenanting body requirements.

4. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

5. Tāngata Whenua will be notified of any resource consent application concerning or potentially affecting indigenous plants or animals.

6. All resource consent applications concerning or potentially affecting indigenous plants and animals must be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

7. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

8. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

9. Councils and Tāngata Whenua will together jointly develop catchment management strategies.

10. Councils will transfer powers associated with the protection of indigenous vegetation on council owned land to Tāngata Whenua, upon a viable application being made under Section 33 of the Resource Management Act.

11. Bioprospectors will form appropriate agreements with Ngatiwai and the appropriate Tāngata Whenua before carrying out any bioprospecting activities.

12. Bioprospecting management criteria will be produced and adhered to during these activities, such as, intensive field work and laboratory monitoring and reporting to Ngatiwai and the appropriate Tāngata Whenua.

9.2.2 Indigenous Trees Issues for the Ngatiwai rohe

- Several councils exercising functions within Ngatiwai territory do not have a native tree management plan and therefore indigenous trees are continually damaged and destroyed. These indigenous trees are a taonga to Ngatiwai whanau, hapu and iwi.

  Explanation
  Since 1850, 80% of Te Tai Tokerau.s indigenous vegetation has been destroyed.

  Mature indigenous trees are very vulnerable to damage or destruction during subdivision development, when they are seen as expendable if they are in the way of a house site, or an accessway; or they impede a spectacular view, which adds a considerable monetary value to a property.

  Some trees within The rohe of Ngatiwai are sacred due to their particular customary use or by an incident which occurred on or near it. There is for example a karaka tree at Kiripaka that is sacred to descendants of Rangitukiwaho, tupuna of the Ngatitaka hapu of Ngunguru. The name of that tree is Te Whangai Mokopuna, meaning food for my grandchildren. That tree is the last tree standing of what was a karaka tree orchard that was planted by that tupuna. Because of this history that tree was made tapu by Ngatitaka kaumatua. There are numerous others of this type of tree in the Ngatiwai rohe.

Photo: Tui Shortland

Indigenous Trees Objectives for the Ngatiwai rohe

- All indigenous trees over a certain height or trunk girth are protected from damage or destruction, except where those trees may have spread beyond their normal expected area or if they are required for Tāngata Whenua customary purposes, such as, for medicines or weaving.

- Trees made sacred are fully protected from damage or destruction.

Photo: Tui Shortland

Indigenous Trees Policies for the Ngatiwai rohe

1. No subdivision, use or development will result in damage to or destruction of any indigenous trees without an appropriate assessment being made of how those trees impact a proposed development.

2. All indigenous wetlands trees (such as kahikatea) will be protected from damage or destruction, unless Tāngata Whenua give their written approval.

3. All indigenous tidal trees, such as manawa (mangrove), will be protected from damage or destruction, unless Tāngata Whenua give their written approval.

4. All coastal pohutukawa will be protected from damage or destruction, unless Tāngata Whenua give their written approval.

   Explanation
   Pohutukawa are an icon of the northern coasts of Aotearoa New Zealand. There are numerous pohutukawa on the Ngatiwai coast that are more than 200 years old.

5. No hierarchical values will be placed on indigenous trees within any council.s planning documents, eg a STEM (Standard Tree Evaluation Method) evaluation to decide differing levels of protection.

6. Mature stands of manuka or kanuka on publicly owned lands are prohibited from being cut for sale as firewood.

   Explanation
   These trees act as pioneer species to support the growth of other native species.

7. Tāngata Whenua are the kaitiaki of indigenous trees in their rohe.

8. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting indigenous trees, because of their special relationship with these taonga.

9. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around indigenous trees.

10. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

11. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

Indigenous Trees Methods for the Ngatiwai rohe

1. All indigenous trees more than three metres in height or with a trunk girth greater than 150 mm (where the trunk is measured 0.8 metres from the ground) will be protected from damage or destruction. The exception to this is manawa, in certain overgrowth situations. In the case of a tree with multiple trunks (such as pohutukawa) the girth measurement shall be the aggregate or collective measurement of all trunks which have a girth of 250 mm or more. These figures have been obtained from Auckland City Council.s District Plan.

2. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

3. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

4. Tāngata Whenua will be notified of any resource consent application concerning or potentially affecting indigenous trees.

5. All resource consent applications concerning or potentially affecting indigenous trees must be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

6. Only after appropriate effective engagement and adequate remediation or mitigation, or for safety, infectious disease, possible damage to property, or overgrowth reasons will Tāngata Whenua support the destruction of any indigenous trees over three metres in height or 150 mm in girth, measured 0.8 metres from the ground. These figures have been obtained from Auckland City Council.s District Plan.

7. Where indigenous trees are to be cut down the tree is to be provided to Tāngata Whenua to be used for customary purposes, such as propagation, carving etc.

8. Trees identified as tapu by Tāngata Whenua are not permitted to have work done around the base of them (other than grass trimming) out to a three metre circumference past the drip line.

   Explanation
   This will ensure the cultural and spiritual integrity of their status is maintained. No excavation, deposition of material, construction, earthworks for services or the storage of materials may occur.

Indigenous Trees Methods for the Ngatiwai rohe continued

9. Rates relief will be offered by councils as an incentive and a method of compensation for those land owners who covenant land with indigenous trees or trees made sacred by tupuna on it meeting covenanting body requirements.

10. Councils will transfer powers associated with the protection of specific indigenous trees on council owned land to Tāngata Whenua, upon a viable application being made under Section 33 of the Resource Management Act.

11. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

Photo: Tui Shortland

9.3 Te Unaunahi Tuatoru:

9.3.1 Indigenous Fauna Issues for the Ngatiwai rohe

- Within the rohe of Ngatiwai the life-supporting capacity of indigenous fauna is being negatively impacted by farming, subdivision, forestry practices and development. This can lead to biodiversity losses.

  Explanation
  Te Tai Tokerau has the highest number of threatened indigenous plant and animal species in Aotearoa New Zealand (more than 100 according to the Northland Regional Council.s 2002 State of the Environment Report).

  High percentages of our indigenous species are endemic; they are found nowhere else on earth.

  To Ngatiwai, indigenous fauna are whanau and taonga, to be looked after for future generations.

  Indigenous fauna have positive environmental effects. They are kaitiaki of their habitats and people; they are indicators of the health of their surrounding environment; they provide signs of events to come; they are kai for other animals and for humans; they have a recreational and tourism role, and they also have customary, historic, landscape and visual amenity values to communities.

Photo: Tui Shortland

Indigenous Fauna Objectives for the Ngatiwai rohe

- The maintenance and restoration of natural species.
- The enhancement of endemic and endangered indigenous animals.
- Tāngata Whenua are acknowledged as the kaitiaki of all indigenous animals and their associated ecosystems within their rohe.
- There is an increased Tāngata Whenua involvement in the management of indigenous animals.
- Tāngata Whenua traditional environmental knowledge in relation to animals is appropriately acknowledged and utilised.

Photo: Tui Shortland

Indigenous Fauna Policies for the Ngatiwai rohe

1. All proposed land based activities which result in the modification of existing trees and vegetation will be preceded by a comprehensive biological audit to identify indigenous animal and plant species in that area. This includes permitted activities for which certificates of compliance have been applied for.

2. No hierarchical values will be placed on indigenous fauna within any council.s planning documents to decide differing levels of protection.

3. All councils will adhere to the 1992 United Nations Convention on Biological Diversity (CBD) adopted at the Earth Summit in Rio de Janeiro and ratified by the New Zealand Government.

4. All councils will adhere to and implement the New Zealand Biodiversity Strategy.

   Explanation
   The New Zealand Biodiversity Strategy was written to implement the Convention on Biological Diversity within Aotearoa New Zealand.

5. Indigenous fauna are taonga tuku iho to Tāngata Whenua.

6. Tāngata Whenua are the kaitiaki of their indigenous fauna.

7. Ngatiwai kaitiakitanga will be recognised as a viable management approach with respect to its indigenous fauna.

8. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially impacting indigenous biodiversity, because of their special relationship with these taonga.

9. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around indigenous fauna.

10. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

11. Only after appropriate effective engagement and adequate remediation or mitigation, or safety or security reasons, will Tāngata Whenua support any negative or destructive impacts on their indigenous fauna.

Indigenous Fauna Methods for the Ngatiwai rohe

1. All resource consent applications concerning or potentially affecting indigenous plants and animals must be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

2. Tāngata Whenua will be notified of any resource consent application concerning or potentially affecting indigenous plants or animals.

Photo: Tui Shortland

9.4 Te Unaunahi Tuawha:

9.4.1 Engagement Issues for the Ngatiwai rohe

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their ancestral taonga, mineral and geothermal resources.

Engagement Objectives for the Ngatiwai rohe

- Tāngata Whenua are acknowledged as the kaitiaki of their rohe.

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral taonga, is recognised and provided for as a matter of national importance by councils.

- There is an increased Tāngata Whenua involvement in the management and monitoring of environmental resources.

Engagement Policies for the Ngatiwai rohe

1. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting environmental resources, because of their special relationship with these taonga.

2. Whenever Tāngata Whenua are involved in setting conditions for consent, they will then be resourced appropriately by the applicants or council to monitor compliance of those conditions.

Engagement Methods for the Ngatiwai rohe

1. Tāngata whenua will be notified by the relevant council of any resource consent application concerning or potentially affecting environmental resources.

2. Councils will actively promote to consent applicants pre-application engagement with Tāngata Whenua as being best practice.

3. All resource consent applications concerning or potentially affecting environmental resources will be lodged with an impact assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

4. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge throughout their strategies and plans.

9.5 Te Aho Tapu:

9.5.1 Matauranga Ngatiwai Issues for the Ngatiwai rohe

- The misappropriation or misuse of Ngatiwai indigenous knowledge and the cultural, genetic or biological resources and practices to which that knowledge relates, without the prior informed consent of Ngatiwai.

Explanation
The matauranga of Ngatiwai and the cultural, genetic or biological resources and practices to which that knowledge relates, is the intellectual property of Ngatiwai and must not be used in any way without prior written consent.

Matauranga reflects the wisdom of our tupuna and is a taonga to Ngatiwai. Ngatiwai have a responsibility to guard, protect and control the dissemination of this knowledge for the benefit of future generations.

Misappropriation refers to the wrongful taking or copying of cultural, genetic or biological resources and practices, and the matauranga Ngatiwai surrounding them. It also relates to the gaining of proprietary rights over such material. Misuse refers to the inappropriate use of cultural, genetic or biological resources and practices and the matauranga Ngatiwai surrounding them, but does not imply that any proprietary rights have been gained by the person or entity using the resource. The sharing or explaining of Ngatiwai matauranga, tikanga or kaupapa does automatically lead to the recipient.s rightful use or exploitation of that knowledge.

An example of the misappropriation of a Ngatiwai resource is the widespread cultivation, through garden centres, of one of its off-shore island plants, raupo taranga. This plant is also known as the Poor Knights Lily (Xeronema callistemon). Raupo taranga is found naturally only on Tawhiti Rahi and Aorangi (Poor Knights) and on Taranga within the Hen and Chickens group. Raupo Taranga was unknown apparently to Pakeha until about the early 1920s, when William Fraser, the Whangarei Harbour Board.s engineer became aware of it. In 1924 a Dominion Museum expedition to the Poor Knights headed by WRB Oliver collected the first specimens. No benefits to Ngatiwai have resulted.

Te Iwi o Ngatiwai, through the Ngatiwai Trust Board, is one of the claimants to Waitangi Tribunal claim 262. The Wai 262 claim is being progressed on behalf of all iwi Maori. Since the original claim was lodged in 1991, an amended statement of claim has been made. It now encompasses the following issues: Maori cultural and intellectual property rights; retention and protection of matauranga Maori; environmental, resource and conservation management, and ownership claims to base resources and species; and tino rangatiratanga o nga taonga katoa.

Ngatiwai Trust Board support the Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples made in 1993 at Whakatāne, Aotearoa New Zealand. The Mataatua Declaration preamble states that indigenous peoples of the world must be recognised as the exclusive owners of their cultural and intellectual property.

Matauranga Ngatiwai Objectives for the Ngatiwai rohe

- The matauranga of Ngatiwai (Ngatiwai knowledge base and knowledge systems), and the cultural, genetic or biological resources and practices to which that knowledge relates, are to be used for the betterment of Ngatiwai now, and into the future.

Matauranga Ngatiwai Policies for the Ngatiwai rohe

1. Any information about Ngatiwai matauranga, and the cultural, genetic or biological resources and practices to which that knowledge relates, obtained from Ngatiwai by councils, government departments, other organisations and private individuals is an intellectual property right of Ngatiwai, and must in no circumstances be alienated from them.

2. Ngatiwai knowledge will be classified as inalienable cultural heritage which is not subject to the laws relevant to public domain.

Matauranga Ngatiwai Methods for the Ngatiwai rohe

1. Anyone choosing to engage with or use Ngatiwai information or resources must seek the prior written consent of Ngatiwai to do so.

2. Matauranga Ngatiwai, including historical interpretation, cultural impact assessment information and evidence presented at consent hearings, must be regarded as confidential and owned by Ngatiwai.

Photo: Tui Shortland

9.5.2 Wāhi Tapu Issues for the Ngatiwai rohe

- The misunderstanding of what wāhi tapu means to Ngatiwai and the consequent mismanagement of their wāhi tapu by councils and others.

Explanation
The term wāhi tapu is in this case is used to describe a place that is sacred, significant or important. "The reason why wāhi are tapu is because we are from that soil, and so all land is tapu". (Raukura Robinson, 2007).

Some Wāhi tapu are places other than where a human burial has occurred. Some wāhi tapu have both tangible and intangible values and dimensions.

Wāhi Tapu Objectives for the Ngatiwai rohe

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga is recognised and provided for as a matter of national importance by councils.

- Wāhi tapu within the rohe of Ngatiwai are correctly understood and managed by all who empower themselves under the Resource Management Act.

Photo: Tui Shortland

Wāhi Tapu Policies for the Ngatiwai rohe

1. All wāhi tapu are sacrosanct; to be given the highest level of protection.

2. It is inappropriate to apply any value system, practice, or physical modification to a wāhi tapu that may diminish its status. No hierarchical values will be placed on wāhi tapu within any council's planning documents.

3. Tāngata Whenua are the kaitiaki of wāhi tapu, both tangible and intangible, within their rohe.

4. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting wāhi tapu (including archaeological sites), because of their special relationship with these taonga.

5. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning earthworks within a one km landward setback from mean high water springs.

Explanation
Unknown subsurface wāhi tapu can be discovered during earthworks.

6. Only after appropriate effective engagement and adequate remediation or mitigation, or safety or security reasons, will Tāngata Whenua support any negative or destructive impacts on their wāhi tapu.

7. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around wāhi tapu.

8. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

9. The vesting of wāhi tapu to Ngatiwai is a relevant tool of protection.

Wāhi Tapu Methods for the Ngatiwai rohe

1. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

2. Tāngata Whenua will be accorded affected party status by the relevant council of any resource consent application within four kilometres of the coastline, or within one kilometre of a recorded archaeological site.

3. All resource consent applications within four kilometres of the coastline or within one kilometre of a recorded archaeological site must be lodged with a Cultural Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

4. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

5. Coastal sand dune areas will be classified as .hazard prone areas. because of skeletal burials.

6. All councils will produce cultural heritage strategies.

7. Councils will transfer powers associated with the protection of specific Wāhi Tapu on council owned land to Ngatiwai, upon a viable application being made under Section 33 of the Resource Management Act.

8. Provisions for an acquisition fund for historic or cultural heritage sites or areas are to be initiated within council's long term council community plans.

9. Territorial authorities, regional councils and national government are to work together in a coordinated effort to develop a national fund for the protection of Wāhi tapu.

10. Councils will offer rates relief as an incentive and a method of compensation for those land owners who covenant land with wāhi tapu.

Photo: Tui Shortland

9.5.3 Rāhui Issues for the Ngatiwai rohe

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their resources, which at times is due to a lack of understanding and use of rāhui as a contemporary tool for the management of a resource.

Explanation
Ngatiwai kaitiakitanga includes the regulation of resources through the use of rāhui. Rāhui is both a traditional and contemporary form of managing a resource. Rāhui is the temporary prohibition of any natural resource for rejuvenation purposes or the temporary prohibition of access to a place for health and safety purposes. This system recognises the need to balance human requirements with the survival of a species or resource.

Rāhui Objectives for the Ngatiwai rohe

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga is recognised and provided for as a matter of national importance by councils.

- The use of Rāhui is recognised, respected and practised.

Rāhui Policies for the Ngatiwai rohe

1. Recognition of and respect for rāhui as a viable tool for managing resources.

2. Recognition of, respect for, and compliance with rāhui will be accorded by all councils to Tāngata Whenua.

Rāhui Methods for the Ngatiwai rohe

1. Councils and Crown agencies will give effect to the practise of rāhui by including compliance statements within their plans and operational documents.

2. Rāhui is initiated by kaumatua/kuia and may be put in place and monitored by Iwi, Hapū or Marae.

3. The utilisation of rāhui alongside other management tools, such as abatement notices, infringement notices, daily bag limits, closed seasons.

9.5.4 Taniwhā Issues for the Ngatiwai rohe

- The existence of misperceptions by the general public around taniwhā, and the consequent mismanagement of places over which taniwhā reside by councils and others empowered under the relevant legislation.

Explanation
The Taniwhā which this document refers to are those which look after resources and places as kaitiaki. For example, at the foot of the town side of the Onerahi hill in Whangarei is the Waimahanga Stream. Here lives a taniwha named Te Karuwha, who is particularly significant to the Mahanga people of Ngati Kororā, a Hapū of Ngatiwai.

Taniwhā play a major role in the enforcement of the management of resources and places over which they reside. For example, areas can be designated as wāhi tapu due to the local existence of taniwhā.

Taniwha have featured in the news in recent years. In 2002, Tainui Hapū, Ngati Naho, requested that Transit New Zealand halt construction of 100 metres of State Highway 1 near Meremere after they raised concerns about road work encroaching on the home of taniwhā Karu Tahi. Transit and Ngati Naho jointly agreed to a modification of the road design to preserve most of the site. They also agreed to have a Hapū member present when critical works were taking place to ensure that Ngati Naho's cultural values were protected.

Taniwhā Objectives for the Ngatiwai rohe

- Taniwhā are accorded their due respect.

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga is recognised and provided for as a matter of national importance by councils.

Taniwhā Policies for the Ngatiwai rohe

1. Relevant management mechanisms are provided over resources and areas which Taniwhā reside.

Taniwhā Methods for the Ngatiwai rohe

1. Any changes to the environment within which a Taniwhā resides is prohibited within the written approval of Tāngata Whenua.

2. Any development which may have flow on effects on the environment within which a Taniwhā resides is prohibited within the written approval of Tāngata Whenua.

3. The legislative requirements in regard to Tāngata Whenua tangible and intangible beliefs including Taniwhā will be reviewed.

9.5.5 Ngatiwai Landscapes Issues for the Ngatiwai rohe

- The ongoing damage and destruction to areas or sites of customary value which contribute to or a part of Ngatiwai cultural landscape.

Explanation
At times areas or sites of customary value are afforded a hierarchical status without input from the relevant Tāngata Whenua. Sites such as middens can be considered as a pile of rubbish. Other significant features are weighed against the views or positions of houses.

- Areas or sites of customary value are often limited to western definitions, such as .archaeological..

Explanation
Under the Historic Places Act 1993 it is an offence to destroy, damage, or modify, or cause to be destroyed, damaged, or modified, the whole or part of any archaeological site, knowing or having reasonable cause to suspect it is an archaeological site. Therefore at times Ngatiwai landscapes cannot be considered in Historic Places Trust authorities for destruction, damage or modification.

- The scope of the Building Act 2004 is focused on the control of building, rather than to addressing any potential customary impacts.

Photo: Tui Shortland

Ngatiwai Landscapes Objectives for the Ngatiwai rohe

- The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, Wāhi tapu and other taonga is recognised and provided for as a matter of national importance by councils.

- The protection of areas or sites of customary value.

- All councils implement more appropriate provisions for cultural landscapes under their historical heritage responsibilities, such as the development and implementation of cultural landscape strategies.

- The effective definition of areas and sites of customary value by Ngatiwai.

- Robust forms of linkage mechanisms are established between the Building Act and the Resource Management Act by all district councils, so Ngatiwai landscapes are not accidentally damaged, destroyed or modified.

Photo: Dane Karapu

Ngatiwai Landscapes Policies for the Ngatiwai rohe

1. The recording of Ngatiwai landscapes will be supported by councils.

2. Councils must take responsibility for advocating and educating landowners and developers about areas or sites of customary value.

Explanation
Several councils within the Ngatiwai rohe do not have a cultural heritage policy.

3. The areas and sites of customary value which contribute to or a part of Ngatiwai cultural landscape must be defined by Tāngata Whenua.

4. Any decisions made in regard to the definition of areas or sites of customary value to Ngatiwai or within Ngatiwai territory must be made in accordance with Tāngata Whenua.

5. Councils and Tāngata Whenua will jointly develop customary value, cultural landscape and or cultural heritage strategies.

6. All planning provisions in relation to Ngatiwai landscapes must be written in conjunction with Tāngata Whenua.

Explanation
Cultural landscape policy and strategies are currently being developed by councils. These policies and strategies will be more effective if they are consistent with how Tāngata Whenua define and manage them.

7. Tāngata Whenua promote the use of innovative non-destructive, non-intrusive geophysical surveying techniques (e.g. ground penetrating radar, soil resistivity measurement, magnetic field anomalies and disturbances measurement) to reveal the subsurface archaeological landscape, whenever possible, and appropriate.

Explanation
Landowners and developers can use these geophysical tools to swiftly survey areas of land under development consideration.

8. Project Information Memorandum (PIM) must contain any areas or sites of customary value, including those on the NZAA database that may be affected by the proposed building project.

Explanation
A situation arose some years ago at Pataua South, near Whangarei, where additions to an old bach were planned. It was discovered during earthworks that the bach sat on part of a huge midden site spreading over five or six properties. The midden contained moa bone fragments as it was near a sandy peninsular where moa were hunted. Subsequent research revealed the site was not recorded on the PIM.

Ngatiwai Landscapes Methods for the Ngatiwai rohe

1. Ngatiwai pā must be protected from cut and fill earthworks for the construction of houses and access ways, and forestry harvesting sky hauler platforms.

Explanation
The landward part of The rohe of Ngatiwai begins right on the coast itself. Residence on the coast gave access to abundant resources. Evidence today can be seen in the large numbers of pā around these areas. Where such Pā are located, there is a high occurrence of other relevant features, such as tracks, disposal sites, and wāhi tapu, including burial sites.

Two hundred years of development without the effective engagement and management of Tāngata Whenua has destroyed the surface evidence of these areas and site.

2. Earthworks along ridgelines or within 100 metres of the top of a ridgeline are prohibited, unless express written approval is provided by Tāngata Whenua.

3. Only after appropriate effective engagement and adequate remediation or mitigation, or for safety or security reasons, will Tāngata Whenua support any negative or destructive impacts on their cultural heritage.

4. Ngatiwai cultural landscape Areas or sites of customary value which contribute to or are a part of Ngatiwai cultural landscape, must not be impacted upon negatively without the express written approval of Tāngata Whenua.

Explanation
In most circumstances Tāngata Whenua will only carry out maintenance or study that will enhance the conservation of the physical, spiritual, and cultural integrity of their cultural heritage.

5. All archaeological assessments within the rohe of Ngatiwai will be carried out by a suitably qualified Tāngata Whenua resource management unit representative and a qualified archaeologist, recognised by the NZ Historic Places Trust under Section 17 of the Historic Places Act.

6. Where there is sufficient evidence that subsurface areas or sites of cultural significance exist, geophysical surveying methods will be utilised to assess the existence of such areas post development.

7. All applications to the New Zealand Historic Places Trust to modify damage or destroy a site or area will be jointly worked through with Ngatiwai and will be concurrent with the consent application being processed.

8. Tāngata Whenua are acknowledged as the kaitiaki of the areas and sites of customary value within their territory.

Ngatiwai Landscapes Methods for the Ngatiwai rohe continued

9. The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, Wāhi tapu and other taonga is recognised and provided for as a matter of national importance by councils.

10. There is an increased Tāngata Whenua involvement in the management and monitoring of their areas and sites of customary value.

11. Tāngata Whenua traditional environmental knowledge in relation to their areas and sites of customary value is appropriately acknowledged and utilised.

12. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around areas and sites of customary value.

13. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

14. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice, particularly in relation to decisions on the location of lot boundaries, house site building platforms and access ways relative to archaeological sites.

15. Tāngata Whenua will be notified by the relevant council of any resource consent application concerning or potentially affecting areas and sites of customary value.

16. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting areas and sites of customary value, because of their special relationship with these taonga.

17. All resource consent applications concerning or potentially affecting areas and sites of customary value will be lodged with a Tāngata Whenua Impact Assessment written by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

18. Whenever Tāngata Whenua are involved in setting conditions for a consent, they then are responsible or jointly responsible for monitoring compliance with those conditions.

19. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

Ngatiwai Landscapes Methods for the Ngatiwai rohe continued

20. All consents involving earthworks within a four kilometre distance of Mean High Water Spring require an initial soil scrape, monitored by the appropriate Tāngata Whenua, to be undertaken as a standard consent condition. Written notice of the intention to commence earthworks will be given to Tāngata Whenua 15 days working days prior to work commencing. A written report will be provided by Tāngata Whenua to the relevant council at the completion of monitoring.

Explanation
An initial soil strip is a method routinely recommended and used by Tāngata Whenua to identify the existence of any unknown subsurface archaeological sites. A small digger is suitable for such work. The digger blade carefully skims the surface layer of vegetation and topsoil so any sites, should they exist, may be identified. This is a precautionary measure.

21. A training programme for machinery operators is available from Ngatiwai and must be enforced by councils to ensure that during any earthworks, the identification of areas or sites of customary value is increased.

22. All consents involving earthworks within a four kilometre distance of Mean High Water Spring require monitoring by Tāngata Whenua monitors in the event of areas or sites being discovered.

23. Should previously unrecorded subsurface archaeological sites be discovered during earthworks; or koiwi are exposed; or if there is a death on site, then all relevant project operations in the area of the event must cease immediately. The contractor or the person monitoring the earthworks will immediately advise the site manager and Ngatiwai Trust Board, and take steps to secure the area to ensure that it remains undisturbed. The site manager will advise the New Zealand Historic Places Trust (and the NZ Police if appropriate). The site manager will ensure that staff or representatives are available to meet and guide the appropriate Ngatiwai representatives to the site, and assist them with any reasonable requests they may make. In the case of discovery of human remains, Tāngata Whenua and the property owner / developer will jointly seek any necessary approval of the New Zealand Police or the Historic Places Trust so that the remains can be appropriately recovered and buried at a site nominated by the Ngatiwai and Tāngata Whenua representatives. All relevant construction operations or work will remain halted until such measures are decided. All representatives involved in the situation will ensure that they act in a respectful manner, being careful to involve no unnecessary parties or publicity at any time.

24. Where electricity, telecommunications, access ways, pile foundations, road use upgrade and maintenance and effluent disposal systems are to be laid underground, the proposed route for the trenching, thrusting or directional drilling will be assessed, by spear probing, for archaeological sites prior to earthworks starting and will be monitored by Tāngata Whenua.

25. Should taonga tuturu such as adzes, sinkers or carvings be discovered within Ngatiwai territory, they must be passed to the Ngatiwai Trust Board as a registered collector of artefacts under the Antiquities Act 1975.

26. Any museum who knowingly accepts found Tuturu Taonga within Ngatiwai territory must past such Taonga to the Board until ownership is finalised.

Ngatiwai Landscapes Methods for the Ngatiwai rohe continued

27. Tāngata Whenua will be notified of any building consent application within four kilometres of landward Mean High Water Spring and within one kilometre of a recorded archaeological site.

9.5.6 Customary Materials Issues for the Ngatiwai rohe

- The lack of direct and effective Ngatiwai involvement, as the kaitiaki, in the sustainable management of their customary resources.

Explanation
Customary resources are taonga tuku iho and belong to Tāngata Whenua.

Customary resources include all tangible and intangible resources utilised by Ngatiwai to sustain Hapū and Marae.

- Ngatiwai taonga and their natural environment are being mismanaged and therefore customary resources and provisions sourced from the environment are negatively impacting the cultural diversity of Ngatiwai.

Explanation
Other management regimes, such as managed cultural harvesting, are not being considered as viable management tools.

The customary utilisation of native bird feathers for weaving has increasingly declined due to deforestation and management, such as allocation.

The kiore, are being completely eradicated due to the negative impacts on the environment however these impacts have not been compared appropriately to their customary values.

Photo: Tui Shortland

Customary Materials Objectives for the Ngatiwai rohe

- Tāngata Whenua are acknowledged as the kaitiaki of their customary resources within their rohe.
- The relationship of Tāngata Whenua and their culture and traditions with their taonga is recognised and provided for as a matter of national importance by councils.
- There is an increased Tāngata Whenua involvement in the management and monitoring of customary materials.
- Tāngata Whenua traditional environmental knowledge in relation to their customary resources is appropriately acknowledged and utilised.
- An abundance of resources is available for cultural harvesting by Tāngata Whenua.
- The establishment, by Tāngata Whenua, of store houses for Tāngata Whenua use and management of their customary resources.

Photo: Tui Shortland

Customary Materials Policies for the Ngatiwai rohe

1. Tāngata Whenua are the kaitiaki of customary resources in their rohe.

2. Customary resources are the property of Tāngata Whenua and therefore should remain in or be returned to their possession.

3. Tāngata Whenua are an affected party to any resource consent application within their rohe concerning or potentially affecting customary resources because of their special relationship with these taonga.

4. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making around customary resources.

5. Whenever Tāngata Whenua are involved in setting conditions for a consent, they will then be resourced appropriately by the applicants or council to monitor compliance with those conditions.

Photo: Clive Stone

Customary Materials Methods for the Ngatiwai rohe

1. Tāngata Whenua will be notified by the relevant council of any resource consent application concerning or potentially affecting customary materials.

2. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

3. All resource consent applications concerning or potentially affecting customary resources must be lodged with a Tāngata Whenua Impact Assessment by the relevant Tāngata Whenua. Suggested consent conditions will be included in the assessment.

4. Tāngata Whenua will receive copies of any infringement or abatement notices or Environment Court proceedings issued by a council within Ngatiwai territory.

5. Councils will give effect to respect for Tāngata Whenua traditional environmental knowledge by including that knowledge in their strategies and plans.

6. When customary resources are scare or endangered, their management must be determined by Tāngata Whenua. This will be recognised and provided for by councils.

7. An abundance of resources is available for cultural harvest by Tāngata Whenua.

Photo: Tui Shortland

9.5.7 Exotic Plantation Forestry Issues for the Ngatiwai rohe

- The mauri of water and its associated ecosystems is being damaged through mismanagement of forestry activities.

Explanation
Physical damage is occurring to indigenous aquatic ecosystems due to forestry activities. Streamside banks and swamps are impacted upon by the felling of trees into and across them. The erection of culverts is contributing to the gradual erosion of stream banks.

Sedimentation from forestry road formation and harvesting activities is negatively impacting downstream water users (including those with formal easement arrangements). Cumulative sedimentation is causing effects on shallow estuaries, harbours and kaimoana areas. Some logging truck movements are causing negative impacts.

- Forestry activities have off site negative impacts for neighbouring properties.

- The assumption that properties containing plantation forests could not have unrecorded areas or sites of customary value to Tāngata Whenua.

Explanation
Recorded and unrecorded Ngatiwai archaeological sites (Wāhi Tapu) within forestry areas are being damaged or destroyed during forestry road formation and harvesting.

Exotic Plantation Forestry Objectives for the Ngatiwai rohe

- The more sustainable extraction and management of forestry resources without adverse impacts upon the aquatic environment.

- The more sustainable use of logging trucks throughout Ngatiwai territory.

- A more effective management of forestry activities will low to nil impacts on neighbouring properties.

- The protection of areas or sites of customary value to Tāngata Whenua.

Exotic Plantation Forestry Policies for the Ngatiwai rohe

1. Forestry activities permitted or otherwise must adhere to sustainable management best practises.

2. Truck movements and loads are to be kept at rates that will ensure low to nil impacts.

3. Forestry companies develop and implement (in effective engagement with their surrounding local community) a good neighbour code of practise that recognises the long term relationship forestry companies have entered into with the community around them, and the community goodwill toward the company.

4. An increased Tāngata Whenua involvement in the management and monitoring of exotic forestry resources.

5. Tāngata Whenua traditional environmental knowledge in relation to resources is appropriately acknowledged and utilised.

6. The mauri of water and its associated ecosystems are protected and enhanced in ways which enable Tāngata Whenua to provide for their social, economic and cultural wellbeing; and that of generations as yet unborn.

7. The life-supporting capacity of creeks, streams, water bodies, wetlands, swamps, springs, aquifers, thermal waters, estuarine waters and coastal waters enables optimum health and wellness for all Tāngata Whenua; those they host within their rohe; their plants, animals and other whanaunga; and their waterways and moana.

8. The relationship of Tāngata Whenua and their culture and traditions with their ancestral lands, water, sites, Wāhi tapu and other taonga is recognised and provided for as a matter of national importance by councils.

Photo: Celia Witehira

Exotic Plantation Forestry Methods for the Ngatiwai rohe

1. All forestry consent applications will be discretionary, and publicly notified.

2. When establishing an exotic plantation forest, any natural indigenous vegetation of between one and five hectares in area with an average canopy height of at least six metres will be excluded from land clearance and disturbance. (This is a policy of the NZ Forest Accord, signed in 1991)

3. The use of chemical pesticides, fertilisers or any other contaminant in a manner where they can affect or potentially affect any waterway is prohibited, unless decided otherwise by Tāngata Whenua.

4. Exotic plantation harvesting will be proceeded by a comprehensive biological audit to identify indigenous animal and plant species in the harvesting area, as well as a cultural health audit to assess the mauri of the resource or area, prior to development commencing. Consent conditions will stipulate continued regular assessment of the cultural health of the resource or area.

5. Wildlife corridors will be planned for within and between plantations. These areas will be mapped and joined by, if necessary, council-managed wildlife corridors. All thee corridors will be permanent native bush and will be fenced off.

6. Forestry operations will be channelled into the most appropriate areas by a land use classification system. Forestry development will only be allowed in this designated area.

7. Sky hauler platforms will be sloped in towards the hill or ridge so water run-off does not erode and wash away cut and fill areas.

8. Roads are to be located as far from a stream as possible.

9. Stream crossings must be minimised.

10. Riparian margin planting of indigenous eco-sourced flora must extend to five metres on all waterways.

11. Harvested areas must be replanted with eco-sourced indigenous flora.

12. Organic methods of weed minimisation must be utilised.

13. Road dust from logging trucks is to be minimised by tar seal or speed limits to avoid affecting household water supply, property, stock and horticultural crops during harvesting.

14. Speed limits are to be imposed along school bus routes and where roads are narrow, winding or unsealed.

15. Logging truck vibration and noise is to be kept at a minimum outside of business hours.

16. Develop corporate principles to guide relations (e.g. focus on long-term and reciprocal relationships; build trust; ensure mutual respect; focus on win-win activities; adopt openness, transparency, full disclosure, etc. as working norms), identify people and operations within the company to manage implementation of the principles, create processes to measure progress.

Exotic Plantation Forestry Methods for the Ngatiwai rohe continued

17. Forestry companies are to hold regular meetings with communities, outside formal agreements.

18. Forestry companies are to play an active, voluntary role in the communities by, funding community cultural events, schools, curriculum development, Tāngata Whenua history projects; sponsoring extracurricular activities such as teams for Tāngata Whenua games and celebrations; and establishing career days.

19. Planting of pine trees right up to the boundary is prohibited to avoid neighbouring houses and properties to loose their sunlight for years at a time.

20. Tāngata Whenua are an affected party to any forestry activity within a four kilometre distance of Mean High Water Spring.

21. Councils will actively promote to consent applicants pre-application effective engagement with Tāngata Whenua as being best practice.

22. Use will be made of all relevant forms of knowledge and practises and information, including Tāngata Whenua traditional environmental knowledge, in assessments and decision-making.

23. Tāngata Whenua will be notified of any resource consent application concerning earthworks relating to forestry road construction or harvesting.

24. Whenever Tāngata Whenua are involved in setting conditions to consent, they must then be responsible or jointly responsible for monitoring compliance with those conditions.

25. The destruction of Ngatiwai pā located along ridgelines from cut and fill earthworks for the construction of forestry harvesting sky hauler platforms is prohibited without the express written approval of Tāngata Whenua.

Exotic Plantation Forestry Methods for the Ngatiwai rohe continued

26. Forestry companies are to identify Tāngata Whenua interests in forest management planning processes by commissioning Tāngata Whenua Impact Assessments and Reports as part of forest management plans and as the basis for further engagement on forest management plans and to mitigate impacts and compensate for damages incorporating traditional ecological knowledge systems into forest management planning processes.

27. Forestry companies are to achieve more equitable participation of Tāngata Whenua in the benefits of forest management e.g. job opportunities, wood supply opportunities.

28. Forestry companies are to incorporate identified concerns in forest management plans by setting aside tracks of land for Tāngata Whenua areas or sites of customary value, recreational hunting and fishing.

29. Implement forest management plans by providing Tāngata Whenua awareness training for employees to cover respect for customary practices and the identification of areas and sites of customary value.

30. Provide advance notice of forestry activities that may impact on Tāngata Whenua e.g. road building and road decommissioning.

31. Tāngata Whenua will monitor any resource consent application concerning earthworks relating to forestry road construction or harvesting in areas significant to them.

Photo: Celia Witehira

9.5.8 Genetically Modified Organisms Issues for the Ngatiwai rohe

- The use and development of genetically modified organisms without the approval of Ngatiwai.

Explanation
Ngatiwai are not opposed to the pursuit of knowledge but in general Ngatiwai opposes the introduction of this activity in its rohe.

It is contrary to Ngatiwai whakapapa, it breaches tikanga, it represents untested dangers, and is not generally in any way essential to human well-being.

Genetically Modified Organisms Objectives for the Ngatiwai rohe

- Aotearoa New Zealand is free of genetically modified organisms, or products produced from such organisms, except for their use for medical reasons.

Genetically Modified Organisms Policies for the Ngatiwai rohe

1. No genetically modified organisms, or products produced from such organisms, will be introduced.

2. The adoption of the precautionary approach by councils to genetically modified organisms, requiring that all risks be fully understood before these organisms are utilised.

Genetically Modified Organisms Methods for the Ngatiwai rohe

1. A moratorium is placed on all genetic engineering projects within Ngatiwai territory pending the written approval of Tāngata Whenua.

10. Kupu Taka (Glossary)

Animal effluent - Defined in the *Regional Water and Soil Plan for Northland* as effluent from livestock collected or otherwise managed as a point source discharge, and includes sites like feedlots, dairy sheds piggeries and hen houses. It does not include discharges from animals in an unmanaged situation.

Contaminant - Defined in the *Regional Water and Soil Plan for Northland* and the *Resource Management Act 1991 as a* contaminant which includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy or heat, that either by itself or in combination with the same, or other substances, energy, or heat, when discharged into water, changes or is likely to change the physical, chemical or biological condition of water.

Convention on Biological Diversity - This convention acknowledges the important role of indigenous peoples in the management and conservation of natural resources and their biodiversity. Article 1 outlines the objectives, which include:

- The conservation of biological diversity;
- The sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including appropriate access to genetic resources and by appropriate transfer of relevant technologies; and
- Taking into account all rights over those resources and technologies.

The CBD was opened for signatures in 1992 at the Rio Earth Summit.

Effluent - Defined in the *Regional Water and Soil Plan for Northland* as any waste or wastewater to be treated and / or disposed of. It does not include solid waste.

Farm dairy waste - Defined in the *Regional Water and Soil Plan for Northland* as all wastes leaving a farm dairy and yard, including animal urine and excreta, wash down water, detergents, soil, sterilizing agents and other residues.

Kaitiaki - guardian

Kaitiakitanga - guardianship

Kaumatua - someone who knows everything about their tribe, and has the support of their tribe

Kaupapa - policy

Mahinga kai - place where food is grown

Manaakitanga - the way we look after each; honouring people as we do the gods, no matter who they are (mena kore pai to manaaki ki te manuhiri, e kore ratou e hoki mai)

Mana moana - because we are children of the sea we have a right to what it provides (mana wai, ahakoa ki uta)

Mana whenua - because we are children of the land we have a right to that place like no other

Manuhiri - visitor

Matauranga - knowledge base and systems

Maunga - mountain

Mauri - spiritual power, (mana wairua)

Mokopuna - grandchild/children

New Zealand Biodiversity Strategy (NZBS) - The vision of the NZBS is:
- New Zealanders value and better understand biodiversity;
- We all work together to protect, sustain and restore our biodiversity, and enjoy and share in its benefits, as the foundation of a sustainable economy and society;
- Iwi and hapu as kaitiaki are active partners in managing biodiversity;
- The full range of New Zealand.s indigenous ecosystems and species thrive from the mountains to the ocean depths; and
- The genetic resources of our important introduced species are secure, and in turn support our indigenous biodiversity.

The NZBS will be implemented over twenty years from 2000.

Non-point source discharge - Defined in the *Regional Water and Soil Plan for Northland* as any diffuse discharges, such as runoff or leachate from land, onto or into land, air, a water body or the sea.

Paru - black mud found in swamps

Pataka - food store

Puna - spring

Repo - swamp

Rangatiratanga - realm of the chiefs, spiritually and culturally

Riparian zone - The strip of land bordering a stream, lake or estuarine/coastal zone. It is the transitional zone between land and water. It characteristically possesses soil, which re wet and sometimes inundated, is commonly found on floodplains and near the bottom of hill slopes adjoining streams.

Rohe - region of responsibility or area of tribal authority

Tāngata Whenua - people of the land

Taonga tuku iho - something rare or precious handed down (including korero)

Tapu - extremely sacred; there are many types of tapu, used in different ways for different kaupapa; can be restrictive

Tikanga - culture, custom (kaupapa, era whakaaro mau mai i a tatou)

Te Tiriti o Waitangi - The Treaty of Waitangi the Maori version; the founding document between Maori and Pakeha

Torere - Secret places where bones were laid to rest

Tupuna - Ancestor, whakapapa, where you come from

Urupa - Cemetary**,** burial ground

Wahi tapu - An extremely sacred place

Waimate - dead water, water that has been contaminated so that it no longer capable of sustaining life

Wet areas - Wet areas are defined by NRC in the *Regional Water and Soil Plan for Northland* (Appendix 13A*)* as areas of rushes, reeds, stock drinking ponds and manmade drainage channels. A wet area is not considered to be a wetland under this definition.

Whakapapa - genealogy, family history

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Annexure Four: Environmental Management Plans

b) Patuharakeke Te Iwi Trust Board, Hapū Environmental Management Plan 2015

PATUHARAKEKE

HAPU ENVIRONMENTAL MANAGEMENT PLAN 2014

MIHIMIHI

Ehara taku toa i te toa takitahi, engari ko taku toa i te takitini ke. Heoi ano ra, anei nga tai mihi e pari ana. E kore rawa e timu te tai aroha. Ko tatou te waihotanga iho e takatu ana ao po, po ao o te hunga kua takahia te ara whanui a Tane ki tua o te Putahitanga o Rehua, ki te huihuinga o Matariki, moe mai ra ki te wahi ngaro, ki nga ringa atawhai o te matua i te rangi.

Kia kake au ki runga i te manu tipua nei. Kia titiro ai ki te mana whenua, ki te mana moana, otira, ki te mana tūpuna o Te Whangarei Terenga Paraoa. Ka hokioi te manu ra, a, ka tiu, ka hoka, ka whakatopatopata, kia rere ai. Ka tiro iho au ki te maunga tapu o Manaia ki tai, ki te mahinga kai nunui rawa atu o te motu nei ko Tawatawhiti tera, kei Parihaka ki uta, ki te ho te ao o nga awa e rere ana mai Te Ahi-pupu-a-Ihenga, ka rere ki te wahi tapu te pou herenga waka ki Hihiaua.

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> "*Toa ana te riri i Ngatiti, tau ana te marino i te raki.*"

Kati ra, e nga tini tupuna e kore a muri e hokia, a tona wa ka whai atu matou i o koutou tapuwae. Ko oku nui, ko oku iti, tena koutou, tena koutou, tena tatou katoa[1].

[1] Na to matou whanaunga, Te Ihi Tito te nuinga o tenei whakatauki e pa ana ki Whangarei Terenga Paraoa nei.

PATUHARAKEKE HAPU ENVIRONMENTAL MANAGEMENT PLAN 2014

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Ko Patuharakeke te Hapu

Tihei mauri ora!

PART I: INTRODUCTION

1. Mana Whenua

This plan is written on behalf of hapu and whanau of Patuharakeke. Over the last two decades in particular, the hapu have been faced with increasing pressure to respond and have input into a variety of issues such as the increased industrialisation in our rohe, progression of treaty claims, resource management planning and customary fisheries issues. In recognition of the need to have a formalised strategy to deal with these matters this plan has been produced.
As outlined in the pepeha on the previous page, the whakapapa we give begins with Manaia as our maunga, Whangarei Terenga Paraoa as our moana, Rangiora as our whare tupuna, Takahiwai as our place where we stand and we the people are Patuharakeke.

We acknowledge that in various areas we share mana whenua with other hapu, however we provide below a summarized version of our wider rohe, which includes:

"...all the lands beginning at Otaika then west to Tangihua ranges. This includes Ruarangi. Then south through Waikiekie and on to Taipuha and then across to Wakatarariki (Bream Tail)... onwards to the northern point of Mangawhai harbour, then out to Te Hauturu o Toi to Aotea and up through the Mokohinau's to Tawhitirahi and Aorangi (the Poor Knights) and encompassing Marotiri, Ngatuturu and Taranga (the Hen and Chickens). This shared mana whenua and mana moana to these islands is acknowledged through Oneho the daughter of Te Taotahi, son of Motatau, and their ancient Ngati Manaia whakapapa.

“At the Northeastern side of the entrance to Whangarei Harbour, at Home Point, sits the pa of Hikurangi, then at Whangarei Heads (Te Whara) the pa of Te Whakaariki and at Tamaterau the small sentinel pa of Te Pirihi is situated. The boundary runs across the harbour to the south side up through Toetoe to Otaika (the point of commencement) and back down the harbour to take in Kopuawaiwaha, Mangapai, Totara, Springfield, Mata, Mangawhati, Ngatiti, Takahiwai, One Tree Point, Poupouwhenua, Ruakaka, Waipu and Langs Beach to Wakatarariki (Bream Tail)"[2]. A visual depiction of our current mainland rohe for the purposes of contemporary management is provided in Figure 1 below. All the lands and waters, including swamps, lakes and ranges encompassed in this territory have traditionally been the domain of Patuharakeke with occasional seasonal rights such as Patunga Kuaka, Parera, Kopua Mango, Manu Oi shared in common with other related hapu.

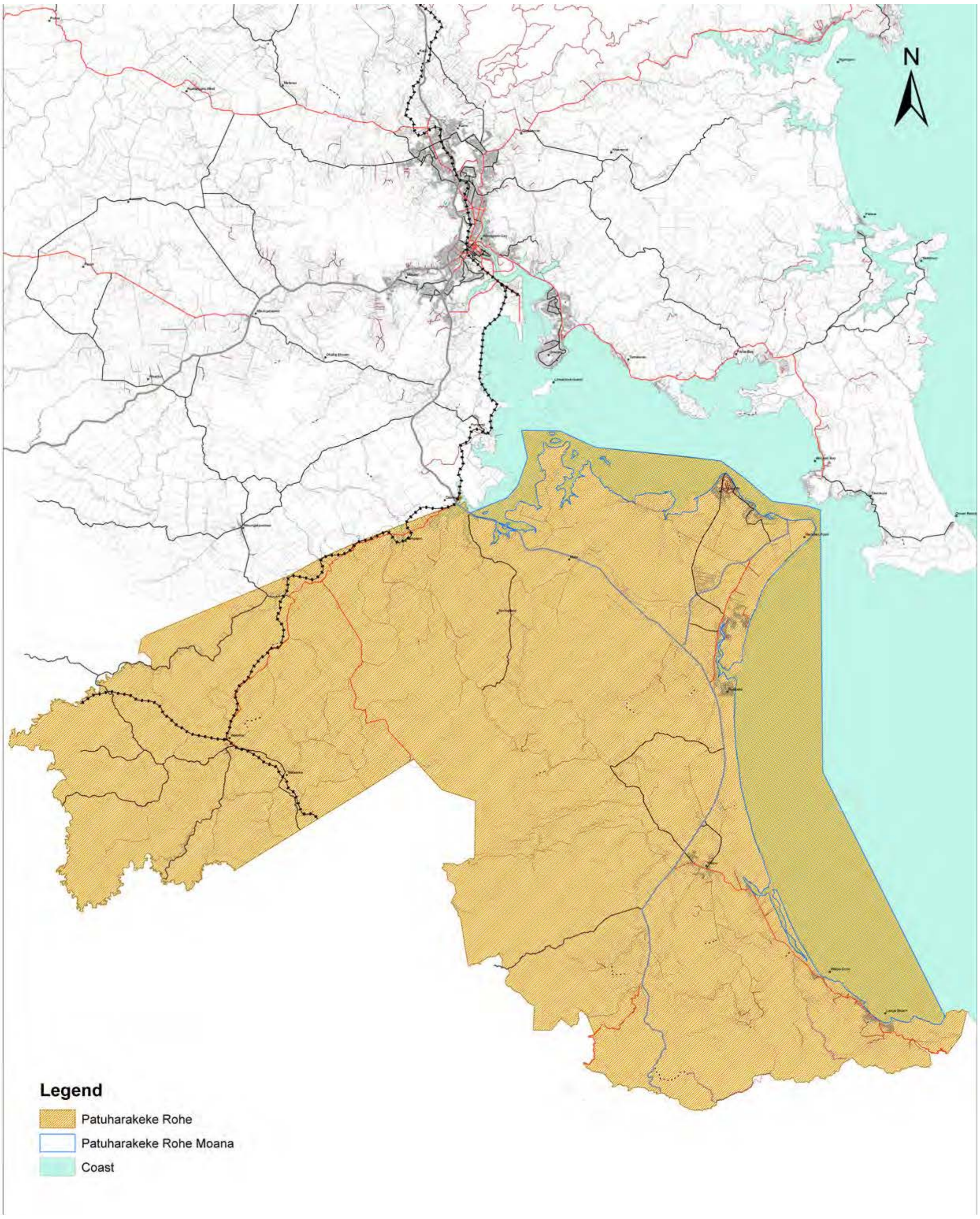

Figure 1: Patuharakeke Mainland Rohe for Contemporary Management Purposes

[2] As described in Brief of Evidence of Paraire Pirihi, Te Paparahi o Te Raki Hearings October 2013

1.2 Te Timatanga – Patuharakeke

Patuharakeke is derived from Ngati Manaia, Ngai Tahuhu, Ngati Wharepaia, Ngati Ruangaio and Te Parawhau and Ngati Tu. Prior to Patuharakeke taking the name Patuharakeke the hapu was more generally known as Ngati Tu with some elements identifying themselves as Te Akitai and Te Parawhau. All of these hapu have origins in Ngai Tahuhu and/or Ngati Manaia.

Patuharakeke are a composite hapu of descent from most major contemporary iwi groups in the north. These include Ngati Wai, Ngapuhi nui tonu, Ngati Whatua and Te Uri o Hau.

1.3 Purpose/ Kaupapa

This plan has been developed primarily for the following reasons:

- To ensure the appropriate engagement and participation of Patuharakeke in the planning and decision-making processes of councils, agencies, and developers with respect to our rohe.
- To assert our tino rangatiratanga and kaitiakitanga over our natural environment and all ancestral taonga; and
- To achieve the full intent of empowering legislative provisions such as those identified in section 1.7 below.
- To clearly identify the environmental management kaupapa of Patuharakeke.

1.4 Vision

"I nga ra e hi ika, he kupenga tatai awhai nuku"

"If you wish to catch fish, first you need to ensure your net is in good order".

Hapu member Harry Maki Midwood shared this whakatauki that was created for Patuharakeke by Harry and Meto Hopa of Kawhia. Through a series of strategic planning hui that have been underway since 2011, whanau agreed this whakatauki covered all the threads of our various discussions and what our journey ahead represented. The "net" was a recurring theme, for example, symbolising concepts such as whakapapa, whanau, matauranga and so on.

This proverb provides an all-encompassing contemporary vision, relating not only to having a healthy environment in order to be able to sustain our physical, cultural, spiritual, social and economic wellbeings, but also ensuring our tribal activities, structures, management practices and operations are reflecting where we are today and where we want to get to. In doing so we also seek to re-engage with korero from our tupuna and our past. With these aspirations, we articulate our approach in this plan.

1.5 Mission

Our Mission is simple:

To revitalise the mauri of our taonga tuku iho.

1.6 The Cultural Framework

The manner in which Patuharakeke responds to resource management issues in our rohe is shaped by several factors:

- A body of knowledge about our land, water and resources built over many generations;

- An holistic worldview that sees people in a familial and symbiotic relationship with the other manifestations of nature around them rather than in domination of it;
- The desire to protect key cultural values and practices such as mauri, tikanga, rahui and waahi tapu that are central to our identity, sense of place and cultural well-being; and
- An historical context where the dispossession of land that followed colonial settlement and Te Tiriti o Waitangi and the confiscation of Poupouwhenua and acquisition of Ruakaka, Mata and Waipu via imperfect purchases had a profound effect on the spiritual, cultural and traditional relationship between Patuharakeke and the environment. As the physical landscape changed, so did the ability of tangata whenua to access and manage the resources upon which they depended (see historical context below in section 3.2).

1.6.1 Key Principles, Values and Practices

The following guiding values, principles or practices shape our view of on the environment and resource management. These are recurring themes throughout this plan and are also intended to guide us in the implementation of this plan:

Whakapapa	The foundation of our framework for managing resources, this demonstrates the relationships between the various elements of the world around us, including human beings.
Kaitiakitanga	Our duty of care and responsibility toward our taonga tuku iho.
Whanaungatanga	Building ongoing positive relationships.
Manaakitanga	Our ability to care for and sustain our whanau and our manuhiri
Matauranga	To protect, revive, enrich and utilise our knowledge in our capacity as kaitiaki
Mana Whenua	*Our right to exercise authority over our rohe and the resources therein.*
Mauri	Protection of the 'life force' contained in all places, species, minerals, ecosystems in our rohe. It can also be understood as a measure of the health and vitality of those elements.
Tikanga	To retain the traditions of our tupuna in all our operations.

1.7 The Constitutional and Legislative Framework

CONSTITUTIONAL FRAMEWORK	COMMENT
Te Tiriti o Waitangi 1840 / the Treaty of Waitangi/ He Whakaputanga 1835	In our view He Whakaputanga o nga Rangatira o Niu Tïreni (The Declaration of Independence 1835) and Te Tiriti o Waitangi need to be read together. Hapu resource management for Patuharakeke is about maintaining the cultural and spiritual integrity of these founding documents. Through He Whakaputanga Maori sought and gained international support of an assertion of political, economic and social rights, acquired an international identity, national flag, and signed a declaration of independence. Te Tiriti o Waitangi further affirmed the protectorate principle and right to exist as a nation and people. Article II of the Te Tiriti confirms the right to exercise authority over natural resources: Maori Text *"Ko te Kuini o Ingarani ka wakarite ka wakaae ki nga Rangitira ki nga hapu – ki nga tangata katoa o Nu Tirani te tino rangatiratanga o o ratou wenua o ratou kainga me o ratou taonga katoa…"* Translation *"The Queen of England agrees to protect the chiefs, the sub-tribes and all the people of New Zealand in the unqualified exercise of their chieftainship over their lands, villages and all their treasures…"*

LEGISLATIVE FRAMEWORK	COMMENT
Resource Management Act 1991 (RMA)	The purpose of the RMA is to promote the sustainable management of natural and physical resources. A number of sections in the RMA make specific reference to the need to recognise and include tangata whenua issues, interests and values, and therefore provide the basis for consultation, collaboration, participation, the development of iwi management plans, development and implementation of appropriate planning tools, and processes and systems for resource consent applications, planning and policy. In achieving this purpose, three main sections 6(e), 7(a) and 8, require

	those exercising powers and functions under the Act to recognise and provide for iwi environmental interests and values. Section 35A requires local authorities maintain records for each iwi and hapu within their area, including contact details and Iwi Management Plans. Clause 3A and 3B of the First Schedule require local authorities to consult with the tangata whenua of the area (through iwi authorities) during the preparation of a proposed policy statement or plan, and set out the criteria for this. Section 33 states that a local authority that has functions, powers, or duties under the Act may transfer any one or more of those functions, powers, or duties to another public authority, including an iwi authority; while Section 36B provides a framework for public authorities and iwi authorities to enter into joint management agreements about natural or physical resources. Section 88 requires resource consent applicants to undertake an assessment of effects on the environment, including cultural effects. Sections 61(2A), 66(2A) and 74(2A) state that regional councils and territorial authorities are required to take into account any relevant planning document recognised by an iwi authority, and lodged with the council, when preparing or changing a regional policy statement, or regional or district plan. Section 104 also provides an opportunity for increased recognition of Iwi Management Plans in local authorities' consideration of applications for resource consent.
Historic Places Act 1993 (HPA)	The HPA is administered by the New Zealand Historic Places Trust/Pouhere Taonga. Its key function is to promote the identification, protection, preservation and conservation of the historical and cultural heritage of New Zealand (s.4 (1) of the Act). Section 4 states that in achieving the purpose of this Act, all persons exercising functions and powers under it are to recognise the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu and other taonga. Any person wishing to undertake work that may damage, modify or destroy an archaeological site (as defined by the Act), or to investigate a site by

	excavation, must first acquire an authority from the NZHPT (ss.10-20 of the Act).
Local Government Act 2002 (LGA)	Although Section 4 of the LGA clearly acknowledges that responsibility for the Treaty obligations lie with the Crown, Parts 2 and 6 of the Act are intended to facilitate participation of Maori in local government. Local government is charged with the responsibility to promote opportunities for Māori to contribute to its decision-making processes.
Environmental Protection Authority Act 2011 (EPA)	This Act establishes the EPA and provides for a range of regulatory functions such as assessing applications for major infrastructure projects, Hazardous Substances and New Organisms, under several environmental Acts (including the Resource Management Act, the Hazardous Substances and New Organisms Act, the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act and the Climate Change Response Act).
Conservation Act 1987	The Department of Conversation Te Papa Atawhai is responsible for the protection of New Zealand's natural and historic heritage as mandated by the Conservation Act 1987. Section 4 of the Act states: "This Act shall so be interpreted and administered as to give effect to the principles of the Treaty of Waitangi".
Treaty of Waitangi (Fisheries Claims) Settlement Act 1992	In addition to settling claims to commercial fishing, the TOWFSA clarified customary fishing rights. Regulations were developed to provide for the customary fishing rights of tangata whenua, the ability of tangata whenua to exercise rangatiratanga over traditional fisheries, and the relationship between tangata whenua and those places used for customary food gathering. The Fisheries 1998 Kaimoana Customary Fishing Regulations allows iwi and hapu to demarcate a rohe moana (coastal marine area) over which they have mana moana status and select tangata kaitiaki whom the Minister of Fisheries (Primary Industries) then officially appoints as guardians. Tangata Kaitiaki can issue permits for customary fishing in the rohe moana. Tangata kaitiaki can utilize customary management tools such as Mataitai reserves and Taiapure – allowing for traditional fishing grounds to be protected as special management areas and either protecting them as reserves or establishing specific rules or bylaws for their management. They can also place a rahui over sites using s186A to strengthen the

	customary closure process.
The State Owned Enterprises Act 1986 (SOE)	This Act is of relevance as there are a significant number of land parcels in our rohe to which it applies. Section 27B provides for the resumption of land to Maori ownership on recommendation of Waitangi Tribunal.
Te Ture Whenua Maori Act 1993 (TTWMA)	TTWMA is administered by the Maori Land Court, the key function of which is to facilitate and promote the retention, use, development, and control of Maori land as taonga tuku iho by Maori owners, their whanau, their hapu, and their descendants.

1.8 Tangata Whenua Planning Tools

A number of tools are made use of by Patuharakeke in the contemporary exercise of kaitiakitanga. These assist with incorporating cultural values and objectives into RMA processes and assessing the cultural health of our rohe. These tools include:

- Cultural Impact Assessments (CIA's)
- Cultural Values Assessments (CVA's)
- Cultural Health Monitoring (see section 3 for a description of Cultural Health Indicator Monitoring Framework for Patuharakeke)
- Sites of Significance Mapping (see section 8 for more information on our mapping project).

1.9 Policy Development and Design

1.9.1 Development

This plan was developed using the following key steps:

- Formation of a hapu "working party" to lead the review and update of the HEMP;
- A Desktop review of existing plan, other HEMPs and identification of gaps;
- An initial workshop to form the working party and allocate tasks;
- One initial hui-a-hapu at the start of the work programme to seek hapu input on the vision and clarification/identify "resource" issues of significance to Patuharakeke;
- Four wananga/workshops with working party and other key hapu members to discuss draft provisions;
- Development of draft provisions (issues, objectives, policies and methods) for the HEMP;
- A "report back" hui -a- hapu seeking ratification of draft plan with presentation of the issues of significance, policy direction and draft provisions to the wider hapu through hui for comment and endorsement;
- Presentation and circulation of the full draft for feedback and editorial review;
- Presentation of the completed HEMP to Local Authorities and Agencies.

1.9.2 Design

The environmental policy contained in this document derives in part from a number of sources, principally the Ngati Hine Environmental Plan, Nga Ture mo Te Taiao o Ngati Hine 2008 and Te Roroa Iwi Environmental Policy (Ratified Version) 2009. These documents were based on earlier iterations of hapu and iwi plans such as those undertaken by Ngatiwai Trust Board and various Ngapuhi hapu, in particular the *Environmental Management Plan for Ngati Rehia, 2007* and the *Ngatiwai Environmental Principles.* We have also taken inspiration and guidance from the Mahaanui Iwi Management Plan 2013 jointly published several Papatipu Runanga of Ngai Tahu.

As with all the documents mentioned, a focal point of our Plan is on building and maintaining durable relationships. We recognise that implementation of our policies will be dependent on the strengths of our relationships with our own whanau and all others who interact within our rohe.

It is vital that Patuharakeke are acknowledged and recognised as kaitiaki and enabled to actively practise kaitiakitanga in regard to all resources within our rohe. Relationships and kaitiakitanga are relevant to all aspects of environmental management. Accordingly, we have prepared a general section on kaitiakitanga and placed this and the relationships section at the front of the document, thereby setting the scene for all natural resource policies that follow.

PART II - PARTICIPATION IN RESOURCE MANAGEMENT PLANNING AND DECISION-MAKING

2. RELATIONSHIPS

Undoubtedly, the participation of Patuharakeke in local government planning and decision making processes was virtually non-existent prior to the enactment of the RMA. This was due to the lack of recognition of tangata whenua and legislative mechanisms that gave visibility to the relationship of tangata whenua with the natural environment. As a result, previous generations had limited success participating in the respective resource management regimes.
Over the last two decades Patuharakeke have adopted various structures to better enable their participation in policy and planning, such as the Patuharakeke Te Iwi Trust Board (PTB). PTB has been increasingly active over the last decade and a half in regard to council and various agencies' issues. PTB has developed a number of policy documents such as Consultation Guidelines[3] in an attempt to identify its position on resource management and other issues clarify appropriate consultation and engagement processes for the benefit of councils and other agencies to secure Patuharakeke's appropriate input. In more recent times this has replaced the previously common occurrence of hapu members being targeted directly in a personal capacity to unwittingly provide consent to activities on behalf of Patuharakeke.

Despite having a number of relationships in place, a number of guidelines, policies and an Environmental Management Plan, Patuharakeke remain entrenched in a primarily reactive mode, where agencies continually engage us as an after-thought once designs are completed and decisions have effectively already been made.

[3] see http://patuharakeke.maori.nz/about-patuharakeke/patuharakeke-trust-board/policies/

In order to achieve our vision and mission, we will need to strengthen existing relationships and create new meaningful ones on a variety of levels. These relationships will be within our own hapu and whanau; our wider whanaunga hapu and iwi links in Tai Tokerau; the community; developers; and agencies with responsibilities in regard to the environment.

Some parties have legal requirements to engage with Patuharakeke either as Treaty Partners and/or under statute (such as the RMA or LGA) and with others it is recognised best practice or tikanga maori. PTB have entered into a number of Memoranda of Understandings with various agencies, industry and developers that have had varying levels of effectiveness. Ongoing collaboration will be required with the following parties, including but not limited to:

2.1 Mana Whenua

- Takahiwai Marae Trustees
- Takahiwai Marae Committee
- Patuharakeke Kainga at Takahiwai, Titahi, Mangapai, Otaika, Toetoe and Tamaterau
- Patuharakeke whanau whanui ie. those living away in other towns and cities in Aotearoa or abroad

2.2 Hapu and Iwi

- Ngapuhi
- Te Parawhau
- Ngatiwai
- Ngati Whatua
- Te Uri o Hau
- Te Waiariki, Ngati Korora, Ngati Taka
- Ngati Tu
- Ngati Kahu o Torongare
- Ngati Manuhiri
- Ngati Rehua
- Ngati Hine

2.3 Community

- Bream Bay Coastal Care Group
- Schools, Kohanga
- The Whitebait Connection Programme
- Ruakaka Economic Development Group, Ruakaka Ratepayers Association
- Marunui Trust
- Bream Head Trust
- Forest and Bird

2.4 Developers/Industry

- Refining NZ Ltd
- Northport Ltd
- Northland Port Corporation
- Carter Holt Harvey (LVL)
- Fonterra
- Dairy NZ
- Federated Farmers
- Mighty River Power
- Golden Bay Cement

2.5 Government Agencies and Institutions

- Northland Regional Council (NRC) & Whangarei District Council (WDC)
- Ministry of Primary Industries (MPI), Ministry for the Environment (MfE), Department of Conservation (DOC), Historic Places Trust (HPT), Environmental Protection Authority (EPA)
- Crown Research Institutes eg. NIWA, Cawthron
- Universities and Academic Institutes
- Northland District Health Board (NDHB)
- Maori Land Court (MLC)
- Te Puni Kokiri (TPK)
- Office of Treaty Settlements (OTS)
- Environmental Protection Authority (EPA)
- Northland Inc Ltd

2.6 Issue

Current relationships are limited in their provision for the full participation of Patuharakeke as equal partners in decision making processes affecting natural and physical resources in our rohe.

2.7 Objectives

a) Patuharakeke will strengthen and establish ongoing meaningful relationships with our neighbours, community, developers and agencies to ensure we are appropriately acknowledged as kaitiaki of our rohe.
b) Patuharakeke will have a partnership role in resource management planning and decision-making within our rohe.

2.8 Policies

a) PTB will endeavour to keep hapu and whanau informed of all issues affecting the development and management of our natural, physical and heritage taonga. For significant issues, PTB will always advocate for these issues to be brought back to the marae for korero and hui, and will provide regular, open consultation through hui between PTB, and our hau kainga and whanau whanui.

b) PTB will endeavour to ensure that Patuharakeke participate in the decision-making processes of government agencies that affect us and our resources and are engaged on all issues of concern to us.

c) Patuharakeke will wananga and work collaboratively with other hapu and iwi to share skills, learning, knowledge, experiences and opportunities. Patuharakeke will consider invitations to participate in multi stakeholder working parties on a case by case basis.

d) PTB will continue to advocate for the recognition of Patuharakeke as a Treaty partner in all multi-stakeholder processes involving the management and development of natural, physical and heritage resources within our rohe. Patuharakeke will consider all requests to join multi- stakeholder processes on a case by case basis.

e) Patuharakeke will continue to work collaboratively and positively with all community groups and stakeholders whose policies and initiatives contribute to the sustainable management and enhancement of resources within our rohe. Patukarakeke will consider all requests to join multi-stakeholder processes on a case-by-case basis.

f) PTB will establish a dedicated Resource Management Unit as a key method of providing for participation of mana whenua in the sustainable management of our rohe and protection of our taonga.

g) PTB will report annually to Patuharakeke hapu on all aspects of its involvement in the sustainable management of our rohe and its resources.

h) PTB will, to the best of our capacity, monitor all applications for development initiatives within our rohe.

i) PTB will direct developers to the appropriate point of contact for their proposal. PTB will enter into consultation with all developers to assist in ascertaining the actual or potential effects of the development proposals on Patuharakeke, our values and our environment. Where any development initiative has the potential to impact on our values or resources, PTB will request that the developers bring their initiatives to the marae for the consideration of the hau kainga.

j) PTB will ensure that adequate measures to avoid, remedy or mitigate any adverse effects on Patuharakeke, our values and our environment are identified for developers and council prior to development proceeding.

k) PTB will, to the best of our capacity, monitor all developments once commenced to ensure that they do not result in adverse effects and that they are completed in accordance with the conditions of their consent.

l) PTB will promote and enhance partnerships between Patuharakeke, central government and its agencies, and regional and district councils. The relationships with Patuharakeke, need to be cognisant of our status as tangata whenua, kaitiaki and Treaty partner.

m) PTB will actively participate in the decision-making processes of all agencies where those decisions affect Patuharakeke, our values or taonga. Patuharakeke will consider requests to participate in such processes in a collective forum of other tangata whenua on a case by case basis.

n) Patuharakeke will actively participate in the management of our taonga – our involvement should be sought at the commencement of all management, planning and monitoring processes.

o) Agencies and other parties should be cognisant of the lack of capacity and resources for PTB to participate in contemporary planning and policy processes. Where consultation or participation in agency processes involves a cost to Patuharakeke, these should be borne by the relevant agency. Where consultants or contractors undertake consultation on behalf of agencies, the contract for service should specify the need for the contractor to consult directly with Patuharakeke on a professional basis.

p) PTB will continue to build the capacity and capability of Patuharakeke to engage with local government, contribute to decision making and implement kaitiakitanga objectives and aspirations.

q) PTB will work with local authorities to develop appropriate methods and processes to assist in building our capacity to contribute to decision making, consistent with local government obligations under the Local Government Act 2002. This includes:

i. The provision of meaningful opportunities to contribute to decision making processes;
ii. The provision of training opportunities on RMA 1991 issues; and
iii. Ensuring that tangata whenua contributions to planning processes are appropriately resourced;
iv. Carrying out cultural inductions for local government, agencies, and other parties and stakeholders.

2.9 Methods

Relationships with Hapu and Iwi

a) Patuharakeke will continue to seek to maintain close communication with other Taitokerau kaitiaki. This includes sharing of skills, learning, information, knowledge and experience and providing support for the kaupapa of other units where this is complementary to our policies and methods. Patuharakeke will consider all requests to join multi stakeholder working parties on a project by project or issue by issue basis.

b) Patuharakeke will actively pursue the wider kaitiakitanga interests of the Iwi of the Taitokerau and consider:

i. collaboration in practical work, technical, training and information systems with other iwi and hapu-based kaitiakitanga units;
ii. developing processes for facilitating the transfer of information between Iwi, based on best practice for kaitiakitanga, eg. the development of tribal GIS systems and collaborative support systems and groups in this area.
iii. coordinating environmental monitoring (eg. kaitiaki/cultural health monitoring) with other iwi and hapu of Te Taitokerau;
iv. collaborating with other Taitokerau Iwi and hapu to prepare generic responses to central and local government policy initiatives.
v. Where feasible, Patuharakeke will network with other Iwi and hapu to investigate whether there are shared activities, learnings and leverage opportunities with local governments; national government and international indigenous arenas.

Relationships with Community Groups

c) Patuharakeke will continue to engage with all community groups involved in the sustainable management and enhancement of our rohe and its resources. Such engagement will be on the clear understanding that Patuharakeke are tangata whenua and as such are mana whenua and kaitiaki within our rohe and, as such, not just another stakeholder.

d) Patuharakeke will remain open to approaches from community groups seeking support or assistance with sustainable management or development initiatives within our rohe. PTB will consider requests to enter into partnerships with community groups for specific projects or initiatives on a case by case basis.

Relationships with Developers

e) PTB will establish a Patuharakeke RMU to work with all responsible developers in our rohe and to facilitate dialogue and engagement with our marae community, hapu and land owners.

f) PTB will continue to advocate that all potential developers should seek to enter into direct engagement with us in regard to their proposals at the earliest possible stage of the development.

g) PTB will enter into agreements with responsible developers to clearly specify the involvement of Patuharakeke in the development process. Where this involvement includes a cost to the marae or hapu, PTB will insist that all reasonable costs are borne by the developer.

h) Patuharakeke will develop protocols covering protection of all waahi tapu and other heritage sites and values in regard to development initiatives and will seek to have these protocols adopted as standard consent conditions for all consents granted within our rohe.

Relationships with Science and Research Organisations

i) Patuharakeke will enhance the exercise of kaitiakitanga through establishing relationships and recognizing collaborative opportunities with Crown Research Institutes, universities and other research organisations through research partnerships.

Information

j) All agencies need to provide adequate and timely information on all activities and programmes affecting Patuharakeke, our values and our taonga to Patuharakeke. In particular, information should be supplied regarding:
   i. resource consents (notified and non-notified), permit and concession applications, including previous staff reports and monitoring/compliance records in the case of consent renewal applications;
   ii. Plan and policy preparation, monitoring and review, for example Long Term Plans, District Plans, Regional Policy Statement and Plans, Conservation Management Strategies and Plans; and
   iii. Work plans and projected projects that could potentially affect Patuharakeke, our heritage, culture and taonga at the commencement of the planning or business cycle.
   iv. Any agencies undertaking scientific research within our rohe should consult with PTB before research commences to determine how their programmes can best co-ordinate with the needs and priorities of Patuharakeke. If the work impacts on taonga of Patuharakeke appropriate protocols must be formally agreed with the kaitiaki from the outset of the research and conditions for the work determined by mana whenua must be respected. Such protocols will include agreed understanding of indigenous intellectual property rights. Additionally, where kaumatua and kuia consider it appropriate, tikanga will be observed in the course of the research; and Patuharakeke should have the opportunity to work beside the researchers, in a paid capacity. Finally, any publications arising from research involving ourselves and our taonga, Patuharakeke shall be invited to review findings and append our own comments to the published information and will be appropriately acknowledged in the publication.

Resource Consents / Concessions / Permits

k) Patuharakeke request that the agencies:

   i. Require all applicants for consents/concessions/permits to demonstrate that they have ascertained whether their proposal has any effects, major or minor, on Patuharakeke values and resources. Where effects, actual or potential, are evident, applicants should be required to provide evidence that Patuharakeke have been adequately consulted and engaged. Where such evidence is not supplied the application should be not be accepted;
   ii. Place conditions on consents that provide for the avoidance of effects on matters of significance to Patuharakeke and provide for the involvement of Patuharakeke in the monitoring and review of resource consents. This should include development of agreed protocols governing any activity allowed by consent or permit that can affect waahi tapu or other heritage matters;
   iii. Include in all council reports on resource consent applications or policy development within the rohe of Patuharakeke, the results of consultation or negotiations held with Patuharakeke;
   iv. Hold hearings, pre-hearings and preliminary meetings on marae where Patuharakeke taonga, values or heritage may suffer adverse effects from the proposal;
   v. Not be involved in decisions pertaining to Patuharakeke resources, values or heritage without full prior discussion with Patuharakeke;
   vi. Develop and implement appropriate processes for informing Patuharakeke of all notified and non-notified applications for resource consent, permits, and so forth of interest to Patuharakeke;
   vii. Develop mutually-agreed processes and timeframes to allow us to conduct site visits and assessments of all proposed activities before final decisions are made;
   viii. Require all prospective applicants at the earliest possible stage of their proposal to agree to the process by which Patuharakeke will consider and monitor the development if requested. This will include allowance for conducting site visits and assessments of all proposed activities prior to lodging resource consent applications and reasonable access for kaitiaki to monitor the development once consent is granted where Patuharakeke consider this necessary; and develop best-practice standards and guidelines for development processes and outcomes within our rohe.

Decision Making

l) All agencies need to engage regularly with Patuharakeke to ensure adequate and timely participation of Patuharakeke in development and implementation of agencies' decision-making and management processes. Agencies should actively consider developing Agreements or Memoranda of Understanding to umbrella their relationships with Patuharakeke and to provide clarity and certainty for both partners.

Joint Management

m) All Crown assets within the rohe of Patuharakeke are subject to actual or potential Waitangi Tribunal claims. This is particularly relevant to WDC reserves and the conservation estate or 'public conservation lands'. All decisions over current acquisition, transfer, disposal and management of

Crown asset must include Patuharakeke from the outset of those processes.

n) The Department of Conservation is obliged by statute to give effect to the principles of the Treaty of Waitangi, and should do so by entering into binding memoranda of agreement with Patuharakeke. These memoranda will include collaborative or co-management agreements for specific localities within the Crown's conservation estate, as well as agreements whereby Patuharakeke have effective input into all aspects of the Department's management processes that affect us, our values, or our taonga.

o) Local authorities have the ability to transfer powers and functions under the RMA and Reserves Act 1977 and the ability under the RMA and the LGA to enter into joint management agreements with Patuharakeke. Opportunities for any of these mechanisms should be identified and incrementally implemented. For example, management of Council owned reserves and similar areas, especially where these contain waahi tapu; present a prime opportunity for this. Patuharakeke will negotiate a schedule for developing joint management agreements over key reserves within our rohe that have high cultural value.

p) In addition to the above, WDC and NRC should:
   i. Provide for the active participation of Patuharakeke in the development, implementation, monitoring and review of all council plans and policies and all decision-making processes that affect us, our values and taonga;
   ii. Recognise Patuharakeke as an affected party to all plan and policy development and all resource consent and permit applications that impact or affect our resources, culture and/or heritage;
   iii. Take into account this Environmental Management Plan in the preparation or review of all statutory and non-statutory instruments (strategies, policy statements and plans) that affect our rohe as the initial step in involving Patuharakeke;
   iv. Where, for whatever reason, there has not been Patuharakeke input into statutory planning processes, such silence is not to be interpreted as agreement or acceptance of any such plan or policy; and
   v. Ensure that an adequate pool of independent maori commissioners approved by or acceptable to Patuharakeke is available for all relevant hearings (resource consent, plan and policy development) where Patuharakeke interests are involved.

PART III: RESOURCE ISSUES

3. KAITIAKITANGA

Kaitiakitanga is fundamental to the relationship between Patuharakeke and the environment. As Kaitiaki, Patuharakeke are responsible for both the knowledge (matauranga) and the practice (tikanga) of kaitiakitanga in relation to resources. This relationship is an intergenerational responsibility rather than a right – a duty we are bound by culture, tradition and whakapapa to maintain. These duties are based upon the ultimate aim of protecting mauri; and secondly, the obligation to ensure the legacy we leave to our mokopuna is a healthy environment.

There has been a large historical loss of knowledge of kaitiakitanga – both the “whys” and “hows” – as a result of colonisation, our virtual landlessness and the progressive introduction of increasing layers of government control over resources and their management.

Te Tiriti o Waitangi guarantees tangata whenua the right to fulfil their kaitiaki obligations to protect and care for taonga in the environment, including land, waterways, natural features, waahi tapu and biodiversity within our rohe. However, there are important questions about the ability of current laws and policies to effectively support these kaitiaki relationships to the degree required by the Treaty. As tangata whenua who hold manawhenua in our rohe, Patuharakeke interests in resource management extend beyond stakeholder or community interests. The articles and principles of Te Tiriti o Waitangi are the underlying mutual obligations and responsibilities that Te Tiriti places on both Patuharakeke and government agencies and local authorities, and reflect the intention of Te Tiriti as a whole.

This Patuharakeke HEMP is a written expression of kaitiakitanga, setting out how to achieve the protection of natural and physical resources according to our values, knowledge and practices. This section provides an overarching policy statement on kaitiakitanga, and is relevant to all other sections of the Plan.

3.1 Recognition of Kaitiakitanga

3.1.1 Issues

a) Local authorities have not been successful in providing effective recognition of kaitiakitanga in natural resource management and governance processes.

b) There is a lack of direct and effective Patuharakeke involvement, as the kaitiaki, in the sustainable management of our ancestral taonga, including water, soil, minerals, air, indigenous flora and fauna and our heritage.

3.1.2 Objectives

a) Patuharakeke are acknowledged as the kaitiaki of all resources within our rohe and are actively involved in the decision-making, management, monitoring and enhancement of those resources including water, soils, mineral, air, flora and fauna and heritage.
b) The relationship of Patuharakeke and our culture and traditions with our ancestral taonga is recognised and provided for as a matter of national importance by Councils and other statutory agencies.
c) Matauranga Patuharakeke or traditional Patuharakeke environmental knowledge is acknowledged, protected and utilised.

3.1.3 Policies

a) Patuharakeke are recognised as the kaitiaki of all resources, including water bodies, energy, soils, minerals, air, flora, fauna and heritage, in our rohe.
b) Local authorities shall ensure that they have the institutional capability to appropriately recognise and provide for the principle of kaitiakitanga.
c) Elected or appointed members (councillors or commissioners) and senior management must provide leadership and support for their staff regarding engagement with Patuharakeke.
a) Use will be made of relevant Matauranga Patuharakeke/traditional Patuharakeke environmental knowledge and practice in management and decision-making associated with all resources, including water bodies, soils, minerals, air, flora, fauna, energy and heritage. The intellectual property rights associated with that knowledge will be respected and protected.
b) PTB are an interested and potentially affected party to any notified and non-notified resource consent application within our rohe concerning or potentially affecting any resource because of our special relationship with these taonga. When PTB is involved in setting conditions for a consent, the applicant or council will resource PTB to regularly monitor and review those conditions.
c) Local authorities will recognize and take into account this Patuharakeke HEMP as "...a relevant planning document recognised by an iwi authority and lodged with the council" in accordance with section 61(2)(a) of the RMA.

3.1.4 Methods

a) PTB requests that all statutory agencies with responsibility for management of all resources recognise Patuharakeke as kaitiaki within our rohe. PTB will monitor all agencies' current and proposed policies to ensure that this happens. PTB also request that all relevant statutory agencies:
   i. Actively promote engagement with tangata whenua as being best practice to resource consent or permit applicants pre-application;

ii. Require that all resource consent or permit applications concerning or potentially affecting all resources, including water bodies, soils, minerals, air, flora, fauna and heritage, be lodged with a PTB Cultural Impact Assessment approved by Patuharakeke as the relevant tangata whenua. Suggested consent conditions should be included in the assessment;
iii. Notify PTB of any resource consent or permit application concerning or potentially affecting all resources, including water bodies, soils, minerals, air, flora, fauna and heritage and provide adequate time and resourcing for PTB to respond in an informed manner;
iv. Provide PTB with copies of any infringement or abatement notices or details of Environment Court proceedings within our rohe.

b) PTB, councils and other agencies and stakeholders will work together to ensure there is ongoing provision of opportunities to instil traditional values and knowledge in our rangatahi through involvement in restoration projects and customary mahinga kai practices.

3.2 Te Tiriti o Waitangi

PTB is the kaitiaki of claim number 745, the blanket claim over our rohe on behalf of Patuharakeke, to the Waitangi Tribunal. There are various other claims within Patuharakeke that have been filed with the Waitangi Tribunal such as Wai 504, Wai 1038 and Wai 1040. In October 2013 these claims were heard before the Waitangi Tribunal as part of Te Paparahi o te Raki inquiry. Box 1 below provides a background to the Patuharakeke Claims. PTB are working to expedite an outcome as soon as possible given the immense development pressure and push by crown entities and local government to sell remaining crown/ surplus assets in our rohe. Resolution of Treaty claims is likely to have significant impact on management of resources within our rohe.

In the interim, the precautionary approach would strongly suggest that significant management decisions should not exacerbate or undermine existing claims. In any dispute as to which version of the Treaty has mana, Patuharakeke policy is that the Maori version has preference. The RMA 1991 requires all persons exercising functions under that act to take into account the principles of the Treaty of Waitangi. The Local Government Act 2002 requires local authorities provide opportunities for Maori to participate in decision-making processes in recognition of the Crown's responsibility to take appropriate account of the principles of the Treaty. The Conservation Act 1987 must be interpreted and administered as to give effect to the principles of the Treaty. The Reserves Act 1977, gives effect to the Treaty of Waitangi as recognised in the Conservation Act. The Fisheries Settlement legislation and Kaimoana regulations provide for Maori rights in fisheries management as guaranteed by the Treaty. Other legislation such as the Hazardous Substances and New Organisms Act 1996, and the Historic Places Act 1993 also place responsibilities on local authorities to recognise the Treaty.

The lack of understanding of Treaty issues by government agencies and local authorities and their inadequate policy and processes to address Treaty obligations, are key concerns for Patuharakeke. The very fact that the RMA hierarchy directs decision makers to 'take [the Treaty] into account', rather than 'recognise and provide for', or 'give effect to', trivializes the status of Te Tiriti.

In our view, it is not sufficient to merely 'take into account' the *principles* of the

Treaty of Waitangi. Instead, Te Tiriti/the Treaty should define the relationship between Patuharakeke and the Crown, and also local government. It is through giving effect to the Treaty that local government can meet their other obligations under the Act such as S6(e) of the RMA to recognise and provide for the relationship of Maori with natural resources as a matter of national importance, and that manawhenua can fully exercise kaitiakitanga rights and responsibilities.

Box 1: Background To Patuharakeke Statement of Claim

Patuharakeke have several claims before the Waitangi Tribunal, including key claims Wai 745 and Wai 1308. 15 years of tireless work and research by our Claims Progression Committee culminated in the presentation of our briefs of evidence before the Waitangi Tribunal in October 2013. While this momentous occasion finally provided the opportunity to relate our experiences and losses as Patuharakeke, the journey is of course far from over, and we will continue in our quest for fair and just recognition of our Treaty grievances.

The key causes of action to which our Statement of Claim relate include undermining the Tino Rangatiratanga of Patuharakeke through nineteenth century land alienation. The alienation and confiscation of land in Patuharakeke's rohe through actions of the Crown and/or their agents has resulted in less than two percent of land remaining in Patuharakeke ownership. From approximately 100,000 acres including coastal lands stretching from One Tree Point to Mangawhai of around 78,000 acres along the eastern seaboard, now only around 5 acres (2.02 hectares) are held communally by Patuharakeke. This includes Patuharakeke's marae complex, urupa, Kaumatua flats and the old Takahiwai Native School grounds.

Confiscation:

- *The 5000 acre Poupouwhenua block (which includes most of Marsden Point and One Tree Point and is shown in Figure 2 below) was confiscated by the Crown in late in 1844. This was in compensation for a settler's house that was burnt down in Matakana earlier that year by a group that included a chief from Patuharakeke owing to a dispute about the imperfect acquisition of the land by the settler. The Auckland Provincial Governor was later quoted in the Southern Cross Newspaper that following an investigation he was satisfied that the events in Matakana had been exaggerated - but the land was still taken.*
- *The underlying purpose of the 'confiscation' was to provide land for settlers.*

Alienation through Corrupt Crown Purchases:

- *An excessively low price paid, then would on sell to settlers shortly after at a massive profit margin (eg. Waipu and Ruakaka Blocks)*

The failure to survey boundaries, then taking land in lieu of survey charges

- *The failure to provide reserves and breach of promise to ensure 10% of future proceeds would go to Patuharakeke (eg. Waiwarawara block)*
- *Public works takings right up until the 1960's (eg. Pukekauri Block)*
- *Busby purchased a large area at Ruakaka and Waipu in December 1839 - he paid 40 pounds and some other items including 60 blankets for an area of about 100,000 acres. This purchase was not recognised as valid by the*

Crown following further investigations in 1841 and 1842. Historians have shown clearly that Maori who agreed to sell land in the 1840s and 1850s thought they were only selling use rights for the buyer to utilise the land, and that the contract was based on a mutual benefit, and not that the land was given up in perpetuity. Busby had been "British Resident " in NZ based in Russell, carried a lot of influence and his purchase was probably NZ's first case of "insider trading"- he would have been aware that he was purchasing only 6 weeks ahead of the signing of the Treaty of Waitangi and would have been aware of the Crown plans to stop Maori from selling land to anyone except the Crown once the Treaty was still signed.[4]

Twentieth Century Breaches:

Twentieth century breaches that are highlighted in our Statement of Claim emphasise environmental issues, such as the industrialisation of Poupouwhenua and the failure of the Crown to protect natural resources such as freshwater resources, Whangarei Terenga Paraoa and other natural resources and heritage within our rohe. These issues are substantively discussed in Part III of this HEMP. Unfortunately the Crown and government agencies persist in underminining our rangatiratanga to the present day. Some current examples that have forced PTB to take legal action to protect our rights include:

Mighty River Power MRP/ "Section 27B Memorials":

- *The State-Owned Enterprises Act 1986 corporatised a number of government agencies (SOEs) through government's restructuring of the public sector in the 1980s. On corporatisation, SOEs sold off assets (lands and buildings) deemed 'surplus to requirements'. Much of this estate had been constructed on lands, or were lands taken from Maori under the Public Works Act. This resulted in court action for lack of Treaty provisions in the disposition of these surplus assets.*

- *The New Zealand Maori Council sued the Crown over the lack of Treaty provision and the 27B amendment of the SOE Act 1986 was the result.*

- *s27B provides for 'remedies' lands to be returned to original owners/claimants to Waitangi Tribunal if they find in claimants' favour, claimants would get first right to purchase back the land...*

- *The Electricity department which ran the Power Station at Ruakaka became 'Electricorp' and eventually after number of iterations, the current Mighty River Power Ltd (MRP);*

- *In 2013 the government sells more of Patuharakeke's potential treaty claims - 49% of MRP on the share market in 'Government Share Offer' under the Mixed Ownership Model and claim that Iwi were offered opportunity to purchase shares in their Treaty Settlement negotiations;*

- *In April 2014 MRP places 11 titles (166ha) on the open international market. PTB (with whom they have a Memorandum of Understanding) was given one days notice of the sale.*

- *Patuharakeke litigates through the High Court to stop the sale and seeks an*

[4] BOE Guy Gudex

urgency hearing before the Waitangi Tribunal.

Ruakaka Racecourse:

- *Questionable purchase by Whangarei Racing Club in 1990 for a price well below government valuation prior to any requirement for consultation with tangata whenua on lands that were to be set aside for treaty settlements.*
- *Whangarei Racing Club has applied to put zoning in place to develop an equine centre, hotel facilities and 350 residential units through a 'Private' Plan Change funded by WDC/ratepayers.*
- *The land is subject to S27B of the Stated Owned Enterprises Act 1986 (SOE Act)*
- *PTB had to lobby the council to commission a Cultural Impact Assessment and have since put in several submissions in opposition*
- *The Plan Change has since been approved by WDC and Environment Court Appeals were lodged by PTB and DOC. Court directed mediation is presently underway.*

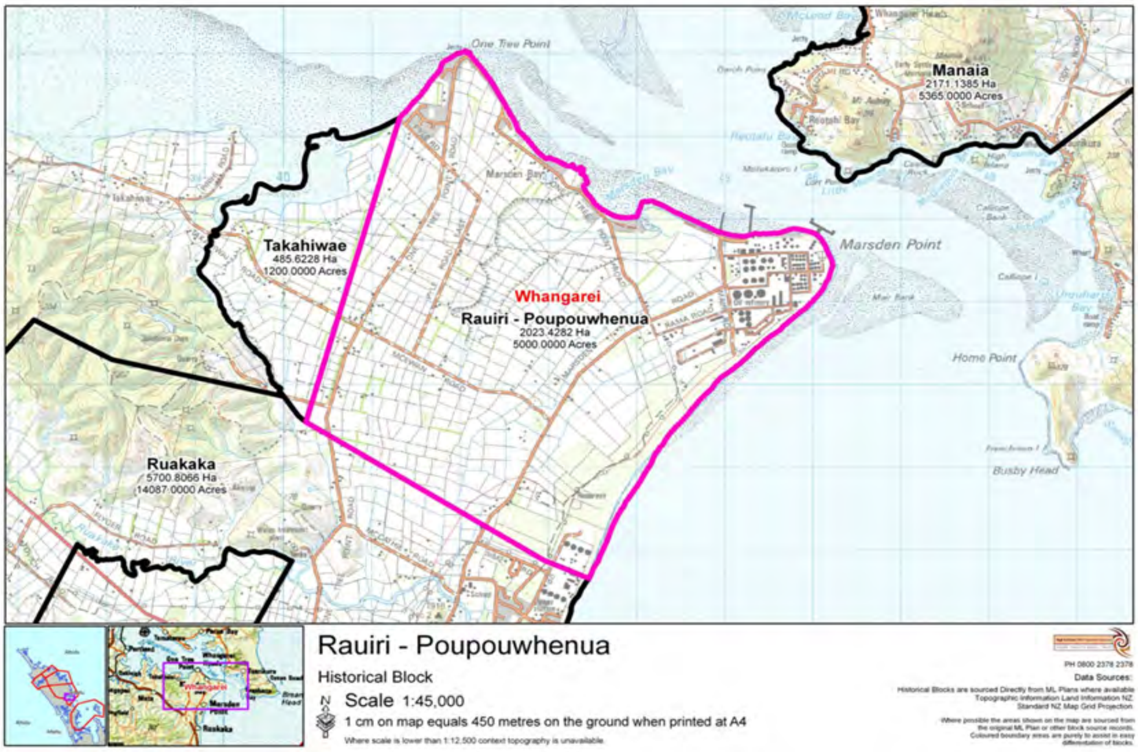

Figure 2: Poupouwhenua Block

3.2.1 Issue

a) There is a lack of proper recognition of and provision for, Te Tiriti o Waitangi as the basis for the relationship between Patuharakeke and local government.

3.2.2 Objective

a) Te Tiriti o Waitangi forms the basis of the relationship between Patuharakeke and local government.

3.2.3 Policies

a) Te Tiriti o Waitangi is an agreement between Patuharakeke tupuna and the Crown, but in contemporary times Treaty obligations also sit with local government in addition to central government agencies.

b) The articles of Te Tiriti o Waitangi should be given effect to in accordance with the significance of the treaty to Maori as the founding document of the nation.

c) In giving effect to Te Tiriti, government agencies and local authorities must recognise and provide for kaitiakitanga and rangatiratanga. As the tangata whenua who hold manawhenua in our rohe, Patuharakeke interests in resource management extend beyond 'generic' stakeholder or community interests.

3.2.4 Methods

Approaches for achieving these objectives and policies are can be found throughout the various sections of this plan, however methods of particular relevance can be found in section 2.9 regarding (i) relationships; (j) provision of information; (k) protocols for consenting, concession and permitting processes; (n-q) decision-making and joint management.

3.3 Kaitiaki Monitoring Tools

As kaitiaki and mana whenua, Patuharakeke must be involved in the monitoring of all aspects of the health of our rohe. For this to happen there needs to be:

- increased integration of monitoring across agencies
- increased reliance and use on community level and community-based monitoring
- increased recognition and use of cultural indicators
- resourcing of kaitiaki

A cultural monitoring framework for our health and wellbeing needs to recognise that:

- Patuharakeke traditional, economic and subsistence foods and practices, and traditional cultural activities are interrelated, as well as mutually supportive and interdependent.
- The overall health and cultural wellbeing of Patuharakeke whanau and hapu is directly related to our ability to manage, harvest, prepare and eat our traditional foods and continue our traditional practices.
- Patuharakeke have the traditional knowledge and maintain practices that will, with proper technical support and resourcing, help to meet our economic and environmental needs and ensure our wellbeing.
- It is important for us as a hapu to determine methods to measure the current state, changes and rates of change (decline, destruction, improvement or revitalisation) of our environment. This must be done with full and effective participation of our taumata and resource management practitioners.

We fully expect our cultural monitoring framework to develop over time in step with our participation. To date, Patuharakeke have developed and utilised indicators primarily in the realm of Tangaroa. We are currently developing an overarching Cultural Health Index ('CHI') methodology framework that will include indicators for monitoring the cultural health of Papatuanuku, Tane Mahuta and of course Wai Maori/freshwater resources.

Tangaroa CHI were developed as part of a Ministry for the Environment project "A Coastal Cultural Health Index for Tai Tokerau"[5] (CCHI) in which Patuharakeke whanau and PTB took part in 2010. The CCHI is based on the calculation of a takutai health measure and mahinga kai measure. We anticipate modifying and adding to this index as part of our overall CHI Framework.

Indicators	Unhealthy				Healthy
1. Catchment land use	1. Land heavily modified (eg. bush, wetlands etc lost)	2	3	4	5. Appears unmodified
2. Adjacent vegetation (MHWS plus 100m)	1. Little or no vegetation – neither exotic or indigenous	2	3	4	5. Complete cover of vegetation – mostly indigenous
3. Adjacent land use (MHWS plus 100m)	1. Margins heavily modified	2	3	4	5. Margins unmodified
4. Takutai condition (sediment)	1. Covered by mud/sand/slime	2	3	4	5. Clear of mud/sand/sediment
5. Changes to takutai	1. Evidence of modification (e.g. dredging, structures, erosion, reclamation)	2	3	4	5. Appears unmodified
6. Water quality	1. Appears polluted (eg. eg, foams oils, slime, marine pests etc)	2	3	4	5. No pollution evident
7. Water clarity	1. Water badly discoloured	2	3	4	5. Water is clear
How would you describe the overall health of the takutai at this site?	1. Very unhealthy	2	3	4	5. Very healthy
Comment					
8. Mahinga Kai Measure					
Abundance	While in the field a collated list of plant, bird and fish species is prepared for each site. A score of 1–5 is then made, depending on the total number of species present. Can also use catch per unit effort measure for specific species (eg how long does it take to fill a sack with pipi?) useful for comparison over time. Also note size of individuals eg. to evaluate whether there is a range of				

[5] see Chetham and Shortland, 2010

	adults, juveniles etc
Change	Comparison of species present today and mahinga kai species historically sourced from the site. Score 1-5
Accessibility of the site	A score of either 1, 3 or 5 is given based on the legal and physical access tangata whenua have to the site: 1 No access to the site. 3 Either physical or legal barriers make access difficult. 5 Unimpeded easy access to the site.

Figure 3: Patuharakeke Coastal Cultural Health Indicators

4. RANGINUI

4.1 Discharges to Air

While air quality in Tai Tokerau generally remains high, Patuharakeke are in a unique, sensitive location owing to the industry clustered at Poupouwhenua/Marsden Point. The oil refinery at Poupouwhenua is a significant emitter of discharges to air, and others in the vicinity such as Northport, the Carter Holt Harvey LVL Plant, and a solvent recovery plant, also contribute to emissions. As such, the Northland Regional Council has developed a specific Marsden Point Air Quality Strategy that came into effect in 2008 and has been included in the Regional Air Quality Plan. This strategy must be taken into account when decisions are made on air quality in the Marsden Point Area.
Discharges to air have the potential to adversely affect local ecology, amenity values and the health of our whanau living and working within this ‘airshed’. While the industries over the years have provided employment for hapu members, many of us feel that our statistics around lower life expectancy and poor health statistics have been influenced in some way as a result of industries’ location and density in our rohe. According to Northland District Health Board, no health impact assessments associated with industry at Marsden Point have ever been undertaken.[6]

PTB have developed a robust working relationship with Refining NZ, the oil refining company, over the last decade in particular, and are provided monitoring results on a regular basis. The refinery has updated technology in recent times to ensure they are performing within consent limits, and strive to take a best practice approach. However, with the existing zoning and projected growth of future industry in our rohe it will be important to remain vigilant and have ongoing input into any future policy development and monitoring on air quality and discharge permit applications.

4.1.1 Issue:

a) The discharge of contaminants-to-air can have adverse effects on Patuharakeke values such as mauri, mahinga kai, waahi tapu, and marae, and the health of our people and communities.

4.1.2 Objectives:

a) To protect the mauri of air from adverse effects related to the discharge of contaminants to air.
b) Patuharakeke are involved in regional decision making on air quality issues.
c) PTB maintain close relationships and dialogue with the air polluting industries in our rohe.

[6] Medical Officer of Health, Dr Jonathan Jarman, pers. comm. 12/12/2012.

4.1.3 Policies:

a) To protect the mauri of air from adverse effects associated with discharge to air activities.

b) To require that the regional council recognise and provide for the relationship of Patuharakeke with air, and the specific cultural considerations for air quality, including the effects of discharge to air activities on sites and resources of significance to tāngata whenua and the protection of cultural amenity values.

c) To support the use of indigenous plantings and restoration projects as a means to offset and mitigate industrial, agricultural and residential discharges to air.

4.1.4 Methods:

a) PTB require input into any resource consent applications seeking to discharge contaminants to air within our rohe.

b) PTB will work with industry to develop cultural monitoring methodologies to complement the existing monitoring regime relating to discharges to air.

c) PTB to work with industry and other relevant stakeholders to consider funding research on the impacts of air discharges at Poupouwhenua to human health.

d) PTB will work with industry and other relevant stakeholders, academic institutions and other interested parties, to fund research to assess the health impacts of activities on Patuharakeke whanau.

4.2 Climate Change

Climate change is a fact and the latest projections from the 5th Assessment Report of the Intergovernmental Panel on Climate Change [7] make alarming reading. According to this publication, some impacts are now irreversible and the adaptation they will demand will present new challenges (as well as opportunities) for tangata whenua [8]. For tangata whenua, the effects of climate change have serious implications, with a lack of information or planning being a major issue. All international evidence to date points to the fact that poor, youth, women and remote communities are disproportionately impacted by climate change. Maori figure highly in all these categories. Climate change is therefore likely to exacerbate many of the inequities already faced by Maori. The adverse effects are potentially wide-ranging and extremely serious. Most modelling sees our rohe with increasing average temperatures, increasing annual rainfall, increased severe weather events and significant sea level rise.

A reaffirmation of traditional ways and knowledge as well as new and untested strategies will therefore be important for ensuring the long-term social, ecological, cultural and economic sustainability of our community in the context of a changing climate. If we consider and plan early for the future impacts of climate variability and change we will be more resilient in the face of that change.

4.2.1 Issues

a) Climate Change will impact the cultural, economic, social, and environmental wellbeing of Patuharakeke.

[7] http://ipcc.ch

[8] See https://www.niwa.co.nz/climate/information-and-resources/climate-and-māori-society

b) The magnitude, nature and timing of these effects on Patuharakeke and our taonga tuku iho have not been assessed.
c) There is a failure by NRC to proactively lead mitigation of carbon emissions within Northland.
d) There is a lack of preparedness planning for adaptation to the effects of climate change within Tai Tokerau and Aotearoa as a whole.

4.2.2 Objectives

a) Our Patuharakeke hapu and whanau community have sufficient information to allow us to plan for the effects of climate change.
b) The potential impacts of climate change on Takahiwai marae, papakainga, and other sites of significance are identified and Patuharakeke are enabled to proactively develop responses and strategies for adapting to or accommodating those changes.
c) Our hapu and whanau community is resilient and capable of being self-sufficient in times of events such as flooding, severe storms, tsunami, and droughts.
d) Our hapu and whanau community is enabled to make the most of any opportunities that a changing climate might bring.
e) Climate change is an integral part of community-based integrated catchment management planning led by tangata whenua.
f) Northland's energy needs are met predominantly from community owned renewable energy resources, generated within the region.

4.2.3 Policies

a) PTB will work collaboratively with our neighbouring hapu and iwi to contribute the views of tangata whenua to regional and national climate change policies and processes.
b) PTB require that the relevant local authorities and agencies recognise and provide for the potential effects of climate change on resources and values of importance to Patuharakeke, for example:

    i. effects of sea level rise on our coastal marae and waahi tapu, including urupa;
    ii. increased salination of rivers and estuaries, affecting mahinga kai resources and customary use;
    iii. warming of oceans and effects on marine ecosystems, including those on the sea floor;
    iv. changes to the amount of rainfall, and effects on aquifer recharge;
    v. changes to the habitats of indigenous flora and fauna, including taonga species;
    vi. increased pressure on already failing infrastructure;
    vii. changes in tourism (especially eco-tourism markets);
    viii. increased transportation costs and energy costs (the end of cheap oil and security of supply);
    ix. health impacts (eg. tropical diseases)

c) PTB support the reduction of emissions as a response to climate change, including but not limited to:

i. Urban planning to reduce transport emissions;
ii. Use of solar water heating and similar measures to reduce energy use; and
iii. Improved farming practices to reduce emissions.

d) Central and local government climate change policy associated with forests and carbon credits should promote, encourage and reward the protection and restoration of indigenous forest.
e) Restoration planning for wetlands and lagoons must take into account the potential for future sea level rise associated with climate change.
f) Local authorities must discontinue their current practice of enabling and promoting beachfront development in our rohe, whether it be industrial or residential.
g) Local authorities must recognise and provide for collaborative catchment management, led by tangata whenua that incorporates responses to impending changes in climatic conditions.
h) NRC should take a proactive response and take action now, rather than adopting the cynical "head in the sand" or hands off privatised model (i.e community must challenge development rather than baseline activities being articulated for public welfare) mentality currently afflicting and influencing central government.

4.2.4 Methods

a) Patuharakeke will work proactively with all agencies and individuals who are seeking positive and pragmatic solutions and responses to climate change.
b) PTB will seek funding and support from appropriate agencies and stakeholders to examine the risks climate change poses, our vulnerability and adaptive strategies we can take to protect our community, values and taonga tuku iho.
c) PTB will not support to any development proposals in the coastal environment where climate change poses an undue risk.
d) Patuharakeke will investigate ways to improve our "carbon footprint" including improving our energy efficiency and investigating opportunities for renewable energy generation and use in our rohe.
e) PTB strongly recommend that Northland Health and local government consider the potential health and social effects of climate change on Patuharakeke in their strategic planning.

5. PAPATUANUKU

Patuharakeke consider all land within our rohe to be ancestral land. Since colonial settlement pre- 1840 all but a fraction of our land has been alienated. Now it is mostly privately owned (general title) with small amounts held by the Crown (mainly conservation estate) or councils (e.g. recreation and road reserves).

Fragments of multiply-owned Maori land, Maori reserves and small blocks of General Land owned by Patuharakeke makes up just 1% of the original tribal estate that was held by the hapu. Increasing numbers of beneficial owners (many overseas) and fragmentation of shares makes management decisions complicated. Generally, Maori land cannot be used as security for raising capital for establishing, maintaining and/or expanding either economic use or social equity (housing, kainga, marae, etc).

Changing land use (forest clearances, conversion to farmland and exotic forestry, coastal subdivision and industrial development, etc) has increased pressure on our land and water resources. The attributes that attract residents today are those that our tupuna valued. Development threatens the remainder of intact pa, kainga, waahi tapu and mahinga kai as lifestyle choices come into conflict with cultural values. While councils are responsible for ensuring that development does not result in adverse effects, lax controls on subdivision, development and land use and a "development above all else" mentality has resulted in inappropriate development, inadequate infrastructure and degradation of our cultural landscape, amenity and natural resources.

5.1 General Matters

5.1.1 Issues

a) Patuharakeke are tangata whenua. Our relationship to this land is central to our being. We consider all land within our rohe as ancestral land.

b) Differences in how land held in Maori title compared to land in general title are treated. This is poorly recognised and provided for.

c) Development places increasing pressure on our land and water resources.

5.1.2 Objectives

a) To have all Patuharakeke ancestral land currently held in crown title in hapu ownership.

b) Maximum protection of our ancestral land from adverse effects of development.

c) True costs of development are carried by those profiting from the development.

5.1.3 Policies

a) No further alienation of Maori land. Long term sustainable use of Maori land should be adopted where it is economically viable.

b) Development of land resources in our rohe should not be at the expense of our relationship with that land, culture and heritage or at the expense of the environment.

c) Development should be preceded by proper infrastructure planning.

5.1.4 Methods

a) PTB will support and encourage, where possible, research into long-term sustainable land uses on Maori land, e.g. permanent cover commercial indigenous forestry.

b) PTB will request MLC and TPK to urgently investigate issues of succession of Maori land shares and the adequacy of current processes for managing this.

5.2 Marae and Kainga

Our marae at Takahiwai remains the centre of hapu life in our rohe. We wish to enhance its status to ensure that in future our marae is a vital living centre of a vibrant hapu community. Our marae has always played an integral and important role as community centre and provides direct benefit to the community (e.g. in times of natural disaster, hosting sporting teams, schools and so forth). This community benefit should be recognised in all policies affecting the rating of such land.

Development of papakainga allows our whanau the opportunity to establish affordable housing. Papakainga cannot be compared to subdivision or housing development on general title land.

5.2.1 Issues

a) Our Takahiwai marae is the cultural heart of our hapu.

b) Our kainga, those that remain in Maori ownership, are the obvious sites for the re-establishment of hapu communities.

c) The right to reside on, use and develop Maori land is constrained by land zoning rules, housing density rules, provision of infrastructure and services, and multiple ownership.

d) Returning settlement assets will provide future opportunity for re-establishment of kainga and marae on that land.

5.2.2 Objectives

a) Our marae is the vital living centre of a vibrant hapu community.

b) Whanau are able to return and live on their whenua.

5.2.3 Policies

a) Our marae is a heritage icon in its own right and should be recognised as such.
b) PTB will encourage and support our Marae Committee and whanau to develop our marae.
c) Papakainga developments initiated by whanau will be supported to facilitate the resettlement and re-association of tangata and whenua. Council control of papakainga should be confined to matters of health and safety and should not require 'reserve' contributions of land.

5.2.4 Methods

a) PTB will advocate that agencies recognise and provide for the policies in this section.
b) PTB will support and assist the marae committee and whanau within our rohe to further develop our marae and kainga on a sustainable basis. In particular support will be given to the marae to develop as a cultural centre of our people and tikanga. Any future development of the marae and papakainga should consider energy efficient building design, methods and materials, environmentally sustainable energy, sewerage, waste and water systems.

5.3 Maori Land Rating

Historically much land has been lost to inequitable rating policies of local government. Patuharakeke consider there has never been full consideration given to the differences between Maori land and land held in general title or the unique situation the owners of Maori land face. We acknowledge the challenges for WDC and NRC in addressing this problem and recent policy initiatives to provide temporary relief for rating on Maori land in some circumstances. However, finding a durable and sustainable solution requires the active attention of central, regional and local government. We consider that MLC has a significant role to play. Because valuation of Maori land is tied to that of general title, we are increasingly seeing a situation where the rate burden on Maori land is increasing because of its proximity to general title land, even though the circumstances of the Maori land has not changed. Further, the notion of valuing Maori land on its saleable value on the open market is unrealistic given the multi-shareholding nature of Maori land tenure and our duties to retain land within our whanau and its connection to our tupuna.

5.3.1 Issues

a) The rating of Maori land is a contentious issue for Patuharakeke and is inaccurately assessed.
b) The intensified housing market in our coastal rohe in recent years has seen a dramatic increase in the rateable value of those properties and therefore increased costs on our local community.

5.3.2 Objective

a) Fair Maori land rating policies.

5.3.3 Policies

a) Maori owned land should not be subjected to the same valuation process as that which applies to land held in general title.
b) Valuation and rating of Maori land should not be affected by escalating property values caused by development and intensification of adjoining or neighbouring general title land. Where such development does result in increased rateable values for Maori land this should be recognised and mitigated through development levies.
c) Local authorities should review their Maori land rating policies and in particular consider the long-term effects of current remittance and postponement policies. Local authorities should seek the full participation of PTB, TPK and the MLC in these reviews.
d) Local authorities in Tai Tokerau should develop a single consistent policy and approach to Maori land rating issues.

5.3.4 Methods

a) PTB will make submissions to all relevant council processes requesting review of Maori land rating policies and processes. This includes insisting that staff involved in setting and processing rating policy receive adequate training in Maori land and rating issues.
b) Where development of general title land causes increases in rating of Maori land, PTB request that the consent authorities negotiate agreements with each developer to ensure that the developer makes adequate long term provisions to mitigate this effect on Maori land owners.

5.4 Soils and Minerals

Minerals are by their very nature limited. Soils are a finite resource and their use must be managed to ensure no adverse effect on the environment and that sufficient mineral and soil resources are retained for future generations. Inappropriate land uses can cause erosion; and sedimentation is one of the major causes of poor water quality in our waterways.

5.4.1 Issues

a) Extractive industries and inappropriate land use and management have the potential to diminish or destroy the mauri of mineral and soil resources in our rohe and there are potential adverse environmental, cultural and social effects.
b) Mineral and topsoil resources are finite.
c) Prospecting, exploration and mining activities can adversely affect areas significant to Patuharakeke including waahi tapu, waterways, mahinga kai and our cultural landscapes.
d) Soil erosion resulting from inappropriate land uses and management.
e) Earthworks activities need to be managed to avoid damaging or destroying sites of significance, and to avoid or minimise erosion and sedimentation.

5.4.2 Objectives

a) The mauri of mineral and soil resources is protected and enhanced in ways that enable Patuharakeke to provide for our social, economic and cultural wellbeing; and that of generations to come.

b) The sustainable use and management of mineral and soil resources without adverse impacts.

5.4.3 Policies

a) Prospecting, exploration and mining activities are not permitted in areas significant to Patuharakeke.
b) Patuharakeke promote innovative, sustainable management practices for mining and quarrying operations, including rehabilitation.
c) Earthworks provided for as a permitted activity in council plans must meet stringent environmental performance standards.
d) Integrated earthworks management plans are required for earthworks consent applications detailing how erosion, sediment control, possible archaeological or cultural sites and rehabilitation are to be managed, and how risks will be identified and minimised.
e) Patuharakeke are involved in decision-making regarding any contaminated land in our rohe.

5.4.4 Methods

a) PTB will advocate for the enhancement of our soils and careful handling of our minerals. In particular we request the relevant statutory authorities ensure that:
    i. Crown Minerals Act and RMA processes are better integrated;
    ii. activities are not permitted in areas we identify as significant;
    iii. permit holders are required to prepare and implement a mine or quarry closure and rehabilitation plan;
    iv. effective erosion and sediment control measures are implemented while soil is exposed and 80% vegetated ground cover is achieved within 3 months of earthworks being complete.
    v. earthworks provided for as a permitted activity require notification of council and PTB, no less than 1 week prior to any work;
    vi. payment of a bond is a mandatory condition for any earthworks;
    vii. Land use is matched with land capability (eg soil type; slope, elevation);
    viii. Encouragement and support for organic farming and growing methods
b) PTB will work with permit holders to plan and implement rehabilitation programmes, costs being met by permit holders.
c) A royalty will be payable to PTB where the extraction of a mineral resource from lands within our rohe has been agreed to.

5.5 Vegetation Clearance and Commercial Forestry

Vegetation is usually cleared for land management purposes, such as the creation or maintenance of pasture or in the creation of residential subdivisions. When land is denuded for long periods, erosion and sedimentation into waterways occurs. There is an associated loss of nutrients and carbon from the soil, and the water holding capacity of the catchment is altered (eg. storm water runs off rather than absorbs). Vegetation clearance also leads to fragmentation and loss of remnant native bush and habitat, loss of opportunities for regeneration, and diminishing of cultural landscape and natural character values.

5.5.1 Issues

a) Vegetation clearance can have adverse effects on waterways, sites of significance, indigenous biodiversity, cultural landscapes and amenity values.
b) Commercial forestry operations can have adverse effects on waterways, sites of significance, indigenous biodiversity, cultural landscapes and amenity values.

5.5.2 Objectives

a) Native vegetation clearance is avoided in our rohe.
b) Sound land management practices become the norm in our rohe with waterways, sites of significance, indigenous biodiversity and cultural landscapes protected from the adverse effects of vegetation clearance and commercial forestry operations.

5.5.3 Policies

a) PTB and Councils will promote land use and land use management that avoids undue soil disturbance and vegetation clearance.
b) PTB will oppose vegetation clearance in areas that are identified as high risk for soil erosion, areas of significant indigenous biodiversity, and culturally significant sites.
c) PTB and Councils will promote the establishment of native forestry operations in the rohe alongside other commercial operations with the ultimate view of phasing out exotic forestry and replacing it with natives.

5.5.4 Methods

a) PTB will assess applications to undertake vegetation clearance in our rohe (eg. the applicant commissions a CIA).
b) PTB will assess proposals for commercial forestry and activities associated with the replanting of existing plantations in our rohe (eg. produce a CIA resourced by the forestry company).
c) PTB will continue to advocate for the protection and enhancement of indigenous forests in our rohe (eg. by way of submissions to National and Regional policy and planning documents etc).

5.6 Subdivision and Development

The last decade and a half has seen a proliferation of unfettered coastal subdivision and industrial and commercial estates in our rohe. This has taken place with little regard to infrastructure requirements and has had negative consequences for fresh and coastal water quality, natural character and our cultural landscapes and seascapes. Decision makers have allowed subdivision development to physically encroach upon high value sites such as the Ruakaka Dune Lake – adjacent to the Ruakaka Racecourse it is the only dune lake in Waipu Ecological District, and in fact the whole Eastern Northland Ecological Region. The Marsden Cove subdivision and marina allowed for modification and damage to residual cockle beds and increased the likelihood of pest species arriving in on the hulls of yachts, as confirmed by the recent infestation of the invasive Sea Squirt "Styela" at that location[9]. The entire southern end of Langs Beach looks like an extremely affluent Auckland suburb and the cultural landscape at this location has been forever altered.

[9] see http://www.biosecurity.govt.nz/files/pests/seasquirt/styela-clava-eia-aug2011.pdf

PTB believe coastal subdivision in Ruakaka, One Tree Point, Waipu Cove and Langs Beach has reached saturation point. There is currently a massive oversupply of sections, yet the councils are actively supporting further growth and expansion of subdivisions through private plan change mechanisms and a permissive planning approach. There appears to be little regard for the concerns consistently raised by Patuharakeke through our responses to consent processes and submissions to such plans as the Marsden Point Ruakaka Structure plan and other planning and policy documents. PTB will continue to maintain a precautionary approach and oppose inappropriate coastal development (especially that which contravenes the NZCPS and impacts our cultural landscapes, seascapes and the natural environment).

While subdivision and residential land development activities can have adverse effects on cultural values, there are some examples where cultural benefits can be gained, including opportunities to reaffirm connections between tangata and whenua. For example, the use of Patuharakeke names and cultural interpretation in developments or roading can re-establish a Patuharakeke presence on these modified landscapes. Acting to ensure developments have 'light footprints' in relation to building design, water, waste and energy also provides cultural visibility and is consistent with achieving the objectives of this Plan. Again, effective engagement and relationships between applicants and tangata whenua are required from the design phase right through to consent being granted and beyond (eg. ongoing monitoring) in order for these positive outcomes to be realized.

Tangata whenua policy in this document is aimed at avoiding sporadic, uncontrolled development in our rohe, and remedying or mitigating impacts of development on our cultural landscapes and seascapes. Coastal land development must be cohesive with the landscape rather than deviate from it, and enhance existing values rather than degrading them.

5.6.1 Issues

a) Subdivision and development can have significant effects on tangata whenua values, including sense of place, cultural identity, indigenous biodiversity, mahinga kai, and waahi tapu.

5.6.2 Objectives

a) Coastal cultural landscapes and seascapes are protected from inappropriate use and development.
b) Patuharakeke has a prominent and influential role in urban planning and development in our rohe.
c) When subdivision and development activities occur, they are based on low impact, innovative and sustainable design.

5.6.3 Policies

a) Councils and agencies will ensure that the cumulative impacts of subdivision and development on the natural and cultural landscape values of our ancestral whenua and coastal areas are recognised and avoided, including:
   i. Effects of incremental development; and
   ii. Ensuring that existing modification of the landscape is not used to justify further change where it is inappropriate to allow further coastal development.

b) Councils and agencies will not allow private ownership (or what is effectively private ownership) of the foreshore as a result of coastal subdivision activities.
c) Local authorities are required to recognise and provide for tangata whenua values in coastal land development activities, such as:
   i. The protection of coastal headlands and skylines;
   ii. The protection of coastal indigenous biodiversity, including remnant forest and endemic species;
   iii. The protection of waahi tapu and sites of significance;
   iv. The protection of view shafts to significant natural features and landmarks;
   v. Access to coastal areas for customary use;
   vi. Patuharakeke aspirations for coastal areas, such as the establishment of mataitai reserves;
   vii. The potential for sedimentation and contamination of fresh and coastal waters; and
   viii. The increased stress on existing water resources and community infrastructure.
d) Local authorities and agencies must take a precautionary approach towards applications where potential effects on the coastal environment are uncertain, unknown or poorly understood.

5.6.4 Methods

a) Councils will work with PTB to implement a consistent approach to the identification and analysis of Patuharakeke interests in subdivision and development activities including[10]:
   i. Encouraging developers to engage with PTB from the outset of development planning to identify potential cultural issues; including the preparation of Cultural Impact Assessment reports (CIA’s);
   ii. Requiring engagement with PTB at the Plan Change stage.
   iii. Requiring that resource consent applications assess actual and potential cultural, social, environmental and economic effects of the proposal on Patuharakeke; and
   iv. Ensuring that effects on our cultural values are avoided, remedied or mitigated using culturally appropriate methods as recommended by PTB.
b) PTB will develop a set of basic principles and design guidelines, along with assessment criteria for subdivision and development.

5.7 Utilities, Amenities and Infrastructure

In the past the design, building and maintenance of major infrastructure has followed not preceded development, leaving infrastructure in continual “catch-up”. Settlements now have old and worn systems struggling to keep up with demand. Developers have not contributed to the true cost of providing infrastructure and services for new development leaving the existing communities to carry the shortfall. There have been occasions where the infrastructure provided as part of large scale developments has been substandard (for example Marsden City roading and stormwater systems have failed), and other times where the council has deliberately pursued a solution which we find unacceptable (eg. an ocean outfall as part of the Ruakaka Long Term Wastewater Treatment Plant Consent). When adequate services

[10] see also section 2.9 of this plan.

for new development are provided, it is often at the expense of providing modern services for existing communities.

Historically Patuharakeke, as kaitiaki and tangata whenua, have not been able to participate fully in decision-making over these assets. Maori land tends to be poorly serviced compared with other parts of the district. We have had decades of experience where Maori land has been taken under various Acts, such as the Public Works Act, to allow for infrastructure. The Pukekauri Lake/Dam is an example of this. Unfortunately, such acquisition has not been accompanied by the resources for their sustainable management.

5.7.1 Issues

a) Increased development and population pressure brings with it increased demand and need for all types of infrastructure, roads, water supply, sewerage systems, storm water, reserves and parks, libraries, museums and information centres.

b) Councils and agencies such as DoC and WDC have acquired large areas of land for public reserves and other infrastructure.

5.7.2 Objectives

a) Patuharakeke participate fully in all decision-making processes of agencies over planning for, development and management of utilities, amenities and infrastructure within our rohe.

5.7.3 Policies

a) Patuharakeke will participate fully in all decision-making processes of agencies over planning for, development and management of utilities, amenities and infrastructure within our rohe. Such participation should commence at the outset of any planning or business cycle.

b) Innovative means of providing for infrastructure should be encouraged, e.g. farming of algae for bio-fuels on sewerage treatment ponds, effluent disposal to support indigenous forestry.

c) New developments should be levied to pay the full and true cost of infrastructure.

d) Provision of public services to green field developments should not be at the expense of the needs of existing communities.

e) Public reserves management should be adequately resourced to ensure that these areas are sustainably managed.

f) Agencies should negotiate a schedule of reserves with PTB for transfer to joint or sole management regimes that include full participation of ahi kaa and kaitiaki.

5.7.4 Methods

a) Patuharakeke will continue to advocate that agencies recognise and provide for these policies.

b) PTB will request that a schedule and process for negotiating joint management agreements over public reserve lands be investigated and included in an MOU or Memoranda of agreement and/or co-management agreements to be jointly developed.

5.8 Public Access

Access has long been a significant issue for Patuharakeke for three principle reasons:

- Kaitiaki require access to all waahi tapu and sites of cultural significance. With the alienation of most ancestral lands from Maori title many of these sites are now on either private or public land. Many of our sites have already been damaged or modified beyond recognition and we have serious concerns about the ability of agencies to ensure our sites are not further compromised.
- Access to customary fisheries, mahinga kai and customary resources. Many of these customary areas are now only accessible across public or private land which raises issues for Patuharakeke and landowners.
- The current Crown policy of providing access for all to and along all parts of our waterways and coastline raises significant issues.

Patuharakeke wish to be fully involved in the preparation of any public access policies or plans by any agency from the outset of the planning process.

5.8.1 Issues

a) Alienation of ancestral land from Patuharakeke ownership restricts our access to many sites of significance to us, including waahi tapu and cultural harvest areas.

b) There is a conflict between public access, protection of sites and resources of importance to Patuharakeke.

5.8.2 Objectives

a) Sites and resources of importance to Patuharakeke and customary access to them, is protected and enhanced.

5.8.3 Policies

a) Policies and plans prepared by statutory agencies must recognise the rights of access that Patuharakeke have:
   i. to all waahi tapu,
   ii. for the harvesting and collection of kai,
   iii.to taonga prized for traditional, customary and cultural uses, and
   iv. for the purposes of kaitiaki/cultural health monitoring.

b) Public access rights should not be given precedence over spiritual and customary values and sites.

5.8.4 Methods

a) Patuharakeke will continue to advocate that agencies recognise and provide for these policies.
b) PTB will work closely with all agencies involved in public access policies and ensure Patuharakeke participate fully in such decision-making processes.
c) Councils issuing consents that could affect customary access will include consent conditions to protect and enhance customary access and cultural monitoring of such sites.

5.9 Overseas Investment and Purchase of Land

Patuharakeke are attempting to restore cultural and traditional associations with the land, including the gathering of knowledge of places, the protection of waahi tapu and the regaining of access to sites of significance. The sale of land to overseas investors can be inconsistent with these aims; and lead to further disenfranchisement. Overseas investors are unlikely to be aware of the cultural importance of the land they are purchasing, and therefore sites, places and relationships may be at risk. In considering applications for the purchase of land under the Overseas Investment Act, the Overseas Investment Office (OIO) needs to formally recognise tangata whenua values associated with the land, in addition to the values that make land sensitive under section 10(1)(a) of the Act.

On the other hand, overseas investment can occasionally foster opportunities to recognise and provide for tangata whenua associations with a specific area, including the protection of and access to sites of particular importance. However, any cultural benefit to be realised from overseas investment will depend on the establishment of formal processes to ensure such rights and interests are sufficiently regarded in the decision-making.

5.9.1 Issue

a) Overseas investments and purchases of property can affect the relationship of tangata whenua with our ancestral lands, water, sites, wahi tapu and other taonga.

5.9.2 Objectives

a) Overseas investors are aware of the cultural importance of any sites they purchase in our rohe and recognize and provide for protection of and access to, sites of significance to Patuharakeke.

5.9.3 Policies

a) In the context of the OIO, Patuharakeke support the retention of New Zealand land in New Zealand ownership. Furthermore, Patuharakeke support the retention of ancestral land in Maori ownership, ensuring domestic ownership.

b) To require that the OIO formally recognise and provide for Patuharakeke interests for all overseas investment applications, in particular:
   i. Patuharakeke historical, cultural, traditional and spiritual relationship with the land;
   ii. The protection of cultural values associated with the land; and
   iii. Patuharakeke access to sites and places of cultural importance.

5.9.4 Methods

(a) The OIO will support PTB to engage directly with potential investors to secure an enduring first right of refusal agreement to any lands purchased within our rohe.

(b) The OIO in conjunction with councils and other relevant agencies, will require the preparation of Cultural Value Reports by PTB to identify values, risk and desired outcomes for any potential purchases in our rohe.

(c) Councils and relevant agencies will ensure that cultural information is placed on LIMs, PIMs and titles.

(d) Councils and agencies will work with PTB to set appropriate consent conditions for the conservation (including maintenance and restoration) of cultural and historical heritage and provisions for access when development occurs on these properties.

5.10 Waste Management

We now live in a throwaway society that has only recently and after-the-fact begun to adopt sustainable practices to waste management and disposal. Other coastal urban communities such as Raglan, Kaitaia and Kaikoura have clearly demonstrated that is possible to greatly reduce waste to landfill volumes (by 70%) via community based management and resulting in a reduced overall cost to the community. Those communities have also demonstrated that responsible waste management can be an attractive community business and employer. A Waste minimisation approach to waste management is consistent with protecting cultural values and achieving outcomes sought in this plan. Reducing the volume of solid waste and wastewater produced in our rohe will reduce pressure on existing infrastructure, and on environmental and cultural values.

5.10.1 Issue

a) The excessive volume of waste in our society is not sustainable.

5.10.2 Objectives

a) A zero-waste rohe for our mokopuna.
b) Patuharakeke will prioritize transitioning to zero-waste marae, kohanga and kainga.

5.10.3 Policies

a) Local authorities and agencies will pursue a waste minimisation approach to waste management in our rohe.

5.10.4 Methods

a) Patuharakeke will advocate that councils and agencies pursue zero waste policies covering our rohe.
b) Patuharakeke will lead by example by investigating and implementing programmes to achieve zero waste for our marae, kohanga, kura and papakainga (eg. reduction of waste produced, and the use of composting and recycling programmes).
c) PTB will support well planned initiatives by tangata whenua and the community to establish sustainable waste management businesses.
d) Local authorities and tangata whenua will maintain dialogue with industry and keep abreast of technological advances to find innovative solutions in waste management (eg. using waste to generate electricity; using treated effluent to irrigate forestry and non-food crops etc).

5.11 Genetic Engineering

Whatever decisions are made regarding genetic engineering (GE) in this generation will have far reaching and irreversible effects for our environment, our flora and fauna, the food we eat and the world our mokopuna inherit. Until it is adequately proven to us that the benefits of genetic engineering do not endanger our environment and our mokopuna, we will take a precautionary approach to ensure we do not place our rohe at risk.

If there is GE contamination it will easily cross into or out of our rohe. As such, it should be controlled at a national level. However, the current management regime does not adequately provide for the potentially adverse effects of genetic engineering on mauri and the cultural, social, economic, and environmental wellbeing of hapu. The use and development of GE is not supported due to their potential to corrupt or interfere with species' whakapapa. Both the mauri and wairua of living things are sacred. As such responsibility lies with kaitiaki to protect the legacy of future generations including protecting the sanctity of whakapapa. Our concerns range from the potential impact on crops, food supply, biodiversity and taonga species, cultural and intellectual property, and the commodification of taonga Maori.

Given the widespread opposition by Maori and much of the broader community to GE in the region, the Whangarei District Council ('WDC') has had the foresight to advocate for a ban all Genetically Modified Organism ('GMO') releases and make any Environment Protection Agency (EPA) approved outdoor GE field trials a discretionary activity in the District plan. The Northland Regional Council ('NRC'), however, seems reluctant to take a stand on this issue and have argued that it is not an issue for the Regional Policy Statement as it is addressed through the HSNO Act administered centrally by the EPA. Patuharakeke have representation on the Maori National Network ('MNN' or Te Herenga) for the EPA (formerly ERMA) for the last 8 years. In our experience the tangata whenua consultation and engagement process for applications under the EPA is markedly inferior than what occurs under RMA processes and we remain of the view that a precautionary approach must be taken until more knowledge is available and tangata whenua are adequately involved in decision making on these issues.

5.11.1 Issue

a) Genetic Engineering is culturally offensive to Tangata Whenua and the current management regime does not adequately provide for the potentially adverse effects of genetic engineering on the mauri of species and the cultural, social, economic, and environmental wellbeing of Patuharakeke.

5.11.2 Objective

a) The cultural values of Tangata Whenua with respect to GE/GMO's are respected and Te Tai Tokerau is declared GE Free.

5.11.3 Policies

a) Patuharakeke oppose the introduction of genetically modified organisms, or products produced from such organisms, on the basis that it is contrary to whakapapa, it represents untested dangers, and is not in any way essential to human wellbeing.

b) Patuharakeke support a GE free rohe.

c) Patuharakeke considers that control of GE is a central government issue. Pending review of the national legislation, release of GMOs should be prohibited locally.

d) Any variation to national policy or practice which allows the introduction of genetically modified organisms or material within our rohe, the responsible agency or business must advise PTB .

5.11.4 Methods

a) Patuharakeke will request that NRC and WDC ensure that release of GMOs is prohibited at a regional level until there is an adequate review of national legislation.

6. WAI MAORI

Fresh water is a most precious taonga for Patuharakeke and the quality and quantity of this resource is a key management issue and therefore huge responsibility for us. Our focal waterways include the Waipu, Ruakaka, Takahiwai and Mangapai Rivers, while Skull Creek/ Mangawhati and other tributaries such as Pukekauri, and Rauiri (Blacksmiths Creek) also have immense cultural significance. The hapu continue to advocate for improvement in water quality in the area with our strong commitment to our lands and waters stemming from our duty as kaitiaki to preserve the resource for generations to come. Without appropriate management of water the legacy for our mokopuna does not bear thinking about. The clearance of the majority of our native forests for pastoral use and ongoing poor land management practices, have systematically ravaged our freshwater resources. As a consequence, tuna, inanga and koura now seldom appear on any whanau tables, and certainly are not in adequate supply to serve at marae events. Watercress was formerly a dietary staple but farm effluent and industrial discharges in our waterways have rendered it unsafe to eat.

Northland Regional Council monitoring data results indicate that habitat quality in the Ruakaka River catchment has declined from sub-optimal to marginal in the last five years and water quality is generally very poor. The site was ranked worst for water quality out of 35 rivers monitored in 2008-09[11]. These results were corroborated by our own cultural health monitoring programme undertaken in 2010 as part of a Ministry for the Environment-funded project. In our assessment of mahinga kai the Ruakaka River mouth location was found to be virtually unusable for gathering kaimoana (Chetham & Shortland, 2010). This kai source not only provided

[11] See http://www1.nrc.govt.nz/Resource-Library-Summary/Research-and-reports/Rivers-and-streams/Northland-Rivers-Habitat-Assessments-2008-2010/Results/#A1

sustenance for Patuharakeke and the local community but is a food source for the many native and migratory birds that inhabit the Ruakaka estuary.

Water allocation in the rohe is also a major issue for mana whenua. Indicative allocation levels calculated using the proposed National Environmental Standards on ecological Flows and Water Levels shows much of the Whangarei Harbour catchment is highly allocated[12]. Water permits are effectively treated as property rights and the resource managed as though it is infinite. The alienation of tribal lands and waters along with a history of Crown agency assumption of water rights has meant that Patuharakeke have lost control and management of principal water bodies that have since been exploited by successive agencies for the economic benefit of others. Pukekauri Dam is a prime example, having been acquired under the Public Works Act in the mid 1960's to supply water for the Marsden Point Oil Refinery. Some years ago WDC decided it was surplus to requirements but negotiations for its return have had little progress.

Crown management of our waterways is spread over agencies e.g. Fish and Game, DOC and NRC, added to this are the numerous stakeholders with interests e.g. environmental groups, farmers, industry and recreational groups. There is a lack of coordination and common approach between these agencies and stakeholders. The tendency is to deal with problems in a reactive fashion, rather than addressing the source of the issue. The recent initiative by a sector of the community to remove Mangroves in the Ruakaka Estuary is an example of this. This project was primarily for aesthetic reasons and was actively supported by NRC through their mangrove management fund.

To date, there have been virtually no opportunities for the active involvement of tangata whenua in decision-making, policy development and monitoring in relation to the management of the quality and quantity of water. There has been minimal utilisation of tikanga, matauranga Maori and cultural indicators in the management of water resources to ensure that adverse impacts on culture and traditions are avoided.

Recent initiatives such as the Whangarei Harbour Catchment Group and Ruakaka River Liaison Committee are positive steps forward but have largely only come about because of the requirements of the National Policy Statement for Freshwater Management[13]. While PTB are participating in both these groups, it has become evident that resourcing is limited and we are yet to see how much weight any policy developed will be given in planning documents. Further, we agree with the viewpoint espoused by Fish and Game, that is: "Despite the overwhelming number of submissions, advice from the Land and Water Forum and scientific and multi-sectoral working groups and detailed consideration of these issues in legal cases which set higher standards including the Horizons One Plan and the Ruataniwha, the changes announced will not require regional councils to provide swimmable, fishable waters which are safe for food gathering"[14]. The onus will be on regional councils to set the bar higher than the minimum standards required by the NPS.

6.1 Issues

[12] Justin Murfitt (Policy Programme Manager NRC) pers. comm.
[13] See http://www.mfe.govt.nz/rma/central/nps/freshwater-management.html
[14] http://www.fishandgame.org.nz/national-policy-statement-freshwater

a) Water is perceived as a public utility and infinite resource rather than a taonga tuku iho.
b) The Mauri of water is in serious decline and needs enhancing and protection.
c) Mana whenua are increasingly unable to feed their whanau and our mana is being eroded through inability to manaaki manuhiri due to degradation of mahinga kai in our waterways.
d) Mana whenua access to clean drinking water and access to safe sanitation is at risk due to over allocation and the pollution of water resources in their rohe.
e) Mana Whenua are increasingly unable to carry out cultural and traditional activities on, within and around water resources.
f) Patuharakeke are not represented in decision-making over water management in Te Taitokerau.
g) Patuharakeke have never ceded sovereignty over our water resources and do not accept that it is a "common resource".
h) Patuharakeke have not shared any of the economic benefits derived from commercial use of our water for infrastructure or commercial purposes.

6.2 Objectives

d) Water is valued as a precious resource essential to all life and is respected for its taonga value above all other values.
e) The mauri of water is enhanced in ways which enable Patuharakeke to provide for our physical, social, economic and cultural wellbeing.
f) Sustainable management of water in Te Tai Tokerau occurs on an integrated catchment basis and is led by tangata whenua.
g) All mahinga kai sites in waterways in our rohe are managed, monitored and enhanced by Patuharakeke.
h) Water quality standards relevant to Patuharakeke are developed and implemented by agencies and monitored by kaitiaki.
i) Water quality is such that future generations will not have to drink treated water.
j) Healthy riparian margins for all the waterbodies in the rohe.
k) Patuharakeke are fully involved in decision-making over water allocation in our rohe.
l) The underlying titles of which the Pukekauri Dam area is comprised, taken under Public Works and later declared surplus to requirement, is in Patuharakeke ownership.

6.3 Policies

a) The right of access to clean water is a basic human right.
b) Patuharakeke have never transferred our customary ownership of our water resources.
c) Patuharakeke will participate fully in any decision-making over water management and allocation within our rohe.
d) Decision-makers will ensure that economic costs do not take precedence over the cultural, environmental and intergenerational costs of poor water quality.
e) To discharge human effluent, treated or untreated, directly to water is culturally repugnant. All direct discharges of pollutants or contaminants should be put to land treatment processes and not discharged into waterways. A timetable should be set for the elimination of any existing discharges to natural waterbodies.

f) NRC will provide an integrated, catchment-management planning and implementation programme that progressively includes all waterbodies in our rohe and is based on intergenerational outcomes.
g) NRC will develop stringent and enforceable controls on the following activities given the risk to water quality:

   i. Intensive rural land use;
   ii. Subdivision and development adjacent to waterways; and
   iii. Discharge to land activities associated with industry

h) Activities potentially affecting waterbodies will be managed on an integrated catchment basis.
i) All aquifers will be protected from contamination and over-allocation.
j) All puna and repo will be protected from inappropriate use and development.
k) Councils and other relevant agencies will recognize and support the use of cultural monitoring and assessment tools by Patuharakeke to compile base line data and assess the state of freshwater resources, including but not limited to:

   i. Cultural Audits
   ii. GIS Mapping of waterways and mahinga kai
   iii. Cultural Health Index; and
   iv. the use of customary management tools for protecting freshwater values.

6.4 Methods

Water Quality

a) Councils and Patuharakeke will jointly develop integrated catchment management strategies including mechanisms for allocating water and monitoring for all waterbodies in our rohe.
b) PTB will continue to participate in initiatives such as the Whangarei Harbour Catchment Group and Ruakaka River Liaison Committee.
c) PTB will take positive action to enhance waterbodies and will develop and implement a monitoring programme using cultural health indicators and other assessment tools as needed.
d) PTB will advocate for the enhancement of all our waterbodies and will work with any party promoting or implementing positive actions to improve water quality. PTB request statutory authorities to:

   i. ensure that water quality standards in our rohe are set based on the elevated standard we want to achieve rather than establishing a minimum lower standard that we can degrade to.
   ii. ensure that when water quality issues arise, the source of the problem must be addressed rather than adopting “band aid” solutions (eg. find new ways to treat water, mangrove removal in estuaries as opposed to addressing sedimentation and pollution in the upper catchment etc).
   iii. promote and provide incentives for the rehabilitation, enhancement and protection of waterbodies and margins;
   iv. ensure that appropriately sited, pupose-built wetlands are used for sewage systems. We object to the use of repo of any size being used for sewage systems; ;

v. prohibit drainage of naturally wet areas or wetlands including draining adjacent land;
vi. ensure that no chemical pesticides, fertilisers or contaminants are used where they can potentially affect any waterbody;
vii. ensure that no liquid waste (e.g. stormwater, sewage and farm effluent) is discharged into a waterbody;
viii. ensure that unrestricted stock access to waterbodies is prevented and nitrogen caps are imposed on farms;
ix. ensure that resource consents for works stipulate regular cultural health monitoring by resourced kaitiaki as part of compliance monitoring. Where data shows that there is an adverse effect on water quality then activities must cease;
x. ensure that riparian margins are as wide as possible and planted in locally sourced indigenous plants;
xi. ensure that when structures are placed in waterbodies, provision is made for indigenous migratory species; and
xii. provide free riparian management plans for farms (NRC).

Water Quantity/Allocation

e) PTB will advocate for appropriate water allocation strategies and request NRC ensure that water permits are granted for a maximum 15-year duration. In addition, permits must include consent conditions that take into account the following matters:

i. the level of existing knowledge about the resource;
ii. the risk to the resource;
iii. the type of the activity supported by the take and use of water; and
iv. justification for volume applied for.

f) PTB will oppose the granting of water permits to take and use water from waterways where there is insufficient information about flows, including flow volume and variability (e.g. small tributaries).
g) PTB will advocate for monitoring, reporting and effective and enforceable penalties for non-compliance, including revoking resource consents and enforced environmental remediation.
h) The underlying land titles of which the Pukekauri Dam area is comprised (taken under Public Works and later declared surplus to requirement) be returned to Patuharakeke ownership promptly.

7. TANE MAHUTA

Patuharakeke are the kaitiaki of the Atua Tane Mahuta. The forests and their inhabitants are the cloak that covers Papatuanuku. Prior to colonisation, Kauri, Rimu, Totara and Puriri forests dominated the Takahiwai, Ruakaka and Waipu ranges. Indeed, the Pukekauri block and lake in the Takahiwai ranges can be literally translated as, “hill ensconced in kauri”. This place is referred to in our tribal pepeha and illustrates the importance of these places and their biodiversity to our cultural identity. These forests and the river tributaries within them were home to a number of species now threatened, endangered or extinct in our rohe. These include Brown kiwi; long fin tuna; koura; kokopu; Hotchsetters frogs; Kukupa and many more species. Today’s secondary remnants are primarily kanuka and manuka forests infested with possums, wild goats, pigs and weed plant species.

Dense lowland forests of species such as totara, kahikatea, kowhai, rewarewa, titoki, puriri, karaka, pukatea, and nikau once flanked our awa. All that remains now are slivers 50–100 m wide, with an under-storey often grazed by cattle and infested with riparian weeds. These include such weed species as Chinese privet, creeping, jasmine, Jerusalem cherry, inkweed, woolly nightshade and crack willow[15].
Extensive wetlands and dune lakes throughout Mata, Ruakaka and Waipu were once teeming with tuna, kokopu, ducks, shags, crakes and rails. They were not only significant sources of kai for Patuharakeke, but sites for gathering rongoa species, weaving and building materials, and repositories for cultural and spiritual artefacts for the hapu. Wetlands are now almost completely drained and the last remaining and regionally significant Dune Lake is at risk from unfettered subdivision developments.

Indigenous plants and animals are the result of countless generations of whakapapa from nga Atua. Our tupuna interacted with these flora and fauna, their very survival depended on these taonga and therefore their sustainable management. Maori had

[15] See http://www.doc.govt.nz/Documents/conservation/land-and-freshwater/land/waipu-ecological-district/waipu-pna-level-1-q07-112-q07-145.pdf

no concept of “conservation” where resources or areas were locked away for “natural”, “aesthetic” or “amenity” values. Indigenous flora and fauna are part of an holistic and interdependent association that are bound to all the other deities and their offspring, including humans. They are indicators of the health of our environment.

During the past 160 years or more, since the Crown has assumed responsibility for managing our native plants and animals, we have seen significant and devastating loss of biodiversity through poor management, deforestation and pest and disease incursions. Since 1850, 80% of Te Taitokerau’s indigenous vegetation has been destroyed[16].

Mature indigenous trees are extremely vulnerable to damage during building development where they are regarded as expendable if in the way of a potential house site or access, or impede a spectacular view. Wetlands are equally considered expendable and continue to be drained for agriculture, while at the same time cattle are allowed to roam on river banks and in pockets of remnant bush. What little natural bush remains requires protection and enhancement to the best of our ability.

Patuharakeke have an extensive history of working collaboratively on the ground with a range of parties including DOC, WDC, NRC, schools, conservation and community groups such as the Whitebait Connection. Biodiversity isn’t just about the land, but also waterways and their interconnectedness and interdependence. Healthy kai needs a healthy home. Customary fishing and food gathering sustains our people and enables manaakitanga and takoha. Additionally, there are potential economic benefits from sustainably managed ecosystems including employment in sustainable forestry and conservation management and eco-tourism.

7.1 Issues

a) The mauri of indigenous flora and fauna is being negatively impacted by land use, development, disease and pest incursions leading to biodiversity losses.
b) All indigenous flora and fauna are taonga tuku iho to Patuharakeke.
c) Decline in key species (eg. tuna, kukupa, kauri) has significant adverse cultural, social, health and economic effects on Patuharakeke.
d) Matauranga Maori in relation to indigenous biodiversity is at risk due to loss of access to sites and other taonga and the ability to practice kaitiakitanga.
e) Weed and pest control is critical to the protection and restoration of indigenous biodiversity.
f) The current regime fails to protect the kaitiaki relationship of tangata whenua with indigenous flora and fauna with regard to the commercial use of indigenous species.

7.2 Objectives

a) The mauri of indigenous ecosystems is protected and enhanced enabling Patuharakeke to provide for our physical, social, economic and cultural wellbeing.
b) A pest free rohe for our mokopuna.
c) Restoration and expansion of both natural and managed indigenous forestry within our rohe.

[16] Te Roroa HEMP

d) An abundance of kai and cultural materials from sustainably managed ecosystems.
e) Healthy mahinga kai enabling Patuharakeke to harvest key species for sustenance, commercial and customary needs. Confidence that the use of our resources is being sustainably managed with Patuharakeke as decision makers and managers within our rohe.
f) Patuharakeke grow and encourage the use of Matauranga Maori in the sustainable management of our biodiversity.

7.3 Policies

a) Patuharakeke will honour their responsibility as kaitiaki of the Atua Tane Mahuta through practical and positive expression of kaitiakitanga.
b) PTB will consider all positive initiatives that benefit indigenous biodiversity in our rohe and will participate on a case-by-case basis, particularly supporting those which:

    i. Articulate clear strategies of eradication, as opposed to control or management;
    ii. Use a range of tools and methods, rather than relying on a 'magic bullet'' approach;
    iii. Occur across agencies to align and co-ordinate efforts to maximise success;
    iv. Minimise the use of hazardous substances, and favour natural solutions;
    v. Employ schedules and techniques that avoid or limit the impact of operations on mahinga kai and other cultural values;
    vi. Value cultural, environmental and community costs in equal proportion to economic cost when designing pest control operations; and
    vii. Where the impacts or risks associated with a specific method of pest control are uncertain, then the precautionary principle is to be adhered to.

c) Proposed activities which involve modification of existing indigenous flora or habitats of indigenous fauna are to be preceded by thorough biological audits to identify indigenous species and potential impacts.
d) Patuharakeke will only withdraw our objection to any negative impacts on our indigenous flora and fauna after effective engagement and agreed remediation or mitigation are identified, and a timetable for implementation is agreed.
e) PTB will actively seek opportunities to get kaitiaki actively involved in weed and pest management.
f) Patuharakeke will not compromise the retention of our customary harvest and use rights to meet Crown policies or objectives.
g) Crown agencies and local authorities must provide active protection of the kaitiaki relationship of tangata whenua with indigenous flora and fauna and matauranga o Patuharakeke as guaranteed by Te Tiriti o Waitangi.

Commercial Use Of Indigenous Flora And Fauna

h) Researchers and bio-prospectors cannot use matauranga o Patuharakeke without consent of Patuharakeke.

i) The use of taonga species or matauranga for commercial gain must include benefits to tangata whenua.

7.4 Methods

Indigenous Biodiversity and weed and pest management

a) Patuharakeke will promote a pest free rohe and will actively work with others to control predators and pests within our rohe.
b) Patuharakeke will promote the use of locally sourced seeds and plants for revegetation /landscaping.
c) PTB will advocate for the enhancement of all our indigenous flora and fauna as a high priority and will work with any party promoting or implementing positive actions to improve habitat.
d) PTB request statutory authorities to provide for the following:
    i. incentives for land owners who actively protect and enhance indigenous biodiversity;
    ii. all new subdivision and land use consents include legally enforceable conditions that protect and enhance indigenous biodiversity e.g. limiting planting of vegetation in gardens, etc to locally sourced seeds and plants only, protecting wildlife corridors;
    iii. pest control programmes are co-ordinated and targeted at a community level to ensure maximum efficiency;
    iv. where indigenous trees are felled, or fall as a consequence of natural events, they are to be provided to Patuharakeke to be used for customary purposes, e.g. carving.

e) Patuharakeke will continue with, and grow our cultural health monitoring programme, undertaking the following actions:

    i. Ongoing audits of our waterways, ngahere, mahinga kai and other sites to provide a baseline to assist in our role as Kaitiaki; and against which to monitor habitat improvement initiatives;
    ii. Identification of innovative ways to improving habitats;
    iii. Utilisation of Matauranga Maori and cultural indicators or tohu whenever possible;
    iv. Other education, and training opportunities that will benefit our Kaitiaki in terms of carrying out the monitoring programme; and
    v. Seeking support (funding, sponsorship, resources, capacity building etc) from crown partners and stakeholders to implement our cultural health monitoring programme;

    vi. PTB will continue to keep a watching brief on national and regional biosecurity programmes of relevance to our rohe, eg. Kauri Dieback Joint Agency Response.

f) PTB will identify ways our customary practices can be reinforced by planning and sustainable management practices.

g) PTB will seek management and decision making authority over key biological resources and their habitat over time via mechanisms such as s.33 transfers under the RMA and relevant sections such as s2, Chapter 2 and 6 of the Reserves Act 1977.

8. WAAHI TAPU ME WAAHI TAONGA

This section covers issues associated with our cultural heritage: sites, resources, traditions, knowledge, and landscapes of significance to Patuharakeke. This includes waahi tapu, mahinga kai and other sites of significance, and the traditional and contemporary landscapes in which they occur.

Waahi tapu and sites of significance are considered to be a most precious taonga to Patuharakeke. These sites place Patuharakeke in our rohe over a long period of time. As such, the destruction of any site of significance is of great concern to our hapu. These historical "footprints" become increasingly important and sacred and confirm the korero that has been passed down over generations. Through colonisation and land alienation, large scale physical destruction of waahi tapu and other sites of significance occurred. Together with the loss of access to them and thereby knowledge of them (in many cases) has had far reaching impacts on Patuharakeke.

While the wholesale destruction of waahi tapu that occurred prior to introduction of the RMA and Historic Places Act 1993 (HPA) no longer occurs, in our view there is still a long way to go before waahi tapu and cultural landscapes are afforded appropriate status. Patuharakeke assert that they should correctly have the same status as 'natural' or 'built' heritage status in the planning regime. Typically, agencies continue to take a narrow interpretation of our heritage, focussing largely on archaeological sites. Mechanisms in the HPA, when they are effectively implemented, actually only result in the protection of a singular site. Moreover, emphasis is generally placed on the expertise of archaeologists or landscape architects rather than kaitiaki and tangata whenua holding ahi kaa. In our view this undermines our knowledge and fails to capture the wider cultural landscape setting or context. It also precludes many sites of significance from protection. Nevertheless, we recognise that some development has the potential to enhance and improve cultural landscape values and access to sites of significance which can be supported on a case-by-case basis.

Our tupuna knew all of our rohe – homes, gardens, trails, ceremonial areas, landing sites, fishing sites, battle sites, urupa, places where whenua were always buried; tupapaku washed; and where taonga are secreted away. All these places were named by our tupuna and in naming them they tied those places to our culture and our heritage forever.

The naming of sites was and is bound by tapu. As with any example of colonisation, the new settlers have written over many of our original names. In some instances, our names were wrongly recorded, abbreviated, changed or omitted completely. A key example in our rohe, is Poupouwhenua, now known by the majority of the local population as Marsden Point.

It is important to Patuharakeke and the legacy we leave for the future that these historical inaccuracies be corrected and the proper names recorded. However, traditional place names, tupuna names and other cultural interpretation or tikanga, can only be used after proper consultation and approval from Patuharakeke.

8.1 Issues

a) Ongoing damage, destruction and mismanagement of waahi tapu and areas or sites of significance that contribute to, or are a part of, our cultural landscape and seascape.

b) Areas or sites of customary value are often limited to western definitions, such as "archaeological".

c) There is a need for a comprehensive and accurate source of maps and data on sites of significance within our rohe.

d) Changes in land ownership and use have often denied Patuharakeke access to sites of significance and waahi tapu.

e) To date Patuharakeke have rarely been engaged in any discussion over the naming of places within our rohe.

f) The use and interpretation of Maori cultural traditions, tikanga, values, language and symbols in the rohe of Patuharakeke.

8.2 Objectives

a) The protection and enhancement of areas or sites of customary value.

b) All councils implement more appropriate provisions for cultural landscapes under their cultural and heritage responsibilities, such as the development and implementation of cultural landscape strategies.

c) Councils, DOC and HPT work collaboratively to afford protection and management of waahi tapu, sites of significance and cultural landscapes in partnership with Patuharakeke as a priority for policy development, action and resourcing.

d) The Patuharakeke sites of significance mapping project is completed and used by Patuharakeke in conjunction with local agencies to effectively protect and manage waahi tapu in a manner consistent with our tikanga.

e) Patuharakeke have access to sites of cultural significance in our rohe.

f) Robust forms of linkage mechanisms are established between the Building Act and the RMA by all councils, so our cultural landscapes are not accidentally damaged, destroyed or modified.

Figure 4: Patuharakeke Sites of Significance Overlay

8.3 Policies

a) The recording of our cultural landscapes and seascapes, will be supported by Councils.

b) Councils must take responsibility for advocating and educating landowners and developers about areas or sites of customary value, in consultation with PTB RMU.

c) Our cultural landscapes and seascapes should be afforded at least as high a priority as other landscape values when being considered as part of any process under the RMA, the Conservation Act, the Reserves Act or the LGA.

d) Preparation of landscape assessments for resource consent applications and similar processes should be done in conjunction with PTB RMU to ensure that the cultural aspects of the landscape are given full recognition alongside other values such as natural character and amenity values.

e) Monitoring of effects on cultural landscapes and waahi tapu (including marine cultural heritage) within our rohe is the responsibility of the ahi kaa and kaitiaki. This should be reflected in all relevant consent conditions. This function should be formally transferred to PTB RMU as mana whenua and resourced appropriately.

f) Any areas and sites of customary value that contribute to, or are a part of our cultural landscape must be defined by Patuharakeke.

g) Councils and PTB RMU will jointly develop customary value, cultural landscape and or cultural heritage strategies in respect of our rohe.

h) The original names of all parts of our rohe as named by our tupuna should be used in all maps, charts, plans and other records.

i) The advice and input of Patuharakeke should be sought and observed in the naming of any new places or features within our rohe.

j) PTB, in conjunction with agencies and stakeholders, will encourage the use and representation of Maori culture (e.g. tikanga, markers, symbols, names, design) in public open space and the built environment when appropriate, including but not limited to:

   a. (a) Markers and designs as deemed appropriate.

   b. (b) Naming of features, roads, reserves, or buildings.

k) To support the use of interpretation as a tool to recognise and provide for the relationship of Patuharakeke to particular places, and to incorporate Patuharakeke culture and values into landscape design.

l) The interpretation of our values and history is best provided by Patuharakeke, and PTB RMU should be commissioned and resourced to provide this service.

m) PTB will ensure any use of names, and other cultural interpretation in such instances will require internal discussion with the relevant whanau and the Patuharakeke taumata prior to any decision being made.

8.4 Methods

Cultural Landscapes and Seascapes

a) PTB RMU will request that councils and other relevant agencies afford cultural landscape and seascape values at least as high a priority as other landscape values when preparing plans and policies and when considering landscape values during resource consent processes.

Patuharakeke Sites of Significance Mapping

a) PTB RMU will complete the mapping of the cultural landscapes and waahi tapu (including marine cultural heritage) within our rohe through the Sites of Significance mapping project (SOSM). Once this exercise is completed, we require councils to adopt this overlay on their own planning maps and to work with PTB RMU to develop adequate policy for the protection and management of these landscape and heritage values.

Waahi Tapu

a) Where a proposal has the potential to affect a site identified in the SOSM overlay as a level 2 or 3 site[17] or has been assessed by PTB RMU as having the potential to affect waahi tapu, PTB RMU require that all relevant agencies ensure that one or more of the following directives occur:

    ii. Cultural Impact Assessment or Cultural Values Assessment (CIA/CVA);
    iii. Site visit;
    iv. Archaeological assessment, by a suitably qualified tangata whenua RMU representative and a qualified archaeologist, recognised by the NZHPT under s.17 of the Historic Places Act;
    v. Cultural monitoring to oversee excavation activity, record sites or information that may be revealed, and direct tikanga for handling cultural materials;
    vi. Inductions for contractors undertaking earthworks;
    vii. Accidental discovery protocol agreements (ADP); and/or
    viii. Archaeological Authority from the New Zealand Historic Places Trust.

b) PTB RMU requests that all agencies require that when any of the following situations arise, including:
    i. previously unrecorded subsurface archaeological sites are discovered during earthworks; or
    ii. koiwi are exposed; or
    iii. there is a death on site of a build/development project;

[17] There are three levels of significance in the Draft Patuharakeke SOSM framework, level 1 being the lowest and level 3 the highest. These levels have an associated protocol to determine how much information is shared (if any) with the public, councils etc.

that all relevant project operations in the area of the event must cease immediately.

The contractor or the person monitoring the earthworks will immediately advise the site manager and PTB RMU and take steps to secure the area to ensure that it remains undisturbed. The site manager will advise the NZHPT (and the Police if appropriate). The site manager will ensure that staff or representatives are available to meet and guide the appropriate Patuharakeke representatives to the site, and assist them with any reasonable requests they may make.

In the case of discovery of human remains, mana whenua and the property owner / developer will jointly seek any necessary approval of the Police or NZHPT so that the remains can be appropriately recovered, assessed, and buried at a site nominated by Patuharakeke representatives. All relevant construction operations or work will remain halted until such measures are decided. All representatives involved in the situation will ensure that they act in a respectful manner, being careful to involve no unnecessary parties or publicity at any time.

c) Any application for an Archaeological Authority to damage, destroy or modify a waahi tapu site must involve engagement with PTB RMU.

d) PTB RMU have the right to identify sites that are of high importance and sensitivity and are not under any circumstances to be modified, damaged or destroyed. This would thereby ensure that an Authority is not granted.

e) Should an Archaeological Authority be granted, PTB RMU must be involved in the setting of conditions on the authority, including:

    i. Cultural monitoring provisions;
    ii. Induction training for contractors undertaking earthworks; and
    iii. Tikanga issues surrounding accidental discoveries.

f) PTB RMU will investigate and prioritise becoming certified as a registered collector of artefacts under the Protected Objects Act 1975. Any museum that knowingly accepts unearthed taonga tuturu (such as adzes, sinkers or carvings) discovered within our rohe must pass such taonga to PTB once registration has occurred and ownership is finalised.

Access to Sites of Significance

g) Patuharakeke must have unrestricted access to waahi tapu and other places of cultural significance on Crown land within our rohe.

h) PTB, in conjunction with the relevant agencies will aim to increase the ability of tangata whenua to access sites of significance on private land. This will be done by exploring such options as:

    i. Engaging landowners to develop access arrangements;
    ii. Engaging landowners to develop management plans to protect sites;
    iii. Opposing development that creates situations where places are 'land locked';
    iv. Registering sites or places with the NZHPT;

v. Caveats on land titles;
vi. Creation of reserves; and
vii. Use of covenants.

Ingoa Waahi

i) PTB RMU will request any agency or individual selecting new names for places or features within our rohe to consult with Patuharakeke in order to select appropriate names.

Patuharakeke Tikanga Tuturu

j) To require that the use and representation of Maori culture as per Policy 8.3 (h-m) above, involves and is endorsed by, Patuharakeke as the tangata whenua when it occurs within our rohe.

k) To require that any interpretation or information relating to Patuharakeke history, values, traditions or place names is agreed to and approved by PTB RMU.

9. TANGAROA

9.1 Coastal Water Quality

Patuharakeke lament the ongoing deterioration of the health of our water systems and in particular, the impact that this is having on our kaimoana and mahinga kai in the Whangarei Harbour and Bream Bay areas. Despite numerous statutory requirements and undertakings, the role of Patuharakeke as kaitiaki, tangata whenua and Treaty Partner in the management of these taonga remains tokenistic and diminished.

The status of our food basket has become critical. Our once pristine waterways are now clogged and suffocated by the silt of uninterrupted urban and rural development with their associated nutrient, pesticide, herbicide and industrial pollutants. Dumping of dredge spoil and cement fines discharged from the Portland cement works during the latter half of last century destroyed extensive seagrass beds in the harbour. These beds provided essential habitat for shellfish and finfish species. Widespread encroachment of mud and mangroves has displaced oyster beds and degraded the formerly white sandy beaches of Takahiwai and Ruakaka and Waipu estuaries. Pipi, kutai, cockle/tuangi, pupu and scallops/tipa were among the taonga species that were casualties of this mismanagement (Chetham, 2013).

Sewerage discharges have also been an historic stressor on the health of the harbour and continue to the present day. This means that even species just beginning to replenish in the harbour are unable to be harvested on a regular basis. In our view the cumulative impacts of discharges from industries such as Northport and the Refinery have not been adequately quantified.

Recent initiatives such as the Whangarei Harbour Catchment Group and Ruakaka River Liaison Committee are positive steps forward but have largely only come about because of the requirements of the proposed National Policy Statement for freshwater. While PTB are participating in both these groups, it has become clear that resourcing is limited and we are yet to see how much weight any policy developed will be given in planning documents.

9.1.1 Issues

a) The cultural health of Whangarei Terenga Paraoa, Bream Bay and our estuaries is adversely affected by:
   i. Direct discharges of contaminants, including wastewater and stormwater;
   ii. Sedimentation
   iii. Diffuse pollution from rural, urban and industrial land use;
   iv. Reclamation, drainage and degradation of coastal wetlands; and
   v. The cumulative effects of activities.

b) Patuharakeke are not represented in decision-making over the management of coastal waters in our rohe.

9.1.2 Objectives

a) Whangarei Terenga Paraoa, Bream Bay and our estuaries are precious taonga and the home of myriad species and are respected for their taonga value above all else.
b) The mauri and cultural health of the harbour, Bream Bay and our estuaries is protected and enhanced in ways that enable Patuharakeke to provide for our physical, social, economic and cultural wellbeing.
c) Patuharakeke have a leading role in managing, monitoring and enhancing coastal water quality in our rohe.
d) The management of coastal water quality in Te Tai Tokerau occurs on an integrated catchment basis and is led by tangata whenua.
e) Coastal water quality standards relevant to Patuharakeke are developed and implemented by agencies and monitored by kaitiaki.

9.1.3 Policies

a) Coastal water quality is required to be consistent with protecting and enhancing customary fisheries, and with enabling Patuharakeke to exercise their customary rights and safely harvest kaimoana.
b) Patuharakeke will participate fully in any decision-making over the management of coastal waters in our rohe.
c) Decision-makers will ensure that economic costs do not take precedence over the cultural, environmental and intergenerational costs of degrading coastal water quality.
d) The discharge of human effluent, treated or untreated, directly to coastal waters is culturally repugnant. All direct discharges of pollutants or contaminants (wastewater, industrial, storm water and agricultural) to coastal waters should be avoided and existing discharges ultimately eliminated.
e) PTB will oppose any new consent applications seeking the direct discharge of contaminants to coastal water, or where contaminants may enter coastal waters.

f) NRC will provide an integrated catchment management planning and implementation programme that progressively includes all waterbodies in our rohe and focuses on intergenerational outcomes.
g) NRC will implement rigorous controls restricting the ability of boats to discharge sewage, bilge water and rubbish in our harbour, estuaries and coastal waters.
h) Councils and other relevant agencies will recognize and support the use of cultural monitoring and assessment tools by Patuharakeke to compile base line data and assess the state of coastal water resources, including but not limited to:
   v. Cultural Audits;
   vi. GIS Mapping of harbour, estuaries and mahinga kai;
   vii. Cultural Health Index; and
   viii. the use of customary management tools for protecting freshwater values.

9.1.4 Methods

a) Councils and Patuharakeke will together jointly develop integrated catchment management strategies including mechanisms for allocating water and monitoring for all waterbodies in our rohe.
b) PTB will continue to participate in initiatives such as the Whangarei Harbour Catchment Group and Ruakaka River Liaison Committee.
c) PTB will take positive action to enhance our coastal water quality and will develop and implement a monitoring programme using cultural health indicators and other assessment tools as needed.
d) PTB will advocate for the enhancement of coastal water quality and will work with any party promoting or implementing positive actions in this regard. PTB request statutory authorities to:

   i. ensure that coastal water quality standards in our rohe are set based on the elevated standard of water quality we want to achieve, as opposed to establishing a minimum lower standard that we can degrade to;
   ii. promote and provide incentives for the rehabilitation, enhancement and protection of estuarine areas and coastal margins;
   iii. develop a strategy to deal with sedimentation by identifying the key sources and activities; implementing effective controls on those activities; and promoting indigenous reforestation, riparian margin enhancement and soil conservation as measures to address sedimentation in our harbour and estuaries;
   iv. prevent the discharge of liquid waste (e.g. stormwater, sewage and farm effluent) to coastal waters;
   v. unrestricted stock access to coastal margins is prevented;
   vi. Where data shows that there is an adverse effect on coastal water quality then activities must cease; and
   vii. resource consents for works stipulate regular cultural health monitoring by appropriately resourced kaitiaki as part of compliance monitoring.

e) PTB, councils and other agencies with responsibilities in the coastal marine area will formalise a programme of cultural health monitoring of the health of the Whangarei Harbour, Bream Bay and Estuaries in our rohe. The programme will be carried out by katiaki and focus on matters such as:
   i. Quality of mahinga kai habitat;
   ii. Species diversity and abundance;

iii. Water quality; and
iv. Suitability of traditional mahinga kai areas for customary use.

9.2 Foreshore and Seabed

Patuharakeke has manawhenua, manamoana, mana takutaimoana over the foreshore and seabed in the south of Whangarei harbour and through Bream Bay. This inalienable right has been ignored by successive local governments; a stance which was legitimised by the The Marine and Coastal Area (Takutai Moana) Act 2011. This has been to the detriment of the health of our foreshore, seabed, harbour and waterways – and all people who seek to enjoy these areas. It has impacted on our duties and obligations as tangata whenua holding mana over that area to undertake our duties as Kaitiaki. Loss of control over these sites has allowed some of our most significant kaimoana beds, bird roosting sites, tauranga waka, waahi tapu, and nohoanga sites to be lost forever to industrialisation and reclamations.

While the replacement Takutai Moana Act 2011 differs from the original Foreshore and Seabed Act of 2004 in a number of ways, it is still severely lacking in adequate recognition of the longstanding rights and interests of Patuharakeke in relation to our foreshore and seabed. In our opinion we remain the owners of the foreshore and seabed within our rohe as we were prior to and on the 6th of February 1840. We have never relinquished this title. The government contends that the mechanisms in the Act for recognition of our management role (e.g. taking into account hapu or iwi management plans, specifying roles and responsibilities in legislation, recognising customary interests through awards) will result in real or effective partnerships in governance or management of the Foreshore and Seabed. In reality, the existence of such tools in existing legislation (e.g. RMA 1991, LGA 2004) has not resulted in any real partnership roles or responsibilities and has not proved viable in practice.

The concept of ‘public domain’ is merely thinly disguised de facto Crown ownership. The Crown still essentially controls and manages it, which equates to ownership. Meanwhile, areas already in private ownership remain excluded, most of which are non-Maori. Moreover, while the right to access the High Court to claim customary title has been reinstated, tangata whenua should not have to prove their rights exist. As the foreshore and seabed is inherently Maori, the onus and burden should be on the Crown to prove its claim to the contrary. Further, the tests to prove non-territorial nor territorial interest are too onerous as in most instances our “exclusive use and occupancy” has been disturbed due to breaches of the Te Tiriti o Waitangi (Chetham & Pitman, 2010).

Vesting

Patuharakeke vehemently opposed the application by Northland Port Corporation (‘NPC’) to construct a timber port (Northport) in the late 1990’s. The port facility opened in 2002 and the area of reclamation administered by the Minister of Conservation under section 9A(1) of the Foreshore and Seabed Endowment Revesting Act 1991 (Revesting Act) and leased to NPC. Following the outcome of the resource consent process both NPC and Patuharakeke applied for vesting of the fee simple title of the reclamation under section 355 of the RMA. At present DOC’s position is that the Minister of Conservation will delay vesting the land in either party until treaty claims pertaining to the area are settled.

9.2.1 Issues

a) The historical loss of our foreshore and seabed rights has resulted in adverse cultural, environmental, social and economic impacts on Patuharakeke. These are perpetuated in the contemporary context by the lack of appropriate statutory recognition of our customary rights over the foreshore and seabed.
b) Patuharakeke have specific interests in Port and reclamation activities that require addressing.

9.2.2 Objective

a) Recognition of, and appropriate provision for the longstanding rights and interests of Patuharakeke in relation to the foreshore and seabed.
b) A partnership regime with respect to port and reclamation activities in our takutai moana.

9.2.3 Policies

a) Patuharakeke will continue to seek just outcomes through our Waitangi claims processes (and other mechanisms) and advocate for an equitable partnership stake in port activities that will allow us to reaffirm our kaitiaki status and allow us to properly discharge our responsibilities. This would provide income to assist us to appropriately look after and manage our foreshore and seabed.
b) Patuharakeke will continue to seek ways to express our customary rights and interests over particular sites and areas within our takutai moana (eg. see policies in section 9.8.3 of this plan).

9.2.4 Methods

a) PTB's Treaty of Waitangi claims progression committee will continue to pursue these matters as set out in our amended statement of claim inter alia before the Waitangi Tribunal.
b) PTB will continue to engage with Northport, NPC and NRC to build and maintain robust working relationships to address cultural issues and achieve positive cultural, environmental and economic outcomes.
c) PTB and NPC will investigate the feasibility of having a Patuharakeke representative appointed to the NPC Board of Directors.

9.3 Access to the Coastal Environment

Over the last 170 years Patuharakeke access to the coastal environment for gathering mahinga kai and carrying out kaitiaki responsibilities has been significantly reduced and impacted by the degradation of sites, loss of mahinga kai resources, restrictions to physical access and competing uses. Customary access is a customary *right*, which means that tangata whenua must have unencumbered physical access to the coastal marine area.

There are multiple reasons to restrict public access to sensitive areas to protect habitat and breeding grounds for indigenous species. Vehicle access can adversely impact on our sensitive estuarine and dune habitats, whilst creating safety issues for beach users. We are also of the view that vehicle access has contributed to the depletion of kaimoana resources in the area. Horses are exercised with little restriction along Ruakaka beach. This compromises ecological values and conflicts with other beach users. Kite boarders, walkers and uncontrolled pets have disrupted breeding shorebirds in our wildlife refuges. Landowners adjacent to the beach often form their own illegal access and further degrade the dune and beach environment. Some sectors of the community hold the view that the beach is “their road”, “their playground” etc and they can do whatever they like.

A disconnect between agencies with responsibilities in regard to the coastal marine area (eg. DoC, WDC, NRC, MPI, the Police) means it is difficult to create cohesive policy, set bylaws and police them. Effective collaborative management between these agencies and Patuharakeke along with community involvement and support will be required to protect our coastal resources, natural character and landscape values and public amenity.

Nevertheless, while coastal access must be managed to protect indigenous biodiversity and cultural heritage values, it cannot unduly restrict customary access. Patuharakeke access to sites and resources in the coastal environment for customary and kaitiaki purposes must be recognised and provided for independently from general public access. Further, purchasers of land adjacent to the coast cannot be allowed to own (either literally or illusory) the foreshore, therefore further impeding access.

9.3.1 Issues

a) Patuharakeke access to the coastal marine area and customary resources has been reduced and degraded over time.
b) Unrestricted access to the coast by the public, vehicles and horses can have adverse effects on kaimoana, taonga species, waahi tapu, public safety and amenity values.

9.3.2 Objectives

a) Healthy dune and beach ecology, safety for beach goers, and protection of sites of significance, natural character and amenity through collaborative management between Patuharakeke and the respective agencies.
b) Customary access is protected and enhanced.
c) Vehicular access to the beach is limited to the following purposes:
   i. Customary management and kaitiaki monitoring eg. of mahinga kai (including policing of any bylaws) by Patuharakeke;
   ii. Emergency and lifeguard services;
   iii. Scientific or ecological research or monitoring in conjunction with Patuharakeke.

9.3.3 Policies

a) Customary access to the coastal environment is a customary right, not a privilege, and must be recognised and provided for independently from general public access.
b) Policies and plans prepared by statutory agencies must recognise the rights of access that Patuharakeke have:
   v. to all waahi tapu:
   vi. for the harvesting and collection of kai;
   vii. to taonga prized for traditional, customary and cultural uses; and
   viii. for the purposes of kaitiaki/cultural health monitoring.
c) PTB will continue to work collaboratively as a partner with the various agencies to find solutions to issues with public access to the coast in our

rohe.

d) PTB will oppose coastal land use and development that results in the further loss of customary access to the coastal marine area, including any activity that will result in the private ownership of the foreshore.

9.3.4 Methods

a) Patuharakeke will continue to advocate that agencies recognise and provide for these policies.
b) PTB will work closely with all agencies involved in public access policies and ensure Patuharakeke participate fully in such decision-making processes.
c) Patuharakeke will take opportunities to educate the community about our cultural values in relation to the coast and encourage attitudinal change.
d) Councils issuing consents that could affect customary access will include consent conditions to protect and enhance customary access.
e) PTB will continue to lobby our agency partners and local business and industry to seek funding for a kaitiaki monitor to patrol Ruakaka beach and other important areas on a fulltime basis. We envisage a kaitiaki monitor would undertake the following types of activities:
    i. Monitoring of kaimoana beds and adherence to any fishing restrictions;
    ii. Coastal cultural health surveys;
    iii. Monitoring of sites of cultural significance;
    iv. Monitoring of wildlife;
    v. Observation of any dog or horse bylaws;
    vi. Education and advocacy with general public.

9.4 Offshore Oil Exploration and Mining

Our century of reliance on oil is at a turning point. The BP Deepwater Horizon oil spill in the Gulf of Mexico in 2010 has highlighted the far-reaching consequences that our dependence on oil is having on the natural world and on the climate. Now they have depleted most easily accessible oil, companies are pushing into areas previously considered too remote, expensive or risky to exploit. Our precious coastlines here in Aotearoa are now in their sights and our government appears set on doing all they can to accommodate these large oil and mining interests.

The current regulatory regime provided by the Crown Minerals Act 1991 and Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act ("EEZ Act") is confusing, difficult for hapu to engage in and weak. Prospecting and exploration for petroleum and minerals are classified as "permitted activities". While drilling requires a permit, decisions by the EPA to date have been made in spite of a glaring lack of information, particularly in regard to oil spill modelling and emergency responses. In order to feel confident about these activities taking place in our waters we would need the world's most sound, best practice environment standards, full liability cover and clean up capacity. This is not the case in Aotearoa at present. Moreover, the government has recently legislated to deny the right to voice opposition at sea, further impinging on our civil rights and our tino rangatiratanga. Patuharakeke therefore support the stance of Te Whanau a Apanui:

"We are resolute in our defence of our ancestral lands and waters from the destructive practice of deep sea oil drilling. This is an issue for all peoples of New

Zealand and we call on those who support our opposition to stand with us in defence of what we all treasure," [18].

9.4.1 Issue

a) There is a lack of appropriate environmental policy in place to protect the realm of Tangaroa from the potential harmful effects of offshore petroleum exploration and mining.

9.4.2 Objective

a) Offshore petroleum exploration and mining is not permitted within the boundaries of our gazetted rohe moana (see 5 below), and extending in an easterly direction from Patuharakeke landward coastal boundaries to the limit of New Zealand's Exclusive Economic Zone ('EEZ').

9.4.3 Policies

a) Patuharakeke will oppose any offshore petroleum exploration and mining proposals within the boundaries of our gazetted rohe moana, and extending in an easterly direction from Patuharakeke landward coastal boundaries to the limit of New Zealand's EEZ.
b) The Crown and petroleum and mining companies are required to engage in early, and good faith consultation with Patuharakeke should any proposed prospecting, exploration or drilling licences be sought within the boundaries of our gazetted rohe moana, and extending in an easterly direction from Patuharakeke landward coastal boundaries to the limit of New Zealand's Exclusive Economic Zone.

9.4.4 Methods

a) PTB will work collaboratively with hapu and iwi to continue to oppose these activities and seek statutory change to protect our coastline from these destructive practices.
b) PTB will investigate utilization of Section 15(3) of the Crown Minerals Act 1991 (CMA) and the Minerals Programme for Petroleum (2005) provisions to protect areas of historical and cultural significance from inclusion in an offshore exploration permit block or minerals programme.

9.5 Oil Spill Risk

Because New Zealand's only oil refinery is located at Poupouwhenua, at the entrance to Whangarei Terenga Paraoa, there is a high risk of a marine oil spill in our rohe. Large oil tankers bring crude oil from overseas to be discharged from the tankers to the refinery where it is then refined and transformed into various petroleum-based products. These are then either transported to Auckland via pipeline or transported by coastal tankers to other ports around the country, for distribution to consumers. Along with our Bream Bay Coast and harbour, islands of great significance to Patuharakeke such as Tawhitirahi and Aorangi (the Poor Knights Islands) and Marotiri, Ngatuturu and Taranga (the Hen and Chicken Islands) are in close proximity to shipping navigation routes. Some incidences of minor spills and ships running aground have occurred in the past and resulted in requirements to avoid ships greater than 45m in length traversing the area between the Poor Knights and

[18] Dayle Takitimu, Te Whanau a Apanui [Greenpeace press release, March 2011]

the Mainland and smaller oil tankers (Aframax – 750,000 barrel capacity) entering the Whangarei Harbour. At this point in time Refining NZ is exploring the possibility of once again bringing Suezmax ships (1 Million barrel capacity) to their jetty.
In addition to tankers coming into the refinery, there are also a substantial number of cargo, container, and log and woodchip ships loading and unloading at the Northport facility at Poupouwhenua. These ships then travel to and from the main ports of Auckland and Tauranga and Northport. Given the desire to expand all of these ports in the near future, considerable increases in shipping movements are likely.

While NRC has a Marine Oil Spill Contingency Plan[19] and Oil Spill Response Team that could deal with minor spills, the recent example of the Rena running aground off Tauranga illustrated New Zealand's general lack of preparedness for major oil spills.

9.5.1 Issue

a) The location of the oil refinery, Northport and busy shipping routes in our rohe moana and coastal waters places our marine environment at risk of oil spill.
b) A significant oil spill would have devastating consequences for our kaimoana, taonga species, amenity and recreational values and the cultural health of our rohe moana.

9.5.2 Objectives

a) Patuharakeke are informed and able to participate in any oil spill response.

9.5.3 Policies

a) NRC, Refining NZ and Northport will immediately advise PTB of any oil spills within our rohe moana and coastal waters.
b) NRC will consult on their Oil Spill Response Plan with Patuharakeke and to our satisfaction. This must also include a contingency fund for remediation and recovery.

9.5.4 Methods

a) PTB will work collaboratively with NRC, the Refinery and Northport on education and training initiatives and exercises with regard to oil spills.
b) Patuharakeke will take part in any oil spill response within our rohe moana and coastal waters. These exercises will be funded by the various industry and local government parties giving consent to the activities.

9.6 Industrial Activities at Poupouwhenua

Te Poupouwhenua Block compromised some 5000 acres and is the name for the land area and foreshore now known as Marsden Point and included much of One Tree Point (see Figure 2). This land was obtained illegally by the Settler government from Patuharakeke through confiscation for a land dispute at Matakana. The incident was misreported by the infringing settler at Matakana and reported to Settler authorities and was used as a mechanism by the Crown to acquire Poupouwhenua. It is a key focus of our Statement of Claim to the Waitangi Tribunal. The site was an important tauranga waka (canoe landing site) and was utilised frequently by various waka taua/war parties stopping there to prepare for battles further south.

[19] Currently under review

Seasonal migrations during the summer months were common for Patuharakeke along with other Whangarei and inland hapu. These were primarily for harvesting the varied and abundant kaimoana at this location, although waterfowl from wetlands such as Rauiri/Blacksmiths Creek, and plants such as pingao from the fore dune were also utilised. Much of the area along the foreshore and dunes between the now Marsden Point Wharf and Refinery Jetty was regularly used as a nohoanga (camping site for harvesting kai) by Patuharakeke and other whanaunga from the Whangarei area up until the 1960s development of the site began and consequently restricted this practice.

The Northland Harbour Board recognised the natural attributes of Poupouwhenua for port development and began acquiring land at Marsden Point in the early 1960's. A few years earlier, Royal Dutch Shell had surveyed the site and found it suitable for the construction of an oil refinery which commenced operating in 1964. At the time, there was little knowledge of the effect industrialisation was going to have on the cultural health of the harbour. The local community were assured that growth would provide economic benefits, and this perception has driven industrial expansion in the area ever since, although in our view benefits to tangata whenua have never been realised.

Instead, refinery construction activities wiped out extensive mussel beds and flattened the dune systems. During 1966-69, a major dredging programme was undertaken to deepen the main channel and 754,000 m3 of sediment was removed and pumped on to Snake Bank and the Takahiwai shoreline. The reclamation of seabed at Poupouwhenua for the construction of the Timber Port in 2002 resulted in the destruction of arguably the largest remaining (and readily accessible by foot) pipi bed and shorebird roosting sites (Chetham, 2013).

A specific condition of the coastal permits and consents created a mitigation fund administered by NRC. A kaitiaki roopu was established to work with the consent holder NorthPort to select projects to enable improvements to the health of the Whangarei Harbour, and the study and/or mitigation of the effects of the port development on waahi tapu, taonga, and other features of special interest to tangata whenua. While some valuable work has been undertaken as a result of the Whangarei Harbour Kaitiaki group's establishment, the genuine hope of tangata whenua that the environmental mitigation fund would assist in building our capacity as kaitiaki and promoting our participation in the management of our harbour did not eventuate.

Given that this Fund is tied to a specific consent condition and its timeframe is coming to an end, we believe it is time for industry, tangata whenua, the community and stakeholders to explore a new mechanism going forward to improve the cultural and environmental health of the harbour. PTB have an MOU with Refining NZ and the relationships and understanding have improved markedly over recent years. PTB and Northport are also working on building a better rapport with one another. As such, this aim should be achievable.

The siting of these activities in our rohe has increased the likelihood of pest species arriving in ballast water and on the hulls of ships. The long term and cumulative effects of stormwater discharges from the port and refinery has not been quantified in our view. As tangata whenua we have grave concerns about their impacts on our now scarce kaimoana resources and the mauri of Whangarei Terenga Paraoa. These vast industrial complexes have forever distorted and impacted on our cultural landscape and seascape.

9.6.1 Issues

a) Industrial activities at Poupouwhenua have had adverse impacts on the mauri and cultural health of Whangarei Terenga Paraoa and cultural landscapes and seascapes.
b) There is a need to work closely with NRC, NPC, Northport and Refining NZ to manage effects of industrial activities on the mauri and cultural health of the harbour and the relationship of tangata whenua to it.

9.6.2 Objectives

a) The mauri and cultural health of Whangarei Terenga Paraoa and cultural landscapes and seascapes are not further compromised by industrial activites at Poupouwhenua.
b) Patuharakeke maintain robust and effective relationships with Northport and Refining NZ and the relevant statutory authorities.

9.6.3 Policies

a) NRC will require that Northport and Refining NZ recognise and provide for the relationship of Patuharakeke to Poupouwhenua and the harbour and our aspirations to manage the harbour as mahinga kai, by:
   i. Ensuring that port activities at all times seek to avoid or minimise pollution in the harbour;
   ii. ensuring that consents for works or discharges stipulate regular cultural health monitoring by resourced kaitiaki as part of compliance monitoring;
   iii. Where data shows that there is an adverse effect on water quality then activities must cease;
   iv. Providing appropriate mitigation and/or compensation where cultural and environmental effects cannot be avoided, (i.e. such funds as for restoration projects);
b) Major dredging programmes will be avoided and CIA's will be mandatory for any dredging proposal in our rohe moana or coastal waters; and
c) PTB, NRC, Northport and Refining NZ will work collaboratively to develop a research program to investigate and address how dredging, reclamation, sedimentation and discharges in the harbour are affecting mahinga kai.

9.6.4 Methods

a) NRC implement effective marine rules to protect the harbour from the effects of point discharges and those associated with ballast, bilge and sewage from ships and boats, including biosecurity risks.
b) PTB will oppose any new land or foreshore reclamations in our rohe moana and coastal waters.
c) PTB will continue to participate on the Whangarei Harbour Kaitiaki Roopu for as long as it continues to function.
d) PTB, NRC, Northport, Refining NZ and other tangata whenua groups/ hapu and stakeholders will investigate an appropriate mechanism to implement a long term Whangarei Harbour Improvement fund or strategy going forward.

9.7 Marine Mammals

Whangarei Terenga Paraoa translates as "the meeting place of the whales". Whales have a special place in Patuharakeke tradition, they are seen as a kaitiaki or guardians and tribal korero states our tupuna named and called to known and favoured sea mammals and also chanted them back out to safety during strandings. After being hunted to the point of collapse last century they have recovered only to be at risk from marine pollution (heavy metals, toxins, plastics etc), noise pollution, boat strike, harassment from some tourist operators and boat operators, set nets and other commercial fishing practices, plummeting food resources, and the effects of sonar to name a few.

There are a number of theories as to why marine mammals strand, but it seems likely to be at least partially due to the increasing human-induced pressure their habitat is under. Our affinity and spiritual connection with whales and dolphins means Patuharakeke as kaitiaki have a foremost responsibility to advocate for the protection of these intelligent and majestic creatures. Whilst whale strandings are a sad occasion for Patuharakeke, they provide us with a valuable opportunity to revive matauranga associated with the preparation of whalebones for carving and obtaining other resources such as oil/ spermaceti. The Department of Conservation holds statutory responsibility for marine mammals under the Marine Mammals Protection Act 1978 and the Conservation Act 1987. We are fortunate that Ngatiwai developed the first protocol with DOC for the management of whale strandings. This provides for the recovery of bone and teeth by tangata whenua and the provision of scientific samples.

To date we have built our capability in this area through collaboration with Ngatiwai and have developed Patuharakeke Whale Stranding Guidelines[20] to guide the process and communications with DOC. A mass stranding of Pilot whales in Bream Bay in 2006 provided an opportunity for Patuharakeke to host a national tohora wananga. The wananga was a great success and allowed the building of more connections with hapu and iwi with knowledge and/or interest in whales and the recovery of resources from beached whales. Tikanga around flensing, boning out, burial, naming and gifting[21] of bone and so forth were shared and developed. Patuharakeke have since demarcated and named the site where the whales were buried (for later uplifting and cleansing) as a waahi tapu (the "Tahuna Tohora")[22].

9.7.1 Issues

a) The habitat of marine mammals is facing immense human-induced pressures.
b) Patuharakeke have developed a formal process around Marine mammal strandings and their cultural harvest. However we do not yet have the appropriate holding permits in place for taonga such as whalebone. Presently DOC requires that we get permission from Ngatiwai Trust Board to utilise their holding permit.

9.7.2 Objectives

a) Increased numbers of healthy whales and dolphins inhabiting and migrating through our coastal waters and harbour.

[20] see Patuharakeke Whale Stranding Guideline (http://patuharakeke.maori.nz/about-patuharakeke/patuharakeke-trust-board/policies/)
[21] see Patuharakeke Tohora Taonga Committee Tuku Taonga Process Guideline (http://patuharakeke.maori.nz/about-patuharakeke/patuharakeke-trust-board/policies/)
[22] shown on Figure 4 Sites of Significance Overlay

b) A strong partnership between DOC and Patuharakeke with regard to the management of marine mammal strandings and cultural harvest in our rohe.
c) Revival of matauranga and tikanga associated with marine mammal strandings and cultural use.

9.7.3 Policies

a) The cultural, spiritual, historic and traditional association of Patuharakeke with marine mammals, and the rights to exercise rangatiratanga and kaitiakitanga over marine mammals is guaranteed by Te Tiriti o Waitangi.
b) The relationship between Patuharakeke and DOC for the recovery, disposal, storage and distribution of beached marine mammals shall be guided by the principles of partnership.
c) To require that a standard procedure be introduced that Patuharakeke are involved in the determination of burial sites for beached whales that do not survive, and that burial locations are retained as waahi taonga and therefore protected from inappropriate use and development.

9.7.4 Methods

a) Patuharakeke will continue to advocate for a clean and healthy marine environment for marine life, including dolphins and whales.
b) Patuharakeke will continue to utilise and update the Patuharakeke Whale Stranding Guideline as necessary.
c) Patuharakeke will apply for a holding permit for whale bone and other taonga through DOC as a priority.
d) Patuharakeke will continue to work collaboratively with Ngatiwai and other hapu and iwi to build knowledge and understanding with regard to the cultural harvest of stranded marine mammals.
e) Patuhakeke will work with NGO’s (eg. Project Jonah) to build our capability in marine mammal rescue techniques.

9.8 Customary Fisheries

The waters of Whangarei Terenga Paraoa, Bream Bay and our estuaries are a taonga gifted by our tupuna. We as kaitiaki have a duty to conserve and protect this taonga for our mokopuna. These waters once teemed with kaimoana such as kuku, tipa, kina, paua, tuatua, kokota, huwai, pipi, pupu, papaka, kumukumu, pioke, kahawai, tuna, kanae, wheke, whai, tamure, aua, patiki, and parore. However, more than a century of poor management practices has seen an immense decline in marine species as a result of degraded water quality, habitat loss and unsustainable harvest. The decline of kaimoana species, is accompanied by a decline in traditional knowledge in regard to those species, their uses and management practices. This impacts on our duty as Kaitiaki and displaces an important role and function for our tamariki and mokopuna.

Our mana as tangata whenua, is further diminished by our inability to practise manaakitanga to gather kai moana for the table both for our families and manuhiri (something we were formerly renowned for). Not only does this impact on our cultural wellbeing, but it has economic consequences, as we are unable to put kaimoana on whanau dinner tables, a practice that has always supplemented low incomes and our diet.

The current fisheries model has not successfully protected or sustained our mahinga kai and taonga species. While the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992 (TOWFSA) was intended to remedy Treaty breaches, none of the purported benefits have "trickled down" from the Mandated Iwi Organisations ("MIO"s) formed under the TOWFSA to Patuharakeke. Accordingly our participation in fisheries is limited to customary management and the recreational take we use to feed our whanau. Further, the mismanagement and pollution of the environment; water quality; privatised fishing property rights to certain fish species; over-fishing caused through by-catch, and over-allocation of fishing rights; the state of our kaimoana resources has left customary harvest virtually untenable. Only a handful of permits for customary take have been granted, let alone requested, by our Rohe Moana Committee in the past five years as Kaimoana is in such short supply.

Taiapure and Mataitai Reserves are the only fisheries management opportunities for Maori arising from fisheries settlement in relation to customary harvesting and management practices. However, relatively few have been established in the north island. This is a reflection of the onerous process and information requirements, serious time delays, and lack of access to technical support.[23]

Moreover, the fragmented nature of current fisheries management does not reflect our holistic view of coastal ecosystems. At present, the disconnect between managing the fish species and their habitat is a major issue. Having the best fisheries management tools in place would be pointless if the habitats that support the fishery (including adjacent land and waterways) are degraded.

Our rohe moana and tangata kaitiaki were gazetted in May 2009 under the Kaimoana Fisheries Regulations 1998. Figure 5 below shows our gazetted rohe moana although our traditional interests extend far further than depicted by the map. Limited capacity and resources have not allowed us to reach our goal of creating mataitai reserve for parts of our customary fishery. However, our committee have been active in monitoring our mahinga kai, using cultural health indicators and also through joint surveys with research organisations such as NIWA.

Our concern over depletion of pipi stocks at Marsden Bank led us to petition the Minister of Fisheries for a rahui (s186A closure) under the Fisheries Act 1996 in February 2011 to allow stocks to recover. Due to a lack of its recovery PTB have since extended the closure period for a further two years. The adjacent Mair Bank is now under threat and we are currently exploring options with MPI, NRC and Industry stakeholders as to how we can arrest this decline. What has become clear is that harvesting pressure is not the only factor affecting pipi at these sites and further research is required to identify the causes.

Overall, the relationship with the Crown with respect to our fisheries is a challenging one. We find it extremely hard to get any traction, with the responsible government departments. This has been particularly difficult over the past several years with the ongoing restructuring within Ministry of Fisheries and the now Ministry of Primary Industries. This has meant that staff and policy seemed to constantly change. It has become increasingly difficult to get support and information and we have seen Ministry capacity diverted away from customary fisheries.

[23] http://www.edsconference.com/content/docs/2012_papers/Stephenson%20%26%20Kirikiri.pdf

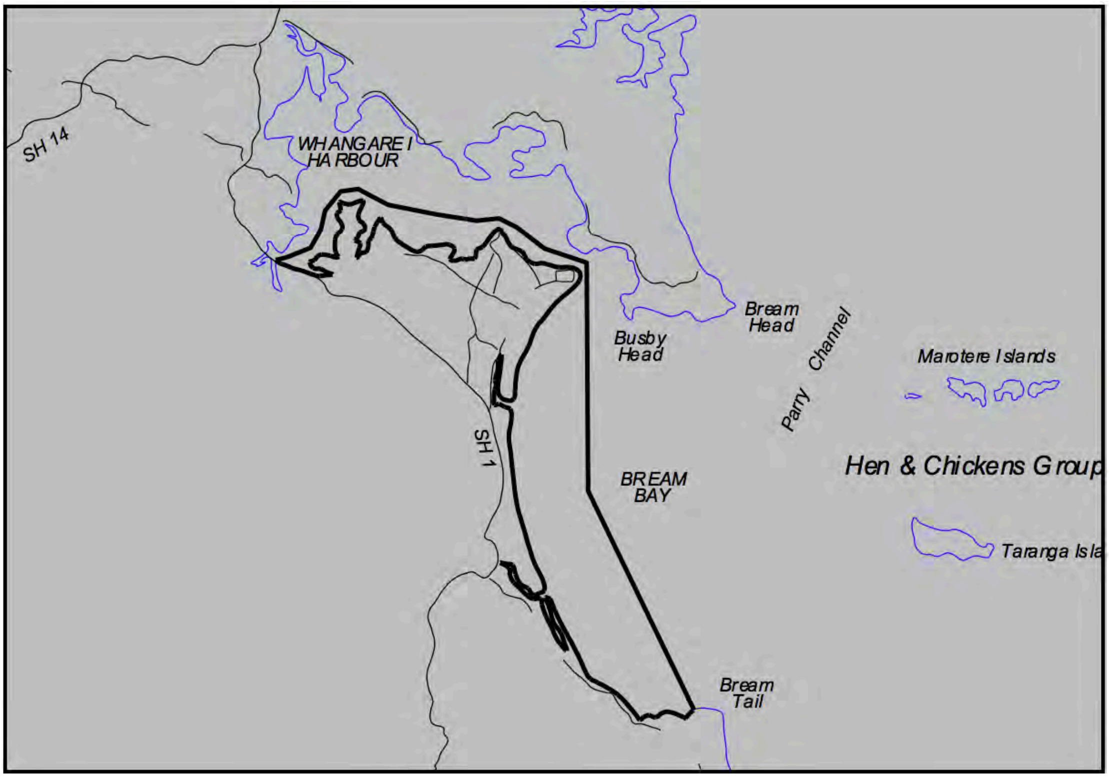

Figure 5: Patuharakeke Rohe Moana Gazetted Boundaries

9.8.1 Issues

a) Increasing pressure on the kaimoana resources in our rohe as a result of:
   i. Discharges to the coastal marine area and harbour, and impacts on coastal water quality;
   ii. Harvesting pressure;
   iii. Lack of awareness among visitors of the importance of our harbour, bays and estuaries as mahinga kai;
   iv. industrial activities; and
   v. Biosecurity risk.

b) There is a need to implement appropriate tikanga-based management tools for protecting and enhancing the marine environment and customary fisheries.

9.8.2 Objectives

a) That there is diversity and abundance of mahinga kai in our rohe moana, the resources are uncontaminated and healthy, and Patuharakeke have unimpeded access to them.
b) The role of Patuharakeke as kaitiaki of the coastal environment and sea is recognised and provided for in coastal and marine management.
c) Traditional and contemporary mahinga kai sites and species within our rohe moana, and access to those sites and species, are protected and enhanced.
d) Our rohe moana is protected through tikanga-based management of fisheries.
e) Te rohe moana o Patuharakeke is managed as a mahinga kai and mataitai, first and foremost.

9.8.3 Policies

a) Agencies and stakeholders will support the protection and enhancement of our rohe moana through tikanga-based customary fisheries management tools, and supported by matauranga Maori and western science, including:
   i. Mataitai;
   ii. Rahui; and
   iii. Tangata tiaki/kaitiaki.
b) Agencies and stakeholders will support the development of an ongoing monitoring scheme by Patuharakeke using Cultural Health Indicators ('CHI') to assess the health of our rohe moana.
c) To continue to jointly investigate and implement kaimoana reseeding projects in the rohe moana where traditional stocks are degraded either through the Whangarei Harbour Health Improvement Fund/Kaitiaki Roopu or another mechanism.
d) PTB will continue to develop and establish sound research partnerships with NRC, Crown Research Institutes, government departments, universities and other organisations to address issues of importance to tāngata whenua regarding the management of our rohe moana.
e) NRC will require protection or restoration mechanisms such as bonds, levies and mitigation funds as consent conditions for any application with the potential to adversely impact our rohe moana.
f) NRC will require that water quality in the harbour, our bays and estuaries is such that Patuharakeke can exercise customary rights to safely harvest kaimoana.
g) PTB will continue to work with local authorities to develop appropriate policies and rules to implement and enforce measures to improve coastal water quality (for example as set out in policies 9.1.3 and 9.6.3 of this plan).
h) PTB will work with MPI and other stakeholders to improve compliance with fisheries regulations through the following measures:
   i. Education of the wider community regarding the harbour, bay and estuaries as mahinga kai;
   ii. Continued support for kaitiaki to monitor the rohe moana area, including the rahui on Marsden Bank pipi bed; and
i) PTB will work with MPI and other stakeholders to continue to initiate and support research projects on kaimoana health, abundance and diversity in our rohe moana.

9.8.4 Methods

a) PTB will prioritise finalisation of our Draft Rohe Moana Management Plan.
b) PTB will prioritise the development of a mataiatai reserve application under the *Customary Fishing Regulations 1999* to establish mataitai reserves on particular areas of Whangarei Harbour and Bream Bay and seek the support of MPI and other agencies and stakeholders to advance it.
c) PTB will investigate making an application to MPI to extend our rohe moana boundaries to reflect their traditional extent (ie. East of Bream Bay to the 12 mile limit).

9.9 Aquaculture

Tangata whenua have been practicing forms of aquaculture for centuries. Shellfish seeding is a traditional form of aquaculture still practiced today. Other methods of cultivating kaimoana involved the storage of kaimoana in rock pools, or under piles of rocks for "on growing" or until they were required. Rocks were placed to create structures for oysters in particular in specific locations for easy retrieval. Many traditional customary activities are now classed as aquaculture and are unable to be carried out without a permit. Patuharakeke have aspirations in this area and wish to explore mechanisms for developing marae-based or customary aquaculture (eg. for non-commercial purposes such as to enhance, support, restore and supplement existing or depleted kaimoana beds).

The last decade has seen multiple legislative changes for the aquaculture planning regime. Reforms in 2004 saw a requirement for regional councils to establish Aquaculture Management Areas ("AMA's"). This coincided with the passing of the Maori Commercial Aquaculture Claims Settlement 2004 ("MCACSA") entitling Iwi with a coastal rohe (essentially existing Mandated Iwi Organisations with fishing quota) to be entitled to 20% of any new space created in AMA's. The assets were to be held in the Takutai Trust and administered by Te Ohu Kai Moana until they were transferred to Iwi. Establishment of AMA's proved to be a lengthy and complex process. NRC's Plan Change 4 became stalled in the appeals process before effectively becoming redundant after further reforms in 2011 scrapped the AMAs in favour of a return to managing applications for marine farming space on a 'first come, first served' basis.

The 2011 amendments to the MCACSA presented the Maori entitlement to 20% of new space (or the equivalent) but introduced new mechanisms for delivery of that entitlement, focused primarily on a 'regional agreements' model. Regional agreements may include, space, cash or anything else that is agreed between the Crown and iwi with coastal interests in the relevant region and may be based on anticipated new aquaculture development, not just 'new space' that has already been created.

At present marine farming in our rohe is restricted to small oyster farms in Parua Bay. Development of aquaculture initiatives is currently led by Northland Inc. Northland Inc instigated the formation of the Northland Aquaculture Development Group ('NADG') in order to collaboratively to develop the 'Northland Aquaculture Development Strategy'. The strategy was officially launched at NIWA's Bream Bay Aquaculture Park in November 2012 and aims to see aquaculture in Northland developed into a $300 million industry employing more than 700 extra workers in less than two decades[24].

The group is made up of five working groups; Finfish, Oyster, Greenshell Mussel, Freshwater and Paua with a collective membership that includes the local aquaculture industry, iwi, and scientists. A shore and sea based farmed kingfish industry is being heavily promoted as one of the potential highlights of the North's future aquaculture industry and much of the initial work to develop this resource is being done out of the Bream Bay Aquaculture Park. The NADG also wants to significantly grow the Greenshell mussel industry, and aims to double the earnings of the oyster and paua industries. Due to a lack of capacity and resourcing Patuharakeke have had limited involvement in this collective to date.

NIWA operates the Bream Bay Aquaculture Park at the site of the old Marsden Power Station on land leased from Mighty River Power. This land has s27B SOE Act Memorials on the title and forms part of our Waitangi Claim. PTB also has an MOU with NIWA that requires both parties to act in good faith, communicate openly, and

[24] see www.northlandinc.co.nz/tell-me-about-aquaculture-strategic-plan-test

regard each other as equal partners, and includes other matters such as joint initiatives and shared environmental and scientific endeavours.

Patuharakeke need to have a say in how and where aquaculture occurs in our rohe. Inappropriate aquaculture locations and unsustainable practices have the potential to compromise values and resources important to Patuharakeke. Sustainable aquaculture, on the other hand, has the potential to contribute to the cultural, social and economic well-being of Patuharakeke and the wider community. Aquaculture and marine farming proposals need be considered on a case-by-case basis. Patuharakeke may identify areas that are inappropriate for aquaculture, based on the specific values located there, for example if the area is a traditional mahinga kai.

9.9.1 Issues

a) Patuharakeke have specific rights and interests associated with where and how aquaculture takes place.
b) Aquaculture can have adverse impacts on values of importance to Patuharakeke, such as cultural landscapes and seascapes, mahinga kai and other taonga species.
c) Sustainable aquaculture has the potential to contribute to the cultural, social and economic well-being of Patuharakeke and the wider community.
d) Patuharakeke have a specific interest in the title on which the Bream Bay Aquaculture Park is located that requires addressing.

9.9.2 Objectives

a) The specific rights and interests of Patuharakeke in aquaculture are recognised and provided for in our rohe moana and coastal waters, and including in any shore based aquaculture in our rohe.

9.9.3 Policies

a) Responsible agencies must ensure that Patuharakeke have an explicit and influential role in decision-making regarding the allocation and use of coastal space for aquaculture in our rohe moana and coastal waters and including shore based facilities in our rohe.
b) To require that all applicants, including Mandated Iwi Organisations, initiate early and effective engagement with Patuharakeke when considering marine farming ventures in our rohe moana and coastal waters;
c) When any sustainable aquaculture ventures are agreed to within our rohe moana, Patuharakeke will share tangible economic benefits.
d) No new commercial aquaculture is to be located within the Whangarei Harbour.
e) Agencies and stakeholders will work collaboratively with PTB to explore ways of developing marae-based or customary aquaculture (eg. for non-commercial purposes such as to support, enhance, restore and supplement existing/depleted mahinga kai).

9.9.4 Methods

a) Councils will require a Patuharakeke CIA to be produced for any aquaculture proposals in our rohe, rohe moana and coastal waters.
b) PTB will continue to engage in the NADG and other collectives as deemed appropriate by the hapu.
c) PTB will assess all aquaculture proposals in our rohe, rohe moana and coastal

waters on a case by case basis with reference to:

i. Location and size, species to be farmed;
ii. Consistency with Patuharakeke aspirations for the site/area;
iii. Effects on natural character, seascape and marine cultural heritage values;
iv. Visual impact from land and water;
v. Effects on customary fishery resources;
vi. Monitoring provisions;
vii. Cumulative and long term effects;
viii. Impact on local biodiversity (introducing species from outside the area); and
ix. Impacts on off-site species.

PART IV: REVIEW AND EVALUATION SECTION

This HEMP has been prepared by PTB. It will be distributed to Patuharakeke via the website, e-mail circulation and a number of printed copies will be made available to the various Patuharakeke committees and potentially kohanga and schools within the rohe. The PTB website can be found at www.patuharakeke.maori.nz. The plan will also be made available to our whanaunga in neighbouring hapu and iwi and stakeholders and interested parties by way of this website. The plan will be formally lodged with WDC and NRC by October 2014.

The establishment of the PTB RMU is still to be initiated. A primary function of the unit will be stewardship of this plan including establishing a monitoring and review framework in collaboration with the hapu. Over time, further issues may arise or become more important necessitating new or additional policy to be formulated or the amendment of existing policy. Therefore, PTB will formally review this plan at least every five years. The plan will be treated as a “living document” however, and rolling reviews will occur as necessary.

As such, hapu requests for review, change or additions to this plan can be made in writing to PTB. All requests will be received on a case-by-case basis and considered by PTB at their monthly meetings. Unless advised otherwise by PTB, policy contained in this document may be modified, deleted, changed or enhanced by formal resolution of the PTB.

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Annexure Five: Consultation draft report technical review and Refining NZ's responses.

a) **Hui outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project for Patuharakeke Te Iwi Trust Board**
b) **Refining NZ responses to "Hui Outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project" Dated April 2017**

Annexure Five: Consultation draft report technical review and Refining NZ's responses.

a) **Hui outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project for Patuharakeke Te Iwi Trust Board**

HUI OUTCOMES AND
TECHNICAL REVIEW OF REFINING NZ DOCUMENTS SUMMARY
FOR CRUDE SHIPPING PROJECT

for

Patuharakeke Te Iwi Trust Board

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Date: April 2017

Purpose of Report

Refining NZ (the applicant) has commissioned a suite of technical reports to inform an assessment of effects to support a proposed application for resource consents to dredge and realign the channel approach to and adjacent to the Marsden Point refinery complex and the disposal of the dredgings in the CMA. This work will enable berthing of fully laden Suezmax oil tankers, currently not available due to the draft of these vessels.

As part of the Tangata Whenua engagement being undertaken by Refining NZ, Patuharakeke Te Iwi Trust Board (Patuharakeke) has contracted a review of the technical documents, the results of which were presented and discussed at a hui at Takahiwai Marae, on 7 April 2017 of Tangata Whenua o Whangarei Te Rerenga Paraoa.

Refining NZ staff and technical experts joined the hui in the afternoon and presented giving an overview of the proposal, and summaries of the AEE reports on coastal processes, ecology and marine mammals. This provided an opportunity for the hui participants to raise questions and comment on the material presented.

This report provides a summary of the key questions resulting from the review of the technical documents and raised in the hui for consideration by Refining NZ and will inform the Cultural Impact Assessment being undertaken by Patuharakeke.

Overview

There are a broad suite of issues arising from the review of the technical documents supplied which we advise Patuharakeke seek further information and clarification on from Refining NZ. In general terms however, there appear five key areas of concern:

- The economic analysis provided by NZIER, including the overall viability of the refinery in the long term.
- Related to this is the relationship of the proposed application within the context of climate change and New Zealand's current and future policy over the lifetime of the consents sought.
- The overall health of the harbour and the role of Refining NZ as a key stakeholder.
- The practical implementation of the responsibility of kaitiakitanga by Patuharakeke in relation to the harbour.
- The potential impacts of dredging, including disposal of dredgings.

Economic Analysis

An economic assessment report has been provided by NZIER. The basis for Refining NZ's application to dredge is the assertion that this will result in a reduction in costs to the refinery by reducing transport costs by allowing for bigger ships (Suezmax), which can currently only enter partially laden, to berth fully laden. Refining NZ argue that this would decrease the transport costs for the refinery and its customers of importing crude oil from overseas by having fewer shipping movements at lower cost delivering more crude.

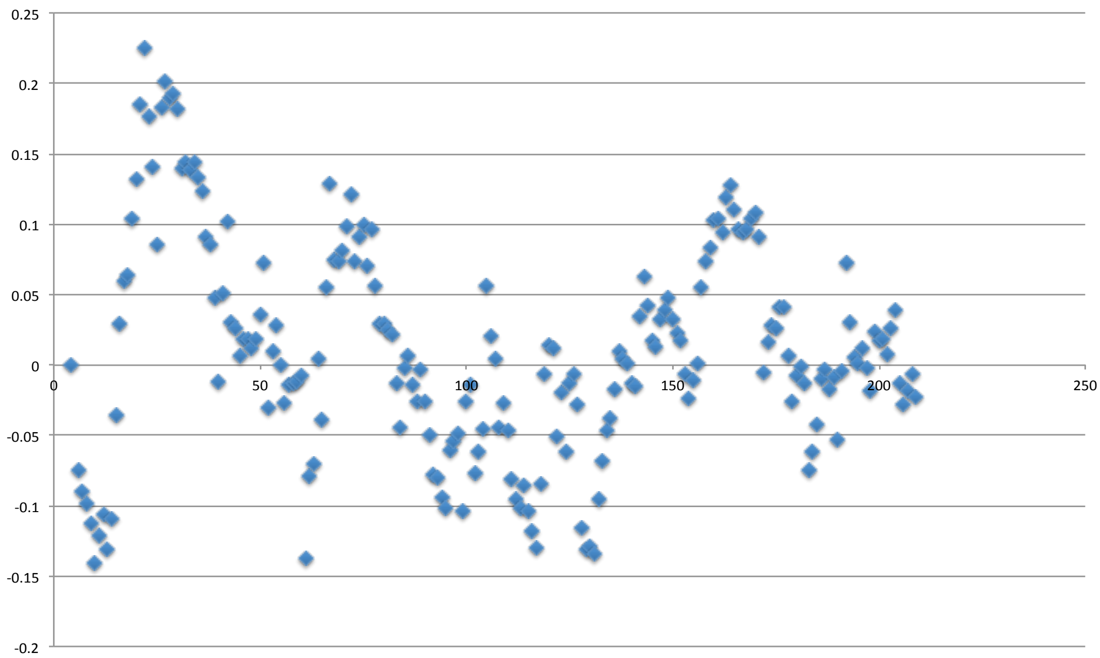
The analysis appears seriously flawed in several regards. At best it is not robust, and in several instances, especially in regard to the analysis of transport costs, appears factually incorrect and is misleading about the potential benefits, and especially the conclusion that reduced numbers of ships equates to reduced Greenhouse Gas (GHG) emissions. Full analysis of the report is hampered by the lack of depth and base data, assumptions and calculations provided in the economic assessment to support the assertions made.

We note that our findings at this stage are preliminary given the scope of the review we have been requested to undertake. We have, however, had the benefit of advice from colleagues at University College London, widely considered as leading experts in this field.

Firstly, the cost of transport is one of a number of key factors that make up the cost of refinery operations and the resultant profit of the refinery. There appears an assertion that transport cost is the key determinant of overall economic viability for the refinery. The assessment concludes that the proposed dredging will result in cost savings of USD 0.61/barrel. It is not clear whether these savings are predicted as an average over the lifetime of the proposed consent or in the immediate near future.

There are multiple key factors that affect the cost of crude transport to Marsden, many of which appear to have been ignored by NZIER. Such factors include freight rates, which have been historically highly volatile, and ship speed, which strongly influences ship fuel consumption and therefore is a key factor in tanker day rates. If we use actual day rate charter prices for the past 17 years (obtained from Clarkson's) and fuel prices (which the charterer pays) at an assumed rate of USD 500/tonne we can model the transport costs of Aframax versus Suezmax over identical routes. The resulting graph shows that there are many points in time (negative numbers) when Aframax would have achieved significantly greater savings than Suezmax. Based on this initial calculation, which provides an "apples for apples" comparison of ships sailing identical voyages, the average savings assessed are conservatively USD 0.01/barrel not the USD 0.61/barrel arrived at by NZIER. We accept that closer analysis and additional data sets may vary this calculation, however the point remains that there is a difference of a factor of 60 in the potential savings between this and the NZIER assessment.

Net cost/saving $ per bbl of fully loaded Suezmax vs. fully loaded Aframax, 2000 - 2017, assuming 20 day voyage and $500/t fuel



Given that the assessment on return on investment for dredging calculations is inherently based on these projected savings we suggest they are probably highly questionable and could result in no actual savings in transport costs from dredging and in some scenarios increased costs.

It is noted that only limited and insufficient data is given on the projected source of the crude that would be carried by the Suezmax tankers. Currently it appears some very limited loadings are being sourced from West Africa, Russia or the Middle East aboard Suezmax tankers. If larger or more regular shipments are envisaged from these sources, then they will likely be travelling more than twice the distance compared to the Aframax (which appear mostly to source from Asia). This means that the Suezmax are at sea for longer, burning more fuel and generating more GHG emissions, so distance travelled and vessel speed are critically important to both transport cost and GHG emissions. For example, the distance from Singapore to Marsden is approximately 5,800 nautical miles; from Qatar to Marsden is just over 8,000 nautical miles, Nigeria to Marsden is approximately 10,000 – 14,000 nautical miles (depending on route taken) and assuming that both ship types are likely to be travelling at 15 knots this means 16 days at sea for an Aframax and anywhere between 27 and 40 days for a Suezmax from Nigeria or 22 days from Qatar.

The assessment also assumes the current global availability of Suezmax tankers to service a Marsden destination is assured. We again note the 35-year life of the proposed consent. In the past decade shipping generally, and oil tankers in particular, have undergone extreme highs and lows in terms of capacity, availability and day rate charters. Nobody predicted an end to the oil price or shipping boom prior to 2006 or that current over-capacity would exist today. It appears somewhat short-sighted to predict that ships of this size will be available for this route over the next 35 years and the entire profitability argument is hinged on this assumption.

It could be that it is just as effective to continue to use Aframax ships, but newer and more efficient ones, steaming at lower speeds and achieve the same or greater transport cost improvements without the need to dredge. We would be happy to provide additional analysis and modelling on these points in the future.

Along with the global availability of ships other factors such as the NZ exchange rate and day charter rates are also influential and remain volatile. The current work in the International Maritime Organisation in regard to future regulation of emissions from ships will also be significant in determining future transport cost and thus the future financial viability of the refinery. International shipping itself has to reach zero carbon emissions by 2040 if we are to stay within 2°C of global warming[1] and aim at no more than 1.5°C (we are already at 1.1°C of global warming[2]). We note the recent comprehensive study prepared for the Danish Ship Owners Association and being submitted under the current IMO Roadmap meetings that modelling to achieve Paris Agreement targets assuming shipping was ascribed a "fair share" of reductions burden, would entail the almost complete decarbonisation of shipping early in the second half of this century. These "bigger picture" factors have not been fully addressed or considered. This could mean that even if the dredging of the channel were to go ahead, the refinery may still not be financially viable in the medium to long term.

We also note the concerns which were discussed at some length in the morning session of the hui, regarding the projections of cost associated with any future remediation of the site and the basis for the economic assumption implied that failure to undertake this dredging programme would almost automatically mean the closure of the refinery and/or its transition to a transit port. We would expect to see a far greater justification for these conclusions. The economic importance of the refinery to the region and the harbour residents is well understood. There is no disputing that it is a significant employer in the region. However, without sounder evidence, the argument that future viability hinges almost exclusively on this application appears couched as a "veiled threat". The economic benefit has been highlighted, however negative effects on local employment (e.g. reduced

[1] http://www.lr.org/en/news-and-insight/news/LR-and-SCC-release-Low-Carbon-Pathways-2050-study.aspx and Smith, T.W.P., Traut, M., Bows-Larkin, A, Anderson, K., McGlade, C. and Wrobel, P. "CO_2 Targets, Trajectories and Trends for International Shipping". University College London and University of Manchester 12th May 2015.

[2] http://library.wmo.int/opac/doc_num.php?explnum_id=3414

ship movements would assumedly require less pilot/tug boat/stevedore hours) and the outsourcing of high skill work such as dredge operations) has not been mentioned or only cursorily.

In regards to the findings presented on costs of potential remediation of the site, assumedly in the event of a downscaling or abandonment of the current operations, we would like to see a more detailed assessment. However no rationalisation of the $300 million figure has been provided and it is unclear on what basis this was calculated. While there may be a saving to current balance sheets through depreciation of deferred expenditure, the physical reality is that remediation of the site will eventually be required and that the actual costs of such work are unlikely to diminish over time. This was raised in the hui, with concerns being expressed that the cost of remediation would be left to the next generations to deal with.

Given the above, our recommendation is that Refining NZ reconsider the economics of dredging more fully taking into account the variables that influence transport cost, and consider alternative options (beyond the options of alternative mooring and lightering approaches) for ensuring their longer term viability. We discuss the climate change related aspects below. However, it may be that in developing a long term strategy (or at least a strategy covering the proposed 35-years of consent) that Refining NZ needs to consider developing a low carbon transition plan for its operations in light of a range of options as to where NZ's energy demands could be within this time horizon.

Finally in regards to the economic assessment and in context of seeking long-term sustainable management of the resources within Patuharakeke's rohe, we would also have liked to have seen more work on the sustainable use of dredge material. This however appears to have been discarded as a consideration prematurely. We note that Patuharakeke, Ngatiwai and other Te Tai Tokerau iwi have been involved in numerous consents for sand extraction from the CMA and while we can understand that this is not a core activity of the refinery and that proper analysis may show it to be economically unviable, it does seem ironic to be considering consents for disposal of sand on the one hand and receiving applications for reclaiming sand extraction of sand on the other eg. Pakiri etc.

Climate Change

Given the nature of the refinery's operations and products this application needs to be considered squarely in terms of effects of climate change over the lifetime of the consent. The issue arises under two broad headings: physical effects of climate change affecting coastal process, geomorphology, ecosystem health and extreme weather events; and secondly within the context of NZ's current and future oil demand and NZ Government policy on GHG emissions and related decarbonisation.

In regards to the first, we note that there is some scattered reference throughout the technical reports to the increasing effects of climate change and related sea level rise and weather volatility. Of greatest concern is the reliance by several technical experts on the increasing scale of effect on what are now out-dated projections. In some examples reference is being made to 2008 MfE guidelines and in others to the findings of the 2014 IPCC report. We note that the IPCC report was based on data from 2012 and prior, and is considered by the IPCC authors as extremely conservative. A range of recent publications by leading experts, for example on the rate of Antarctic melt, suggest that climate change effects could increase more dramatically and in much short timeframes than previously considered. Even if, in RMA terms, this is a low probability scenario, we have to conclude that the results could be significant. There can be no question of the increasing impacts of acidification on marine ecosystems, which will only exacerbate the stress that current harbour ecosystem health is already under. Leading weather scientists and modellers, for example at NOAA and NASA, are currently divided on the likely impact of climate change on Pacific weather patterns which could also affect predominant swell and wave patterns affecting the north east coast of NZ.

However we find that there is so far only limited consideration of these matters in the technical reports reviewed.

In regards to the second point, this must be viewed in the context of the 2016 Paris Agreement to which NZ is a signatory and has made a Nationally Determined Contribution (NDC). It is noted that the Paris Agreement calls for regular review and increasing ambition of NDCs over time, the next formal milestone being the Facilitative Dialogue in 2018. It is highly likely that there will be increased pressure on NZ to consistently increase its current level of ambition and this would be advanced under a change of political leadership in the future. NZ's current energy policy calls for gradual reduction and a move towards decarbonisation of all forms of energy within the economy. We note however that the analysis provided by Refining NZ only considers a scenario of steady increase in oil demand and it is our opinion that a number of future scenarios should correctly be modelled to reflect potential change given the 35-year timeframe sought for these consents. We also note the tension between the cost saving argument presented (i.e. a reduction in number of ship movements) and the projected rate of increase in energy demand, which would see ship movements increase over time to in excess of existing numbers.

Given that the current economic analysis provided is couched in terms of local, regional and national benefit and given the age of the refinery asset and the limitations of product that it can accept and on-sell, it may well be that in overall terms, and in the context of international climate change policy, the refinery is best considered as a "stranded asset" and that there may be greater national benefit in a scenario of importing refined product in smaller ships direct from source. We raise this as illustrative of the need for greater analysis and are not favouring this as a preferred position at this point.

Overall Health of the Harbour

At the time of the last major dredging and reclamation consents sought by the then Northland Port Corporation, a range of submissions alleged that the overall health of the harbour was already poor and in decline. The actual area under consideration as being impacted by the proposed consents varies from report to report but in general terms is quite narrow and limited to the mouth of the harbour. We note the strong preference of Tangata Whenua to a catchment-based approach, which is reinforced by most ecological management best practice. There are a number of ways in which harbour health trend could be determined. We are a little surprised at the lack of any comprehensive analysis of this, especially given the potential and promise of the mitigation measures put in place in previous consents.

However, if we use the indicator of mahinga kai, the dramatic fall in size, abundance and health of resident shellfish populations within the vicinity of the area of consent would appear to attest to this negative trend. The decline in pipi in particular has not been attributed to any one specific cause, but anecdotal evidence is that this could be due to cumulative impacts and/or loss of habitat of spat, which has meant that no or little natural juvenile recruitment has occurred on Mair and Marsden banks.

Many of the technical reports only consider impacts on a small portion of the harbour. In addition there are already existing consents (such as North Port) that have yet to be fully implemented which also impact on the health of the harbour and should be taken into account as cumulative impacts. What seems relatively apparent is that there is little evidence in increase in harbour ecosystem health over time, especially when contrasted with the historical record. While there is some limited evidence of improvement in some indicators (such as recolonisation of small areas of sea grass) this is likely indicative of the significant length of time to recover from previous activities in the catchment.

Practical Application of Kaitiakitanga

Previous consents for the North Port development provided for involvement of Tangata Whenua in harbour restoration, administered by NRC through the Whangarei Harbour Health Improvement Fund. How effective was this?

Tangata Whenua have consistently called for greater recognition and practical participation in all aspects of work related to the restoration of the health of their harbour. While this has been acknowledged in legislation, policy and the opinion of all stakeholders, the reality is that the effective practice of kaitiakitanga by the kaitiaki is highly limited. This can be evidenced in the authorship of the various technical reports prepared for Refining NZ for these consents. If kaitiakitanga was being fully and actively practised then we would have expected a reasonable proportion of the technical reports relating to the harbour and its health to have been sourced from the kaitiaki. Achievement of this was certainly a desired outcome by Tangata Whenua from the Whangarei Harbour Health Improvement Fund and it appeared an objective that had general support. There are likely multiple explanations as to why it did not eventuate. However, a more pragmatic, practical and robust approach is required now and into the future if effect is to be adequately given to the practice of kaitiakitanga.

Are there more effective ways for Refining NZ as a major stakeholder and Tangata Whenua to work together to achieve the overall goal of improving the health of the harbour? We would expect the cultural impact assessment that Patuharakeke will produce to offer firm guidance in this regard. We would point to the highly successful partnership models that have been employed in other harbours such as Whaingaroa/Raglan where committed multi-stakeholder processes with full partnership of kaitiaki and Tangata Whenua have resulted in dramatic improvements to harbour ecosystem health.

Potential Impacts of Dredging and Disposal of Dredgings

The technical reports reviewed conclude that there are a range of potential impacts of dredging and disposal of the dredgings, but these are assessed mostly to be either of no or less than minor impact. The impacts of most relevance relate to:

- Noise – of dredging and ship movements – both on land and underwater (on marine mammals in particular)
- Loss of habitat and species (in the dredging and disposal areas)
- Sediment – plumes during dredging (increased turbidity) and smothering of habitats
- Changes in tidal dynamics – this could lead to increased erosion in some places

Most of these effects are assessed as minor and temporary, as long as the newly dredged channel does not infill quicker than expected. However, we note that the need for maintenance dredging is possible within a 2 – 20 year timespan. Obviously earlier or more frequent maintenance dredging is likely to have greater impact on recolonisation and stability.

Impacts on recreation, landscape, archaeology, natural character, are considered unlikely given the existing industrial nature of Marsden Point and the current use of the harbour by other commercial shipping activities.

Some of the reports recommend limits on dredging to mitigate potential impacts (e.g. no dredging in the inner harbour north of No.18 Buoy when wind is not from the north or at night/weekends, no dredging when a marine mammal is within 50m), which may mean that capital dredging takes longer than the 6 months proposed.

Some impacts that the AEE reports determine will be either minor or positive are dependent upon there being fewer ships coming in to the refinery. For example risk of oil spills is assessed as being lower than current levels on this rationale. We question that the intent is to keep ship movements to below current levels throughout the lifetime of the consents, which would be needed to support this assertion, however a resource consent condition limiting the number of ship movements to only a certain number a year would be one way to alleviate this concern. So this means that there is no guarantee of reduced risk of oil spills, reduced GHG emissions, etc. as these are all contingent on fewer ships.

Key Issues/Concerns Raised in Hui

- Concern that the dredging might not result in the continued viability of the refinery and that the dredging would have been undertaken for no reason – or that the dredging is to allow for other activities not currently being disclosed by Refining NZ (ulterior motive?). How long would the refinery stay open if dredging went ahead – can Refining NZ guarantee that would be for lifetime of the consents sought?
- The need to consider more longer term options to ensure the on-going provision of employment at Marsden, including use of biofuels and other low carbon alternatives to crude oil refining. What guarantee is there that work resulting from the dredging would go to locals?
- Lack of holistic consideration of the harbour and the impacts of this proposal given the other activities and impacts already experienced in the harbour – tangata whenua have a different "world view" to Refining NZ and western science. Need to take a longer timeframe perspective.
- Health of the kai moana and the potential for dredging and disposal to result in shellfish and fish moving to other locations affecting Tangata Whenua's ability to provide for their cultural/customary practice rights.
- Desire for kaitiaki to be more actively involved in monitoring and improving health of the harbour and the need to reconsider engagement due to failure of mechanisms such as the Whangarei Harbour Health Improvement Fund.
- Potential impacts on marine life that they are guardians of, including pipi, stingray and other taonga species.
- How does the decline in pipi affect the stability of Mair bank? And how does this relate to the changes in currents and tidal flows modelled? What happens if the pipi don't recover? Concerns over the erosion already being experienced that need to be addressed regardless of the proposed dredging.
- If the existing channel doesn't meet international guidelines then shouldn't that be remedied regardless of the dredging proposal? If a major oil spill did occur who would be responsible for paying for the clean up?

Conclusions

The commentary above covers the major areas arising from review of the technical documents supplied by Refining NZ and our interpretation of the concerns voiced by Tangata Whenua and our discussions with representatives of Patuharakeke. The list is not to be considered exhaustive and we stress the initial nature of our findings. A more comprehensive "blow by blow" analysis of the reports has been provided separately to Patuharakeke to inform development of their cultural impact assessment which we understand to be the next step in the Tangata Whenua engagement process. We also note that this review has been undertaken specifically for Patuharakeke and should not be considered definitive of the views of all Tangata Whenua with relationship to the harbour.

Technical Documents Reviewed

Phase I Reports:

- Bioresearches, *A Review of Literature on the Marine Natural Environment of the Whangarei Heads, Bream Bay and its Adjacent Coastline*, December 2015.
- Bioresearches, *Coastal Bird Survey (February - March 2015)*, June 2015.
- Bioresearches, *Coastal Bird Survey (November 2015 - March 2016)*, May 2016.
- Bioresearches, *Existing Environment Assessment - Ecology of the Dredge Area - Whangarei Heads*, September 2016.
- Bioresearches, *Preliminary Ecological Assessment of Potential Dredge Spoil Disposal Areas*, June 2016.
- Brian T. Coffey and Associates, *Complementary Literature Review*, February 2016.
- Cawthron Institute, P*hase 1 Preliminary Review of Potential Dredging Effects on Marine Mammals in the Whangarei Harbour Region*, November 2015.
- Greenaway & Associates, *Harbour Deepening Recreation Literature Review*, 2015.
- Kerr & Associates, *Baseline Benthic Survey - Channel Adjacent Areas Report*, November 2016.
- Kerr & Associates, *Baseline Ecological Survey - Disposal Areas 1.2 and 2.2 and Reference Areas*, November 2016.
- Kerr & Associates, *Baseline Photographic Survey - Three Mile Reef*, June 2016.
- Styles Group, *Short-term Passive Underwater Acoustic Survey of Whangarei Harbour Entrance and Marsden Point - Preliminary Investigation*, November 2015.
- Tonkin &Taylor, *Stage 1 Geomorphology and Baseline Report*, August 2015.

Phase II Reports:

- Bioresearches, *AEE Report Coastal Birds Consultation Draft*, March 2017.
- Brown NZ Ltd, *Marsden Point Crude Shipping Project: Landscape Assessment*, March 2017.
- Cawthron Institute, *Marine Mammals Assessment Consultation Draft*, March 2017.
- Clough & Associates, *Marsden Refinery Whangarei Harbour Dredging: Archaeological Assessment Draft for Public Consultation*, December 2016.
- Coffey & Associates, *Assessment of Marine Ecological Effects Excluding Seabirds and Marine Mammals*, February 2017.
- Greenaway & Associates, *Recreation and Tourism Effects Assessment Consultation Draft*, March 2017.
- MetOcean Solutions, *Establishment of Numerical Models of Wind, Wave, Current and Sediment Dynamics*, February 2017.
- MetOcean Solutions, *Predicted Physical Environmental Effects from Channel Deepening and Offshore Disposal*, February 2017.
- Navigatus Consulting, *Environmental Spill Risk Assessment for Proposed Tanker*

Operations Associated with Engineered Channel - Consultation Draft, February 2017.

- Navigatus Consulting, *Navigational Risk Assessment of Channel Designs - Consultation Draft*, December 2016.
- NZIER, *Economic Assessment of Channel Deepening at the Marsden Point Refinery*, February 2017.
- Poten & Partners, *Crude Shipping Alternatives Marsden Point*, August 2016 (in Tonkin &Taylor *Mid-point Multi-criteria Alternatives Assessment Report*).
- Royal Haskoning DHV, *Shipping Channel Concept Design Report*, November 2016.
- Royal Haskoning DHV, *Technical Memo*, August 2016 (in Tonkin & Taylor *Dredging & Disposal Options Summary Report*).
- Styles Group, *Whangarei Harbour Entrance and Marsden Point Channel Realignment and Deepening: Assessment of Environmental (Airborne) Noise Effects*, February 2017.
- Tonkin & Taylor, *Coastal Processes Assessment*, February 2017.
- Tonkin & Taylor, *Dredging and Disposal Options Synthesis Report*, February 2017.
- Tonkin & Taylor, *Mid-point Multi-criteria Alternatives Assessment*, December 2016.

Other Documents Reviewed:

- APEC *Energy Demand and Supply Outlook – 5th Edition New Zealand* (p.123 – 131).
- EIA *World Energy Outlook 2016*
- Ministry for Primary Industries, *Biomass survey and stock assessment of pipi (Paphies australis) on Mair and Marsden Bank, Whangarei Harbour, 2010*, June 2013.
- Ministry of Business, Innovation & Employment, *Unlocking our energy productivity and renewable potential, the New Zealand Energy Efficiency and Conservation Strategy 2017-2022*, December 2016.
- Ministry for the Environment, *New Zealand's Sixty National Communication under the United National Framework Convention on Climate Change and the Kyoto Protocol*, 2013.
- Ministry of Transport, *Future demand: how could or should our transport system evolve in order to support mobility in the future?* November 2014.
- Ministry of Transport, *A Low-Carbon Transport Future* http://www.transport.govt.nz/futures/stories/the-future-of-low-carbon-transport/
- New Zealand Government, *Draft Government Policy Statement on Land Transport 2018/19 – 2027/28*, February 2017.
- New Zealand Government, *New Zealand's Action on Climate Change*, September 2016.
- New Zealand, *Submission under the Paris Agreement New Zealand's Nationally Determined Contribution*.
- New Zealand, *Submission to the ADP, New Zealand's Intended Nationally Determined Contribution*, 7 July 2015.
- New Zealand, *Submission to the ADP Addendum to New Zealand's Intended Nationally Determined Contribution*, 25 November 2015.

- New Zealand Government, *New Zealand Energy Strategy 2011-2021 Developing our energy potential and the New Zealand Energy Efficiency and Conservation Strategy 2011-2016*, August 2011.
- NIWA, *Pipi survey at Marsden Bank, Whangarei Heads*, May 2012.
- NIWA, *Investigation into the decline of pipi at Mari Bank, Whangarei Harbour*, June 2014.
- NZ Business Council for Sustainable Development, *A Sustainable Energy Future for New Zealand by 2050: A Business View*.
- Pawley, *Population and biomass survey of pipi (Paphies australis) on Mair Bank, Whangarei Harbour*, 2014.
- Pawley, *Population and biomass survey of pipi (Paphies australis) on Mair Bank, Whangarei Harbour*, 2016.
- Refining NZ, *Annual Report 2016*.
- Royal Society of New Zealand, *Transition to a low-carbon economy for New Zealand*, April 2016

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b) Refining NZ responses to "Hui Outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project" Dated April 2017

Refining NZ response to "Hui Outcomes and Technical Review of Refining NZ Documents Summary for Crude Shipping Project" dated April 2017

Thank you for your comments as outlined in the Technical Review. We have raised these comments with the relevant independent experts and our responses to the key issues raised by that review are set out below.

Economic Analysis

The purpose of the NZIER economic report was to provide an assessment in relation to the Resource Management Act's requirements on the economic consequence of deepening the channel to Marsden Point refinery, including:

- Value of additional work and spending on channel deepening;
- Direct economic benefit of accessing larger ships; and
- Strategic interest in improved competitiveness and longevity of the refinery operation.

By default, the NZIER report assumes continuation of current shipping patterns and continued dominance of oil products in transport in New Zealand, in the short to medium term, while acknowledging longer term changes may occur. It is not intended as detailed proposal cost/benefit analysis which is an internal matter for Refining NZ and is instead focussed on external effects on the economy and environment.

Freight benefits

The NZIER analysis was informed by a freight study performed by Poten & Partners, a United States based company with a long history in providing tanker brokerage and consultancy services.
The Poten & Partners study performed an in-depth and robust analysis of the freight savings considering many aspects and variables mentioned within the Technical Review. We have included a copy of this report to provide further background on this matter (noting its results have been adjusted for additional throughput following the Te Mahi Hou unit commissioning).
Poten & Partners note within their report that:

"Marine transportation costs benefit from strong economies of scale:

- *The costs of building a larger vessel are proportionally cheaper than building smaller vessels;*
- *The number of crew members of a larger vessel is very similar to the crew of a smaller vessel reducing the cost per tonne of cargo carried;*
- *Fuel costs per tonne of cargo carried are significantly lower on larger vessels".*

The report goes on to analyse the shipping classes and markets and gives guidance on the likely benefits that could accrue from the crude shipping proposal. We take confidence from the Poten and Partner's analysis, given their specialist knowledge in these markets and that their results conservatively align with Refining NZ's own internal analysis and feedback from our customer oil companies.

We have difficulty commenting on the Technical Review's alternative freight savings analysis without further specific detail. We do note however that:

- The NZIER report uses NZ$ 0.61/barrel, not US$ as referred to in the Technical Review, as an indicative average over the short to medium lifetime of the consent, held constant in real terms;
- It is unclear exactly which Clarkson's dataset was used and if/how overage was taken into account;
- A 20 day voyage assumption is very short considering the bulk of our cargoes we are targeting are ex the Middle East, which typically represent ~50% of the refineries total crude diet. We also assume that both the journey to Refining NZ and the return journeys have been accounted for (doubling the total journey time). We also note that apparently 15 knots is considered a fast assumption for typical tanker speeds even when fuel prices are low; and
- The Technical Review's US$0.01/barrel difference between Aframax and Suezmax looks improbably small in view of substantial new orders for Suezmax or larger vessels which reflect expectation of economies of scale.

Based on the modelling and the best information to hand, Poten & Partners and Refining NZ are confident that there are material savings to be made by accommodating larger crude parcels.

Additional benefits

The NZIER report also briefly mentions that Refining NZ's customers could *"take advantage of crude sourcing and trading benefits that may accrue from access to more commonly traded larger parcel sizes"*. Larger standard sized crude parcels are more easily traded creating additional value for our customers as noted by Poten & Partners within their report:

"*Another distinguishing characteristic of Suezmax tankers is its typical cargo size: One million barrels. Traditionally, this one million barrel cargo size has made it easy to buy, sell and/or hedge Suezmax cargoes, which has made this vessel class popular with traders, who want the option to trade their cargoes."*

Greater access to standard sized crude parcels gives our oil company customers greater flexibility and priority in terms of cargo loadings and also at times, discounts over less standard parcel sizes. While quantifying the value of these trading and sourcing benefits is difficult, given that Refining NZ is not in the crude oil trading business, our customers have confirmed that there is additional value to be gained. Enabling and supporting our customers to do business in a manner they are used to with other refineries capable of taking the proposed cargo size, is of strategic value to Refining NZ

Contribution to Refinery Sustainability

The review suggests that an assertion is made that crude transport cost is a key determinant for Refining NZ's economic viability.

NZIER has confirmed that their analysis is not predicated on the assumption that failure to dredge would automatically lead to closure of the refinery or its conversion to an import terminal. NZIER advise that it is based on the recognition that Marsden Point is a relatively small refinery on a world scale and that failure to realise potential economies (such as lower crude delivery costs) increases the disadvantages it faces against increasing competition from products refined at scale in other countries. Ultimately this increases the likelihood of potential closure or transformation at some time in the future, but the timing of that is far from certain.

The NZIER report does not set out to predict when it might be, but does consider the present value effects of varying longevity of the operation that could result from larger loads staving off the threat to the refinery's competitiveness.

NZIER clearly state within their report that "*RNZ faces increasing competition from larger refineries in Asia, which has been attributed with the closure of several Australian refineries of similar scale to Marsden Point. In the absence of channel deepening it will be more difficult to maintain competitiveness and continue to operate at its current level.*"

This is underlined on the Deeper Story website (www.deeperstory.co.nz) under the heading "Keeping jobs in Northland":

"New Zealand's demand for fuel is met by product made at Marsden Point and fuel imported from overseas. To keep Marsden Point running - and jobs in Northland - our fuel products need to be of the highest quality and cost competitive with imports. Bigger cargoes would reduce the cost of transporting crude oil to the refinery. The proposed changes will help us keep pace with imports from increasingly competitive Asian "mega-refineries"."

These statements are true and accurate and we believe that they have been consistently and clearly communicated throughout our consultation on this proposal.

Refining NZ is continually pursuing improvement initiatives to maintain or lift its operational and environmental performance and improve its competitiveness. This is evidenced by a history of capital investment in the refinery which since 2005 amounts to around $760 million. The proposed crude shipping proposal direct freight savings alone are a significant contributor to Refining NZs ongoing competitiveness as well as providing strategic benefit, as mentioned above.

Future Suezmax Availability and Suitability

Poten & Partners has advised that oil tankers have been around since the end of the 19th century when oil started to move from supply to demand areas. Since then global oil demand has grown to approximately 100 million barrels per day, the majority of which is moved by sea on oil tankers. The current fleet (1st April 2017) consists of 474 Suezmax tankers (with an additional 81 under construction).

The tankers that are currently on order will be delivered over the next three years and have an expected lifespan of 25 years. While there is a continued demand for oil, there will be a requirement for ships to move it and economies of scale, in terms of ship size, will likely prevail. Poten & Partners therefore believes it is a relatively safe assumption that there will be Suezmax ships around for the next 35 years.

The Technical Review also suggests using newer more efficient Aframax travelling at slower speeds as an alternative to utilising Suezmax. Poten & Partners notes that *"Vessel operators try to maximize the efficiency of the vessel by optimizing the speed of the vessel where possible. In recent years, this has often resulted in slowing down the vessel during the ballast leg as the fuel savings outweighed the longer voyage time."* The tanker market is always balancing the cost of fuel versus the voyage time and associated costs. While we agree that the use of newer more efficient ships will improve shipping economics this will also apply to Suezmax class vessels. We believe economies of scale will still prevail and support the proposed benefits. We repeat that enabling fully laden Suezmax will provide our customers with additional crude sourcing and trading benefits as outlined above.

Shipping Emissions and IMO MARPOL Regulations

NZIER notes that the Paris Accord set international emission reduction targets that countries signed up to, but did not place specific requirements on each country or sector. There is, as yet, no firm basis on which to assess the economic effects of such changes or the effectiveness of the Paris Accord. The comments on climate changing emissions refer to aspirational targets rather than officially agreed requirements. NZIER notes that it is inefficient to expect a single company to pursue these in the absence of comprehensive national policy that aims at spreading the marginal cost of emission abatement across all industries and activities.

Further, it is our understanding that regulations on international shipping pursuant to the Paris Agreement, have not been decided and remain a 'work in progress'. For as long as there is international trade and commerce it is expected that shipping will continue to be required. Over the longer term it is likely they will convert to lower carbon intensive methods such as biofuels or Hydrogen fuel cells, and/or seek carbon offsetting measures. In either case this will come at a cost to shipping companies that will be passed onto the market. We believe economies of scale will continue to prevail between shipping classes thereby supporting the proposal objectives and Refining NZ's ability to remain competitive.

Poten & Partners also notes in their 2015 report that:

"Additionally, new environmental regulations affecting the shipping industry in the coming years (in 2020 or 2025) will force owners to burn significantly more expensive Marine Gas Oil (MGO) instead of the cheap Heavy Fuel Oil (HFO) they are currently using or alternatively perform expensive modifications to the vessel to reduce sulphur emissions. The expectation is that a significant part of the fleet will switch to the more expensive fuel, which will favor the economies of scale of Suezmaxes over Aframax tonnage."

Poten & Partners has reconfirmed this expectation in recent discussions and agree that the proposed changes should only improve the overall economics and objectives of the proposal.

In any event, we also note that while an important issue in itself, greenhouse gas emissions is not directly relevant to the crude shipping proposal RMA application. The RMA expressly directs decision makers not to have regard to the effects of discharges on climate change except in the limited circumstances of considering the positive benefits of renewable energy in reducing discharges of greenhouse gases.

Refinery Viability in a Decarbonised Shipping World

Refining NZ's processing income (which is charged to its customers for refining the crude oil into finished products) is based on the effective landed cost of crude oil and finished products. Should shipping costs significantly increase due to future regulation these costs would apply equally to the transport of crude oil and supply of alternative finished product imports. As such, Refining NZ's margin is protected and potentially enhanced given the economies of scale of crude oil imports compared to finished product imports. We do not believe that the future cost of shipping will have an impact on the refinery viability. The same increase in the shipping cost of crude on Suezmax ships applies equally to finished oil products imported from overseas refineries on smaller ships, with reduced economies of scale. Again, the economies of scale supports the case for enabling fully laden Suezmax vessels.

Greenhouse Gas Emissions

Refining NZ receives crudes from various origins, but predominantly from the Middle East and Far East oil fields. Whilst it is acknowledged that the absolute shipping cost of a cargo of crude oil from the Far East is likely to be lower than one originating in the Middle East (by virtue of its proximity to Marsden Point), Middle East crudes remain attractive to Refining NZ's customers because of their relatively lower purchase cost . This allows the refinery to derive a greater 'refining margin' from these crudes (i.e. receive a higher processing income), although there is an operational limit to the quantity of Middle East crude that the refinery is able to process.

For freight saving and greenhouse gas comparisons it has been assumed that the regional crude diets will largely remain similar to today, representing a consistent quality of crude diet, keeping the refinery optimally loaded. This being the case, the Aframax shipments currently originating in the Middle East, West Africa and Russia are expected to shift to Suezmax vessels in the future on these same routes. This means that less bunker fuel will be consumed in the future to deliver the same quantity (and quality) of crude oil as today. Therefore NZIER's suggestion that this will result in a greenhouse gas reduction seems to be a reasonable conclusion.

NZIER notes that: "*With or without the channel deepening project, change in the sources of crude due to regional pricing could lead to switching sources to longer routes with higher emissions (e.g. substituting supplies from West Africa or Middle East for those from Asia), but other things being held constant, larger loads reduce the emissions per barrel transported*".

Typically the absolute cost of crude and its relevant qualities will be the drivers of regional crude selections as opposed to crude freight differentials. While NZIER states that this proposal *"could also enable Refining NZ's customers to adjust their slate of crudes from different source regions"* and "*Increasing accessibility of Suezmax to Marsden Point would enable greater access to West African crudes"*, we do not foresee large scale changes to regional crude supply patterns as these crudes are generally more difficult to process because of their poorer qualities. In our view, levering economies of scale to use less fuel to deliver the same amount crude oil is a net positive outcome for the environment.

While greenhouse gas emissions is an important issue in itself, it's not directly relevant to the crude shipping proposal. As noted above, the RMA expressly directs decision makers not to have regard to the effects of discharges on climate change except in the limited circumstances of considering the positive benefits of renewable energy in reducing discharges of greenhouse gases.

Remediation Costs and Employment

On the cost of potential site remediation and employment implications of conversion to an oil terminal, the NZIER report relies on information supplied by Refining NZ, which in turn has been based on its own experience and Australian refinery closures. Specifically, the NZIER report considers the present value benefit of deferring site remediation further into the future, considering remediation cost in constant dollar terms. NZIER disagrees with the Technical Review's assertion that remediation costs are unlikely to diminish over time, given the likelihood of technical improvements in remediation of the sort that have enabled mining to become increasingly effective at recovering trace quantities of materials from previously worked over spoils.

The NZIER report considers the reduction in direct employment and contractors at Marsden Point should the site convert from a refinery to an import terminal. NZIER considered employment associated with changes in the number of ship movements (e.g. pilotage) to be relatively small by comparison with that at the refinery. The report does not predict how shipping movements change in the long term, given this could be attributed to a range of factors such as demand growth or decline, loss of refinery competitiveness or technological change.

Sand Extraction Alternatives

The Technical Review includes a desire for more detailed assessment on the sustainable use of the dredge material. We agree that the dredged material is a potential resource and have included capacity in the consent for beneficial use for other activities by others. However, the disposal areas at the two marine disposal sites are designed to take the full volume and this a prudent approach in the situation where the size of the resource is greater than the expressed need. This does not preclude other parties from utilising this resource and Refining NZ would welcome discussions with potential users of the resource.

Climate Change

Physical Effects of Climate Change on Coastal Processes

We have discussed the questions raised in the Technical Review with Tonkin and Taylor and a response is set out below:

There is a range of possible futures in terms of sea level rise and climate variability. However, over the next 35 years (to around the middle of the century) the rate of sea level rise and anticipated change to storm intensity etc. are generally not as significant as the period from 2055 to 2100 (refer figures 1 and 2 below from the Parliamentary Commissioner for the Environment, 2015). The sea level rise rates to the middle of the century are projected to be similar to or up to double the rate of sea level rise that has occurred over the last 100 years (around 17 cm), while rates between 2055 and 2100 could be more than five-fold the rates of sea level rise observed over the last 100 years.

Changes in erosion and inundation potential resulting from sea level rise, have been assessed and mapped. These effects increase with increasing sea level rise.

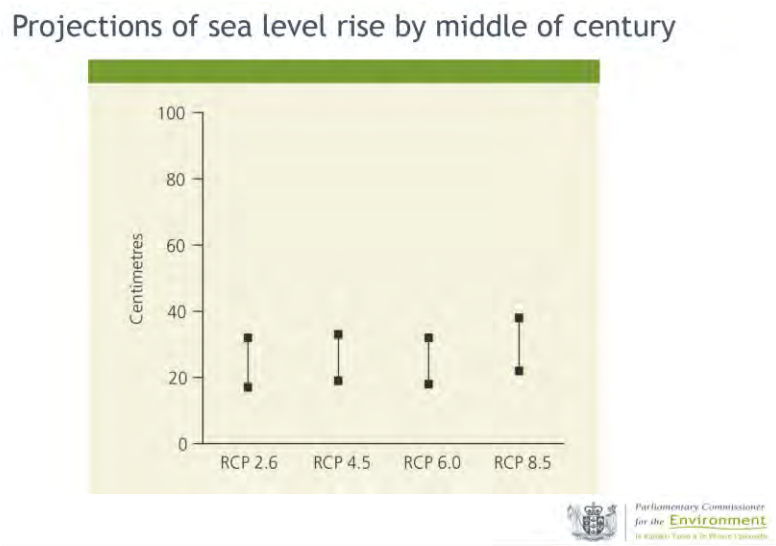


Figure 1 Projections of sea level rise by the middle of the century

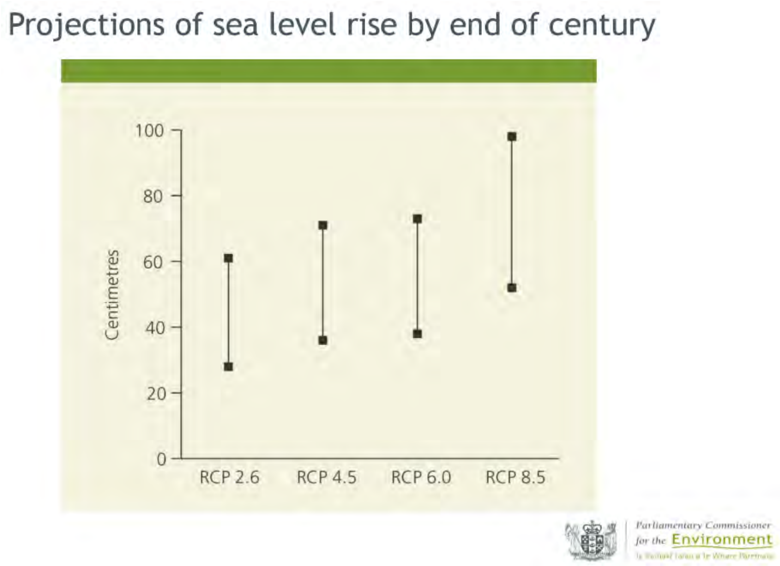


Figure 2 Projections of sea level rise by the end of the century

The issue to consider for the current application is the effects of the proposal on the existing and future environment. With very little effect identified in the present day, the dredging and disposal operation is not likely to have more significant effects with increased sea levels and variability. That is not to say increased sea level and variability will not have an effect on the wider system, including the harbour and the ecosystem. It could also potentially affect the operation of Refining NZ. Paradoxically, increased sea level rise might have the consequence of reducing the need, or the amount of maintenance dredging. This would further reduce the longer term effects of the channel deepening proposal.

New Zealand's Current and Future Oil Demand and Greenhouse Gas Policies

The Technical Review suggests that *"a number of future scenarios should correctly be modelled to reflect potential change given the 35-year timeframe sought for these consents*".

NZIER has advised that their Economics report section 2.3, draws on a single scenario based on published MBIE forecasts. This avoids cluttering the report with extraneous material that in an RMA setting would be regarded as speculative and not informative. NZIER has relied on MBIE to have sorted through alternative futures in publishing its central forecast.

Refining NZ is acutely aware of the potential impact of future de-carbonisation on transport fuels. The company continuously monitors information and announcements from sources within NZ and around the world to gain an understanding of any developments taking place that may impact on future transport fuel demand (and hence the need for refinery processing capacity). The refinery also uses scenario planning techniques to identify business risks and opportunities, exploring the likely impacts on the company from a future scenario unfolding. The Energy Scenarios developed by the BusinessNZ Energy Council are a good example. These are not predictions, but credible assessments of what might happen to energy demand in a future world. Based on that combination of information, Refining NZ remains optimistic that there will be a need for its services for many years to come, and remains willing to consider investments in projects with considerable lifespans.

It is worth noting that Refining NZ produces around 70% of New Zealand's transport fuels today, with the remaining 30% of the country's fuel products imported. It is therefore imperative that Refining NZ remains 'the supplier of choice' to its customers, so that when NZ's transport fuel demand starts to decline sometime in the future, the refinery continues to be fully utilised whilst import volumes are reduced. This requires the company to continue with its relentless pursuit of improved efficiencies so that it remains competitive with its customer's alternate supply options – finished product imports from overseas.

Overall Health of the Harbour

We acknowledge the concern that hapu and iwi have for the overall health of the harbour.

Modelling Extent

Tonkin and Taylor has advised that the hydrodynamic modelling included the entire harbour as well as Marsden Bay to make sure all potential effects on the hydrodynamics and possible changes in flow were considered. With that modelling Tonkin and Taylor was able to assess possible changes in tidal current and water levels over the entire Whangarei Harbour. The modelling showed no significant change to tidal currents beyond Snake Bank, so overall effects related to hydrodynamics are low. The relatively small changes within the harbour is due to there being no significant change to the throat of the harbour's cross-sectional area, with the greatest changes occurring on the lower (deeper) slopes of the ebb tide delta, which is more a depositional area.

Existing Harbour Health

Expert ecologists engaged by Refining NZ have undertaken a comprehensive assessment of the existing environment. This includes a detailed and thorough analysis of published material on water quality, ecological habitats, species distribution and health. That research also draws on information from other disciplines such as coastal processes, and the cultural values assessment provided by Tangata Whenua.

In order to supplement and field-test that research, Refining NZ commissioned a range of surveys, to sample benthic organisms, ascertain indicative species diversity and density (including of indicator species), test sediment properties including potential contamination, analyse both hard- and soft-bottomed shoreline habitats, and to widen the understanding of the size and abundance of shellfish populations. Armed with this data the ecologists have developed a detailed understanding of harbour health in the context of those areas of Whangarei Harbour and Bream Bay (shown in Figure 2 of the AEE).

When considering the actual and potential effects against that existing environment, the various experts (particularly the coastal engineers and ecologists) have considered the future effects of resource consents which are as yet unimplemented. This includes specifically the Northport 'Berth 4' consent, and Whangarei District Council's consent for the proposed Ruakaka wastewater outfall structure. Where appropriate, the cumulative effects of these third party activities, together with the effects of the crude shipping proposal, have been considered and assessed.

Practical Application of Kaitiakitanga

Refining NZ acknowledges and supports the important role of Tangata Whenua in the Whangarei district generally, and in particular in the harbour and surrounds. To that end, we have worked hard to foster and strengthen our relationship with Tangata Whenua, illustrated by our Memorandum of Understanding with Patuharakeke.

In recognition of the relationship, considerable effort has been made throughout this proposal to keep Tangata Whenua informed, and actively involved where practicable. A series of hui has been held right from the inception of the proposal. Draft reports have been provided to Tangata Whenua ahead of these being made public and provided to third parties. Further hui have been held to discuss the findings and recommendations of those draft reports. Tangata Whenua have been informed of proposed studies and field work, and given the opportunity to input. Tangata Whenua have been involved in the following:

- preparing a cultural values assessment and cultural impact assessment for the proposal;
- accompanying the consultants undertaking ecological sampling; and
- acting as a marine mammal observer on board the vessel carrying out seismic surveys.

You have made the suggestion that "a reasonable proportion of" the expert technical reports should have been sourced from the kaitiaki. While we have outlined above the various proactive steps taken to involve Tangata Whenua in the work undertaken, ultimately Refining NZ is required to demonstrate it has adequately assessed the effects associated with its proposal. In order to do that, it has commissioned a range of independent, qualified and experienced experts across a range of disciplines. While efforts were made to use local providers where possible, ultimately the best person/firm was selected for each discipline, in order to ensure that the most robust information was collected and to give Refining NZ, Tangata Whenua, the local community and ultimately the consent authority, confidence that the assessments are appropriate. That said, Refining NZ has commissioned Patuharakeke Trust Board to undertake an assessment of cultural effects (in consultation with other iwi/hapu) and provide a cultural impact assessment. As part of that process, Refining NZ has contributed to the costs of independent expert consultants to assist, interpret and assess the various other draft expert reports prepared.

Ultimately, Refining NZ is very willing to engage proactively with Tangata Whenua, and to listen – and respond where necessary, to any feedback. Through this process, Refining NZ has heard that Tangata Whenua wish to be more actively involved in practical and technical work to ascertain harbour health.

Potential Impacts of Dredging and Disposal

Maintenance Dredging

While we note the impact of maintenance dredging, this is likely to be of much smaller volumes and area compared to the initial capital dredging campaign.

We also note that the Technical Review questions the proposed 35 year consent period with concerns about the effects, should the refinery close for any reason. Tonkin and Taylor notes that the proposed dredging and disposal does not include physical structures to modify or change the tidal flows or wave action. Further, they advise that if maintenance dredging was stopped due to it no longer being necessary, they would anticipate the previously dredged areas to slowly infill, restoring levels to be in equilibrium with the tidal flows and wave action (recognising that due to increased sea level rise and increased tidal flows, the equilibrium situation may well be different from the present day equilibrium).

Dredging Duration

The Technical Review suggests that the proposed night time noise restrictions on the inner channel section may extend dredging durations. This is unlikely to be an issue given 80% of the dredging is in the outer channel section. This allows the dredge to relocate to this section of the channel at night where noise restrictions do not apply.

Some downtime has also been allowed for in the calculations of possible durations to account for other unforeseen issues. We remain confident that our suggested duration is realistic.

Number of Ship Movements

The proposal does not seek to limit the number of ship movements. This is not part of this application. Moving to larger parcel sizes, as proposed, will always mean fewer ships compared to using smaller parcel sizes as we do today. It follows that there will be a net reduction in navigational/environmental risk and emissions compared to the counterfactual case of using existing cargo sizes.

Refining NZ does not have any current plans for significant capacity increases and suggests that this would be unlikely given the levels of investment required and market trends. Supplying around 70% of New Zealand's total transport fuels demand ensures Refining NZ remains fully utilised and ensures it can sustain current and future demand swings.

Key Issues and Concerns

Refinery Viability

As mentioned above, we believe the crude shipping proposal will provide material benefits that will support Refining NZ to remain competitive with imports.

Scenario planning confirms our confidence that there will be a need for our services for many years to come, and hence, our willingness to consider investments in proposals with considerable lifespans, such as this proposal. Refining NZ has no ulterior motive in terms of its crude shipping proposal and has been transparent about the drivers behind the proposal.

Employment

One of the key ways we can ensure continued jobs at the refinery is by remaining competitive through projects such as the crude shipping proposal. Refining NZ regularly reviews its strategic plans and takes into consideration future technologies such as biofuels. We engage with other stakeholders seeking to work with renewable energies, and continue to seek out opportunities that are economically viable.

We are always supportive of using local resources for related activities as identified, where this makes sense to do so, however, there is no guarantee that work resulting from the dredging would go to locals. We are open to using New Zealand based dredging providers where they have the capability and experience. Typically though, dredging companies capable of taking on a job of this scale are based offshore.

Holistic Consideration

Refining NZ and the independent experts fully acknowledge that Tangata Whenua have a different perspective when considering issues relating to the harbour – a perspective that include a range of cultural issues, historical and spiritual connections to the harbour and surrounds and the landforms and species that reside within.

The ecological assessments attempt, where appropriate, to include consideration of the cultural effects: such as identifying mahinga kai areas of importance to Tangata Whenua; and recognising the cultural affiliation with marine mammal species. Having done so, those assessments reach conclusions about the level of actual and potential effects. Notwithstanding those ecological assessments, Refining NZ has also commissioned a cultural impact assessment. That cultural impact assessment should be read together with the range of other expert reports prepared, to gain a more holistic understanding of the effects associated with this proposal.

Kai moana Impacts

Dr Brian Coffey has specifically considered the physicochemical and ecological impacts within the dredge and disposal footprint. There are a number of points to make in this respect. First, the areas affected are spatially confined: a total of 4.37km2 is affected, the majority of which is in the outer channel and disposal area 3-2. The affected areas are not known to be areas within which significant customary practices occur. Second, the effects within this differ according to species: many species are mobile, and will simply exhibit avoidance behaviour during dredge operations (although anecdotally, there is evidence that some finfish species will be attracted immediately following disposal in order to feed on the organisms exposed). Other species will be smothered, and for that reason, Dr Coffey has assumed complete mortality within those areas. Third, the effects will be relatively short term: the directly affected areas are expected to recover within 6-12 months. Taking all of these factors into account, Dr Coffey's conclusion is that effects will be minor to moderate and will be addressed by proposed mitigation measures.

Kaitiaki Involvement

We acknowledge Tangata Whenua's desire to be actively involved in monitoring and improving the health of the harbour.

We acknowledge Tangata Whenua's concerns about the potential impacts on marine life. We believe that a significant amount of work has been undertaken to understand the surrounding environment and to assess any potential ecological effects.

Mair Bank

Our understanding is that the stability of the Mair Bank intertidal region is largely dependent on the shell hash, and as such, is potentially under threat from previously identified pipi die-off. While a concern, this is a separate issue to the crude shipping proposal. We can arrange a separate discussion on this subject if that is required. We agree that this is an important issue regardless and have been working cooperatively with Patuharakeke and others on this issue.

Current Channel and Spill Risk

We agree that the proposed channel configuration is an improvement on the current channel configuration, and note that it becomes more important as cargo sizes increase. Any question about the existing channel configuration is more a matter for the Harbourmaster to consider and respond to.

Refining NZ is committed to the long-term health of the environment. While every effort is taken to avoid the situation of a major spill incident, there always remains some element of risk. To that extent, the courts are clear that the RMA is not a 'no risk' statute. The opinion of the technical experts including the Harbourmaster is that the crude shipping proposal will reduce navigation risk compared to the existing situation.

Marine oil spills are responded to in accordance with the oil spill response strategy prepared by Maritime NZ. In the event of a Tier 3 spill, that response is nationally led and co-ordinated by Maritime NZ. Refining NZ has a dedicated oil spill response vessel, equipment and staff ready to respond. Staff are appropriately trained and regularly liaise and exercise with oil spill response teams from the Northland Regional Council and Maritime NZ. The costs of responding to an oil spill are derived by Maritime NZ from the Oil Pollution Levy, which is collected from the industry.

We hope that our response answers the questions and concerns raised in the Technical Review.

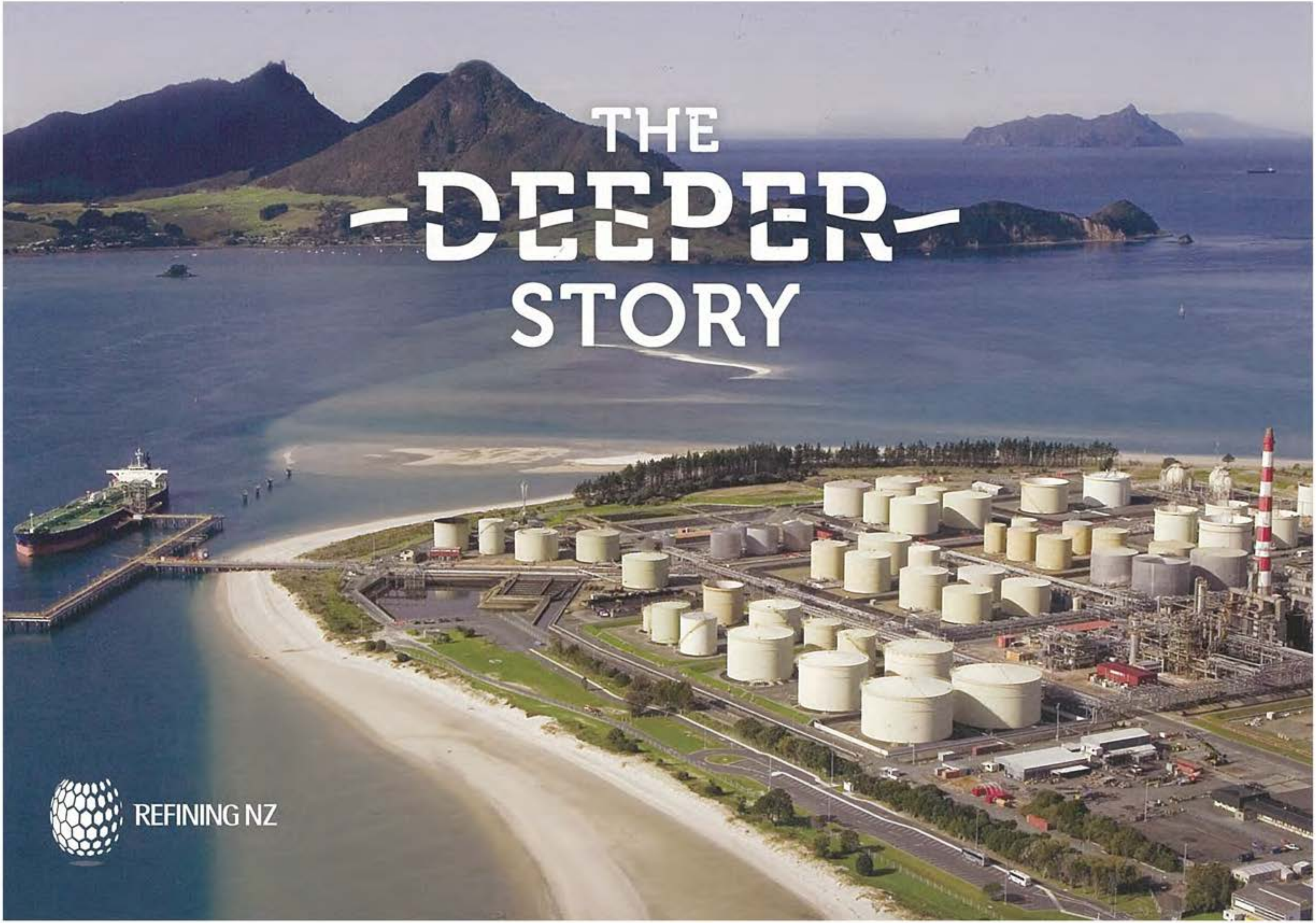
ENDS

Annexure Six: Materials utilised for consultation

a) Introductory brochure to the Proposal
b) Flyers
c) Sample of Advertisements
d) Media releases
e) Facebook posts

Annexure Six: Materials utilised for consultation

a) Introductory brochure to the Proposal


THE
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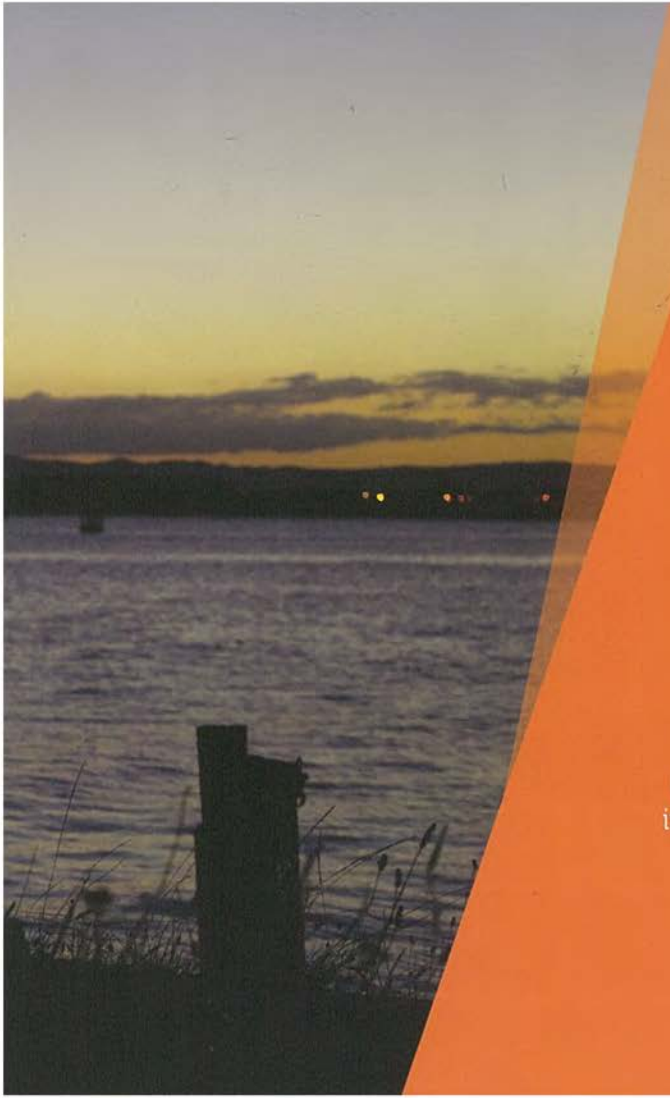


Making Way for Bigger Cargoes

Refining NZ is proposing changes to Whangarei Harbour entrance and looking closely at the effects of the proposed changes.

Whangarei Harbour is an important resource to many people, and is heavily used for recreation and other purposes.

We believe you should have as much opportunity as possible to hear what we are proposing, why it is important, and be able to respond with your own views.

The Deeper Story

Submit your feedback at www.deeperstory.co.nz

Public consultation days in and around Whangarei are also planned. This will be an opportunity to hear from independent experts, and give your feedback directly to the refinery.

1 DEEPENING THE SHIPPING CHANNEL

Deepening the shipping channel by dredging at the entrance to the harbour, the approach to the refinery; and around the refinery jetties.

2 CHANNEL RE-ALIGNMENT

Straightening the shipping channel by removing the S-bend, which would make the channel even safer for shipping, especially in poor weather. Buoy movement will define the new track.

3 DISPOSAL OF THE DREDGED MATERIAL

Dredged material - mostly sand - would be relocated to carefully selected sites where the seabed is made up of similar sand: the majority to the south east in up to 45 metres depth; some closer to shore in up to 15 metres depth to replace lost sand.

HEN AND CHICKEN ISLANDS

Same ships... fewer of them

Larger ships that visit the refinery at Marsden Point are capable of carrying bigger cargoes. But they can't get to the refinery fully loaded, because the shipping channel is not deep enough.

With bigger cargoes, fewer ships would need to visit the refinery to deliver the same amount of crude oil.

Fewer Aframax

More Suezmax - fully loaded

Length 245m / Width 43m / Capacity 700k barrels

Currently bring the majority of crude oil to the refinery

Length 275m / Width 48m / Capacity 1M barrels

Visit the refinery occasionally, but only partially loaded

Means fewer ships overall

Your feedback is important

We're keen to have as much feedback as possible, and have been consulting with Tangata Whenua and community organisations. Your feedback will add to the picture, and help identify areas of cultural value or special interest that need to be taken into account.

REFINING NZ

Keeping jobs in Northland

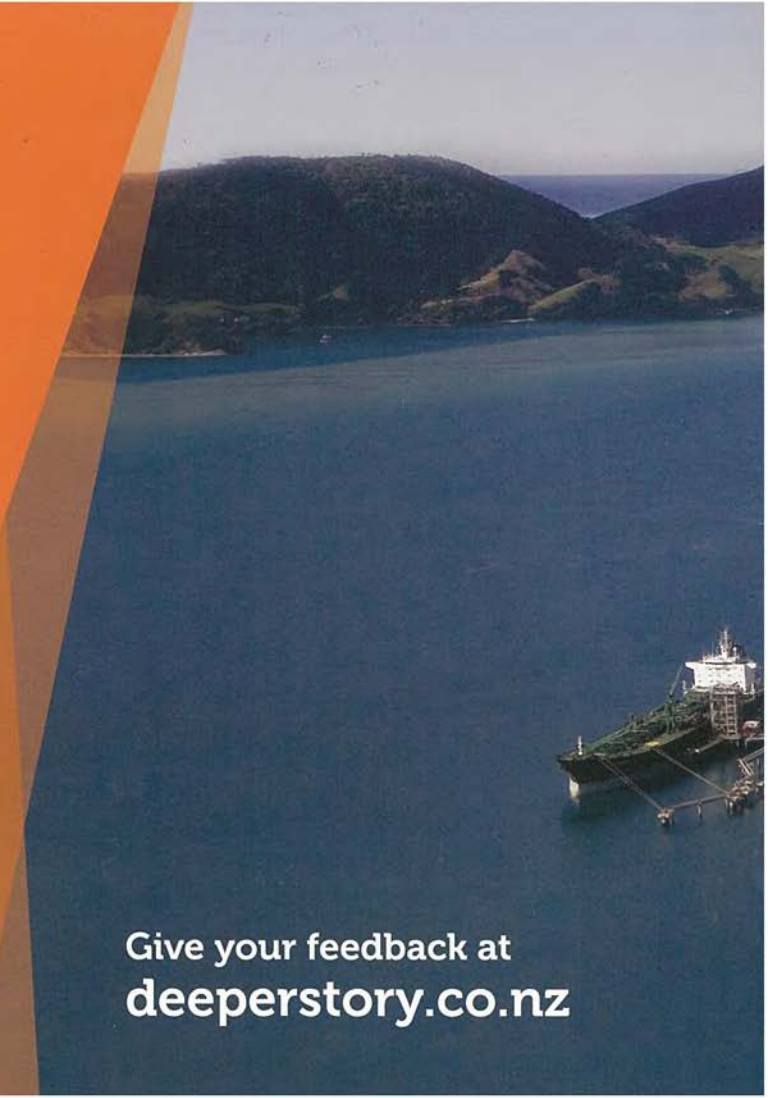
New Zealand's demand for fuel is met by product made at Marsden Point and fuel imported from overseas.

To keep Marsden Point running – and jobs in Northland – our fuel products need to be of the highest quality and cost competitive with imports.

Bigger cargoes would reduce the cost of transporting crude oil to the refinery.

The proposed changes will help us keep pace with imports from increasingly competitive Asian "mega-refineries".

REFINING NZ



Annexure Six: Materials utilised for consultation

b) Flyers

Sight & Sound

We have been busy looking at how our proposed changes will affect noise levels in the area and what changes you might see to the surrounding landscape

How did we assess noise effects?

Refining NZ has consulted with independent experts to carry out two different types of special acoustic assessments.

The first assessment related to underwater noise when the channel is deepened and how this affects marine mammals – you can read about this on our information sheet on marine mammals.

The second assessment looked at air borne noise during the work to deepen the channel, focusing on noise from proposed dredging that may affect a limited number of residents. These could include residential properties along the Whangarei Heads (Reotahi Bay, Little Munroe Bay, McGregors Bay, Taurikura Bay, McKenzie Bay and Urquharts Bay) and the Northport industrial site.

The exact dredging equipment has not yet been selected so noise modelling was carried out based on noise emitted by typical dredging equipment.

The experts used a globally recognised noise prediction software to create models which took into account a variety of relevant considerations including wind conditions, reflection of noise off the water and timing of the dredging work, and the relevant noise limits set by legislation such as the Northland Regional Coastal Plan.

Acceptable noise levels

In the air borne noise assessment, the experts have identified one specific set of climatic conditions where the noise modelling suggests we could exceed relevant planning noise limits when lower noise restrictions apply at night time. In order to avoid this happening, the experts have recommended that we don't dredge at night north of the No. 18 navigation buoy when the wind is blowing from any direction other than north.

At all other times and under all other weather conditions, noise from dredging should be comfortably compliant with relevant noise limits in all affected areas. In most cases it is expected to fall well within the prescribed limits.

The experts have said noise from dredging may in fact be unnoticeable for a large portion of the project.

Outside the harbour, or east of Busby Head, dredging noise will be inaudible for residents. At other locations within the harbour dredging sounds might be audible, but will often be unheard above other typical sounds in the environment such as wind in the trees, birds, insects and waves on the shore.

Active monitoring will be carried out during dredging to make sure we keep within the limits. We are developing a noise management plan to facilitate this.

Sight & Sound

How did we assess visual effects?

Refining NZ commissioned experts to carry out a visual effects assessment, which considered how the proposed changes would affect the landscape, natural character and amenity values of Whangarei Harbour, Whangarei Heads and Bream Bay.

It was carried out in line with relevant rules and laws governing new development such as the Resource Management Act, the New Zealand Coastal Policy Statement and the Northland Regional Coastal Plan.

The assessment looked at possible effects arising from:

- Changes to the seafloor from dredging
- Sand disposal within Bream Bay
- New lead lights off Taurikura
- New hazard marker at Home Point
- Underwater sand plumes from dredging and disposal
- Dredging and disposal operations e.g. vessel lighting

It took into account how each of these project components would affect things such as:

- Existing values (how does the area look and feel currently?)
- Prominence (to what extent would the proposed changes be visible?)
- Landscape effects (changes to structure, land use, interplay of natural vs. man-made elements)
- Natural character effects (effects on landform, vegetation, water areas)
- Amenity effects (public perceptions, residential views and related sense of identity and place).

It also took careful note of identified areas of outstanding natural landscapes, high natural character and outstanding natural character, including (but not limited to) along Bream Bay's beachfront, Home Point's historic WWII gun emplacements and around Busby Head.

Low visual impact

The experts found that overall, there will generally be low level effects on the landscape, natural character and amenity values of Whangarei Harbour, Whangarei Heads and Bream Bay. This is illustrated by the 'impact rating' below:

	VALUES	PROMINENCE	LANDSCAPE EFFECTS	NATURAL CHARACTER EFFECTS	AMENITY EFFECTS	IMPACT RATING
4.1 CHANNEL FORMATION	Moderate / High	Very Low	Very Low	Low / Moderate	None	Low / Moderate
4.2 DISPOSAL AREAS	High / Moderate	Very Low	Very Low	Low	Very Low	Low
4.2 LEAD LIGHTS	Moderate / High	Low / Very Low	Very Low	Very Low	Very Low	Very Low
4.4 HOME POINT MARKER	High	Very low	None	Very Low	None	None
4.5 DREDGING & DISPOSAL PLUMES	Moderate / High	Low	Low	Low	Low	Low
4.6 DREDGING & DISPOSAL OPERATIONS	Moderate / High	Low	Low	Very Low	Low	Low

There are a range of small scale effects above and below water. If these are considered together, the cumulative effect on the landscape, natural character and amenity values remains relatively small scale.

Given the scale of this proposal it might be surprising that the visual effects impacts are not greater. This can be explained by a few factors:

- A lot of the change will be underwater. This means that in many instances there will be limited visual change above the surface.
- Underwater, the dredging and disposal areas are relatively bare, undifferentiated 'sand-scapes' that will not be greatly altered.
- The proposed changes are occurring within an area that is already heavily trafficked with a range of vessels and existing buoys and lead lights. Much of the activity will be focused in the shadow of Marsden Point's oil refinery that is already developed and modified.

It is important to note there will be little change anticipated in the outstanding natural landscapes, high natural character areas and outstanding natural character areas identified.

If you'd like to know more of the nuts and bolts of the visual and noise effects of our proposed changes you can get a copy of the assessment reports from the independent experts here

Recreational

We have been busy looking at how our proposed changes will affect recreational activities in the Whangarei Harbour and surrounds, including Bream Bay.

How did we assess effects on recreation?

During 2015 and 2016 Refining NZ consulted recreational users of the harbour and surrounds.

We also asked independent experts to gather sources – such as past studies and surveys - that identify the many recreational uses of the area.

They concluded the study area is popular for a wide-range of different activities such as swimming, beach-going, diving, snorkelling, kite-surfing, fishing, surfing, shellfish gathering and boating.

Effects on marine mammals

The independent experts have identified the following potential effects during dredging and disposal:

- Turbidity (cloudiness in the water caused by stirred up sediment) affecting swimming and diving
- Exposure to any contaminants that might be in the dredge material
- Effects on the quality, abundance and catchability of marine species - including finfish, shellfish and other seafood
- The dredging activity itself posing a hazard to recreational users, especially boaties

Potential effects once the new shipping channel is operating:

- Long term changes to tides, currents and waves caused by the new seafloor profiles in the channel and at disposal sites
- Changes to beaches and the foreshore from changed wave patterns
- Wakes from larger cargoes on Suezmax vessels
- New and relocated navigational aids — the channel marker buoys and markers

While the assessment identified a number of potential adverse effects on recreation very few actual effects are expected.

Recreational

Turbidity
Unlikely given that sediment plumes will be contained within the channel and so should not encroach on recreational areas.

Waves
Small changes to wave energy are unlikely to affect surfing or swimming in the area.

Tides
The timing of the tides may change slightly but this will have no effect on recreation (tide times change every day).

Beaches
No impacts are expected on surrounding beaches. Over the long term, ongoing maintenance dredging has some potential to impact Mair Bank, however mitigation and monitoring measures to ensure there are no effects and to offset current erosion, are proposed.

» More detail from the independent expert report is available in the coastal processes information sheet.

Marine ecology

The independent experts have concluded that there will be a reduction in the seafloor benthic biomass in places where the actual dredging and disposal activity would be taking place. This impact is expected to be minor overall, due to the following factors:

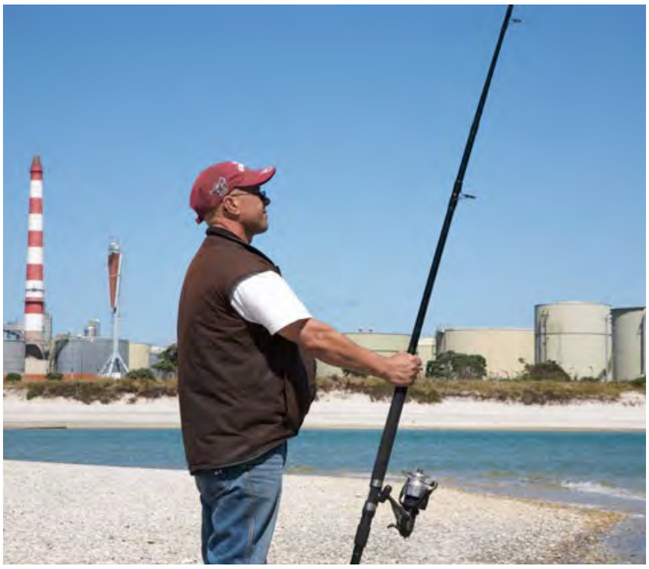
- Temporary nature of the impact (6-12 months) and progressive recovery during this time
- Mobility of finfish
- Limited impacts on other surrounding feeding areas
- Overall scale of the local fishing resource with alternative fishing sites close by

An increase in local finfish activity as dredging exposes food sources is likely to be short lived. Berley will remain an effective way to attract finfish in disturbed dredge/disposal areas.

» Refining NZ commissioned independent experts to review the effects of our proposal on marine ecology – please take a relevant sheet that focuses on this.

Contaminants
No water quality issues are anticipated due to the clean, uncontaminated nature of the dredged material.

Harbour safety
The risk posed by a dredger is no different to that posed by other vessels on the harbour. The proposed aids to navigation are not expected to have any adverse effects on recreational uses of the harbour. Provided boaties continue to comply with Harbour navigation rules then there should be no impact on their activities.



If you'd like to know more of the nuts and bolts of the recreational effects of our proposed changes you can get a copy of the assessment reports from the independent experts here

Marine Mammals

Our independent experts have been busy thinking about how our proposed changes might affect marine mammals in the area

How did we assess noise effects?

The experts considered the impact of proposed dredging and disposal processes on locally and regionally significant marine mammals.

They carried out a review of records that contain data about marine mammal populations in the Whangarei Harbour and wider Bream Bay ecosystem, plus a literature review of the known effects of dredging activities on marine mammals.

This allowed them to pinpoint what mammals might be most susceptible to any effects from the proposed changes, identify the most likely direct and indirect effects, decide on an overall risk level (taking into account things like duration, likelihood and consequence of effects) and make recommendations for mitigation, avoidance and monitoring of effects.

Significance of marine mammals

Of the 29 species of marine mammal that have been sighted in Whangarei Harbour, four regularly or seasonally frequent these waters: bottlenose dolphin; Orca; Bryde's whale; and common dolphin.

Our experts considered these species in their assessment, as well as other marine mammals that visit less frequently but are known to have a low population size (e.g. southern right whale) or are particularly sensitive acoustically (e.g. pilot whale).

They noted the Harbour and Bream Bay are not considered unique or important feeding, resting or breeding habitats for any species.

They also noted the special significance of marine mammals in the Whangarei Harbour to Tangata Whenua generally (in Te Reo – Whangarei-te-rerenga-paraoa means the gathering place of whales).

Marine Mammals

Effects on marine mammals

The experts have identified the following possible direct effects on marine mammals:

- Risk of vessel strikes
- Increased underwater sound production having behavioural or physical impacts
- Risk of entanglement

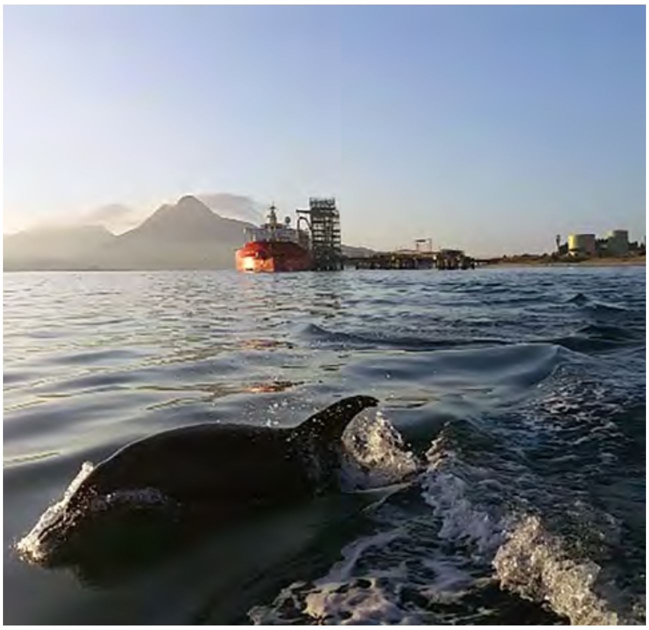
Each of these effects does indicate the potential for a serious consequence e.g. vessel strike leading to the death or injury of a marine mammal.

However, the likelihood of these effects occurring is low and the overall risk level is acceptable, provided we take into account the experts' recommended mitigation actions.

The following indirect effects are possible:

- Physical changes to the underwater environment that damage ecosystem or prey resources

The independent experts have said that any effects associated with the change to the environment are not expected to be detrimental and will only be temporary.



Mitigation & monitoring

The experts have recommended adopting a 'best management practises' approach to mitigate, avoid and/or monitor any effects on marine mammals:

- Simple and common sense boating behaviour is to be followed
- Taking the 'best possible option' method in choosing a dredge and disposal plan (i.e. one that minimises noise and duration)
- Implementing a 'safety zone' when operating in daylight hours, where if a marine mammal is sighted within a set perimeter of the vessel, dredging activity is suspended
- Creating a marine wildlife management plan, in partnership with the Department of Conservation, that allows for monitoring by:
  - » Conducting visual sightings and periodic passive acoustic monitoring in the area before, during, and after dredging and disposal activities
  - » Using monitoring as a learning tool for the future, and to inform any changes needed for future maintenance dredging

If you'd like to know more of the nuts and bolts of the visual and noise effects of our proposed changes you can get a copy of the assessment reports from the independent experts here

Harbour Safety

We have been busy working closely with relevant stakeholders – including the Harbourmaster, Northport and North Tugz – to figure out the best possible channel design

How did we go about assessing navigational risk?

Independent experts commissioned by Refining NZ have been through a significant risk assessment process to make sure the proposed channel can be safely navigated by vessels. This process was informed by:

- Extensive work leading to a preferred channel design (see relevant information sheet)
- Navigation simulations of the proposed channel designs
- An expert stakeholder risk workshop and supporting research

Identify and mitigate navigational risks

One issue identified by the independent experts is the need for pilots to navigate vessels within a narrower outer channel than present. This is because Refining NZ is looking to minimise the impact on the environment by keeping dredging to a minimum and not making the channel any wider than it needs to be.

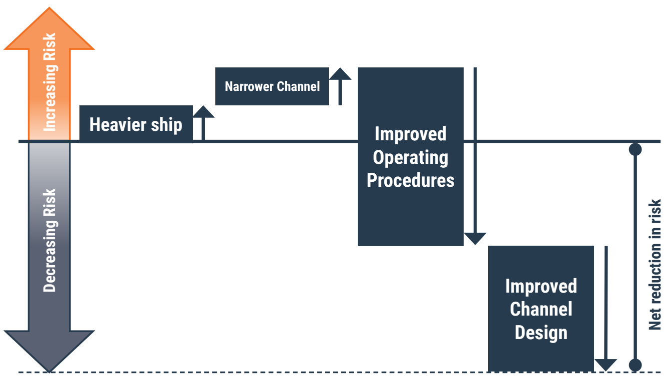
This can be mitigated by adopting best practise operational measures such as the mandatory use of special tools e.g. portable pilot units (PPU) and the installation of other aids to navigation such as lead lights.

Adopting these operational processes will ensure the channel can be navigated safely while avoiding further dredging that may have a negative environmental impact

Lowest risk channel design

The navigational risk assessment concluded the preferred channel design offers the lowest navigational risk of the options considered.

It is the closest to full compliance with best practise international guidelines and it offers safety improvements on the existing channel - beneficial for pilots navigating the harbour.



Harbour Safety

How did we go about assessing the environmental risk posed by potential oil spills?

The independent experts also carried out a specific environmental risk assessment to look at the net environmental impact of the proposed changes. This process drew on the navigational risk assessment and looked at oil spill case studies from elsewhere. It also drew on the expertise of other key experts considering the social and ecological impacts of the construction works associated with the proposed engineered channel.

Identifying environmental risks and mitigating them

The navigational safety improvements offered by the new channel design and operational measures significantly reduce the likelihood of a spill per tanker visit.

There is also a reduced chance of a spill because, overall, there will be fewer tankers visiting Marsden Point.

There is potential for a larger spill, by nature of the tankers carrying greater volumes of oil. A larger spill could result in further oil spread and longer persistence in the environment.

However, these factors would most likely increase to a lesser degree than the increase in cargo carried. If the vessel spilled 25 per cent more oil, this does not necessarily mean the spill area would increase by 25 per cent.

Whilst any large scale spill would have profound effects on the environment over the short to medium term,the increase in cargo size will not make the potential environmental consequences disproportionately worse. When this is balanced with the reduced likelihood of a spill, there is a reduction in risk when compared with the risk today.

Lower environmental spill risk

The independent experts concluded that the combination of fewer tanker visits plus improved navigational safety will significantly outweigh the risk posed by the greater volumes of oil carried on fully loaded Suezmax vessels.

Overall, the environmental risk will be significantly lower with the proposed channel design and operational measures.

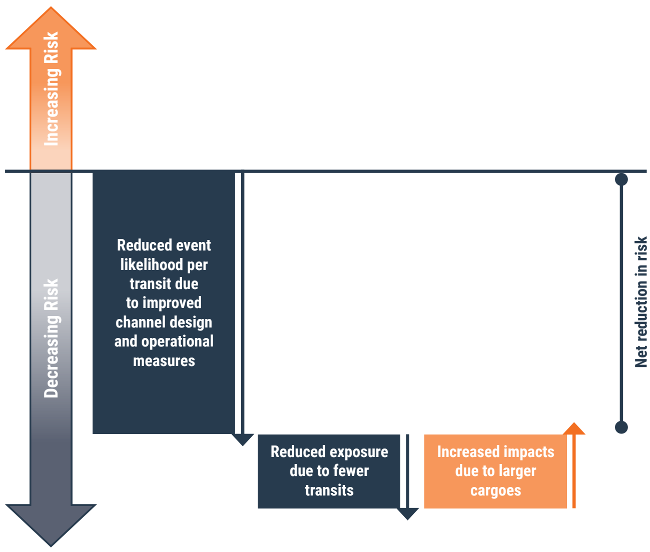
Existing Harbour Safety Measures

Ship movements are governed by a regional harbour safety management system. Key to this is the Dynamic Under Keel Clearance (DUKC) system which monitors a range of factors (i.e. ship dimensions, load, swell, tidal movement) to determine whether a ship has sufficient clearance under the keel to enter the harbour safely.

The refinery employs many measures of its own to ensure ship safety:

- Crude ships are double hulled to provide an extra layer of protection for the cargo
- Electronic aids on our jetties track the speed and direction of a crude ship so it can berth safely
- Jetty hoses and pipes for transferring crude from ship to shore are regularly maintained, with pressure testing of hoses every six months
- Ship tanks are fitted with high level alarms to prevent discharges

In the event of a spill our trained oil spill responders have access to oil spill equipment and are part of a bigger regional response, co-ordinated by the Northland Regional Council (NRC). Regular exercises with the NRC, Maritime NZ and other agencies ensure our oil spill response remains effective.



If you'd like to know more of the nuts and bolts of how our proposed changes affect harbour safety, you can get a copy of the assessment reports from the independent experts here

Ecology

We have been busy looking at possible ecological effects of our proposed changes, including on marine organisms and birdlife

How did we assess effects on ecology?

We commissioned independent experts to carry out ecological effects assessments based on the existing ecological footprint and values of the marine and bird ecology inhabiting the area.

These assessments carefully considered the actual and potential effects of the dredging and disposal activities Refining NZ has planned, and ways to avoid, remedy and mitigate these effects.

Marine Ecology

As recognised in the Northland Regional Coastal Plan (NRCP) and the New Zealand Coastal Policy Statement (NZCPS), the independent experts we commissioned identified soft-bottom benthic communities which lie within our planned dredging and disposal areas.

These communities are dominated by sand dollars, starfish, flatfish, polychaete worms, hermit crabs, shellfish and crabs.

Hard-bottom benthic communities are located adjacent to our dredging and disposal areas, at Motukaroro Island, Whangarei Marine Reserve and Home Point. These communities include kelp beds and sponge gardens of very high ecological value.

Adjacent to one of the disposal areas there is an important fishing spot at Three Mile Reef. This area is not afforded particular protection in the NRCP but is nonetheless, seen to have important local recreational and ecological value.

Actual and potential effects

The experts have identified the following effects:

- In the short term, soft-bottom benthic communities would be effectively eliminated by being removed from the dredge footprint and buried at the disposal areas

» This impact is temporary during which the benthic communities would progressively recover

This does constitute a moderate ecological effect that Refining NZ must account for. The experts have said that provided we take into account their recommended mitigation measures, this effect can be offset.

- Hard-bottom benthic communities and the Three Mile Reef fishing area are potentially vulnerable to sediment plumes and sedimentation effects (such as increased turbidity, where the water becomes cloudy with stirred-up sediment).

The experts have said that provided adverse sedimentation effects can be limited to the planned dredging and disposal footprint, the effects on water columns, plankton, fish and wildlife and coastal habitats are expected to be minor or less than minor.

Mitigation and monitoring

The experts have recommended adopting the following to mitigate, avoid and/or monitor effects:

- Contribute to a harbour enhancement type programme to enhance the likes of shellfish and seagrass communities within and adjacent to the dredging and disposal areas
- Monitor water turbidity against acceptable limits and respond with action where necessary, including operational controls on dredging and disposal
- Keep valves closed on the dredge during transport to prevent spillage outside designated dredge and disposal areas

Ecology

Bird Ecology

The experts used local records of birds and field investigations to determine that together there are 34 species frequenting the area, including 10 nationally threatened and 16 nationally at risk species.

The 26 nationally important species are entitled to protection under the New Zealand Coastal Policy Statement (NZCPS), which requires adverse effects to be avoided. These coastal and pelagic birds include Little Blue Penguin, as well as species of petrel and shearwater.

Actual and potential effects

The experts have identified the following possible effects:

- Water column effects (including increased turbidity)
- Vessel movements
- Vessel lighting
- Underwater noise

» Each of these was considered in relation to adverse impacts they could have on things such as feeding habits, nesting areas and breeding patterns

Our experts identified a couple of specific risk examples:

- Little Blue Penguin's passage to its shoreline nesting area could be affected by increased turbidity
- Pelagic birds such as shearwaters and petrels could be affected by vessel lighting

Provided recommended avoidance and mitigation steps are taken into account, these risks will be acceptable. The overall conclusion is that the impact on coastal and pelagic birds is considered to be low and consistent with the rules set out in the NZCPS.

Mitigation and monitoring

The experts have recommended adopting the following to mitigate, avoid and/or monitor effects:

- Provide Little Blue Penguin nesting boxes both inside and outside the Harbour to mitigate any short term impacts
- Provide nesting boxes for Grey-Faced Petrels at Bream Bay Scenic Reserve
- Carry out a lighting audit of vessels (looking at things like orientation of lighting and dimmers/timers on lights) and rectify any issues where practicable
- Carry out monitoring to provide information on the state of the environment following dredging.

If you'd like to know more of the nuts and bolts of the ecological effects of our proposed changes, you can get a copy of the assessment reports from our experts here

Dredging & Disposal

We've been busy with our experts looking at the best possible plan for harbour dredging and disposal

What is the plan for dredging?

Refining NZ will need to carry out dredging to deepen parts of the existing channel (capital dredging) and do ongoing maintenance dredging to keep the channel at the right depth. This means there will be an upfront dredging programme to prepare the channel, followed by additional dredging as required in the following years.

The capital dredging, which is likely to take up to six months, will occur primarily in the outer channel, jetty approach and around the refinery jetties pocket, with some targeted dredging in other areas. The estimated volume of sand to be dredged is 3.7 million cubic metres over a 1.44 square kilometre area.

Maintenance dredging may be needed every 2-5 years. Although this will depend on how fast sand refills the dredged areas. We expect maintenance dredging will be mainly around the jetties and outer channel.

It is likely that we will use a small to medium sized trailing suction hopper dredge, possibly assisted by a backhoe dredger and barge. A cutter suction dredge may be used for localised dredging. Maintenance dredging is likely to use the same, or smaller size dredgers.

- Trailing suction hopper dredgers are self-propelled ships with hoppers (dredged material storage within the ship's hull). Articulated dredging pipes, or "drag-arms", extend to the sea bottom and dredge while trailing at low speeds.
- Back hoe dredgers are mechanical dredgers consisting of an excavator mounted on a dredging pontoon.
- Cutter suction dredgers use a cutter head and centrifugal pumps to lift and transport dredged material. The pumps produce the flow required to lift the material and, via the pumping head, to transport solid / water slurry through a pipeline from the dredger to a discharge point. Most CSD operations are stationary while dredging.

What is the plan for disposal?

Once the sand has been dredged, it needs to be disposed of safely, in areas that have been carefully selected to avoid adverse effects on the environment (including ecology and tides, waves and currents).

Refining NZ is proposing two marine disposal areas for dredged sand:

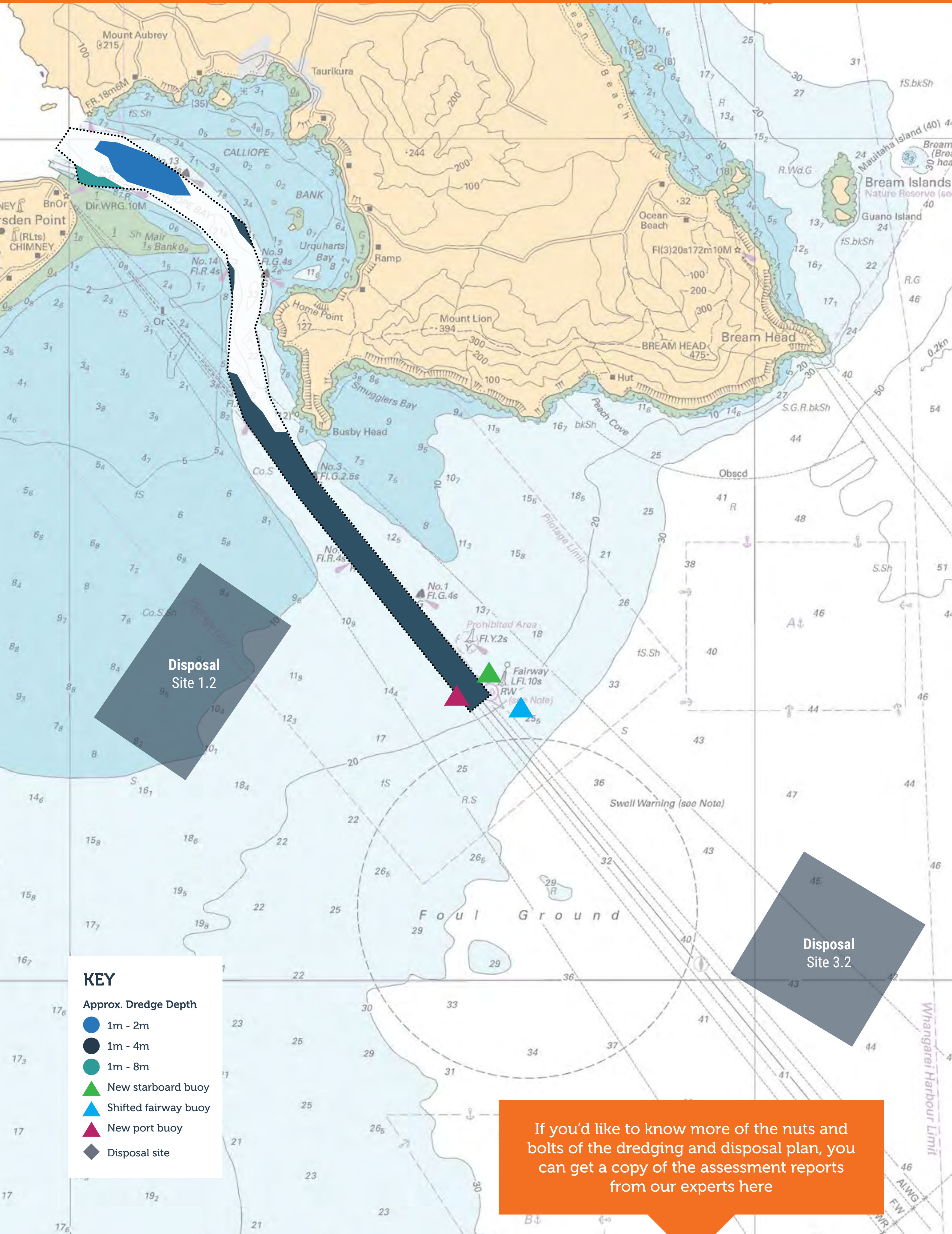
- Area 3-2: in up to 45 metres of water to the south east of the channel
- Area 1-2: nearer the shore in up to 15m of water and on the outer part of the ebb tide shoal

Most of the dredged material will be placed in Area 3-2, which is large enough to take all of the dredged material from both the capital and maintenance dredging programmes if needed.

If sand from the capital dredging is uniformly spread within Area 3-2, it will settle at a height of 1.5 metres from the seafloor. If a targeted site within Area 3-2 is used, the maximum height of the sand would be 4 metres in that spot (less than 9% of total water depth).

The remaining dredged material not going to Area 3-2 will be disposed of in Area 1-2 or to land. Area 1-2 is useful because it helps to provide a pathway for sand to migrate towards the shore. This will assist in preventing erosion and assisting to offset any effects of sea level rise.

Some proportion of the dredged material could also go to land based disposal where it is practical, beneficial and where there are appropriate consents in place. Options could include reclamation or beach renourishment.



If you'd like to know more of the nuts and bolts of the dredging and disposal plan, you can get a copy of the assessment reports from our experts here

Coastal Processes

We've been busy investigating the potential for increased erosion and shoreline change to areas such as Mair Bank using tools like hydrodynamic modelling and field work

The natural state of the harbour

Surveys of the Whangarei Harbour have shown that it is a stable coastal environment, with only a minor northern migration of sand observed over time along the shore of Ruakaka Beach. This means there is currently only small amounts of erosion or coastal change other than the natural fluctuations that come from banks and channels shifting following one-off events like storms.

How will the proposed changes affect the harbour?

The proposed changes will have very little effect, or in some cases no effect, on coastal processes within the harbour and surrounding areas.

Overall, any changes to tidal flows and wave conditions are small and consistent with the natural changes that already occur over time.

In areas of particular interest - including on the ebb tide shoal and Mair Bank – no significant changes to existing coastal processes are expected.

Wave

- The predicted change in wave height during average and moderate wave conditions is insignificant
- During extreme storm conditions where waves offshore can reach more than 5 metres high, some waves might break slightly higher (between 0.1 – 0.3 metres higher) on the edge of Mair Bank. This is no more than is expected in an average year of variable waves

Tidal currents

- There might be some very slight changes to the timing of tidal phases as a result of dredging
- Tidal velocity changes (the speed the tides flow) are expected to be small as a result of dredging and the modified channel
- There is expected to be very little change to the transport of sediment (sand movement) as a result of dredging

» **These changes are consistent with natural coastal processes.**

Coastal Processes

How will we remedy or mitigate any possible effects?

Mair Bank and the coastline extending south from Marsden Point have been undergoing natural change in recent times, including some net loss of sand. The proposed ongoing dredging to maintain the channel may add to the net loss.

To address this, Refining NZ is proposing to dispose a limited amount of dredged sand within the ebb tide shoal area, which will both replace and add to the volume of sand that can migrate landward, preventing erosion. This is a practical solution to replace the loss of sand we know about and to help offset the effects of sea level rise.

We are also putting in place measures to monitor any potential changes to Mair Bank, the channel and the ebb tide shoal. This includes annual surveying of the channel, Mair Bank and the wider ebb tide shoal, before and after dredging.

If you'd like to know more of the nuts and bolts of the effect on coastal processes, you can get a copy of the assessment reports from the independent experts here

Channel Design

We have been busy working closely with relevant stakeholders – including the Harbourmaster, Northport and North Tugz to figure out the best possible channel design

How did we go about designing the channel?

We commissioned independent experts to come up with a number of possible channel options. These options were then assessed, tested, and narrowed down to a shorter list.

The shortlist was put to the test via simulations that considered a range of operating conditions including arrivals and departures, different weather conditions and night vs. daytime sailing.

A preferred option emerged that ticks all the right boxes:

- Safest and simplest to navigate – a big improvement for ship pilots and risk reduction
- Avoids impacting ecologically sensitive, important landscape or natural character areas
- In line with international best practise channel design character areas

What are the key recommendations?

The preferred option includes some channel deepening, channel re-alignment, relocation of existing aids to navigation (lead lights, buoys and hazard markers) and the addition of a few new aids to navigation.

Some dredging of the entrance to the harbour, the approach to the refinery and around the refinery jetties is needed. The dredged material (mostly sand) will need to be disposed of at carefully selected sites.

The channel will be re-aligned for safety, straightening the current 'S-bend' that ship pilots have to navigate as they pass a rocky hazard at Home Point. Some aids to navigation will be added or re-positioned where necessary and designed to minimise their visual impact.

What will I see that is different?

- Replacement of the port entry lead's dayshape with a day/night lead light
- Nine existing buoys re-positioned including Fairway buoy
- Two new buoys added around Fairway Shoal
- A new hazard marker at Home Point
- A new set of lead lights at Taurikaura Bay to ensure ships are on the correct line as they pass the rocky outcrop at Home Point

If you'd like to know more of the nuts and bolts of the channel design, you can get a copy of the independent expert's report here

Annexure Six: Materials utilised for consultation

c) Sample of Advertisements

2016 Full Year Result Webcast

Financial results for the year ending 31 December 2016, were announced on Tuesday 28th February 2017. To view the results presentation, please click on the link below:

http://edge.media-server.com/m/p/bhih9525

Your Energy Hive
Fuelling NZ for over 50 years

We are New Zealand's only oil refinery and we have a reputation as one of Asia Pacific's safest and most reliable refineries.

So what is it exactly that we do? To put it simply, crude oil bought by our customers is shipped to our deep-water port at Marsden Point, near Whangarei, where we refine it into high quality transport fuels for New Zealand. And that's a big job.

We supply:

- all of the country's jet fuel
- nearly 80% of diesel
- around half of all petrol
- between 75 and 85% of bitumen for roading
- all fuel oil for ships
- sulphur for farm fertiliser
- and we even put the fizz in fizzy drinks!

What we do - all day, everyday - helps keep New Zealand's economy buzzing and Kiwis going places. We were one of the first companies ever listed on the New Zealand Stock Exchange and today we are a solid investment for nearly 4000 small and corporate investors. We are a solid contributor to Northland's economy. We employ over 300 staff and for every job at the Refinery, we create another two in Northland and a further six across New Zealand.

We're proud to be supporting our country and we do it while caring greatly for:

- The local environment
- Our Northland community
- Our people

In 2011 we celebrated 50 years of fuelling the country's needs and keeping New Zealanders on the move. Fifty years of refining is a major milestone for our business and we've come a long way since starting out in January 1961.

Our brand book explains more about who we are, why that's important and our commitments to our country, customers and shareholders, our people and community.

Join us on our journey to fuel New Zealand's future.

Crude Shipping Proposal

Refining NZ is proposing bringing bigger cargoes of crude into Marsden Point to reduce freight costs and improve the refinery's ability to compete with imported fuels. For this to be possible some harbour dredging and channel realignment may be required.

On the 9th and 10th of March we held a series of 'drop-in' information sessions, where Tangata Whenua and the public were able to talk directly with environmental and other experts about the studies they are to undertake, and to give their initial input on the proposal.

Latest Articles

Press Releases
Shareholder Disclosure Document 2017 - NZX

Press Releases
Refining NZ Employee Share Purchase Scheme

Press Releases
Director Resignation

Analysts Reports
Analyst Presentation - February 2017

Press Releases
Financial Result 2016 - Appendix 7

Press Releases
2016 Full Year Financial Announcement (Commentary)

The information we presented is available here, along with our media releases on the consultation process:

Refinery seeks public views on bigger crude shipments

Feedback will help refine crude proposal

For further information:
T: 094325115 E: crudeshipping@refiningnz.com ... more

CRUDE SHIPPING INFORMATION SESSIONS

REFINING NZ
Your Energy Hive

Refining NZ is proposing bringing bigger cargoes of crude into Marsden Point to reduce freight costs and improve the refinery's ability to compete with imported fuels.

For this to be possible some harbour dredging and channel realignment may be required.

As part of ongoing consultation Refining NZ is holding the first in a series of 'drop-in' information sessions, where the public can talk with environmental and other experts about the studies they will undertake, and give their initial input on the proposal.

Ruakaka and One Tree Point

Refining NZ Visitor Centre, Marsden Point Highway, Ruakaka. **Monday, 9 March – 5.00pm to 8.00pm**

Central Whangarei

Forum North (Cafler Suite), Rust Avenue, Whangarei. **Tuesday, 10 March – 10.00am to 2.00pm**

Whangarei Heads

Parua Bay School, Whangarei Heads Road, Parua Bay. **Tuesday, 10 March – 5.00pm to 8.00pm**

Contact: Greg McNeill T: 4325115 E: crudeshipping@refiningnz.com www.refiningnz.com

CRUDE SHIPPING INFORMATION SESSIONS

REFINING NZ
Your Energy Hive

Refining NZ is proposing bringing bigger cargoes of crude into Marsden Point to reduce freight costs and improve the refinery's ability to compete with imported fuels.

For this to be possible some harbour dredging and channel realignment may be required.

As part of ongoing consultation Refining NZ is holding the first in a series of 'drop-in' information sessions, where the public can talk with environmental and other experts about the studies they will undertake, and give their initial input on the proposal.

Ruakaka and One Tree Point

Refining NZ Visitor Centre, Marsden Point Highway, Ruakaka. **Monday, 9 March – 5.00pm to 8.00pm**

Central Whangarei

Forum North (Cafler Suite), Rust Avenue, Whangarei.
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www.refiningnz.com

Making Way for Bigger Cargoes

Refining NZ is proposing changes to the Whangarei Harbour entrance.

Same ships... fewer of them

Larger ships that visit the refinery can carry bigger cargoes. They can't at present, because the shipping channel is not deep enough. Deepening the channel to allow bigger cargoes, means fewer ships would need to visit the refinery to deliver the same amount of crude oil.

You are part of the story

Public consultation and expert information days are being held in and around Whangarei. These will be opportunities to hear from independent experts, and give your feedback directly to the refinery.

Expert Information Days:

Ruakaka Fri 7th April . 4pm–7pm
Whangarei Sat 8th April . 8am–12pm
Parua Bay Sat 8th April . 3pm–7pm

Public Consultation:

Look out for The Deeper Story pop-up container from 25 March to 13 April at **Town Basin, Hatea Loop, Whangarei Library, Parua Bay, McLeods Bay, Ruakaka Town Centre.**

Visit **deeperstory.co.nz** for dates and opening times

Making Way for Bigger Cargoes
THE DEEPER STORY
The Deeper Story


The Deeper Story
Submit your feedback at
www.deeperstory.co.nz
deeperstory.co.nz


THE
STORY


Keeping jobs
Northland
THE
DEEPER
STORY
deeperstory.co.nz
dback at
ory.co.nz


THE
DEEPER
STORY

Annexure Six: Materials utilised for consultation

d) Media releases

REFINING NZ
Your Energy Hive

Media Release

26 March 2015

Feedback will help refine crude proposal

Public feedback on Refining NZ's proposal to bring bigger crude oil cargoes to Marsden Point has set the stage for a series of expert studies of the harbour and any potential impacts of the proposal.

The refinery is proposing that around half of all crude oil be transported on ships capable of carrying around a million barrels at a time, a move that would mean fewer crude ships at Marsden Point and require some dredging to allow for heavier cargoes. The first in a series of information sessions were held on the 9th and 10th of March and gave the public the opportunity to speak directly with Refining NZ and independent experts.

Describing the sessions as essential to the consultation process, Refining NZ CEO, Sjoerd Post said they had allowed the refinery to test the proposal with different groups in and around Whangarei.

"Having the independent experts available to talk through their areas of interest (hydrology, ecology, geomorphology, marine mammals, and recreation) continued the dialogue with Tangata Whenua, special interest groups and residents, and helped broaden understanding of the proposal.

"We received a variety of views, including full support for the proposal, but also comment around the choice of location for dredged material, relief that much of dredging will be outside of the harbour (e.g. Fairway Shoal), the importance of Mair Bank, and the continuing role of the refinery as a major employer in the region. There was also a clear message to the Company and the independent experts that the science behind their studies needs to be solid and that their findings should 'tell-it-like-it-is'."

Post noted that the feedback was especially useful for the independent experts who could now embark on their studies armed with local data about the cultural, environmental and recreational values in and around the harbour: "The feedback has thrown up areas to be explored further, including a key question about whether Fairway Shoal might contain material from previous dredging further up the harbour."

Said Post: "The response we had from the first of our drop-in sessions augurs well for the next stage of consultation which will be to report back the findings of the independent experts."

ENDS

……………more/2.

Notes to Editors:

Public information sessions were held at three locations:
Monday 9 March – Refining NZ Visitor Centre;
Tuesday 10 March – Cafler Suite, Forum North;
Tuesday 10 March – Parua Bay School, Whangarei Heads.

For further information:
Greg McNeill, Communications & External Affairs Manager
T: (09) 4325115; M: 021 873623; E: greg.mcneill@refiningnz.com

REFINING NZ
Your Energy Hive

Media Release

6 March 2015

Refinery seeks public views on bigger crude shipments

Refining NZ is holding public information sessions next week about the Company's proposal to bring bigger cargoes of crude oil to Marsden Point.

The proposal could see up to half of all crude oil (around 20 million barrels a year) transported on ships carrying around a million barrels at a time, a move that could mean fewer crude ships at Marsden Point and require some dredging to allow for heavier cargoes. Currently crude oil cargoes arriving at the refinery are typically 600-700,000 barrels in size.

Commenting, CEO Sjoerd Post said the proposal is in its early stages, with the refinery focused first on engaging Tangata Whenua, local residents and key stakeholders on the high-level details before embarking on a series of technical studies and broader consultation.

"Our high-level engagements have already garnered initial reactions and questions on dredging, particularly about where and how deep this may be, and what will happen to the dredged material. A key point in early discussions has been the fact that these ships currently come into Marsden Point, but are under loaded."

The information sessions on the 9th and 10th of March are the first in a series planned by the refinery, and will give the public the opportunity to speak with the independent consultants engaged to study the harbour and any potential impacts of dredging. Currently there are five key areas to be studied: – hydrology; geomorphology; ecology; marine mammals; and recreation.

Said Post: "Given Whangarei harbour is heavily used for recreation and holds special cultural value for the hapu and iwi, it's vital that we test this proposal with different groups, and use the feedback from public sessions to inform the independent studies we plan to carry out."

"We expect the final outputs from these studies will help us to avoid or minimise any potential impacts of this proposal on the harbour."

ENDS

………………more/2.

Notes to Editors:

Public information sessions are to be held at three locations:

Monday 9 March – Refining NZ Visitor Centre, Point Marsden Highway, 5.00pm to 8.00pm
Tuesday 10 March – Cafler Suite, Forum North, Rust Avenue, 10.00am to 2.00pm
Tuesday 10 March – Parua Bay School, Whangarei Heads Road, 5.00pm to 8.00pm

For further information:

Greg McNeill
For further information:
Greg McNeill, Communications & External Affairs Manager
T: (09) 4325115; M: 021 873623; E: greg.mcneill@refiningnz.com

REFINING NZ
Your Energy Hive

Media Release

20 March 2017

Consultation to deliver deeper story on refinery proposal

Refining NZ has started the next round of public consultation about its proposal to bring bigger cargoes of crude to Marsden Point.

The most visible part of the consultation - The Deeper Story pop-up container - outlining the rationale, and scope of the proposal will be located in and around Whangarei from March 25 with refinery staff on hand to answer questions and take feed-back. Expert Information Days on April 7, 8 will be an opportunity to speak to independent experts about the findings of a series of in-depth studies of the harbour, all of which are available on a dedicated website (www.deeperstory.co.nz).

This is the second round of public consultation since the refinery began putting the detail to its proposal. High-level discussions with tangata whenua, local residents and key stakeholders, began in 2014 and armed with initial feedback independent experts were commissioned to carry out a series of technical studies including hydrology, ecology, geomorphology, marine mammals and recreation.

Refining NZ CEO Sjoerd Post said that the first round of broader consultation that followed in in March 2015 was an important test of the proposal with different groups in and around Whangarei.

“We received a variety of views, including full support for the proposal, but also comment around the choice of location for dredged material, relief that much of dredging will be outside of the harbour, the importance of Mair Bank, and the continuing role of the refinery as a major employer in the region. The other clear message to the company and the independent experts was that the science behind their studies needed to be solid and that their findings should ‘tell-it-like-it-is’.”

Said Post: “We took those views on board and since then have continued to update and receive feedback from tangata whenua, local residents and key stakeholders.”

“It’s exciting to have the specialist reports finally complete so we can now talk in more depth about the benefits and the potential impacts of this proposal, especially, how any impacts may be avoided, eliminated or mitigated for.”

……more/2.

Media Release

"Absolutely the most critical parts of the consultation we're engaging in are to make sure a broad range of people have access to all the information they need, and can have answers to their questions so that at the end of the process, they have an informed view of what the refinery is proposing."

ENDS

Notes to Editors:

- The refinery proposal would see around half of all crude oil (around 20 million barrels a year) transported on ships carrying around a million barrels at a time, a move that could mean fewer crude ships at Marsden Point and targeted dredging to allow for these heavier cargoes to enter the harbour safely.

- From March 25 to April 13, 2017 The Deeper Story pop-up container will be at the following locations: Town Basin; Hatea Loop; Whangarei Library; Parua Bay; McLeods Bay; Ruakaka. Dates and times for each location can be found on The Deeper Story website (www.deeperstory.co.nz).

- Expert information days April 7, 8, 2017 will be held in Whangarei (Forum North); Ruakaka (Bream Bay Community Support Trust); Parua Bay (Parua Bay School). Dates and times for each location are on the website.

- A range of information, including the specialist reports by independent experts, report summaries, the rationale for the proposal, are all available on the website.

For information:

Greg McNeill
P: (09) 4325115; M: 021 873 623; E: greg.mcneill@refiningnz.com

Deeper port consultation starts

ANNETTE LAMBLY

The pop-up container with information outlining the deeper port proposal will be around Whangarei until April 13.

Refining NZ has begun its second round of public consultation on its proposed changes to the Whangarei Harbour to allow bigger cargoes of crude to Marsden Point.

The company want to to dredge up to four metres in parts of the outer and inner shipping channels, and up to eight metres in targeted spots around the refinery jetties to allow for Suezmax ships to berth at the port.

These larger ships carry around a million barrels at a time, nearly one third more than the Aframax tankers.

The company says bigger cargoes would reduce the cost of transporting crude oil to the refinery.

Refining NZ chief executive Sjoerd Post says the first public consultation round in March 2015 provided a variety of views, including the choice of location for dredged material, the importance of Mair Bank, and the continuing role of the refinery as a major employer in the region.

"It's exciting to now have the specialist reports finally completed so we can now talk in more depth about the benefits and the potential impacts of this proposal, especially, how any impacts can be avoided, eliminated or mitigated for," he says.

If approved, dredging works could be underway in 2019.

Further feedback is being sought which will help identify issues of importance and areas of cultural value or special interest that need to be taken into account.

There are two alternatives to the proposed dredging:

- Single point mooring; where crude ships berth at a mooring point outside of the harbour and crude is transported by underwater pipeline to the refinery. This would be a major project in itself, and likely have a greater impact on the harbour environment.
- Ship to ship transfer; in deep water to transfer the cargo into smaller tankers for final discharge at the refinery.

Either option would require the use of a carrier capable of twice the cargo of a fully loaded Suezmax – and more storage capacity would be required at the refinery.

"The Deeper Story" pop-up container outlining the proposal will be in and around Whangarei until April 13. There will be information days at Forum North, Bream Bay Community Support Trust and Parua Bay School. Visit deeperstory.co.nz for details.

Pupils seek help to prevent littering

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Annexure Six: Materials utilised for consultation

e) Facebook posts

Facebook Posts advertising the Proposal.

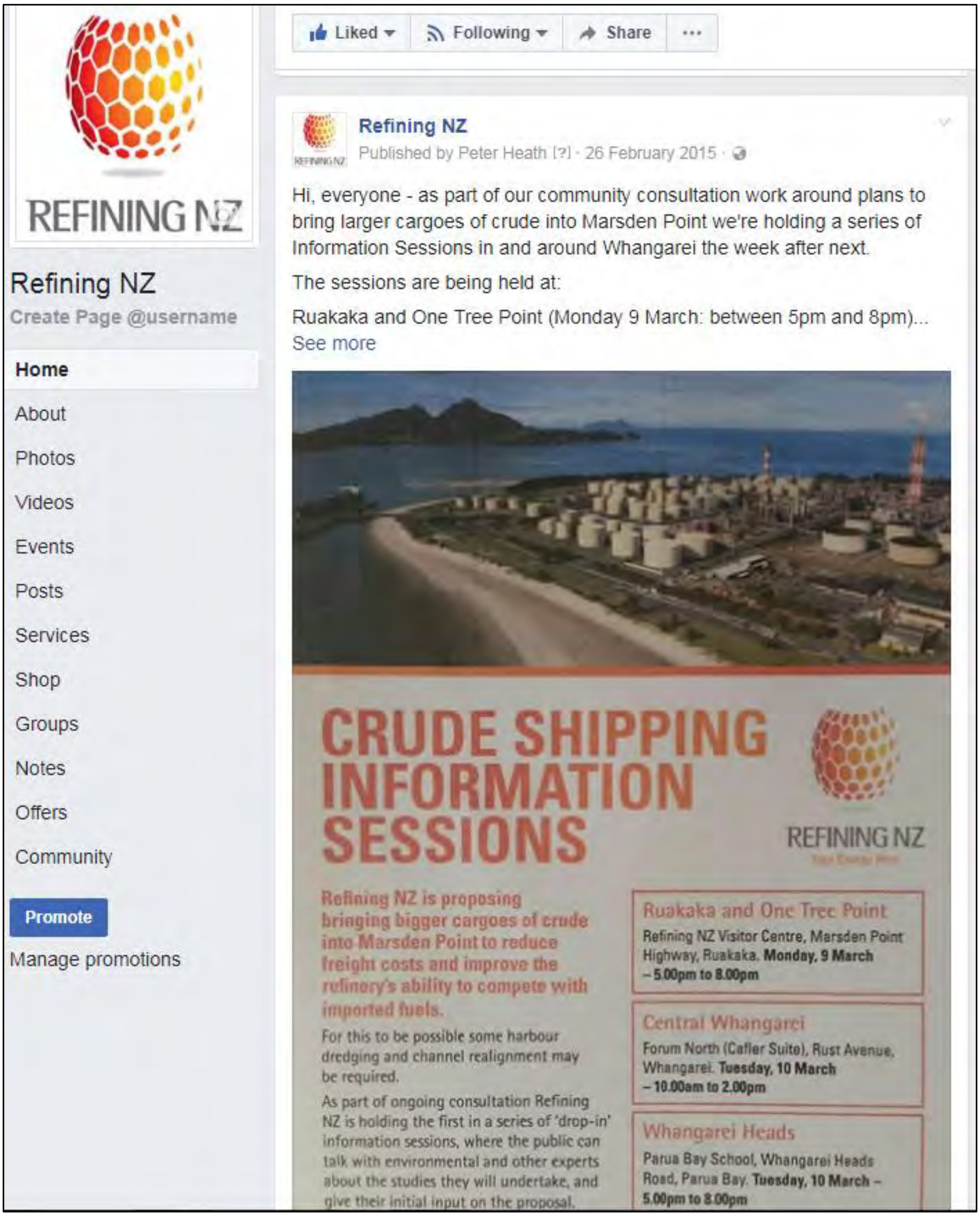
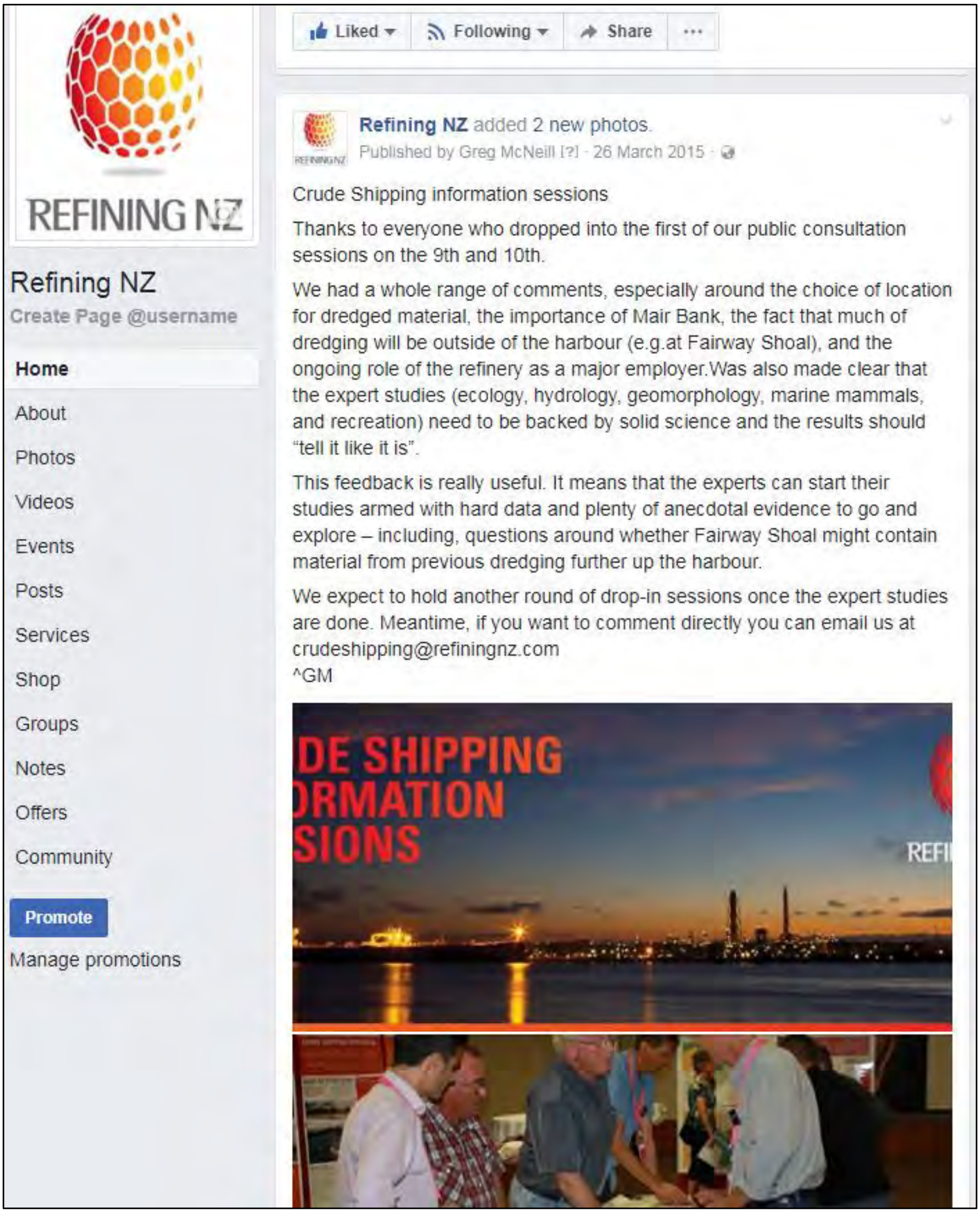


Figure 1: Facebook post on the 26 February 2015 advertising Information Sessions

Figure 2: Facebook post on the 2 March 2015, advertising an Information Session on the 9 March 2015.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Videos

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Posts

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Groups

Notes

Offers

Community

Promote

Manage promotions

Liked Following Share ...

Refining NZ added 2 new photos.

Published by Greg McNeill [?] · 26 March 2015 ·

Crude Shipping information sessions

Thanks to everyone who dropped into the first of our public consultation sessions on the 9th and 10th.

We had a whole range of comments, especially around the choice of location for dredged material, the importance of Mair Bank, the fact that much of dredging will be outside of the harbour (e.g.at Fairway Shoal), and the ongoing role of the refinery as a major employer.Was also made clear that the expert studies (ecology, hydrology, geomorphology, marine mammals, and recreation) need to be backed by solid science and the results should "tell it like it is".

This feedback is really useful. It means that the experts can start their studies armed with hard data and plenty of anecdotal evidence to go and explore – including, questions around whether Fairway Shoal might contain material from previous dredging further up the harbour.

We expect to hold another round of drop-in sessions once the expert studies are done. Meantime, if you want to comment directly you can email us at crudeshipping@refiningnz.com

^GM

Figure 3: Facebook post on the 26 March 2015 providing feedback on Information Sessions held and advertising further Information Sessions.

Figure 4: Facebook post on the 6 May 2015, advertising further public consultation and providing an email for questions.

Figure 5: Facebook post on the 20 May 2015, updating the public on the Proposal

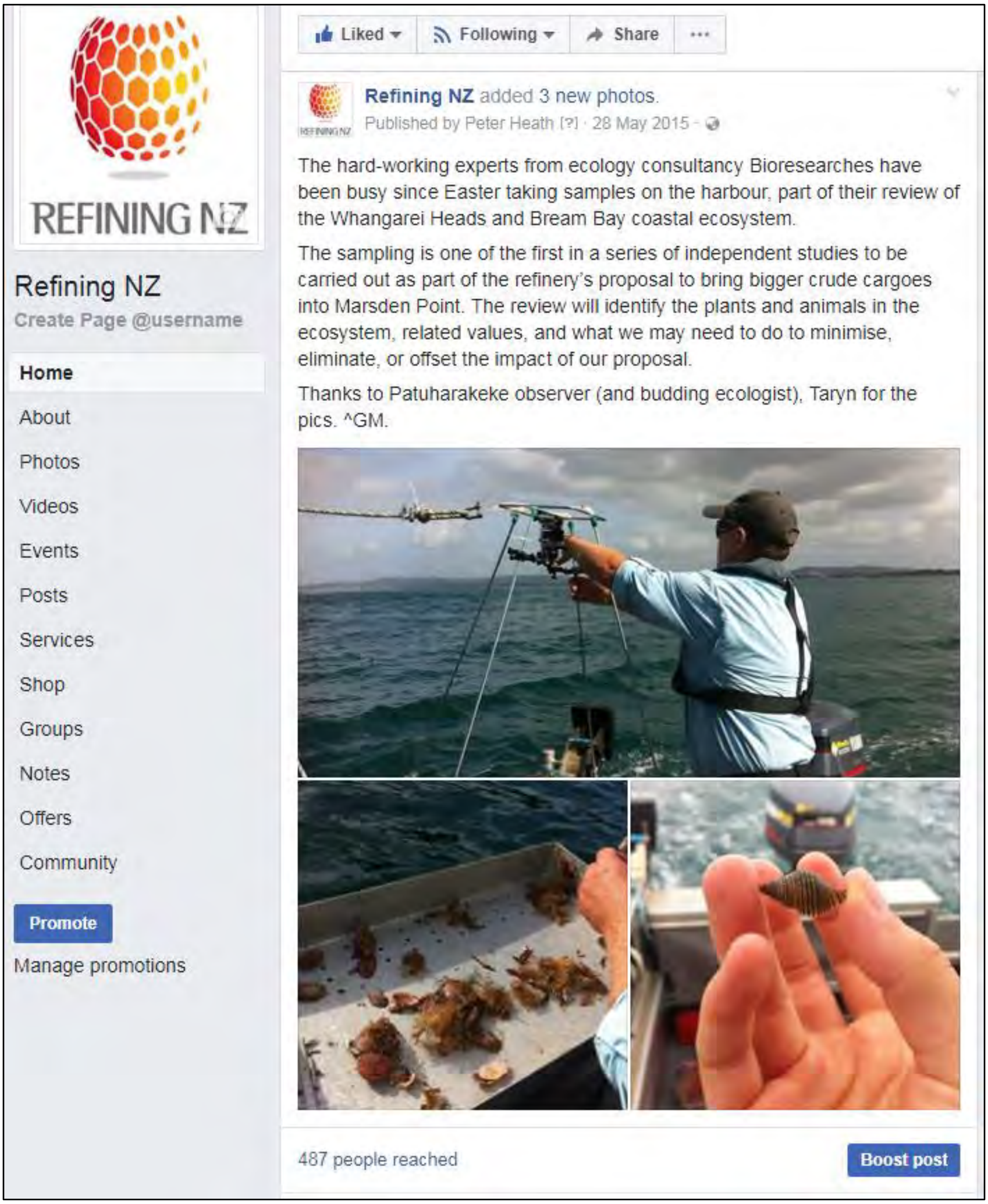


Figure 6: Facebook post on the 28 May 2015, updating the public on samples being undertaken for the Proposal.

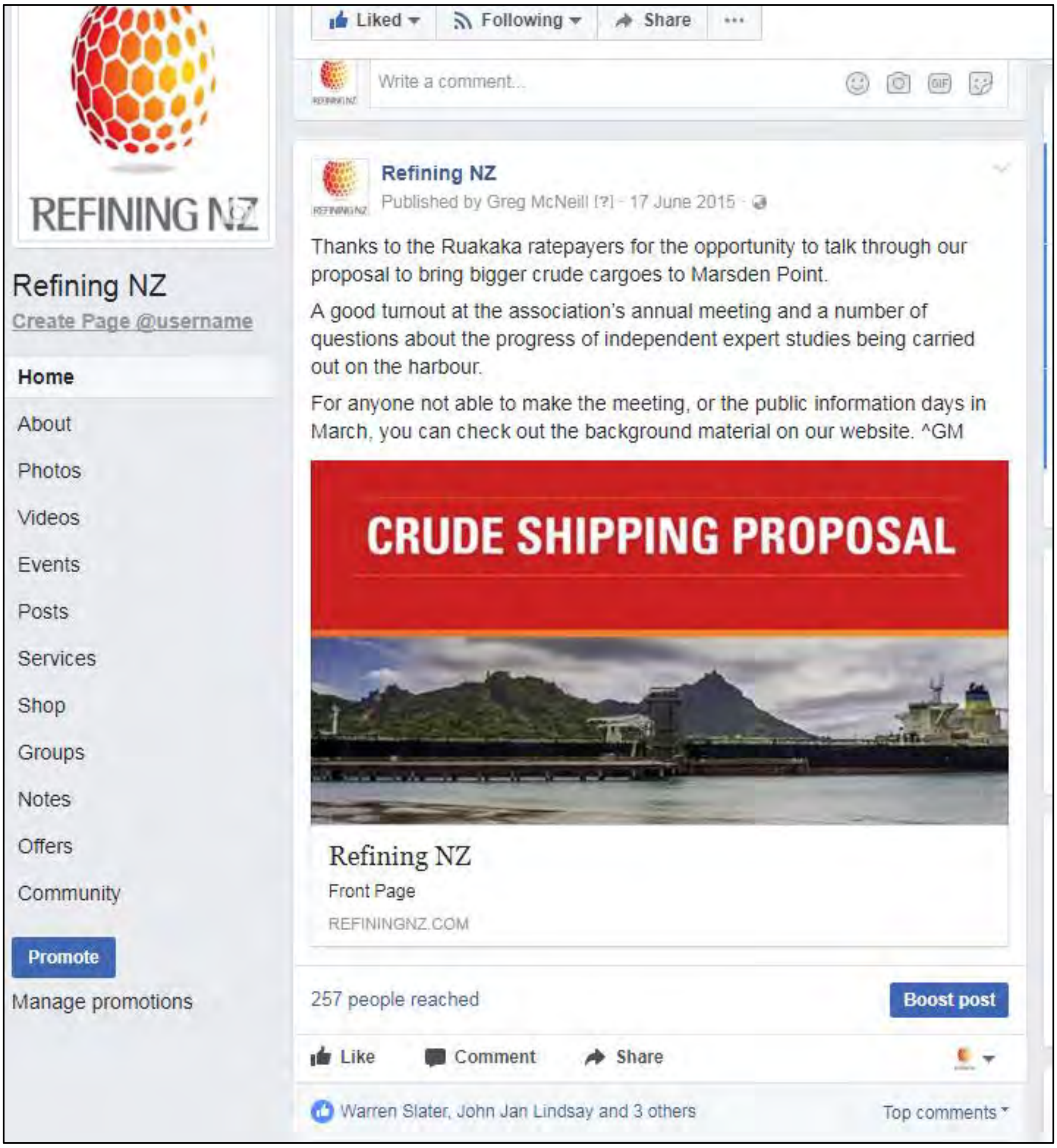


Figure 7: Facebook post on the 17 June 2015, updating the public on the public information days held in March, and informing the public on where they can find more information.

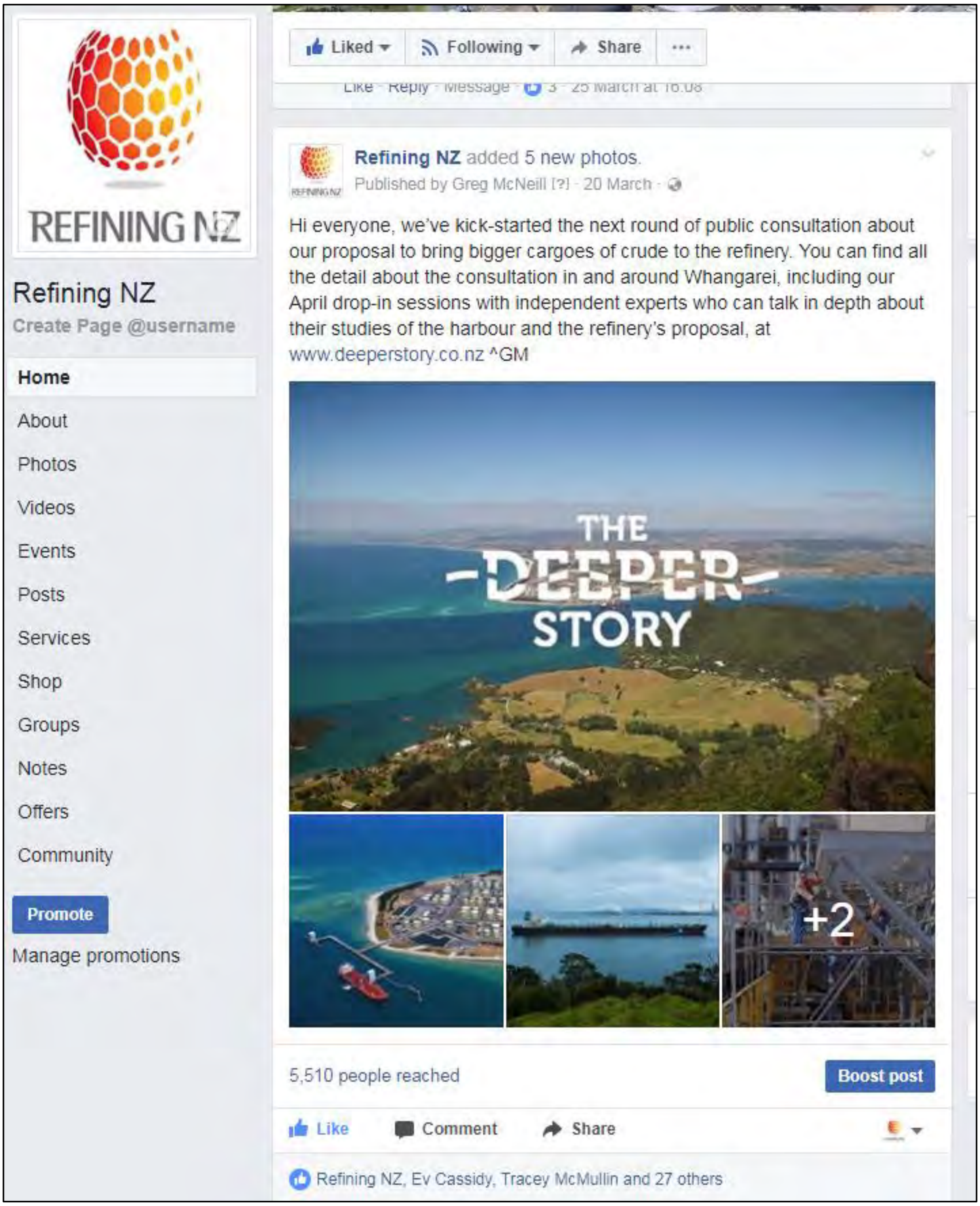


Figure 8: Facebook post on the 20 March 2017, informing the public of further consultation opportunities.

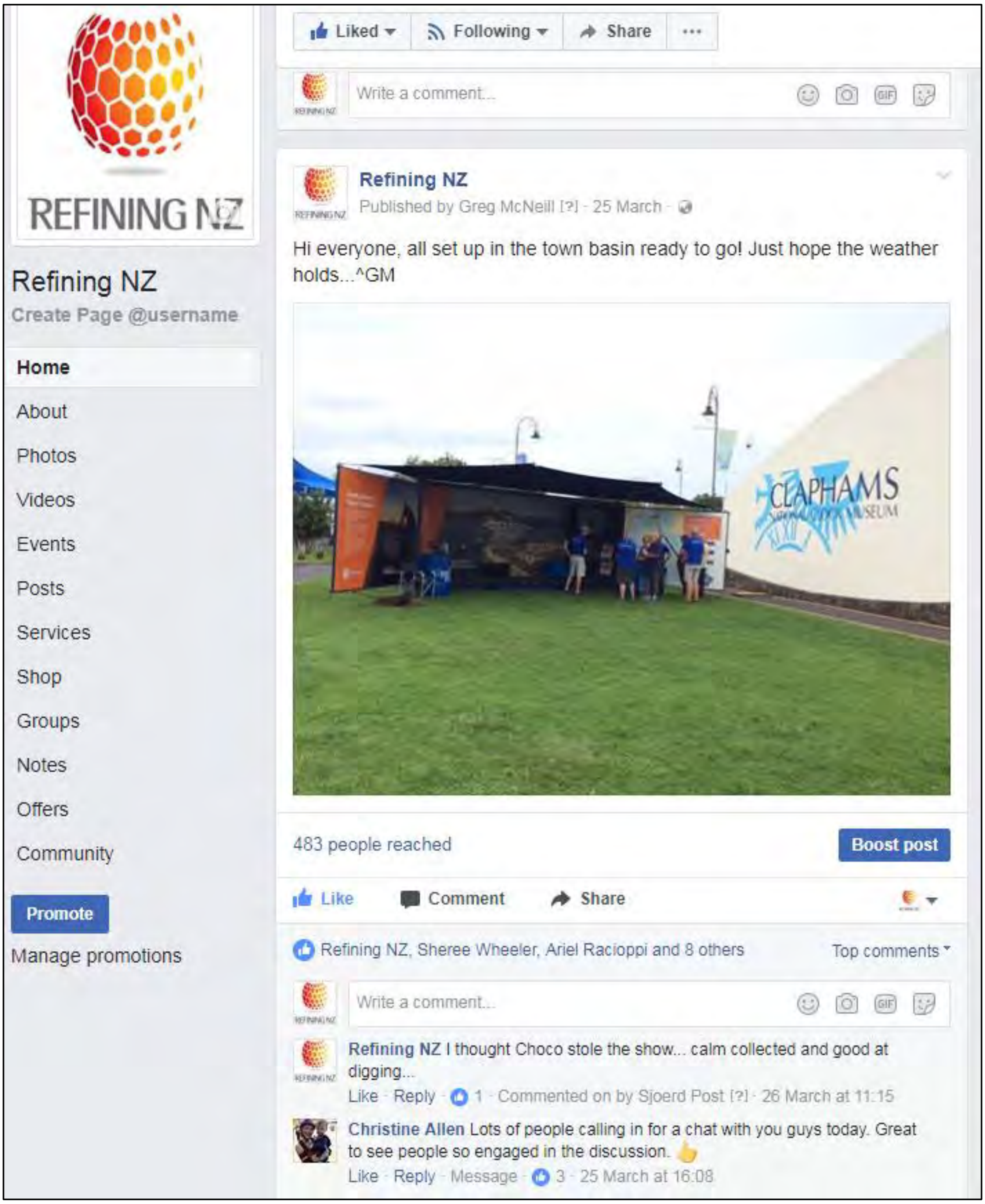


Figure 9: Facebook post on the 25 March 2017, advertising the pop-up containers used for consultation.

Figure 10: Facebook post on the 7 April 2017 informing the public that the independent experts will be attending consultation sessions.

Annexure Seven: Assessment against the Rules of the Regional Coastal Plan for Northland June 2004

Table A: Assessment of the Proposal Against the Provisions of the RCP[1]

Aspect of the Proposal	Provision of the RCP	Commentary
Capital Dredging & Disposal & Navigation Aids		
Removal of Material By Dredging (includes the associated disturbance of the seabed and the fauna & flora, and their habitats) – Coastal Permit	Rule 31.4.8(g) & Rule 31.7.8(b)	The capital dredging of the area zoned **M2MA** is deemed to be a **Discretionary Activity** under Rule 31.4.8(g). We note that while it not strictly required, Refining NZ will undertake capital dredging in this area so as to comply with the applicable standards set out in Rule 31.4.13. The capital dredging of the area zoned **M5MA** is a **Discretionary Activity** in accordance with Rule 31.7.8(a). As with our discussion of the preceding rule, while it is not strictly required, Refining NZ will conduct the capital dredging so as to comply with the relevant standards in Rule 31.7.12.
Discharge of Sediments (containing contaminants) and Water (including contaminants such as sediment) to Water (from the dredge overflow) – Coastal Permit	Rule 31.4.6(b) & Rule 31.7.6(a)	The discharge of water from the overflow of the Dredge into the area of the CMA zoned **M2MA** will contain suspended and entrained sediments which constitutes a contaminant while it is suspended in the water column. In all other respects, Rule 31.4.6(b) is achieved as; (i) the overflow will not cause physical changes to the foreshore and seabed, and (ii) both the water quality standards and the additional matters listed in Standard 31.4.13(c) will be achieved after reasonable mixing. Given the foregoing, the overflow from the dredge cannot occur as a permitted activity in the M2MA. As there are no applicable rules within the RCP that govern discharges that do not accord with Rule 31.4.6(b), this aspect of the proposal constitutes an **Innominate Activity** under section 87B(1)(a) of the Act. The discharge of overflow water from the Dredge into the area zoned **M5MA** is a Permitted Activity, as it will not cause significant adverse effects on the environment once regard is had to the quality of the receiving water and will achieve the applicable standards set out in 31.7.12 (including the water quality standards and the additional matters listed in Standard 31.7.12(c)).
Abstraction of Water While Dredging – Coastal Permit	Rule 31.4.7(b) &	The abstraction of coastal water is part of the dredging process. As a consequence of the changes caused by the dredging process (which are indistinguishable from the associated abstraction of

[1] **Please note:** Some of the standards applying within rules 31.4.13 and 31.7.12 are subjective and require expert input as to whether compliance can be achieved. In assessing the Proposal's compliance against the applicable standards, we have relied on the advice of Jon Styles (acoustic considerations), Justin Cross (lighting), Dr Brian Coffey (water quality and marine ecology) and Richard Reinen-Hamill (geomorphic processes and effects). In doing so, we accept that others may reach a different conclusion should they rely on other expert advice that does not accord with that of the experts listed

	Rule 31.7.7(b)	water), the proposed abstraction infringes standards (ii) and (iii) of Rule 31.4.7(b). Given this, the abstraction of water in the **M2MA** is a **Discretionary Activity** under Rule 31.4.7(d). When undertaken in the **M5MA**, the abstraction also attracts a **Discretionary Activity** classification in accordance with Rule 31.7.7(d), as it will be unable to comply with standards (i) and (ii) of Rule 31.7.7(b).
Placement of Dredged Material on the Seafloor (in both Disposal areas 1.2 and 3.2 only) – Coastal Permit	Rule 31.4.8(f)	The disposal of the dredged material in disposal areas 1.2 and 3.2 is deemed to be a **Discretionary Activity** under Rule 31.4.8(f). While also not strictly required, we note that Refining NZ will undertake the disposal of the dredged material so as to comply with the applicable standards set out in Rule 31.4.13.[2] [3]
Discharge of Sediments (containing contaminants) and Water (including contaminants such as sediment) to Water (from the disposal activities) – Coastal Permit	Rule 31.4.6(b)	The discharge of the dredged water (as part of the dredged material disposal) into disposal areas 1.2 and 3.2 will contain suspended and entrained sediments, which constitutes a contaminant while it is suspended in the water column. In all other respects, Rule 31.4.6(b) is achieved as; (i) the water fraction (as opposed to the sediment) will not cause physical changes to the foreshore and seabed, and (ii) both the water quality standards and the additional matters listed in Standard 31.4.13(c) will be achieved after reasonable mixing. Given the foregoing, the discharge of water to water as part of the disposal activities cannot occur as a permitted activity in the M2MA. As there are no applicable rules within the RCP that govern discharges that do not accord with Rule 31.4.6(b), this aspect of the proposal constitutes an **Innominate Activity** under section 87B(1)(a) of the Act.
Sale of / Removal of Dredged Material from the CMA – Coastal Permit	Rule 31.4.11(b)	Up to 95% of the dredged material may be removed from the area zoned **M2MA**, for sale to others for their use. Rule 31.4.11(b) deems this activity to be a **Discretionary Activity**. As we note in our discussion of Rule 31.4.8(g), while it is not strictly necessary, Refinery NZ will undertake the extraction (via dredging) so as to comply with the applicable standards set out in Rule 31.4.13.

[2] We note that standards 31.4.13(d) and 31.7.12(d) do not apply to the disposal activities, as neither disposal site 1.2 nor 3.2 are within the foreshore, as defined by the RCP or as generally defined by experts in geomorphology. The same interpretation is relevant to the associated discharge of sediment and water to water, and to the two corresponding maintenance dredging activities

[3] We note that there is some ambiguity as to the correct interpretation of standard 31.4.13(c)(iv). We have closely considered this matter, and have engaged with both Dr Brian Coffey, Richard Reinen-Hamill and Chris Simmons (counsel to Refining NZ) over its interpretation. Having done so, we agree with the position that is set out within Dr Coffey's ecological assessment being, in summary, that the sediment does not constitute 'debris'. We note that this interpretation accords with an international definition of the term 'marine debris', which is defined as being *"any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment"* (oceanservice.noaa.gov/facts/marinedebris.html). We accept that others could interpret this standard differently, and that, that could lead to a conclusion that the proposed disposal activities do not comply with this aspect of Rule 31.4.13.

		As there are no applicable rules within the RCP that govern the extraction (for sale or use by others) of the dredged material from the area of the CMA zoned **M5MA**, this aspect of the proposal constitutes an **Innominate Activity** under section 87B(1)(a) of the Act. As we note in our discussion of Rule 31.7.8(a), while it is not strictly necessary, Refinery NZ will undertake the extraction (via dredging) so as to comply with the applicable standards set out in Rule 31.7.12.
Relocation of existing Navigation Aids (buoys 2, 3, 5, 8, 11, 12, 14, and 18, and Fairway Buoy A) and the establishment of five new navigation aids (being two new buoys at Fairway (one of which is a replacement of an existing buoy at Fairway), the Special Mark Beacon at Home Point, and the front and rear lit leads at Calliope Bank – Coastal Permit	Rule 31.4.4(n), Rule 31.4.4(o), Rule 31.7.4(i), & Rule 31.4.6(b).	The establishment (including their erection, placement, occupation of space and maintenance) of the Special Mark Beacon at Home Point and the Lit Front Lead at Calliope Bank and the two new buoys (one of which is a replacement) at Fairway may be undertaken as a **Controlled Activity** (in accordance with Rule 31.3.4(o)) as the Harbour Master has approved the design and location of the structures and the standards set out in Rule 31.3.13 will be achieved by Refining NZ. A copy of the Harbour Master's approval is attached as **Annexure 14**. The relocation of a series of channel marker buoys will be undertaken so as to achieve the requirements of Rule 31.4.4(o) as; (i) the standards set out in Rule 31.4.13 will be achieved by Refining NZ, and (ii) the Harbour Master has approved the location and design of the navigation aids in this zone (as previously noted, a copy of the Harbour Masters approval is attached as **Annexure 14**). A **Controlled Activity** classification applies as a consequence. We note, for completeness, that we cannot guarantee that all future repair and maintenance activities will not result in the discharge or deposition of contaminants, and thus have assumed that Rule 31.4.4(n) cannot be achieved in this instance. The construction of navigation aids will see discharges of minor amounts of contaminants to the CMA. As there are no applicable rules within the RCP that govern discharges of sediment and contaminants (as a consequence of the construction and relocation activities associated with the navigation aids in the M2MA) that cannot achieve rule 31.4.6(b), that aspect of the proposal constitutes an **Innominate Activity** under section 87B(a) of the Act.
Maintenance Dredging & Disposal		

Removal of Material by Dredging (includes disturbance of the seabed and the fauna & flora, and their habitats, on the same) – Coastal Permit	Rule 31.4.8(c) & 31.7.8(a)	While the maintenance dredging proposed in the area zoned **M2MA** includes the 'main channel of the Whangarei Harbour', it also includes the Turning Basin that is in close proximity to the Refinery's Jetty. Some question exists as to whether the extremities of the Turning Basin form part of the Harbour's 'main channel'. As a consequence, and out of an abundance of caution, the maintenance dredging is deemed to be a **Discretionary Activity** under Rule 31.4.8(d). While it is not strictly required, we note that Refining NZ will undertake the dredging in this area so as to comply with the applicable standards set out in Rule 31.4.13. The maintenance dredging conducted within the **M5MA** will be conducted so as to accord with Rule 31.7.8(a), and the associated (and relevant) standards set out in Rule 31.7.12. As a consequence, the maintenance dredging undertaken in the M5MA is a **Controlled Activity**.
Abstraction of Water While Dredging – Coastal Permit	Rule 31.4.7(b) & 31.7.7(b)	The abstraction of coastal water is part of the dredging process. As a consequence of the changes caused by the dredging process (which are indistinguishable from the associated abstraction of water), the proposed abstraction infringes standards (ii) and (iii) of Rule 31.4.7(b). Given this, the abstraction of water in the **M2MA** is a **Discretionary Activity** under Rule 31.4.7(d). When undertaken in the **M5MA**, the abstraction also attracts a **Discretionary Activity** classification in accordance with Rule 31.7.7(d), as it will be unable to comply with standards (i) and (ii) of Rule 31.7.7(b).
Discharge of Sediments (containing contaminants) and Water (including contaminants such as sediment) to Water (from the dredge overflow) – Coastal Permit	31.4.6(b) & Rule 31.7.6(a)	The discharge of water from the overflow of the Dredge into the area of the CMA zoned **M2MA** will contain suspended and entrained sediments which constitutes a contaminant while it is suspended in the water column. In all other respects, Rule 31.4.6(b) is achieved as; (i) the overflow will not cause physical changes to the foreshore and seabed, and (ii) both the water quality standards and the additional matters listed in Standard 31.4.13(c) will be achieved after reasonable mixing. Given the foregoing, the overflow from the dredge cannot occur as a permitted activity in the M2MA. As there are no applicable rules within the RCP that govern discharges that do not accord with Rule 31.4.6(b), this aspect of the proposal constitutes an **Innominate Activity** under section 87B(a) of the Act. The discharge of overflow water from the Dredge into the area zoned **M5MA** is a Permitted Activity, as it will not cause significant adverse effects on the environment once regard is had to the quality of

		the receiving water and will achieve the applicable standards set out in 31.7.12 (including the water quality standards and the additional matters listed in Standard 31.7.12(c).
Placement of Dredged Material on the Seafloor (In both Disposal Areas 1.2 & 3.2 only) – Coastal Permit	Rule 31.4.8(f)	The placement of the dredged material in disposal sites 1.2 and 3.2 is deemed to be a **Discretionary Activity** under Rule 31.4.8(f). As with the disposal of the material from the Capital Dredging. While it is not strictly required, Refining NZ will undertake the disposal of the dredged material so as to comply with the applicable standards set out in Rule 31.4.13.
Discharge of Sediments (containing contaminants) and Water (including contaminants such as sediment) to Water (from the disposal activities) – Coastal Permit	Rule 31.4.6(b)	The discharge of the dredged water (as part of the dredged material disposal) into disposal areas 1.2 and 3.2 will contain suspended and entrained sediments, which constitutes a contaminant while it is suspended in the water column. In all other respects, Rule 31.4.6(b) is achieved as; (i) the water fraction (as opposed to the sediment) will not cause physical changes to the foreshore and seabed, and (ii) both the water quality standards and the additional matters listed in Standard 31.4.13(c) will be achieved after reasonable mixing. Given the foregoing, the discharge of water to water as part of the disposal activities cannot occur as a permitted activity in the M2MA. As there are no applicable rules within the RCP that govern discharges that do not accord with Rule 31.4.6(b), this aspect of the proposal constitutes an **Innominate Activity** under section 87B(a) of the Act.
Sale of / Removal of Dredged Material from the CMA – Coastal Permit	Rule 31.4.11(b)	Up to 95% of the dredged material may be removed from the area zoned **M2MA**, for sale to users or for use in beach renourishment conducted by others. Rule 31.4.11(b) deems this activity to be a **Discretionary Activity**. As we note in our discussion of Rule 31.4.8(d), Refining NZ will undertake the extraction (via dredging) so as to comply with the applicable standards set out in Rule 31.4.13. As there are no applicable rules within the RCP that govern the extraction (for sale or use in beach nourishment conducted by others) of the dredged material from the area of the CMA zoned **M5MA**, this aspect of the proposal constitutes an **Innominate Activity** under section 87B(a) of the Act. As we note in our discussion of Rule 31.7.8(a), while it is not strictly necessary, Refining NZ will undertake the extraction (via dredging) so as to comply with the applicable standards set out in Rule 31.7.12.

Annexure Eight: Regional Coastal Policy Assessment Criteria

RCP Assessment Criteria

General Criteria
The general criteria of the RCP that relate to the Proposal are set out in **Table 1**.

Assessment Criteria
Criteria 1 to 14
Criteria 16 to 25

Table 1: General Criteria

Having considered the Proposal against the provisions listed in Table 1 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.1 of the RCP*):

1. The need for the Proposal is discussed within section 1.5 of this AEE. In summary, we are advised that the Proposal is needed to assist the Refinery to retain its competitiveness. Similarly, the broad and more detailed alternatives to the Proposal have been robustly considered by an array of independent and respected environmental and dredging experts before settling on the Proposal. As we have already noted, the outcome of that assessment was that the Proposal is the preferred option when the applicable environmental and 'practicability' considerations are assessed.
2. There is no other deep water commercial port located in the vicinity of the Refinery that could be used in preference to the Proposal to 'satisfy the potential demand' for the fully laden Suezmax vessels being able to unload their cargo at Marsden Point. The Refinery was constructed at its current location for a number of strategic reasons and considerable investment has been made at the site.
3. We note that Mr Greenaway, Mr Reinen-Hamill, Dr Clough, Mr Styles, Dr Clement, Mr Brown Dr Coffey and Mr Don[1], all assess the actual and potential effects on the environment (albeit some, such as Dr Clement, at various places within their reports) and have considered the potential for cumulative effects to arise. None have concluded that the Proposal will result in unacceptable adverse cumulative effects, or effects that are more than minor after they have been offset / mitigated. While the draft CEA states that unacceptable adverse cumulative effects could arise as a consequence of the Proposal, we take comfort from Mr Coffin's advice that the cultural effects of the Proposal (including any cumulative effects) are capable of being appropriately avoided, remedied or mitigated.
4. Where the experts retained to assess the Proposal have raised the need to avoid, remedy or mitigate adverse effects, including cumulative effects, Refining NZ has, in our experience, adopted their recommendations. This leads us to the opinion that all actual or potential effects have been minimised to the extent that a panel of independent experts believe is acceptable.
5. Mr Brown advises that the Proposal will focus development on areas of the outer Whangarei Harbour that are already developed and accommodate activities that are similar to those that will be enabled following the dredging and disposal campaign. This includes the relocation of existing and the construction of new aids to navigation. This, in our opinion, means that the Proposal will not cause sprawling, sporadic or ad hoc development within the Harbour. The Proposal will, however, create mounds of sediment within Bream Bay where none presently exist. The mounds will not, however, we understand, affect

[1] Refer, for example, to Brown, S, pages 55, sections 4.7, "Marsden Point Crude Shipping Project Landscape Assessment". Dated August 2017

navigation, given they are located outside the shipping channel, and are situated in relatively deep water. Further we note that the gentle nature of the side slopes, the expected uniformity and density of the mounds, and the expectation that the sediment disposed of will progressively smooth over time, leads Mr Boyd to the conclusion that proposed disposal activities are unlikely to adversely impact commercial fishing.[2] Furthermore, we understand the advice of Dr Coffey to be that the areas disturbed by the dredge and disposal activities will be recolonised by benthic invertebrates.[3] We note from our experience that discussions are underway with the Regional Council about making disposal sites 1.2 and 3.2 the dedicated locations for future spoil disposal (from dredging that is conducted within the Whangarei Harbour) in the next generation of the Northland Regional Plan.

6. There are no land based requirements associated with the Proposal. Put another way, there are no aspects of the Proposal that occur outside of the CMA and for which resource consents are being sought as part of this RCA. Mr Styles has, however, considered the noise standards that apply on the land adjacent to the areas that will be disturbed. We understand his advice to be that with the mitigation measures Mr Styles has proposed in place, the Proposal will not breach the standards that apply, and that the adjacent communities will not be subject to unreasonable noise as a consequence of the Proposal.[4]

7./18. As we have noted in the discussion of the RCP's objectives, policies and methods, we understand that the Proposal will maintain the level of public access to and along CMA, and improve the safety of vessels entering the Whangarei Harbour.

8. Mr Greenaway addresses the various recreation effects that could be felt as a consequence of the Proposal. He advises that while the Proposal will generate some adverse effects, they will be confined and 'slight'. Given this advice, we are of the opinion that the Proposal will, in the fullness of time, maintain the recreation values that are present within and around the area that could be adversely affected by the Proposal.

9. A key element of the Proposal is a capital dredging campaign and recurrent maintenance dredging campaigns. We understand that the independent experts retained by Refining NZ have confidence in the measures that are proposed to avoid adverse effects and to mitigate or remedy those effects that cannot be avoided. Further, a suite of monitoring is proposed to confirm the type and magnitude of the effects that are predicted, which will include the effectiveness of the remediation and mitigation measures that have been advanced. This mechanism is in addition to the 'real time' turbidity monitoring that, we understand, will enable effects on the significant habitats surrounding the dredged channel to be avoided.

10. The effects that could be felt by those adjacent to and within (in the context of recreation users) the areas that will be disturbed and, indeed, to the Northland Region and New Zealand, have been addressed in section 3.0 of this AEE, and are supplemented by a range of (detailed) technical assessments. We understand the advice of these technical assessment to be that the Proposal will not give rise to unacceptable adverse effects, but will enable the continuation of a range of positive economic effects that are generated by the Refinery.

11. We discuss the considerations that inform natural character in sections 2.0, 3.0 and 5.0 of this AEE, and in our discussions of the natural character objectives, policies and methods of the RCP. In summary, however, we are of the opinion that the advice of Mr Brown, Dr Coffey, Mr Don, Dr Clement and Mr Reinen-Hamill address all of the considerations listed in Assessment Criteria 11. When read together, this body of advice lead us to the opinion that while short term impacts will be felt on aspects of the environment that contribute to the

[2] Boyd, R, page 36, section 4.2.4, "Commercial Fishing in Whangarei Harbour & Bream Bay". Dated 11 August 2017

[3] Refer, for example, to Dr Coffey, B, pages 50, section 5.0, "Crude Shipping Project, Proposal to Deepen and Partially Realign the Approaches to Marsden Point, Assessment of Marine Ecological Effects, Excluding Seabirds and marine Mammals". Dated 10 August 2017

[4] Styles, J, pages 18 & 19, section 8.0, "Whangarei Harbour Entrance and Marsden Point Channel Realignment and Deepening: Assessment of Environmental (Airborne) Noise Effects. Dated 31 July 2017.

natural character of Bream Bay and the Whangarei Harbour, the impacts are not out of keeping with the level of natural character that exists, and do not adversely affect those values requiring specific protection.

12. As we have already noted, Dr Coffey has recommended an enhancement / rehabilitation mechanism for seagrass and shellfish within the environs in and surrounding the Site, to offset the temporary disturbance of the benthic environs. Similarly, Mr Don recommends that nesting boxes be established for Little Blue Penguin. He notes that the boxes will provide a positive benefit for the population of Little Blue Penguin if they are maintained. While both responses are made to address actual or potential effects, we are of the opinion that they accord with the direction that is advanced by Method 12.

13./14. Mr Brown has considered the outstanding landscapes and/or features that are adjacent to the areas that are to be disturbed by the Proposal. We understand his advice to be that they will not be adversely effected by the Proposal.

16. As we noted in our discussion of the RCP's policy framework, the potential for the Proposal to adversely affect significant indigenous vegetation has been considered by Dr Coffey. We understand his advice to be that while there is the potential for such an effect, due to the turbidity created by the dredging and disposal activities that are proposed, a response has been advanced to address this matter. With that measure in place, we understand that Dr Coffey is satisfied that the significant vegetation adjacent to the disturbed areas will not be impacted. As we have also noted, however, Dr Coffey is recommending an ecological compensation package which is likely to enhance the eel grass and wetlands communities that exist in close proximity to the Site. We say 'likely' as the detail of the compensation package is yet to be discussed with stakeholders and Tangata Whenua, and finalised.

17. As with our response to Assessment Criteria 16, we are of the opinion that this matter has been carefully considered. As we have already noted, we understand the advice of Dr Coffey, Mr Don and Dr Clement to be that with the adoption of avoidance measures and responses, the Proposal will not adversely affect any areas of significant indigenous habitat.

19. As we have noted, we understand Dr Clough's advice to be that the Proposal will not affect any known archaeological sites. An accidental discovery protocol is, however, proposed. Such protocols are, in our experience, common place, and are generally accepted as being effective in responding to any unexpected archaeological effects. For the reasons that we have already discussed, we understand (from Mr Coffin) that the actual and potential cultural effects identified within the draft CEA can be appropriately avoided, remedied or mitigated.

20. As we have already discussed, the documentation before us leads us to the opinion that an array of effective and robust remediation and mitigation measures are proposed where an adverse effect cannot practically be avoided.

21. We understand the advice of Mr Reinen-Hamill to be that the Proposal will not worsen any existing natural hazards to a point that is outside of the natural variation that occurs. Further, we also understand Mr Reinen-Hamill's advice to be that the siting of Disposal Area 1.2 should assist in making the Ebb Tide Delta (Mair Bank in particular) more resilient to erosion.

22. We understand the advice of Dr Coffey to be that the water quality will, very quickly following disturbance, revert back to the quality enjoyed by the surrounding environs, thus meaning that the Proposal will ultimately maintain the water quality within the mixing zone. Further, as we have noted, Dr Coffey advises that the Proposal will comply with the water quality standards that are set out within the RCP.

23. As we have noted in our discussion of the objectives and policies of the RCP, the Proposal is focussed on the navigation channels and will, we understand from the information before us, be undertaken in a manner so as to not present a risk to those vessels within or adjacent to the channels. The location of the proposed disposal areas have been sited so as to avoid ski lanes and protected anchorages. Further, we understand the advice of Mr Bermingham

to be that once completed, the Proposal will simplify the navigation for large vessels entering and departing from the Harbour, and will thus reduce the overall navigational risk of these vessels. We understand that this outcome will represent a navigation benefit.

24. We are advised that the Proposal will not require the provision of new berthing or parking facilities. In that regard, it will make use of the existing berthing facilities, and their associated land based infrastructure (Martin, D, pers. com).
25. As we have noted in several places throughout this AEE, particular care has been taken to design the Proposal in such a way that it will not adversely affect the adjacent Motukaroro Island Marine Reserve or, indeed, the other environmental values of particular note. The advice of Dr Coffey addresses the Marine Reserve directly.[5]

Structures (excluding swing & pile moorings) Criteria

The structures criteria of the RCP that relate to the Proposal are set out in **Table 2**.

Assessment Criteria
Criterion 1
Criteria 4 to 13
Criteria 15 & 16

Table 2: Structures Criteria

Having considered the Proposal against the provisions listed in Table 2 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.1 of the RCP*):

1. The proposed aids to navigation are not the first of their type, and thus will not, in our opinion, establish a precedent for such structures within the CMA. We understand Mr Brown's advice to be that the structures proposed will be consistent with the structures that are already present. We reiterate, for completeness, that the new navigation aids and relocated navigation aids will not extend into an area that is zoned M1MA.
4. The proposed aids to navigation are, we understand, important to the safe and efficient operation of the existing commercial port operations at Marsden Point and are expected to contribute to a reduced level of navigation risk for other commercial vessels frequenting Whangarei Harbour.
5. For the reasons that we have already set out, the Proposal is not expected to impede public access to and along the CMA. The proposed aids to navigation are expected to improve the safety for vessels entering the Whangarei Harbour, although we understand that the main benefactors are expected to be the large commercial vessels and not small pleasure craft.
6. The aids to navigation are to be used for one purpose, being to assist with the safe passage of vessels. Multiple use of the structures is not proposed, although there is nothing to prevent a third party approaching Refining NZ with a proposal to use the structures for a different, complementary, purpose. We reiterate our previous understanding the aids to navigation will be used, to some extent, by navigators that are operating in the vicinity of the Site.
7. The channel is currently by commercial vessels that access the jetty and port facilities associated with the Refinery, Northport, Portland Cement, and the upper harbour (including the Town Basin). Our experience with this project leads us to the opinion that the placement of the proposed aids to navigation have been the subject of a careful and robust selection

[5] Refer, for example, to Dr Coffey, B, pages 51 to 52, section 5.2, "Crude Shipping Project. Proposal to Deepen and Partially Realign the Approaches to Marsden Point. Assessment of Marine Ecological Effects Excluding Seabirds and Marine Mammals". Dated 10 August 2017

process that sought to avoid the sensitive habitats and species that abut the channel, while ensuring the safety of those transiting to and from the Whangarei Harbour. Refining NZ has also sought to minimise the impact of these structures on the adjacent residents, principally by commissioning respected experts in a number of fields to prepare a range of technical assessments, and by following their advice and recommendations (Martin, D, pers. com).

8./9. The size and location of the proposed navigation aids are, we understand, appropriate to their function, and the environment in which they will operate. This is evidenced by the body of the advice that addresses the aids to navigation, and their construction. In that regard, we understand this advice to be that the construction and operation of the navigation aids either will not, or can be managed to ensure that no unacceptable adverse are generated.

10. None of the proposed aids to navigation will be constructed within, or relocated within an area of the CMA that is zoned M5MA. As we have noted, we understand Mr Brown's advice to be that the visual and landscape effects of the proposed aids to navigation will be avoided, or kept to a very low level.

11. Mr Greenaway's advice is that the adverse recreation effects of the Proposal, including (we understand from the navigation aids, are confined and 'slight'. This suggests, in our opinion, that the that the relocation / construction / operation of the aids to navigation will not compromise the recreational use of the CMA.

12./13. Mr Reinen-Hamill has assessed the areas that will accommodate the relocated / new aids to navigation and advises that, in the context of the dynamic coastal environment, the navigation aids will not, by themselves or in tandem with the dredging and disposal activities, create unacceptable erosion or sedimentation.

15. Mr Reinen-Hamill has also considered the implications of sea-level rise for the Proposal. We understand his advice to be that, given the nature of the navigation aids, sea-level rise will have no / extremely limited implications for the location of the proposed structures, or the structures themselves.

16. We understand the advice of the various experts to be that the relocation of the existing aids to navigation will have no adverse environmental effects beyond those that are already felt by the environment (as a consequence of their existence and operation).

<u>Discharges to Coastal Waters Criteria</u>

The discharges criteria of the RCP that relate to the Proposal are set out in **Table 3**.

Assessment Criteria
Criteria 1 to 5
Criteria 7 & 8

Table 3: Discharges Criteria

Having considered the Proposal against the provisions listed in Table 3 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.3 of the RCP*):

1. The advice before us is that the various discharges from the Proposal will occur in close proximity to, and within areas known to be of recreational, ecological and cultural importance. Given, however, the substrate that is being discharged (which has been found to be clean sand with limited 'fines' and contamination), the only effect of particular note is the potential for elevated turbidity plumes. Such a potential has been limited by the Refining NZ agreeing to accept the advice of Dr Coffey to propose turbidity limits, which will result in investigations and operational changes being undertaken if the limits are exceeded. With these measures in place we understand the evidence of Dr Coffey and Mr Greenaway to be that the most notable ecological and recreation values will not be impacted, while the values

of lesser importance will not experience adverse effects that are classified as more than moderate. Equally, we understand the advice of Mr Coffin to be that these measures are an appropriate response to the cultural effects that could arise, but that they should be supplemented by additional avoidance, remediation and mitigation measures that are developed in consultation with Tangata Whenua.

2. The sampling and analysis conducted by Bioresearches Limited, Tonkin and Taylor Limited and Kerr & Associated Limited has lead Dr Coffey to advise that the sediment to be dredged does not contain more than trace levels of contaminants, and that there are no substances that could bio-accumulate to levels that are of concern. Consequently, Dr Coffey, Dr Clements and Mr Don do not, we understand, expect that the discharges will pose any threat to the health of humans or the aquatic life that is apparent.
3. For the reasons set out in section 3.0 of this AEE, and in our discussion of the RCP's objectives, policies, methods and Assessment Criterion 1, the discharges proposed, while creating temporarily heightened turbidity levels, are not expected to generate unacceptable, or lasting, water quality effects.
4. Refining NZ has considered potential alternatives to dredging the existing channel. However, none of those high-level alternatives are feasible, or offer additional environmental benefits over the current proposal. As we discussed in relation to s.105 of the Act, all types of dredging will generate discharges to the water column. While that cannot be avoided, we are advised (Martin, D, pers. com) that Refining NZ has agreed to take necessary operational steps to ensure than any dredge type meets the turbidity controls recommended by Dr Coffey. Put another way, while we understand that a discharge to the water column cannot be prevented, Refining NZ is committed to minimising the turbidity levels to a point that experts have deemed to be environmentally acceptable. This is via 'real time' monitoring at or near the boundary to sensitive receiving environments, and operational response mechanisms according to agreed threshold values. In this instance, that is levels that will not adversely affect the values of particular importance in and around the areas to be disturbed, and will cause no more than moderate effects everywhere else.

   Refining NZ has confirmed that it will discharge up to 97.5% of the sediment dredged (in both the capital and maintenance dredge events) to the land if there is the practicable (that is, cost effective) demand and the necessary resource consents (and other authorisations) in place to enable such a discharge. Should this occur, the discharges associated with the disposal activities will be reduced. Should the discharge of the dredged sediment to land not eventuate, the discharges associated with the disposal operations will be to prescribed sites that a number of experts have, we understand, concluded are appropriate for this purpose.

   The foregoing leads us to the conclusion that the discharges to the CMA have been carefully considered, as have the values of the potential receiving environments, and that it is the most practicable options that are being advanced.
5. As we have previously recorded, Dr Coffey's advice is that the Proposal can be advanced in a manner that achieves the water quality standards set by the RCP.
7. Refining NZ is proposing use of modern dredgers utilising current best practice. It is also proposing 'real time' monitoring of, and response to, turbidity levels. Beyond this, there is no demonstrated need to (and no practicable means by which Refining NZ can) aid mixing of the turbidity plume.
8. We understand the advice of Mr Reinen-Hamill to be that the discharges associated with the Proposal will not cause scouring of the seabed and/or foreshore.

Taking, Use & Diversion of Water Criteria

The taking, use and diversion of water criteria of the RCP that relate to the Proposal are set out in **Table 4**.

Assessment Criteria
Criteria 1 & 2

Table 4: Taking, Use & Diversion of Water Criteria

Having considered the Proposal against the provisions listed in Table 4 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.4 of the RCP*):

1. No structures, aside from the dredging vessels themselves are associated with the taking of the coastal waters that is proposed.
2. We understand that the quantum of the water that is to be abstracted with the dredged sediment will be negligible in the context of the Whangarei Harbour and is not expected to alter water levels or quality to a measurable extent. We also understand that the water taken will not always be 'lost' to the CMA. In this regard, a portion would be returned to the CMA either during the dredging itself, or when the dredged sediment is disposed to sites 1.2 and/or 3.2. Should disposal occur to land, the water (or the vast majority of it) could be lost to evaporation or ground infiltration, or filter back into the CMA. Should the disposal occur to a reclamation, the water is likely to return to the CMA via the decanting / settlement measures

Dredging & Dredging Spoil Disposal Criteria

The dredging and dredging spoil disposal criteria of the RCP that relate to the Proposal are set out in **Table 5**.

Assessment Criteria
Criteria 1 to 15

Table 5: Dredging & Dredging Spoil Disposal Criteria

Having considered the Proposal against the provisions listed in Table 5 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.5 of the RCP*):

1. The choice of dredges to be used in the various parts of the project has, in our experience with the project, been carefully considered as part of the assessment of alternative investigations completed by Tonkin and Taylor Limited. The assessment advises that all three types of dredges (TSHD, CSD and BHD) could be employed to undertake the dredging and disposal works that are proposed, provided they did not exceed key environmental thresholds (such as noise emissions and turbidity levels). This ultimately enables Refining NZ to make the 'dredging type' (or 'types' – if more than one type of dredge is to be used) decision based on economic drivers, with one possible exception. The possible exception is in the berth pocket, where the proximity to the jetty may necessitate the use of a BHD.

2./4. Both capital and maintenance dredging is proposed. We understand that while the modelling predicts that maintenance dredging will be needed in the 35-year resource consent term that is sought, such dredging will only be conducted if the actual accumulation of sediments in the channel warrants it. Given the degree of uncertainty associated with the frequency and quantity of maintenance dredging, we understand that all of the technical assessments have been advanced on the basis that there will be periodic (every two to five years in the inner (harbour) areas and five to 20 years in the outer areas) maintenance dredging, and that the dredged sediment will be deposited in one or both of the offshore disposal sites, to land or a combination of all three of these options.

3. Section 1.0 of the AEE sets out the volumes to be dredged. In summary, approximately 3.7Mm^3 will be dredged in the capital dredging campaign, while up to 4.3Mm^3 could be dredged for maintenance reasons over the life of the resource consent that is sought from the Northland Regional Council. [6]

5. We understand that all of the technical investigations commissioned by Refining NZ to assess the environmental effects of the Proposal have considered the impact of the maintenance dredging that is proposed. As we have already noted, this includes the possibility that such dredging may occur at relatively regular intervals over the life of the resource consent that is being sought. None of the technical assessments highlight any unacceptable adverse effects with such a regime of dredging. A number of the independent experts have recommended monitoring at various stages of the Proposal, with some recommending monitoring associated with each maintenance dredging campaign. The basis for such monitoring is, we understand, to ensure that the effects associated with the dredging do not exceed those levels predicted by the independent experts. Should an unexpected effect arise, or should the magnitude of the effects be greater in magnitude than is predicted, we expect that the conditions of consent would be reviewed, and all future maintenance dredging activities modified to prevent the reoccurrence of such an outcome.

6. As we have noted in section 3.0 of this AEE, in our discussion of the objectives, polices, methods, and indeed in the discussion of the preceding assessment criteria, we understand that the only discharge to water that is associated with the Proposal and that needs to be managed is the discharge of suspended sediment. That discharge will cause turbidity plumes that could have consequential impacts on flora and fauna. The proposed regime of thresholds, investigations and operational modifications is, however, designed so that this potential is managed and as such will align with the direction advanced by superior planning instruments, such as the NZCPS 2010. The emission of noise from the operation of the dredge is addressed by Mr Styles. As we have previously discussed, operational controls and a noise management plan are the mechanisms proposed to ensure that noise arising from the Proposal do no exceed levels that Mr Styles advises are reasonable.

7. We note that Dr Coffey has considered the potential for the dredging proposed to stimulate, or worsen algal blooms. His advice is that the prospect of this occurring as a consequence of the proposal is low, given the clean nature of the sand that is being dredged. He also advises that any adverse effects of this nature will be negligible and will not impact on the significant ecological areas.[7]

8./9. As we have already noted, Mr Reinen-Hamill has considered the potential for the Proposal to impact on the geomorphology of Whangarei Harbour and Bream Bay. As we have noted in our earlier discussion of the applicable objectives, policies and methods and in section 5.0 of this AEE, we understand his advice to be that no notable changes are expected in relation to the natural sediment and water movement patterns (including in the long term) and no unacceptable adverse effects are anticipated. He recommends recurrent (annual) bathymetric monitoring to ensure that this is the case, and to enable the consent holder to take action (at, we suspect, the direction of the Northland Regional Council) if it is not confirmed and/or to determine what quantities of sediment should be placed at Site 1.2 during the maintenance dredging campaigns. Indeed, Mr Reinen-Hamill advises that the disposal of additional sediment to Disposal Site 1.2 will improve the resilience of Mair Bank to sea level rise.

[6] Being the upper bound of sediment accumulation estimated by Tonkin and Taylor Limited (122,000m^3 x the 35-year term of the consent that is sought)

[7] Dr Coffey, B, pages 51 to 52, section 5.2, "Crude Shipping Project. Proposal to Deepen and Partially Realign the Approaches to Marsden Point. Assessment of Marine Ecological Effects Excluding Seabirds and Marine Mammals". Dated 10 August 2017

10. We do not repeat the discussion of the alternatives assessment that has been conducted (in section 1.0 of this AEE), and the rationale behind the disposal of up to 97.5% of the capital and maintenance dredged spoil to land, with at least 2.5% being placed at Disposal Site 1.2. Suffice to say, however, that we understand the advice before us to be that the proposed disposal regime is environmentally acceptable and is considered to be a practicable alternative to the complete sea based disposal.
11. Mr Reinen-Hamill has advised that Disposal sites 1.2 and 3.2 have been designed and sized to accommodate all of the dredging spoil that is anticipated in Refining NZ's proposal (that is, from the proposed capital and recurrent maintenance dredging campaigns).[8] Furthermore, we understand that the assessment of effects conducted for the Proposal and summarised in this AEE assumes that all of the dredged spoil will be placed within these locations and has not identified any unacceptable environmental effects as a result.
12. Tonkin and Taylor Limited have summarised the characteristics of the dredged spoil against the characteristics of the two proposed disposal sites. We understand the disposal sites have been carefully selected so that, among other reasons, the sediment disposed of would be similar in its particle size, chemical composition and make up to the sediment existing in disposal sites 1.2 and 3.2.[9]
13. Of the considerations listed in Criterion 13, the potential for ecological disturbance, contaminant dispersal and heighted turbidity are relevant to the Proposal. As we have noted previously, all of these considerations are addressed in the reports of Dr Coffey, Mr Don and Dr Clement, are summarised in section 3.0 of this AEE, and have been discussed in light of the policy framework set out by the RCP. We do not repeat that analysis, other than to say that we interpret the advice to be that the significant ecological values will not be affected, and the other ecological effects that are will experience are at worst, moderate effects, and restricted to a relatively limited period of time. We note that the majority of these effects are expected to be minor or less).

14./15. While dredging is proposed within the M5MA and M2MA zones, disposal is limited to two M2MA zoned areas in the northern extent of Bream Bay, and/or to land (should the 'receivers' of the sediment have the necessary resource consents in place).

Port Areas Criteria

The port areas criteria of the RCP that relate to the Proposal are set out in **Table 6**.

Assessment Criteria
Criterion 1
Criteria 3 to 6
Criterion 9

Table 6: Port Areas Criteria

Having considered the Proposal against the provisions listed in Table 6 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.9 of the RCP*):

1. The advice to us is that the Proposal is required to enable the efficient operation of the Refinery and is also expected to contribute to its long-term competitiveness. While Suezmax vessels cannot presently enter the Whangarei Harbour fully laden, they can (and do) visit the Refinery. This is, in our opinion, inefficient and could, we understand, threaten

[8] Reinen-Hamill, R, pages 5 & 6, section 2.2, "Crude Shipping Project, Dredging & Disposal Options - Synthesis Report". Dated July 2017

[9] Reinen-Hamill, R, pages 7 to 9, section 3.0, "Crude Shipping Project, Dredging & Disposal Options - Synthesis Report". Dated July 2017

the continued existence and operation of the Refinery if it is not resolved in the manner anticipated by the applications that this AEE supports.

3. Refining NZ is not asking, as a consequence of this Proposal, for the right to exclusively occupy any more of the CMA than it presently does for its existing jetty and associated structures. These are longstanding and legally authorised. The space that will be occupied by the five new aids to navigation is, in the context of the Site, extremely small.
4. For the reasons that we have already set out in section 5.7.1.2 of this AEE and in our discussions of the planning framework, we understand that the Proposal will not alter the access that the public has to and along the CMA. Similarly, we understand the advice of Mr Greenaway[10] and Mr Dickinson (Dickinson, P, pers. com) to be that the proposed dredging is unlikely to totally restrict commercial vessels from entering the Harbour (Mr Dickinson advises that some restrictions are a feature of most dredging exercises). Given their size, Mr Dickinson also notes that it would be normal for recreational vessels to be unaffected while the dredging operation is underway. Put another way, the advice before us is that third parties may be subject to some temporary additional navigational requirements while dredging operations are being carried out, however we understand the advice of Mr Dickinson to be that this is common practice within an entrance to a Harbour that supports a port (or, as is the case here, ports).
5. Based upon the information that is before us, most particularly the advice that the Proposal is needed to enable the on-going competitiveness of the Refinery and that is will not result in notable changes to the jetty infrastructure that is already in place, we are of the opinion that the dredging proposed is in keeping with the purpose, scale and character of the existing access channel and turning basin. Further, as we have noted, the advice before us is that both the changes to the existing aids to navigation and the new aids to navigation will accord with the environs in which they will be located.
6. We are advised that the Refinery's existing jetty and associated loading and unloading facilities are able to service Suezmax vessels, and the larger loads that are anticipated (Martin, D, pers. com). No additional services are needed to enable the Refinery to service the more fully laden tankers.
9. We are also advised that the naturally deep entrance to the Whangarei Harbour was one of the factors behind its initial selection as a suitable site for the Refinery (Martin, D, pers. com). While further capital dredging is now required to cater for fully laden Suezmax vessels, the amount of capital dredging is limited, relative to other dredging campaigns that we are aware of in New Zealand. The relatively small scale of the Proposal is, we understand, due to the suitability of the Harbour entrance for port related activities, and in part due to the efforts of the Refining NZ to keep the dredging footprint to the minimum possible size, while designing the new channel to ensure that safe passage is provided.

Sand, Shingle & Mineral Extraction Criteria

The sand, shingle and mineral extraction criteria of the RCP that relate to the Proposal are set out in **Table 7**.

Assessment Criteria
Criteria 1 to 2
Criteria 8 to 10

Table 7: Sand, Shingle & Mineral Extraction Criteria

[10] Greenaway, R, page 59, Section 5.2.7, "Refining NZ Crude Shipping Project, Recreation and Tourism Effects Assessment". Dated August 2017

Having considered the Proposal against the provisions listed in Table 7 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 32.2.10 of the RCP*):

1./2. Advice to us is that there is no confirmed demand for the sediment that is to be extracted as part of the Proposal (Martin, D, pers. com). While Refining NZ advise that there are possible locations for the sediment (such as to beach nourishment and/or to a possible Northport reclamation for its proposed Berth 4), much seems to hinge on the timing and cost of the sediment, which cannot be determined until resource consents are granted to Refining NZ, and better cost estimates and timing indications can be determined. We understand it is for this reason that Refining NZ is seeking the resource consents necessary to dispose up to 100% of the capital and maintenance dredge spoil to two locations within the CMA. To provide some flexibility for Refining NZ, up to 97.5% of the capital and maintenance dredging campaigns may be disposed of to land, where the necessary authorisations are in place for this to occur.

5./8. The assessment of the actual and potential environmental effects of the proposed dredging activity considered the environmental impact of sediment being removed from the active near shore environment. Further detail on this matter is provided by Mr Reinen-Hamill in his technical assessment. As we have noted previously, we understand the outcome of the investigations to be that the Proposal will not cause erosion or accretion that is outside of the natural range of variation, and will ultimately, via the proposed disposal of some of the sediment at site 1.2, improve the resilience of the Mair Bank to the effects of sea level rise.

6./10. We have set out the environmental baseline that applies in section 2.0 of this AEE, and have noted the values that various experts deemed to be significant. We have also, in section 3.0, set out the magnitude of the environmental effects that we expect the Proposal to cause, and highlight the measures that have been taken to avoid, remedy or mitigate those effects. As we have also already noted, where avoidance, remediation and mitigation measures are proposed, we understand that the independent experts are of the opinion that they are robust and expect them to be effective. Several monitoring programmes are also proposed to, amongst other things, ensure that the magnitude of the effects realised aligns with what has been predicted.

7. As we have noted, the advice of Mr Boyd is that the Proposal will not affect the nearest marine farming activity (which is located in Parua Bay).

9. We have previously signalled (refer to section 3.7.1 and 3.8.6 of this AEE and in our discussion of the policy framework that applies within the RCP) our understanding is that the proposed dredging activities will create turbidity plumes and disturb areas of the seabed, the environmental effects of which are expected to be, at worst, moderate and at best (and in relation to the ecologically significant species and habitats) are avoided.

Duration of Permits Criteria

The duration of permits criteria of the RCP that relate to the Proposal are set out in **Table 8**.

Assessment Criteria
Criteria (a) to (f)

Table 8: Duration of Permits Criteria

Having considered the Proposal against the provisions listed in Table 8 we are of the opinion that the 35-year consent duration (and 25-year duration with regards the aids to navigation) sought by Refining NZ is appropriate. We now set out a concise discussion of the relevant matters that are highlighted in the criteria set out in sub-section 33.6 of the RCP (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-section 33.6*):

(a). The proposed dredging and disposal of sediment can occur in a manner that Mr Reinen-Hamill advises will not cause notable changes to the geomorphological systems and processes that are apparent within both Whangarei Harbour or Bream Bay. In a similar vein, we understand his advice to be that no unacceptable adverse effects are expected, while the use of Disposal Site 1.2 is expected to retain material within the system and improve the resilience of Mair Bank to sea level rise. We take these conclusions to mean that the Proposal can occur in a manner that is sustainable, both in terms of the resource that is being exploited, and its 'environmental footprint'.

(b). Refining NZ has gathered a comprehensive and robust suite of data to show what, in an environmental context, exists, and how it could be affected by the Proposal. In saying that, we understand that the data set will require some additional, targeted, environmental baseline work immediately prior to the commencement of the Proposal in order to address issues such as seasonal variability. That is not, however, to say that the level of certainty associated with the baseline and the effects assessment warrant a short(er) term being imposed. To the contrary, a large team of qualified and experienced independent experts have been assembled to ensure that the data base is robust and is sufficient for an equally robust assessment of the environmental effects to be completed. There have also been a number of 'case studies' in New Zealand where dredging and disposal activities of a similar (if not larger) scale to that proposed by Refining NZ has occurred. Indeed, the creation of the Northport facility via reclamation in close proximity to the Refinery is, in our opinion, a notable case in point. Other examples include the dredging and disposal activity that was relatively recently completed in the ports of Tauranga, Otago and Lyttelton. We are of the opinion that these activities mean that the actual and potential effects likely to arise as a consequence of dredging and disposal activities are well known in the New Zealand context, although how the effects manifest are determined by the specifics of each proposal and the environmental baseline that applies.

(c). A regime of monitoring is proposed, drawing on the recommendations of the experts that have been retained to assess the environmental effects of the Proposal. This monitoring includes some targeted pre-capital dredging and disposal works, monitoring during the capital dredging and disposal activities, and then monitoring post the same. We understand that where needed, further rounds of monitoring will be undertaken in association with the maintenance dredging exercises. We expect this work to supplement the data that has already been gathered.

(d). As we noted in section 5.0 of the AEE, the planning process has commenced to replace the RCP. Refining NZ has provided comments on a draft version of the second-generation regional plan, a key focus being the need for the new version of RCP to reflect the Proposal. A proposed regional plan, which will incorporate the matters now regulated by the RCP, is expected to be publicly notified in September of 2017. Refining NZ expects to continue to work with the Council, and indeed, the other submitters to the proposed regional plan over its development. While the draft plan currently has no legal weight, it is worth noting that the Company is seeking alignment between the proposed regional plan and the Proposal.

(e). The only structures for which resource consent is being sought by Refining NZ as part of this Proposal are the aids to navigation. While we understand that they will require regular maintenance, they are expected to last the 25-years that Refining NZ seeks for this RCA. The advice to us is that the maintenance of the aids to navigation will be undertaken, in practice, by either Northport or the Harbour Master (Martin, D, pers. com).

(f). Should the Council want to be able to undertake a comprehensive 'review' of all of the relevant consents, it can do this via section 128 of the Act. Consequently, this is not a matter that should, in our opinion, influence the term of any resource consent granted to Refining

NZ. It may, however, be a matter that the Council wishes to consider when assessing the frequency of reviews that may be undertaken under section 128 of the Act.

Crown Rents & Royalties, Financial Contribution Criteria
The rents, royalties and financial contributions criteria of the RCP that relate to the Proposal are set out in **Table 9**.

Assessment Criteria
The criteria embodied within sub-section 34.1.2
The 'circumstances' set out in 34.2.1
Criteria (a) to (g)

Table 9: Crown Rents & Royalties, & Financial Contributions Criteria

Having considered the Proposal against the provisions listed in Table 9 we note that (*please note that the numbers that follow correspond with the assessment criteria numbers used in sub-sections 34.1.2, 34.2.1 and 34.2.2 of the RCP*):

Royalty. Refining NZ has confirmed that should it look to dispose of the dredged sediment to land, and where it expects to receive payment from a third party for the sediment, it will engage with the Council to ascertain whether a royalty is to be paid, and the quantum of any royalty. Once it is armed with the Council's position, Refining NZ will then assess whether it wishes to proceed with land disposal, or to rather dispose of the sediment to sites 1.2 and 3.2 in the CMA. Where it decides to proceed with land based disposal, it will pay the royalty in accordance with its agreement with the Council (Martin, D, pers. com).

34.2.1. Having taken advice from a panel of independent experts, and following its engagement with Tangata Whenua, stakeholders, the Council and the general public, Refining NZ has chosen to advance direct avoidance, remediation, mitigation or compensation measures where they are needed, with one key exception; being the possibility of a fund being established to assist with ecological rehabilitation enhancement initiatives within or in close proximity to the Site.

The Whangarei Harbour enhancement / rehabilitation initiative, which will be $150,000.00 for the capital dredging campaign, fits, in our opinion, within the parameters of circumstance 34.2.1(j).

34.2.2(a)./(b). As we have already noted in our response to the policy framework and other assessment criteria of the RCP, Refining NZ's approach to the environmental effects associated with the Proposal has been, in our experience, to seek avoidance first, and where that is not practicable, remediation or mitigation. Where this is not possible, it is proposing, on the recommendation of Dr Coffey, a restoration / enhancement initiative which could, as one alternative, see it providing $150,000.00 (comprising three $50,000.00 contributions) to improve the overall health of the Harbour. Should this occur, the advice to Refining NZ is that such a contribution would appropriately compensate for the temporary loss of benthic fauna that the Proposal will cause.

(c). We are of the opinion that the contribution discussed in relation to criteria (a) and (b) should not be viewed in isolation from the broader approach to addressing the actual and potential effects of the Proposal. When this possible contribution is considered alongside the other avoidance, remediation and mitigation measures that are proposed by Refining NZ, it results, in our opinion, in a Proposal that is consistent with the broad direction that is advanced by the planning framework of the RCP.

(d)./(e). As we have already noted, advice was taken from Dr Coffey as to the quantum of the contribution. In doing so, we are advised that Refining NZ has been mindful of the criteria set out in (d)(i) to (iv). Having followed this process, Refining NZ is of the opinion that the size of the proposed contributions are reasonable and proportionate to the environmental effects that they are addressing (Martin, D, pers. com).

(f)./(g). For the reasons we have set out in our responses to criteria (a) to (e), we are of the opinion that the contributions proposed by Refining NZ are appropriate to the circumstance and have a good chance of being effective in ensuring that any effects that are not capable of avoidance or direct remediation/mitigation are none-the-less addressed to the point that they are acceptable. We are also of the opinion that the quantum for the two contributions are appropriate, given the process that is associated with their establishment.

Annexure Nine: The Regional Coastal Plan for Northland June 2004 Cited Provisions.

Table 1 below lists the Regional Coastal Plan for Northland (June 2004) cited Objectives. **Table 2** lists the cited Policies and **Table 3** lists the cited Methods.

Objective	Description
6.3	The development of an integrated coastal resource management regime which recognises areas of drifting levels of subdivision, use, development and conservation value.
7.3	The preservation of the natural character of Northland's coastal marine area, and the protection of it from inappropriate subdivision, use and development.
8.3	The identification, and protection from inappropriate subdivision, use and development of outstanding natural features and landscapes which are wholly or partially within the Northland's coastal marine area.
9.1.3A	The protection of areas of significant indigenous vegetation within Northland's coastal marine areas from the adverse effects of subdivision, use and development.
9.2.3	The protection of significant habitats of indigenous fauna within Northland's coastal marine area.
10.3.1	The maintenance and enhancement of public access to and along Northland's coastal marine area except were restriction on that access is necessary.
11.3	The management of the natural and physical resources within Northland's coastal marine area in a manner that recognises and respects the traditional and cultural relationships of tangata whenua with the coast
12.3.1	The potential for activities within the coastal marine area to adversely affect heritage values of sites, buildings, places or areas of adjoining land.
12.3.2	The recognition and protection of sites, buildings and other structures, places or areas of cultural heritage value that exist adjacent to the coastal marine area and may be adversely affected by use and development of the coastal marine area.
13.3	The maintenance, and where practicable, enhancement of water quality within Northland's coastal marine area.
15.3.1	Promote, by appropriate submissions to district plans and resource consent applications, the maintenance and enhancement of coastal water quality at or to a level consistent with the purpose for which the coastal water is being managed.
15.3.2	The avoidance, remediation, or mitigation of the adverse effects of subdivision, use and development on the exacerbation of natural hazards in the coastal marine area.
16.3	Provision for recreational uses of the coastal marine area while avoiding, remedying, and mitigating the adverse effects of recreational activities on other users and the environment.
17.3	The provision for appropriate structures within the coastal marine area while avoiding, remedying or mitigating the adverse effects of such structures.
19.3	The avoidance of the effects of discharges of contaminants to Northland's coastal water and the remediation or mitigation of any adverse effects of those discharges of contaminants to coastal waters, which are unavoidable.
21.3	The avoidance, remediation or mitigation of the adverse effects of taking, use, damming or diversion of water in the coastal marine area.
22.3	Provision for capital and maintenance dredging that is needed for the establishment and operation of appropriate facilities in the coastal marine area (such as Marinas and Ports), while avoiding, remedying, or mitigating the adverse effects of such dredging and any associated spoil disposal in the coastal marine area.

23.3	Provision for the extraction of sand, shingle, shell, or other natural material while avoiding, remedying or mitigating any adverse effects of such activity on the coastal marine area.
25.3.1	The protection of the important conservation values identified within Marine 1 (Protection) Management Areas including their ecological, cultural, historic, scientific, scenic, landscape and amenity values.
26.3.1	Subdivision, use and development occurring in such a way as to maintain, and where practicable, enhance, the existing natural, cultural and amenity values in the Marine 2 (Conservation) Management Area.
26.3.2	Involvement of local communities, and other agencies, in the awareness, maintenance and, where appropriate, enhancement of the values within the Marine 2 (Conservation) Management Area
29.3.1	Provision for commercial port operations while avoiding, remedying or mitigating the adverse effects of such operations on the coastal marine area.
35.2	The integration of resource management under the Resource Management Act and fisheries legislation so as to assist in the sustainable management of coastal fisheries and fisheries habitats.

Table 1: Regional Coastal Plan for Northland (June 2004) cited Objectives

Policy	Description
6.4.1	To define areas, within Northlands coastal marine area, which are considered to have important conservation value as Marine 1 (Protection) Management Areas and manage them in such a manner that the conservation values of the individual areas protected **Explanation:** *Within the context of sustainable management, it is important to recognise and protect areas of important conservation value.*
6.4.2	To define all parts of the coastal marine area which are not either Marine 1 (Protection), Marine 3 (Marine Farming), Marine 4 (Mooring), Marine 5 (Port Facilities) or Marine 6 (Wharves) Management Areas as Marine 2 (Conservation) Management Areas and without precluding the provision for appropriate subdivision, use ad development to manage those remaining areas in such a way as to protect, and where practicable, enhance natural, cultural and amenity values. **Explanation:** *In general, Northland's coast has high natural character and amenity value. It also has significant cultural value. The creation of Marine 2 (Conservation) Management Area allows these characteristics to be recognised and an appropriate level of restraint applied to the use and development of natural and physical resources within it, while also recognising that this management area is one where new uses and developments may be accommodated.*
6.4.5	To define areas being managed primarily for port-related purposes as Marine 5 (Port Facilities) Management Areas as a means for providing for the continuation of such activity, where appropriate and of facilitating the management of any adverse environmental effects associated with wharves, jetties or other structures used commercially for loading or unloading goods or passengers. More specifically a "port area" is: A harbour areas where marine terminal facilities such as jetties and wharves are provided at which commercial ships of 4500 Dead Weight Tonnes (DWT), or greater, regularly berth to load and unload cargo or passengers. Such areas can also include ship construction and/or maintenance activity, barging operation and any related structures.

	Port areas which currently meet these criteria are Port Whangarei, Portland and Marsden Point. **Explanation:** *The definition of the three types of areas will allow the Plan to reflect the major existing uses of Northland's coastal marine area which require exclusive occupation of coastal space. This is intended to establish a benchmark against which future expansion of these uses and developments can be measured.*
7.4.1	In assessing the actual and potential effects of an activity to recognise that all parts of Northland's coastal marine area have some degree of natural character which requires protection from inappropriate subdivision, use and development. **Explanation:** *Section 6(a) of the Act is not restricted to unmodified areas. While modified areas may have lost a portion of their natural character, that which remains defines the environmental quality of the area, provides its life-supporting capacity, and contributes to a fuller human experience of the coast.*
7.4.2	As far as reasonably practicable to avoid the adverse environmental effects including cumulative effects of subdivision, use and development on those qualities which collectively make up the natural character of the coastal marine area including: a. Natural water and sediment movement patterns; b. Landscapes and associated natural features; c. Indigenous vegetation and the habitats of indigenous fauna; d. Water quality; e. Cultural heritage values, including historic places and sites of special significance to Maori; f. Air quality And where avoidance is not practicable, to mitigate adverse effects and provide for remedying those effects and provide for remedying those effects to the extent practicable. **Explanation:** *Uses and development are appropriate within Northland's coastal marine area because of the actual or potential effects on natural character.* *The difficulty in defining natural character means that in practice, to effectively protect it from inappropriate subdivision, use and development requires consideration of each of the individual elements which go toward defining it in any particular area.*
7.4.3	*Within Marine 1 and Marine 2 Management Areas and the rules that apply to each of those, identify what subdivision, uses and developments may be appropriate taking into consideration the actual or potential effects on the natural character as required by, amongst others, Policy 1.1.1 of the New Zealand Costal Policy Statement.* **Explanation:** *As explained in section 5.4, because of our general lack of understanding of ecology processes within the coastal marine area, the identification of discrete Marine Management Areas is essential part of the approach to subdivision, use and development taken in this Plan and is required to ensure that natural character is preserved and the life-supporting capacity of the coast safeguard.*

7.4.4	Subject to Policies 1 and 2 above, through the use of rules in the Plan, to provide for appropriate subdivision, use and development in areas where natural character has already been compromised, including within Marine 3, Marine 4, Marine 5, and Marine 6 Management Areas. **Explanation:** *Notwithstanding the general need to protect the coastal marine area, there is obviously a need to provide for appropriate existing subdivision, use and development so that people and communities are able to provide for their social, economic, and cultural well-being and, for that reason, development is provided for in the Marine 3, Marine 4, Marine 5, and marine 6 Management Areas. For the purposes of this Plan, it is considered better that, subdivision use and development is consolidated rather than expanding into new areas where the adverse effects are uncertain or unknown.*
7.4.6	To promote an integrated approach to the preservation of the natural character of Northland's coastal environment as a whole. **Explanation:** *The natural character of a specific coastal area is generally comprised of elements both on land and within the coastal marine area. Therefore, to preserve the natural character of the coast there is a need to integrate management of the coastal marine area with coastal land management.*
7.4.7	To promote, where appropriate, the restoration and rehabilitation of the natural character of the coastal marine area where it has been significantly degraded. **Explanation:** *There may be situations where it is appropriate to identify the restoration or rehabilitation of the natural character as a remediation measure or to support community initiatives seeking to improve areas that are considered to be significantly degraded.*
8.4.1	To recognise and provide for the protection from inappropriate subdivision, use and development of outstanding landscape values, such as those identified in the landscape assessment studies that have been commissioned by a district councils of the Northland region of the following areas: • Cape Maria van Diemen/Cape Reinga/ North Cape. • Kokota sandspit, Parengarenga Harbour entrance • Matai Bay, Cape Karikari • Whangaroa Harbour entrance including Pekapeka Bay • The Cavalli Islands • The islands of the outer Bay of Islands • The Cape Brett peninsula including Motukokako (Piercy) Island • Bream Head and Mount Manaia • The Poor Knights Islands • Ngunguru Sandspit • The Hen and Chickens Islands • Mangawhai Sandspit • Whangape Harbour entrance • Hokianga Heads • Maunganui Bluff • North Head, Kaipara Harbour entrance **Explanation:** *To effectively protect outstanding landscapes, these need to be individually identified, The landscapes values of the listed areas are considered outstanding.*

8.4.2	To recognise and provide for the protection from the inappropriate subdivision, use and development of landforms and/or geological features of international, national or regional importance which are wholly or partially within Northland's coastal marine area. **Explanation:** *As with the landscapes, to effectively protect outstanding natural features these need to be individually identified. The New Zealand Geological Society has identified features within Northland which are international, national or regional significance. For the purposes of this Plan, features within these categories are considered outstanding.*
8.4.3	To identify and protect from inappropriate subdivision, use and development any other regionally outstanding features and landscaped within Northland's coastal marine area in a co-ordinated and consistent manner. **Explanation:** *While some outstanding landscapes and natural features are known, there is much of the coastal marine area, particularly the subtidal area, which has yet to be investigated. Provision therefore needs to be made to allow these to be identified and appropriately dealt with.*
8.4.4	To promote the identification and protection of outstanding natural features and landscapes immediately adjacent to Northland's coastal marine area in a co-ordinated and consistent manner. **Explanation:** *As with natural character, landscapes and natural features are generally comprised of elements both on land and within the coastal marine area. Therefore, to effectively protect these landscapes and natural features requires integrated management of the coastal marine area and coastal land.*
9.1.4.1	To identify areas of significance indigenous vegetation, including mangroves, within Northland's coastal marine area and protect these from the adverse effects of subdivision, use and development. **Explanation:** *Estuarine vegetation (principally mangroves and saltmarsh) forms the basis of many coastal food chains and is the habitat of many indigenous birds, fish, and other marine species. It is also most at risk from subdivision, use and development and therefore warrants special protection. Whilst it is important to consider the threats posed to estuarine vegetation, it is also necessary to cater for the full range of habitat types within the coastal marine area.*
9.1.4.4	To monitor the distribution and abundance of significant indigenous vegetation within the coastal marine area as a basis for the identification of adverse effects of subdivision, use and development. **Explanation:** *This is required to ensure that the policies within this section are effective.*
9.1.4.7	To avoid where practicable, the introduction and spread of exotic species which represent a threat to significant indigenous vegetation. **Explanation:** *Some introduced exotic vegetation species have the potential to become invasive and outcompete indigenous species. Where such species have been introduced, (accidently or otherwise) their spread needs to be monitored and controlled to avoid and adverse effects on indigenous vegetation. The most effective means of avoiding adverse effect is to ensure that exotic organisms with pest potential are not introduced into the region.*

9.1.4.8	To promote, when appropriate, the restoration and rehabilitation of degraded areas of significant indigenous vegetation. **Explanation:** *Although there is the potential for vegetation to be modified by subdivision, use and development of the coastal marine area, there is also the opportunity to restore vegetation. For example, this may be done by replanting areas that have been degraded as a result and development.*
9.2.4.1	To identify habitats or habitat areas of indigenous fauna that have moderate, moderate high, high or outstanding value within Northland's coastal marine area and protect these from adverse effects of subdivision, use and development. **Explanation:** *While there is some general understanding of the relative importance of habitats within the coastal marine area, there has been no investigation to identify those which may be considered "significant" within Northland. Provision therefore needs to be made to allow these to be identified and appropriately dealt with. Such provisions will draw on existing methodologies for ranking habitat values such as those used for the Sites of Special Biological Interest and Protected Natural Areas programmes. It is noted that a Biogeographical Ecological Classification System is currently under development for the Coastal Environments of Northland.*
9.2.4.2	To provide for the restoration and enhancement, where necessary, of significant habitats of estuarine and marine fauna, in Marine 1 and Marine 2 Management Areas. **Explanation:** *Although habitats can be modified by subdivision, use and development of the coastal marine area, there is also opportunity to enhance habitats, for example, by fencing off an intertidal area and/or planting around it. This would assist in remedying or mitigation any adverse effects of subdivision, use and development.*
9.2.4.3	In processing coastal permit application for subdivision, use and development within all Marine Management Areas, require specific assessment of the actual and potential effects of the proposed subdivision, use or development on any significant habitat in the vicinity and, if significant, particular consideration be given to either: a. Declining consent to the application; or b. Requiring as a condition of the permit, mitigation and/or remedial measures to be instituted. **Explanation:** *The protection of habitats is important to the continued survival of indigenous fauna and the maintenance of the species diversity within the coastal marine area. These areas are not only at risk from unauthorised activities but, unless closely controlled, also from authorised activities.*
9.2.4.4	To avoid where practicable, the introduction and spread of exotic species which represent a threat to natural character and the significant habitats of indigenous fauna. **Explanation:** *Exotic plant and animal can often outcompete indigenous species or modify the environment so that it is unsuitable for indigenous species. Where such species have been introduced (accidently or otherwise) their spread needs to be monitored and controlled to avoid any adverse effects on habitats of indigenous fauna. However, control of exotic plants and animals have already become established can be extremely difficult. For example, because they are submerged, subtidal species can spread to new area and remain undetected for some time.*

10.4.1	To promote, and where appropriate, facilitate improved public access to and along coastal marine area where this does not compromise the protection of areas of significant indigenous vegetation, significant habitats of indigenous fauna, Maori cultural values, public health and safety, or security of commercial operations. **Explanation:** *The maintenance and enhancement of public access to and along the coastal marine area is a matter of national importance.*
11.4.1	To recognise and, as far as practicable, provide for the concerns and cultural perspective of tangata whenua with respect to the protection of natural and physical resources (especially seafood) in the coastal marine area. **Explanation:** *Section 6(e) of the Act requires provision for the relationship of Maori to the coast. A significant part of this relationship revolves around access to and use of seafood resources.*
11.4.2	To recognise and, as far as practicable, provide for the concerns and cultural perspective of tangata whenau in regard to the disposal waste into water. **Explanation:** *The disposal of waste to coastal water is abhorrent to Maori. To give effect to section 6(e) of the Act, this factors needs to be provided for.*
11.4.4	To investigate options for involving tangata whenua in monitoring the effects of use, development and protection of resources within the coastal marine area. **Explanation:** *Maori involvement in monitoring the use, development and protection of coastal resources is one means by which kaitiakitanga may be provided for. There are a range of possible options for involving Maori in monitoring.*
12.4.1	To identify sites, buildings and other structures, places or areas of cultural heritage value within Northland's coastal marine area and, where practicable, assist in the protection of those at risk from the adverse effects of use and development. **Explanation:** *Sites of cultural heritage value within the coastal marine area provide important links to our past. Provision for their protection is available under various Acts but such protection can be enhanced by the provisions of this Plan.*
12.4.2	To encourage tangata whenua to identify waahi tapu and other sites of traditional, spiritual or cultural significance to Maori within or immediately adjacent to the coastal marine area within their rohe and to assess for themselves the most appropriate means of providing for the protection of these sites. **Explanation:** *The Act requires that the relationship of Maori to ancestral sites be provided for. However, because of the cultural significance of these sites, Maori are often reluctant to reveal their location to others (including other Maori). It is therefore for Maori to decide how the protection of these sites should be provided for.*
12.4.3	In assessing the political effects of a proposed activity to identify whether an activity will have an adverse effect on a known site, building, place or area of cultural heritage value within the costal marine area or on adjoining land. **Explanation:** *Although this Plan is restricted in its coverage to the coastal marine area, the potential adverse effects of use and development within the coastal marine area on the adjoining land such that it should be provided for (e.g. coastal erosion, provision of access).*

13.4.1	To classify the waters within Northland's coastal marine area as a means of clearly identifying the water quality management aims for individual areas of coastal water, and in a manner which recognises: a. The high standard of existing water quality of the majority of Northland's coastal waters; b. Existing detailed information on the quality of the waters of the Whangarei Harbour and the Bay of Islands; c. The importance of water quality to safe contact recreation and the quality of naturally occurring and commercially-grown edible shellfish resources; d. The need to safeguard the life-supporting capacity of coastal waters and ecosystems, and to ensure that appropriate water quality standards are maintained. **Explanation.** *The classification of water provides a public statement of the community goals for particular coastal waters. It also allows water quality standards to be tailored to these goals and discharges to be managed accordingly.*
13.4.2	As far as practicable, to identify any parts of the coastal marine area which are, or which have the potential to be, significantly degraded by use and development and institute appropriate remedial action giving priority to areas of high use by the general public. **Explanation.** *Not all coastal waters are at risk of degradation from inappropriate use and development. Efficient utilisation of management resources means that effort should focus on those areas where water quality is known to be degraded or is threatened to be degraded.*
15.4.1	To promote a consistent and co-ordinated approach toward managing coastal erosion and other natural hazards in Northland, including the identification and protection of natural systems which are a natural defence against erosion and inundation. **Explanation.** *Natural hazards can affect, and be exacerbated by use and development of both the coastal marine area and adjoining coastal land. Effective management of natural hazards therefore requires an integrated approach to use and development within the coastal environment.*
15.4.2	In consideration of coastal permit applications as far as practicable, to ensure that use and development, including coastal works, structures and reclamations within the coastal marine area: (a) are located and designed so as to avoid risk of damage by natural hazards; and, (b) cause minimal interference with natural sediment transport processes. **Explanation.** *Coastal works and structures can be affected by, and can cause, natural hazards. It is inappropriate to locate works and structures in areas where these would be placed at risk as a result of these hazards. Where works and structures interfere with natural sediment processes, coastal erosion or accretion may result, which could adversely affect other uses of the coast.*
15.4.3	In consideration of coastal permit applications to ensure that any natural hazard control measures undertaken in the coastal marine area are the best practicable option and the most effective in the long-term. **Explanation.** *There are a number of measures which may be used to control coastal erosion. Choosing the wrong option can create major long-term*

	environmental problems and be financially draining. Careful consideration of all options is therefore necessary before a final choice is made.
16.4.2	In consideration of coastal permit applications, subject to relevant protection policies within this Plan, to provide for new uses and developments within Marine 1, Marine 2, and Marine 4 Management Areas which maintain or enhance recreational opportunities within the coastal marine area. **Explanation.** *Uses and developments which enhance recreational opportunities can enhance public benefit from the coastal marine area and therefore should be encouraged where appropriate.*
16.4.3	In consideration of coastal permit applications within all Marine Management Areas, to ensure that uses and developments which occupy coastal space or utilise coastal resources, do not unnecessarily compromise existing recreational activities. **Explanation.** *Recreation as a public activity can be restricted by private use and development of the coastal marine area; for example, those uses requiring exclusive occupation of coastal space. Because the coastal marine area is generally considered to be public space, such restrictions need to be minimised.*
17.4.3	Within all Marine Management areas, to consider structures generally appropriate where: a. There is an operational need to locate the structure within the coastal marine area; and b. There is no practicable alternative location outside the coastal marine area; c. multiple use is being made of structures to the extent practicable; and; d. any landward development necessary to the proposed purpose of the structure can be accommodated; and. e. any adverse effects are avoided as far as practicable, and where avoidance is not practicable, to mitigate adverse effects to the extent practicable. A structure that does not meet all of the considerations listed above may also be an appropriate development, depending on the merits of the particular proposal. **Explanation.** *Because structures have the potential for adverse effects there is a need to control them within the coastal marine area and authorise them when they are considered appropriate. In considering how adverse effects are avoided, remedied or mitigated, minimisation of the size of the structure may be relevant, particularly in the Marine One and Marine Two Management Areas.*
17.4.4	Notwithstanding Policy 3, within Marine 1 and Marine 2 Management Areas, to assess applications for new structures, with particular reference to the nature of and reasons for the proposed structures in the coastal marine area and to any potential effects on the natural character of the coastal marine area, on public access, and on sites or areas of cultural heritage value. **Explanation.** *As stated in Section 5.4, an effects-based approach is being taken toward new use and development in the coastal marine area. This policy is one which provides for the approach to be put into practice.*
17.4.8	In assessment of coastal permit applications to require that all structures within the coastal marine area are maintained in good order and repair and that appropriate construction materials are used. **Explanation.** *Maintaining structures in good order and repair and ensuring that*

	appropriate construction materials are used are key elements in mitigating adverse effects. If not maintained, visual effects are increased, for example, and public safety may be put at risk.
17.4.9	In Marine 1, 2, 3 and 4 Management Areas to restrict the presence of buildings and signs within the coastal marine area. **Explanation.** *Because they tend to have significant visual impact, the presence of buildings and signs within the coastal marine area needs to be controlled. In particular, buildings within the coastal marine area (which for the purposes of this plan include houseboats) are often seen to 'urbanise' what is generally regarded as public open space. This is considered inappropriate except in special circumstances.*
19.4.4	To ensure that the individual and cumulative effects of authorised discharges to the coastal marine area do not compromise the maintenance and enhancement of coastal water quality. **Explanation.** *Where discharges to the coastal marine area are allowed, these need to be closely monitored to ensure that significant effects are detected as early as possible.*
19.4.7	To ensure that the Regional Council, within its legal mandate, takes all reasonable steps to prevent and respond to oil spills should they occur. **Explanation.** *The regular traffic of oil tankers to and from the Marsden Point oil refinery at the entrance to Whangarei Harbour, means that Northland has been identified as the region of greatest risk from oil spills in New Zealand. It is therefore necessary to ensure that all practical steps are taken to minimise the risk of oil spills occurring, including those available under other legislation, such as the Maritime Transport Act 1994.*
21.4.1	To adopt a permissive approach to the taking of coastal water and open coastal water, other than for large intakes (such as for thermal power stations) where adverse effects are no more than minor. **Explanation.** *For all practical purposes, there is an inexhaustible quantity of coastal water to be taken. The quantities taken for most uses and developments are usually instantly replenished, therefore, making close control unnecessary.*
22.4.1	Within Marine 1, Marine 2, Marine 4 and Marine 6 Management Areas, to restrict capital dredging except where the dredging activity is associated with a marina or port development, and in making such exceptions, integrate where appropriate, in accordance with sections 102 and 103 of the Act, any required consent process for associated dredging spoil disposal. **Explanation.** *Like reclamation, capital dredging has the potential to significantly change the coastal marine area. Close control is therefore required, particularly in areas of conservation value.*
22.4.3	To provide for capital dredging within Marine 5 Management Areas where the dredging is required to allow access of vessels to new or extended authorised structure, subject to the avoidance, remediation or mitigation of adverse effects; and where appropriate, in accordance with sections 102 and 103 of the Act, to integrate any required consent process for associated dredging spoil disposal. **Explanation.** *To remain economically viable, ports may need to expand. Because of the size of the vessels visiting ports, such expansion often requires capital dredging. Provision therefore needs to be made for this eventuality within port*

	areas.
22.4.4	Within Marine 2, Marine 4, Marine 5 and Marine 6 Management Areas, to provide for maintenance dredging of navigation channels and around wharves, and where appropriate, in accordance with sections 102 and 103 of the Act, to integrate any required consent process for associated dredging spoil disposal. **Explanation.** *There are a number of areas within Northland's coastal marine area which have been dredged and whose continued use depends on the maintenance of the dredged depth. Provision therefore needs to be made for this activity to be carried out.*
22.4.6	In Marine 1 and Marine 3 Management Areas to restrict the disposal of dredging spoil. **Explanation.** *The disposal of dredging spoil in these areas may have an adverse impact on the conservation values and on the high water quality standards required for marine farming operations.*
22.4.7	*To promote land-based disposal of dredging spoil from both capital and maintenance dredging of the coastal marine area, where this better meets the purpose of the Act.* ***Explanation.*** *Disposal of dredging spoil to sea or into intertidal areas can create significant adverse effects. In most situations, spoil disposal to land avoids these effects and therefore should be used where practicable.*
22.4.8	Where land-based dredging spoil disposal is proven not to be a viable option, to require evaluation of options by the applicant for the disposal of dredging spoil within the coastal marine area or beyond territorial limits, including the characterisation of the material to be dredged and environmental surveys of possible disposal sites. **Explanation.** *There are a number of options for disposal of spoil within the coastal marine area and/or beyond territorial limits. Choosing the right option can mean the difference between creating and avoiding adverse effects. Careful consideration of the options is therefore necessary.*
23.4.1	In assessment of coastal permit applications to apply the precautionary approach for extraction of sand shingle, shell and other natural material, and require the consideration of alternative sources in areas where knowledge of replenishment rates or potential adverse effects is uncertain. **Explanation.** *Sand or shingle extraction in inappropriate areas can cause significant adverse effects, including the exacerbation of coastal erosion. Sand or shingle extraction at rates which exceed rates of sediment replenishment are by definition unsustainable and should be avoided where practicable.*
23.4.2	To promote the sustainable extraction of sand from areas of known sediment replenishment. **Explanation.** *The best means of ensuring that sand extraction activity is sustainable and adverse effects are minimised is to target appropriate areas where sediment is replenished at rates exceeding the extraction rate.*
23.4.3	To ensure that extraction activity within the coastal marine area is managed in ways which avoid, remedy or mitigate adverse effects on the natural character of the coast and its ecological, cultural and amenity values. **Explanation.** *Extraction of sand, shingle, shell, and other natural material can*

	adversely affect the ecological, cultural, and amenity values of the coastal marine area, therefore controls over it are necessary.
25.4.1	The Council and Consent Authorities will give priority to avoiding adverse effects on the important conservation values (as identified in Appendix 9) associated with an area within any Marine 1 (Protection) Management Area when considering the subdivision, use, development and protection of the Northland Region's Coastal Marine Area. **Explanation.** *Section 6 of the Resource Management Act 1991 states that it is a matter of national importance to recognise and provide for the preservation of the natural character of the Coastal Environment and the protection of outstanding natural features and values and the relationship of Maori with their culture and spiritual values and other taonga. These aspects of the Resource Management Act 1991 are further developed through the New Zealand Coastal Policy Statement, and are particularly relevant to the application of the Marine 1 (Protection) Management Area.* *This policy is designed to give the greatest possible protection to those identified values in the discrete Marine 1 (Protection) Management Areas without precluding appropriate subdivision, use and development. Priority will be given to avoiding adverse effects arising from activities in these areas.* **Principal Reasons** *It is a matter of national importance to recognise and provide for the preservation of natural character in the Coastal Environment, the protection of outstanding natural features and landscapes, and the protection of areas of significant indigenous vegetation and habitats of indigenous fauna as well as the relationship of Maori and their culture and traditions. Since the Marine 1 (Protection) Management Area consists of these things then this Policy is designed to further this requirement of the Resource Management Act 1991.*
26.4.1	Where there is a lack of knowledge about coastal processes and ecosystems in the Marine 2 (Conservation) Management Area, to adopt a cautious approach to decision-making. **Explanation.** *A cautious approach to decision-making includes ensuring that there is as much information as practicable on the effects of a proposal and minimising the risk of irreversible effects.* **Principal Reasons** *This Policy is designed to implement Policy 3.3.1 of the New Zealand Coastal Policy Statement and Objective 26.3.1.*
26.4.2	To recognise that different areas within the Marine 2 (Conservation) Management Area have distinct natural, cultural and amenity values that should be maintained and where possible enhanced. **Explanation.** *The Marine 2 (Conservation) Management Area is not homogenous and it is important to remember that each area has unique attributes, which must be considered within the context of the policy provisions relevant to the Marine 2 (Conservation) Management Area.* **Principal Reasons** *This Policy is designed to implement Objective 26.3.1.*
26.4.3	To provide for sustainable, use and development whilst ensuring that the intensity, character and scale of use and development is compatible in relation to the character (including natural character), heritage and amenity values of the adjoining

	coastal environment. **Explanation.** *This Policy is intended to ensure that use and development in the Marine 2 (Conservation) Management Area is not inconsistent with the surrounding environment.* **Principal Reasons** *This policy is intended to give effect to Policy 3.2.1 of the New Zealand Coastal Policy Statement.*
29.4.1	To recognise and provide for the operational requirements of existing ports within Northland's coastal marine area including: a. The berthage of commercial ships adjacent to port facilities; and, b. maintenance dredging of navigation channels, turning basins and berths for the purposes of safe berthage, and manoeuvring of commercial vessels multiple use is being made of structures to the extent practicable; c. authorised structures (including buildings on wharves, wharves, dolphins, slipways and cargo handling areas) necessary for port operations; and. d. placement and maintenance of navigation aids; and. e. signage; while avoiding, remedying or mitigating the adverse effects. **Explanation.** *Port operations within Northland's coastal marine area contribute significantly to the region's economy. For these to continue to operate, provision needs to be made for such things as occupation of space and dredging requirements and other port-related requirements. The Marine 5 Management Area in particular caters for the requirements of port operations.*
29.4.4	To ensure, within the constraints of legislation relating to foreign-owned vessels, that port owners, port operators and, where relevant, ships' agents take all practicable steps to avoid: a. the creation of noise and dust nuisance during loading and unloading of ships; b. spillages and other loss of cargo during loading and unloading operations; c. discharges of contaminated stormwater from cargo handling areas; d. oil spills; e. sewage discharges from ships at berth; f. the introduction of exotic organisms via ballast water discharges. **Explanation.** *Adverse effects of port operations can result from a range of sources. Each needs to be managed to ensure that the effects of the port operation as a whole are avoided as far as possible. Those who own or operate the port* facilities are primarily responsible for avoiding the adverse effects of their operations.
35.3.2	When processing coastal permit applications, to consider the effects of the proposed activity on commercial, recreational and customary fisheries, including taiapure and maataitai reserves. **Explanation.** *Fishing is a major use of the coastal marine area and can be affected by use and development.*

Table 2: Regional Coastal Plan for Northland (June 2004) cited Policies

Methods	Definition
6.5	The Purpose of this plan, Northland's coastal marine area extends from the landward boundary of Mean High Water Spring out to the 12 nautical mile limit. The agreed cross-river boundaries for Northland's coastal marine area are shown in Appendix 1. The coastal marine area has been divided up under the following six zones or Marine Management Areas: • Marine 1 (Protection) • Marine 2 (Conservation) • Marine 3 (Marine Farming) • Marine 4 (Moorings) • Marine 5 (Port Facilities) • Marine 6 (Wharves) The Marine 1 (Protection) Management Area is applied to those areas within Northland's coastal marine area identified as being Areas of Important Conservation Value. The priority in these areas will be the protection of those significant described values specifically identified as occurring within each particular area. The boundaries and values of these areas are summarised in Appendix 6. For more specific boundary location information contact the Northland Regional Council. The Marine 2 (Conservation) Management Area is applied to any part of the coastal marine area which is not otherwise covered by any of the other five classes of management area as indicated on the Coastal Plan Maps. Any new Coastal Marine Area that is not otherwise indicated on the Coastal Plan Maps will be classified as a Marine 2 Management Area. This category is applied to areas to be managed to conserve ecological, cultural, and amenity values. Marine 3 (Aquaculture) Management Areas are those to be managed principally foe aquaculture activities and include: • Specific areas to which coastal permits to occupy space in the coastal marine area for the purposes of aquaculture activities applied as at 20 December 1994; and • Specific areas to which Marine Farming Act 1974 leases or licences applied as at 20 December 1994; or • New areas establish through the Resource Management Act 1991 Plan Change process. All Marine 3 (Aquaculture) Management Area within Northland's Coastal Marine Area are shown on the Coastal Plan Maps. Individual marine farm boundaries within Marine 3 (Aquaculture) Management Areas are derived from the specified grid coordinates provided in the resource consent applications. For more specific boundary location information, contact the Northland Regional Council. Other activities should only be provided for within Marine 3 (Aquaculture) Management Areas where they are compatible with aquaculture activities. Marine 4 (Moorings including Marinas) Management Areas are those defined as being appropriate for permanent moorings and which are being managed primarily for this purpose. These marine 4 (Moorings including Marinas) Management Area boundaries are shown on the Coastal Plan Maps, for more specific boundary location information contact the Northland Regional Council. Marine 5 (Port Facilities) Management Areas are those being managed primarily for the port-related purposes. For the purposes of this Plan, "port areas" are areas within the coastal marine area which contain or are directly associated with the

	wharves, jetties or other structures used commercially for loading and unloading goods or passengers. More specifically, a "port area" is: A harbour area where marine terminal facilities such as jetties and wharves are provided at which commercial ships of 4500 Dead Weight Tonne (DWT), or greater, regularly berth to load and unload cargo or passengers. Such areas can also include ship construction and/or maintenance activity, barging operations and related structures. Port areas which currently meet these criteria are Port Whangarei, Portland and Marsden. For more specific boundary location information contact the Northland Regional Council. Marine 6 (Wharves) Management Areas are those areas that should be managed as small commercial wharves. These wharves are predominately commercial, and include mixes users such as vessel loading/unloading commercial passengers services, public access and buildings. The nature of operation t these wharves is not such that the public needs to be generally excluded from the facility, although some minor exclusion may be required at times for safety reasons. The boundaries of these are listed in Appendix 8. Where previously unidentified sites in the Marine 2 (Conservation) management Area of important ecological, cultural, historic, scientific, landscape and amenity value are identified in accordance with the criteria set out in Appendix 9, the Northland Regional Council will give full consideration (including ensuring the recognition of, and provision for any customary right of Iwi/Hapu determined to exist by any court or tribunal Courts) to promoting a plan change to the Regional Coastal Plan to incorporate those sites into the Marine 1 (Protection) Management Area. The Northland Regional Council may facilitate private plan changes which are rigorously documented.
7.5.3	Require baseline monitoring of all major new subdivision, uses and developments within the coastal marine areas including, where relevant, ecological monitoring.
8.5.1	In processing resource consent application for subdivision, use and development in the vicinity of the areas listed in policy 1, require specific assessment of the adverse visual effects of the proposed activity and where landscape values are significantly adversely affected, particular consideration be given to either: a. Declining consent to the application, or b. Requiring as a condition of the permit, mitigation and/or remedial measures to be instituted as far as practicable.
8.5.3	In processing resource consent applications for subdivision, use and development in the vicinity of those listed areas, require specific assessment of the impact of the proposed activity on these landforms and/or geological features of international, national or regional importance. Where the proposed use or activity is likely to lead to the disturbance and/or destruction of part or all of the listed natural features, decline the consent application.
8.5.6	In processing resource consents applications for subdivision, use and development within the coastal marine area, to give particular consideration to any adverse effects on any adjoining natural features and landscapes.

9.1.5.2	In processing coastal permit applications, require specific assessment of the potential effects of the proposed subdivision, use or development on any significant indigenous vegetation in the vicinity and, where relevant, require appropriate steps to be taken to avoid, remedy or mitigate the potential loss or degradation of the vegetation.
9.1.5.12	Provide assessment criteria within this Plan to promote the consideration of restoration and reinstatement of ears of significant indigenous vegetation s a remediation measure when processing coastal permit applications.
9.2.5.1	Within Marine 1 (Protection) and Marine 2 (Conservation) Management Areas, ensure that any identified significant habitats are protected from use and development through the use of appropriate assessment criteria.
9.2.5.2	Within all Marine Management Areas to identify and determine the relative values of areas containing the habitats of indigenous fauna using the methodologies established under the Sites of Special Biological Interest and Protected Natural Areas programme. (in the absence of a site assessment under these programmes, assessments of significant should include the criteria listed within the appendices).
9.2.5.4	Include assessments criteria to require specific assessments of the actual and potential effects of the proposed use or development on any significant habitat in the vicinity.
9.2.5.9	Investigate the introduction of exotic species into the coastal marine area with a key focus on ports, port navigation channels and vessel maintenance facilities.
11.5.1	Require consultation with tangata whenua over the development proposals within the coastal marine area which may affect known resources of significant to tangata whenua.
11.5.2	Consult with iwi authorities over the traditional and cultural relationships of Maori with natural and physical resources within the coastal marine area of their rohe including the identification of traditional access to sites within the coastal marine area containing resources of Maori cultural value.
11.5.4	Encourage applicants to consult with tangata whenua over the development proposals within the coastal marine area which include a proposed or potential discharge of contaminants to coastal waters.
11.5.7	In consultation with tangata whenua: a. Identify sites, including waters, of special significance to iwi within the coastal marine area; b. Identify specific uses and developments affecting those sites; c. Assess the most efficient means if monitoring any adverse effects of those uses and developments with particular reference to involving tangata whenua.
12.5.1	Consult with the NZ Historic Places Trust, the Department of Conservation, direct councils, iwi authorities, and other relevant organisations, in regards to the type and extent of available information on sites, buildings and other structures, places, or areas of heritage value within the coastal marine area.
12.5.4	Gather information on legislative protection mechanisms currently applied to specific sites of heritage value and use this to help ensure that applicants for coastal permits are aware of any constraints that the formal protection status may place on a proposed activity where this could affect the protected site.

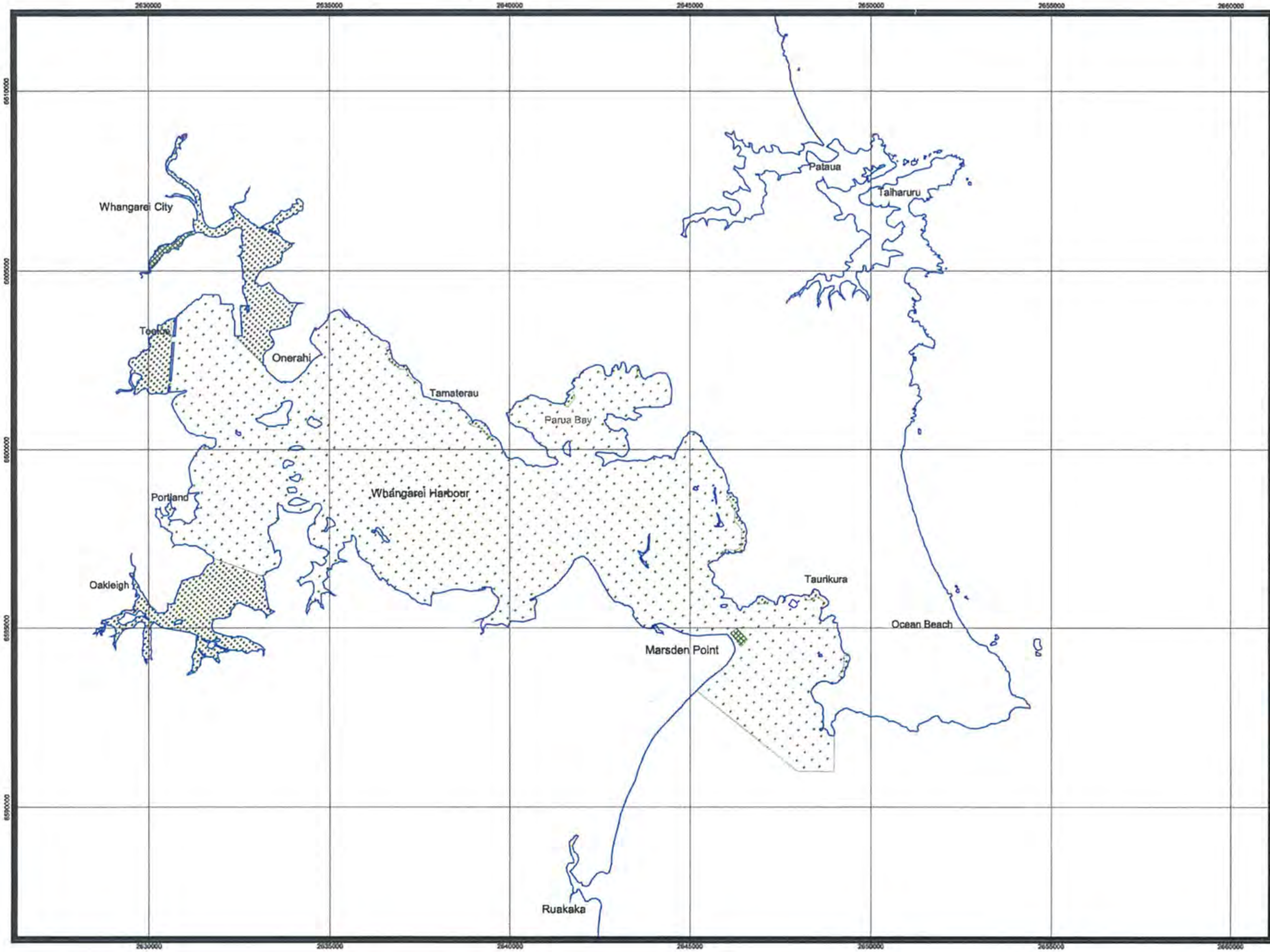
12.5.8	Gather information on legislative protection mechanisms currently applied to specific sites of heritage value and use this to help ensure that applicants for coastal permits are aware of any constraints that the formal protection status may place on a proposed activity where this could affect the protected site.
13.5.1	Reclassify the waters of Whangarei Harbour in accordance with the Whangarei Harbour Water Quality Management Plan, apply the relevant water quality standards as set out in Appendix 4, and ensure that these standards are maintained through regular monitoring and control of activities affecting or likely to affect water quality.
13.5.3(b)	For all coastal waters other than those within the Whangarei Harbour and the Bay of Islands: In the interim, use the following classes from the Third Schedule of the Resource Management Act for the maintenance and enhancement of coastal water quality in the specified situations: i. For estuaries and other inner harbour areas influenced by major river inflows - AE, CR, C A, (i.e. to be managed for aquatic ecosystems, contact recreation, cultural and aesthetic purposes); ii. nearshore areas on the open coast and in harbour areas away from major river inflows - AE, CR, A, C, SG (i.e. to be managed for aquatic ecosystems, contact recreation, aesthetic purposes, cultural purposes and for the gathering or cultivation of shellfish for human consumption); iii. open coastal waters - NS, C (i.e. to be managed in its natural state and for cultural purposes)
13.5.4	Promote, by appropriate submissions to district plans and resource consent applications, the maintenance and enhancement of coastal water quality at or to a level consistent with the purpose for which the coastal water is being managed.
15.5.4	Place restrictions, through the use of appropriate assessment criteria, on the location and design of coastal works, structures and reclamations in areas which are identified as being prone to natural hazards.
15.5.5	Include assessment criteria within this Plan to ensure use and development within the coastal marine area, including coastal works, structures and reclamations, do not cause or accentuate coastal erosion.
15.5.6	Require shore profile monitoring programmes for any approved activities, including sand extraction, which could potentially have an adverse effect on natural sediment transport processes.
16.5.4	Include appropriate assessment criteria for resource consent applications in this Plan to allow the effects of new uses and developments on existing recreational activities to be taken into account in decision-making.
16.5.7	Ensure that Regional Council Harbour Bylaws governing the speed of watercraft are enforced so that potential risks to the health and safety of other users from watercraft are avoided.

17.5.8	Include assessment criteria within this Plan requiring the consideration of the appropriateness of new and existing, unauthorised structures within all Marine Management Areas.
17.5.16	Include appropriate performance standards in this Plan and conditions on resource consents relevant to the state of repair of structures.
19.5.11	Where appropriate, develop and implement state-of-the-environment monitoring to assess the cumulative effects of authorised discharges on the coastal marine area.
22.5.1	Include rules within this Plan restricting (capital dredging within Marine 1, Marine 2, Marine 4 and Marine 6 Management Areas), except where associated with a marina or port development**.**
22.5.3	Include a rule within this Plan making dredging a discretionary activity within the Marine 3 (Aquaculture) Management Area.
22.5.8	Include rules in this Plan restricting the disposal of dredging spoil in Marine 1 and Marine 3 Management Areas.
22.5.9	In processing applications for resource consents for dredging spoil disposal, require evaluation of the costs and benefits of land-based disposal options.
22.5.11	Include rules within this Plan making dredging spoil disposal within Marine 2, Marine 4, Marine 5, and Marine 6 Management Areas, a discretionary activity, subject to specified criteria and require, through assessment criteria, the evaluation of the potential adverse environmental effects of the activity.
23.5.1	Include rules within this Plan making the extraction of sand, shingle, shell, or other natural material a discretionary activity within Marine 2 Management Areas, and within existing authorised locations in Marine 1 Management Areas, and include assessment criteria which allow for the consideration of alternative sources of sand, shingle, shell, or other natural material where the potential adverse effects of proposed activities are unknown.
23.5.2	Impose strict monitoring and information requirements and short terms of consent on any extraction of sand, shingle, shell or other natural material where adverse effects are unknown.
23.5.5	Require monitoring of the effects of sand extraction on adjacent shoreline profiles as a condition of all permits to extract sand from within 500m of beaches.
23.5.7	Include conditions on coastal permits requiring: a. the restriction of extraction volumes and rates to a level less than the rate at which sand can be replenished, and b. monitoring for significant changes in median particle size resulting from extraction in order to minimise risks of beach slope destabilisation
29.5.8	Include performance standards within this Plan facilitating the control of noise from port operations.

29.5.9	Include policies and rules to control cargo spillages, stormwater discharges, oil spills and sewage discharges from vessels or port facilities within Marine 5 Management Areas.
35.4.3	Where appropriate, in consultation with the Ministry of Fisheries, consider the effects on fisheries when processing resource consent applications.

Table 3: Regional Coastal Plan for Northland (June 2004) cited Methods

Annexure Ten: Planning maps from Northland Regional Council – significant values



Water Quality

Whangarei Harbour

N

Map Scale
1 :100000

LEGEND LOCATED AT BACK OF MAP FOLDER

Topographical and Cadastral information derived from Land Information NZ. CROWN COPYRIGHT RESERVED

Map grid values are shown in NZMG co-ordinates, GD 1949.

These maps are an indicative representation, for more specific information contact the NRC.

The RCP for Northland covers the coastal marine area which extends from the landward extent of Mean High Water Springs and the negotiated cross river mouth boundary to the 12 Nautical Mile limit.

Caution: This map should not be used for navigational purposes.

Locality Map:

NORTHLAND REGIONAL COUNCIL

CARING FOR NORTHLAND AND ITS ENVIRONMENT

Northland Regional Coastal Plan Map Legend

Regional Boundary Line

TLA Boundary

State Highway

Road

Aircraft Beacon

Boat Ramp

Jetty/Wharf

Pontoon

Grid Point

Slip

Protected Anchorage

Beacon

lit

unlit

Buoy

lit

unlit

Bridge

Foot Traffic

Train

Vehicle

Powerline

Underwater Cable

Underwater Pipe

Cliff Edge

Track & Walkway

River

Coastal Marine Area Boundary

Surfing Area

Land outside NRC Region

Prohibited Anchorage Area

Skilane

Marine 1 (Protection) Management Area

Marine 2 (Conservation) Management Area

Marine 3 (Marine Farms) Management Area

Coastal Permitted Marine Farms (Post 20 December 1994)

Marine 4 (Controlled Mooring) Management Area

Marine 4 (Discretionary Mooring) Management Area

Marine 5 (Port Facilities) Management Area

Marine 6 (Wharves) Management Area

Cultural Water Quality

Water Quality

CA

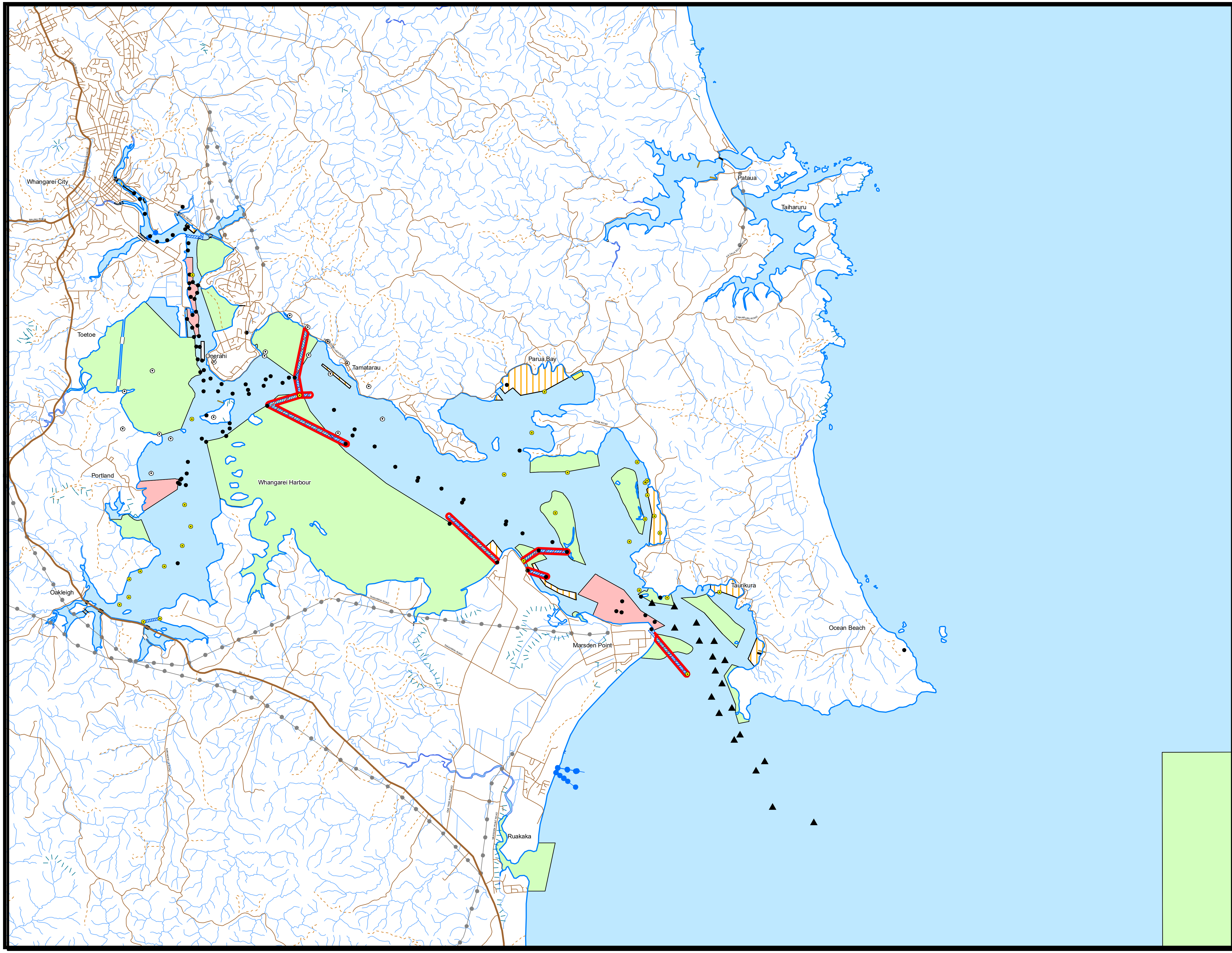
CB

CN

Mixing Zones For Major Dishcarge

Map A3

Whangarei Harbour



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Map Scale
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LEGEND LOCATED AT BACK OF MAP FOLDER

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Map grid values are shown in NZTM coordinates NZGD 2000

These maps are an indicative representation, for more specific information contact the NRC.

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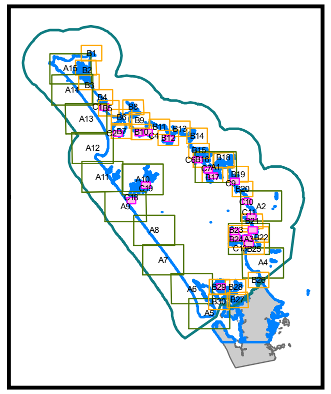
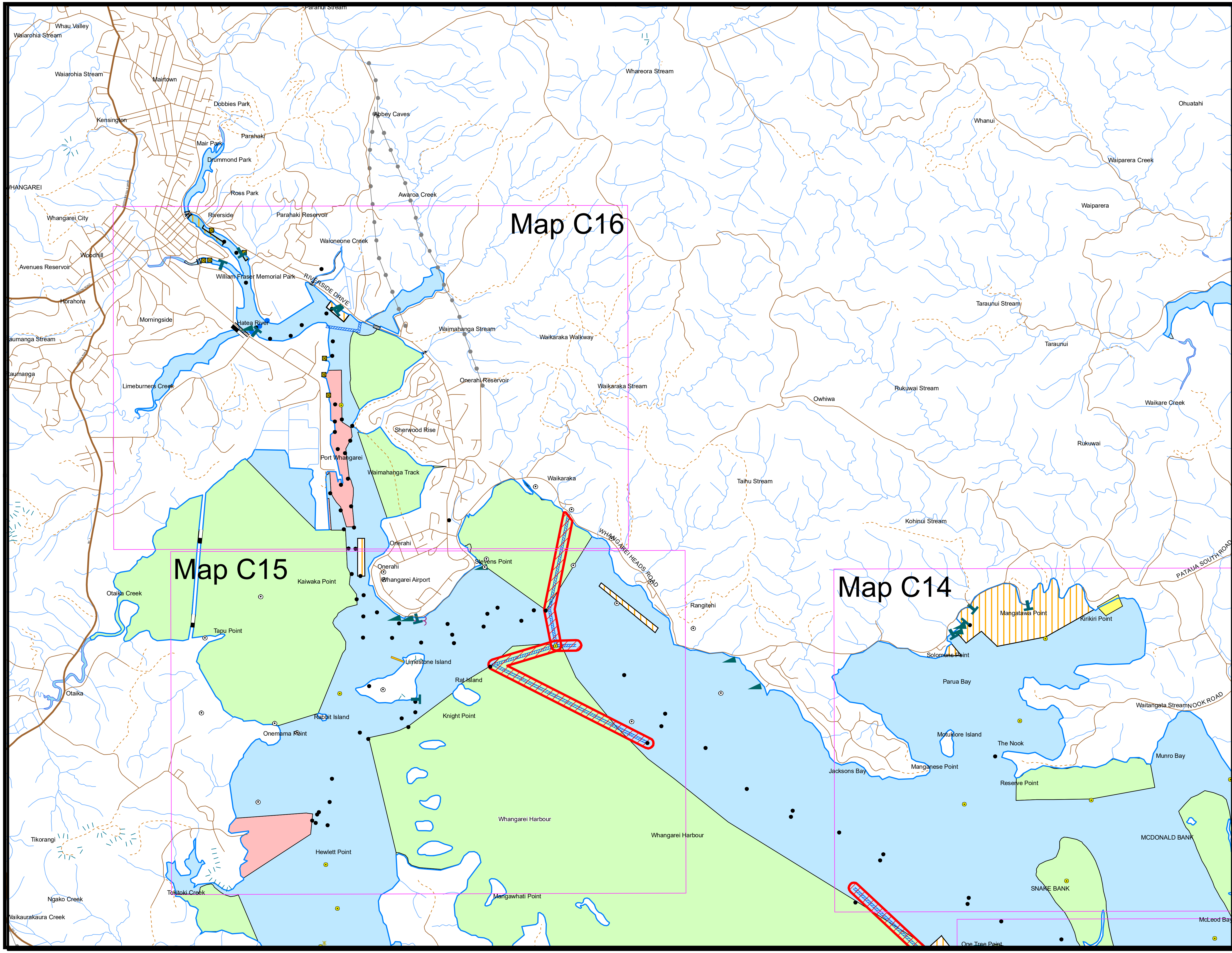
Caution: This map should not be used for navigational purposes.

Locality Map:



NORTHLAND REGIONAL COUNCIL



Map B23

Whangarei Harbour

N

Map Scale
1:50,000

LEGEND LOCATED AT BACK
OF MAP FOLDER

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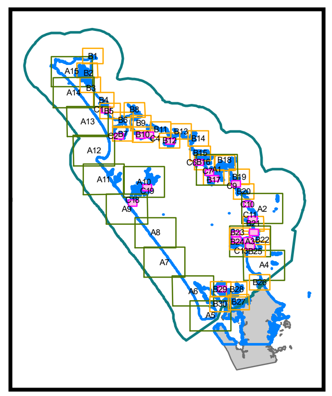
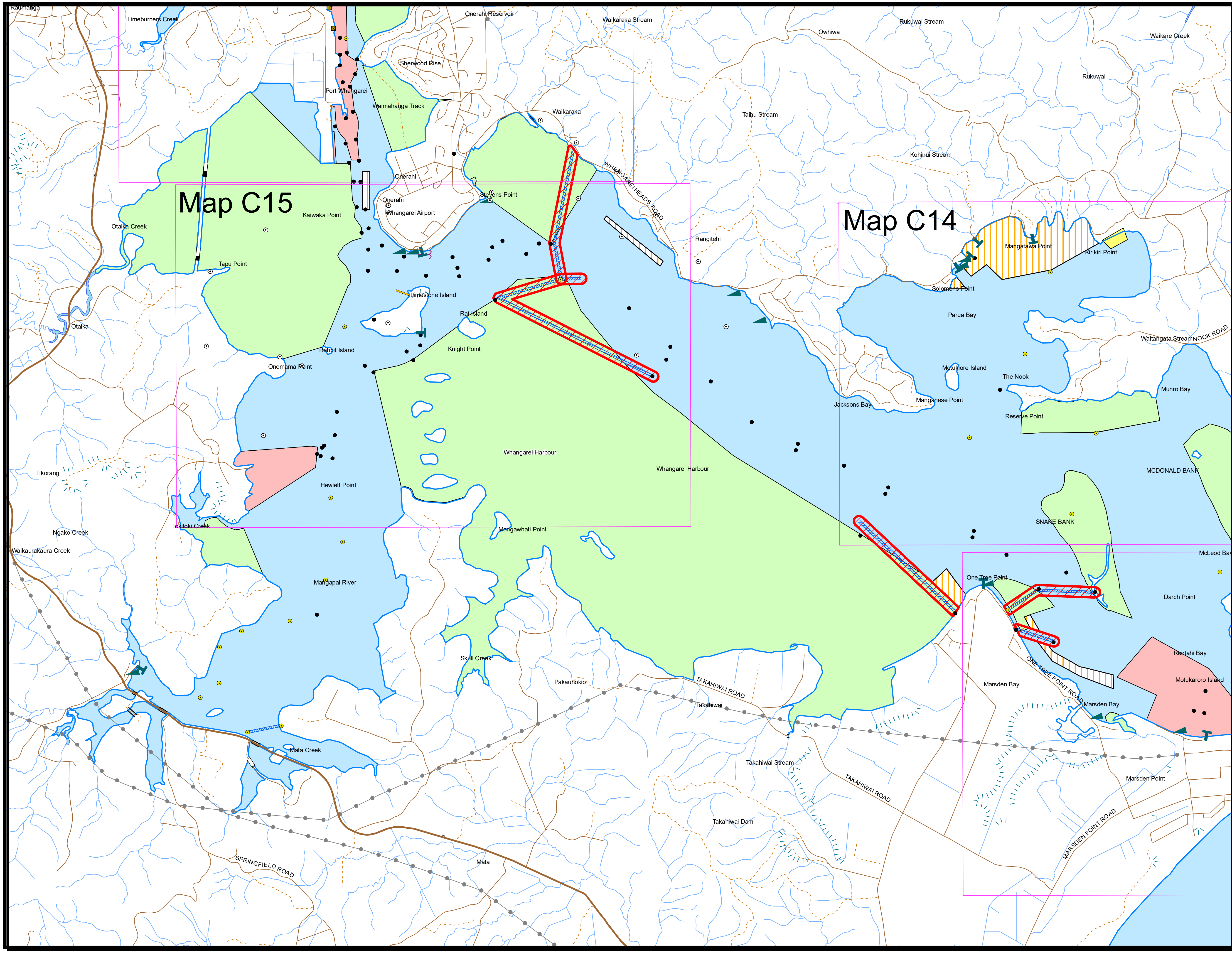


NORTHLAND REGIONAL COUNCIL



Map B24

Whangaraei Harbour

N

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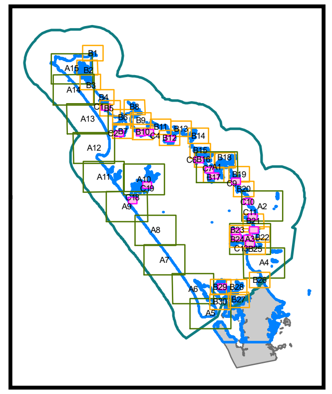

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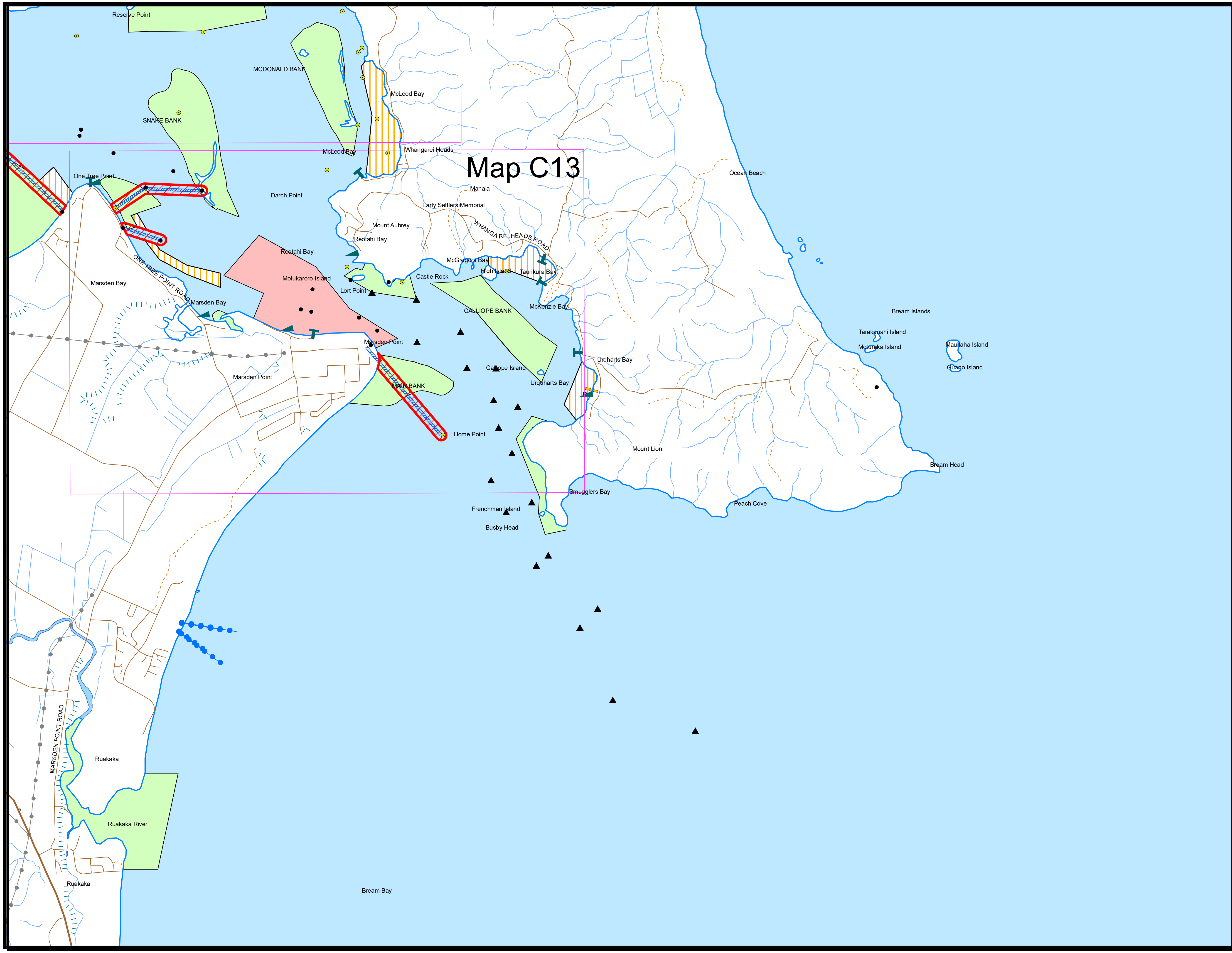
Map B25

Whangarei Heads
Bream Head



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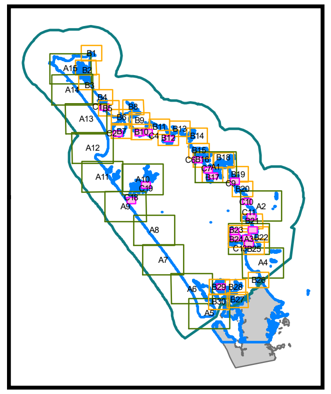
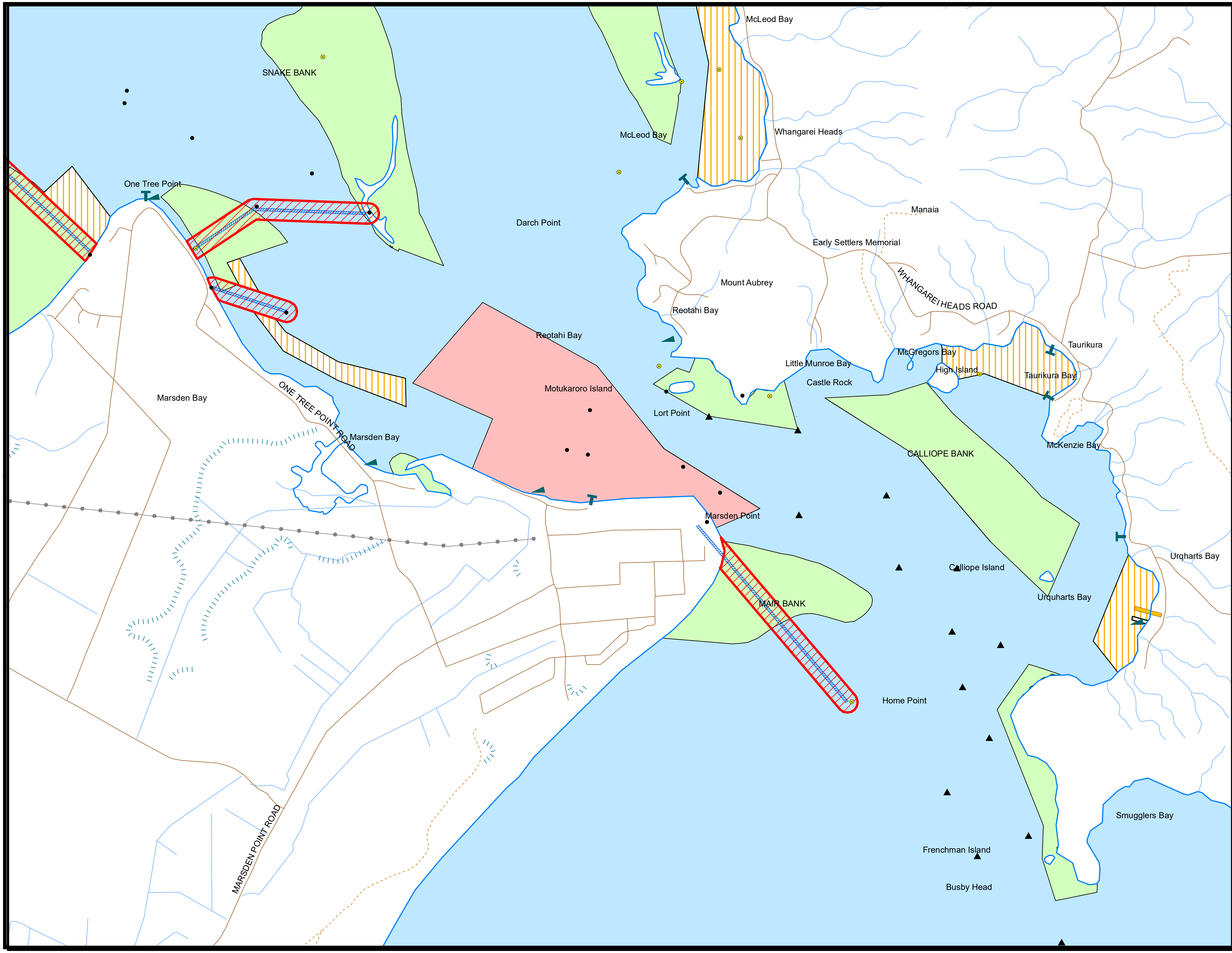


NORTHLAND REGIONAL COUNCIL



Map C13

Whangarei Harbour
Marsden Point

N

Map Scale
1:25,000

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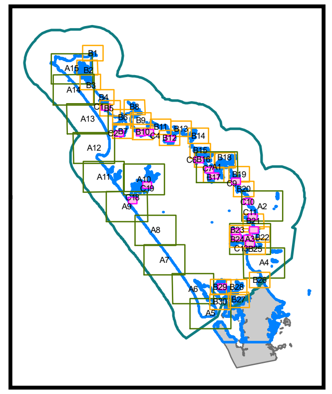
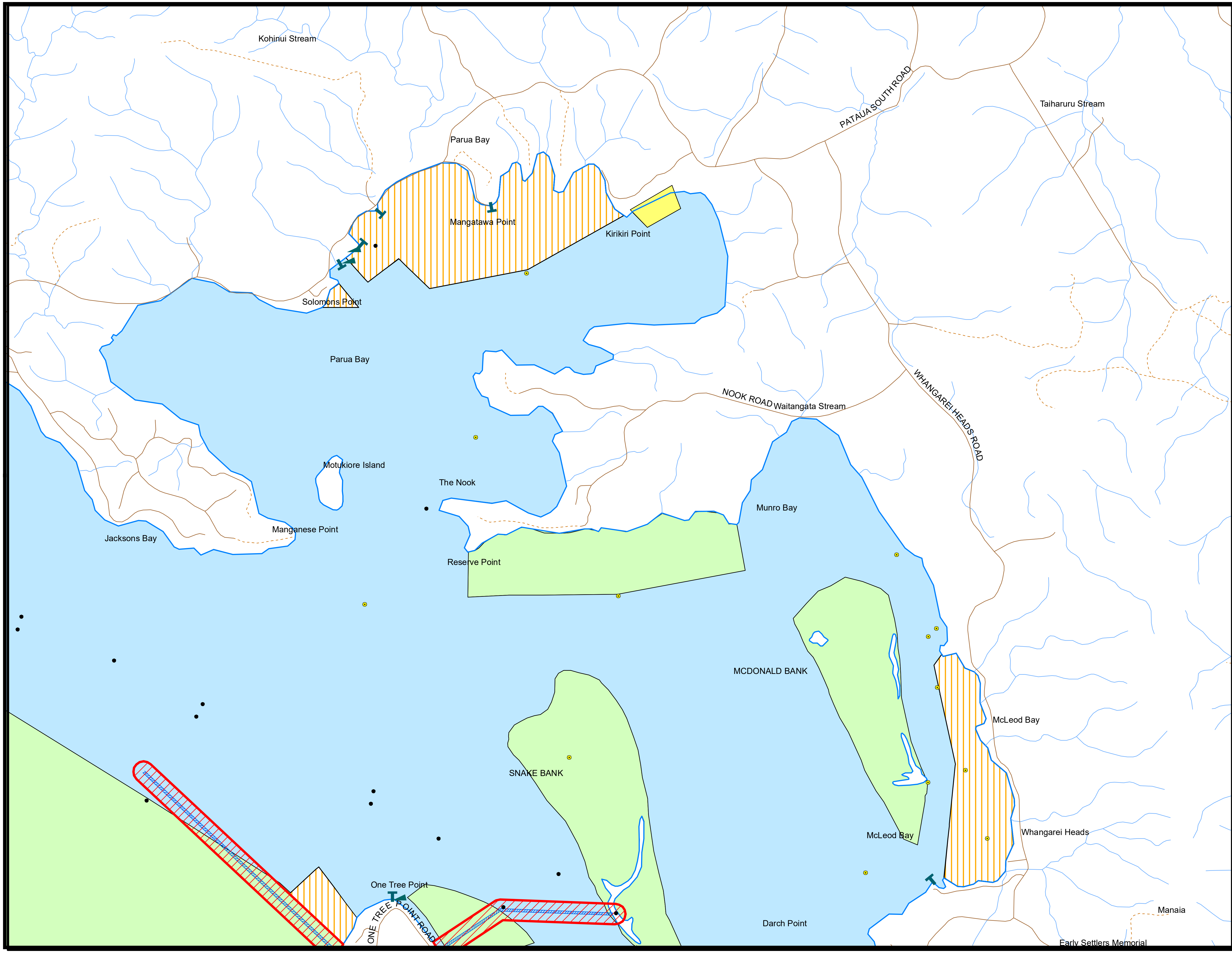


NORTHLAND REGIONAL COUNCIL



Map C14

Whangarei Harbour
Parua Bay

N

Map Scale
1:25,000

LEGEND LOCATED AT BACK
OF MAP FOLDER

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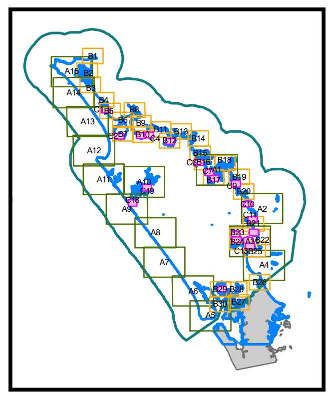
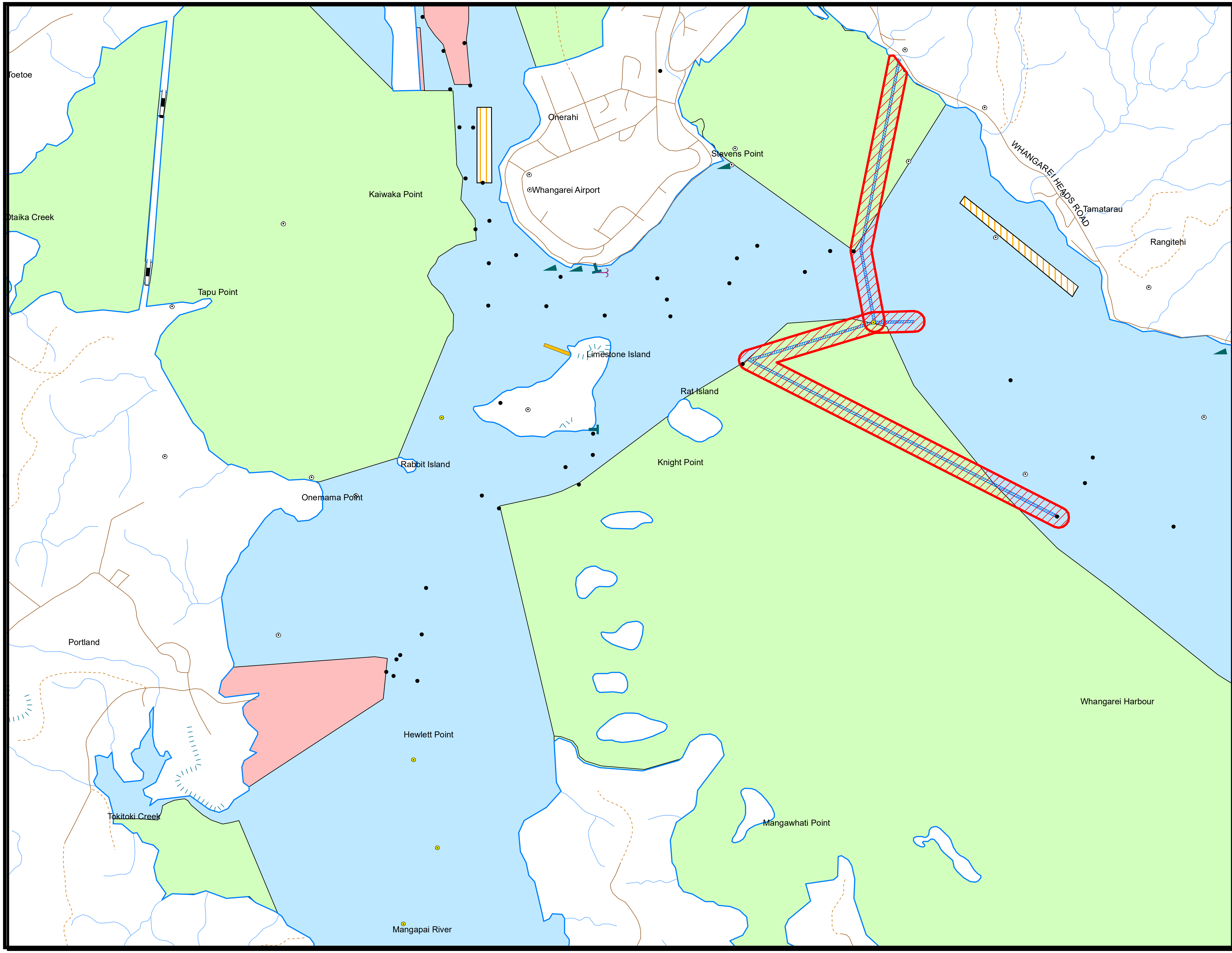


NORTHLAND REGIONAL COUNCIL

Map C15

Whangarei Harbour Portland



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Map Scale 1:25,000

LEGEND LOCATED AT BACK OF MAP FOLDER

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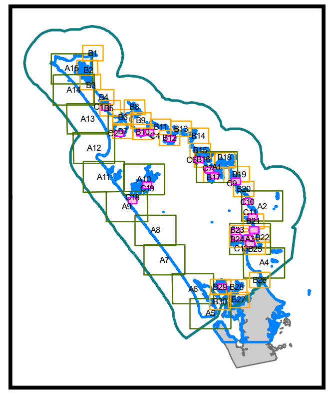
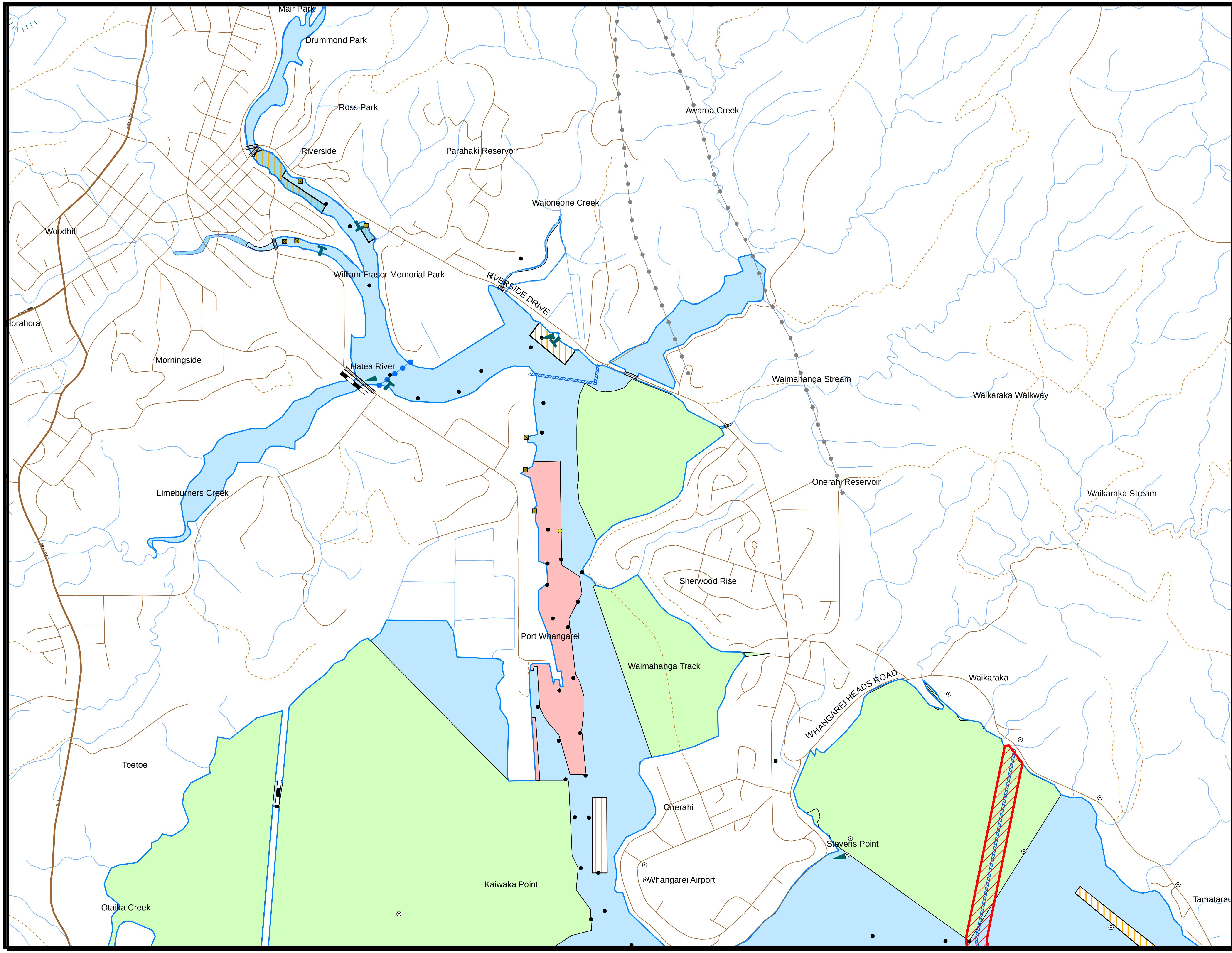


NORTHLAND REGIONAL COUNCIL

Map C16

Whangarei Harbour
Town Basin/Onerahi



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Map Scale
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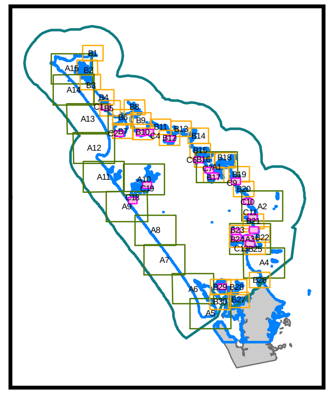


NORTHLAND REGIONAL COUNCIL

Legend ✕

Moorings

▲

Marine Pollution Regulation (MPR) Zone

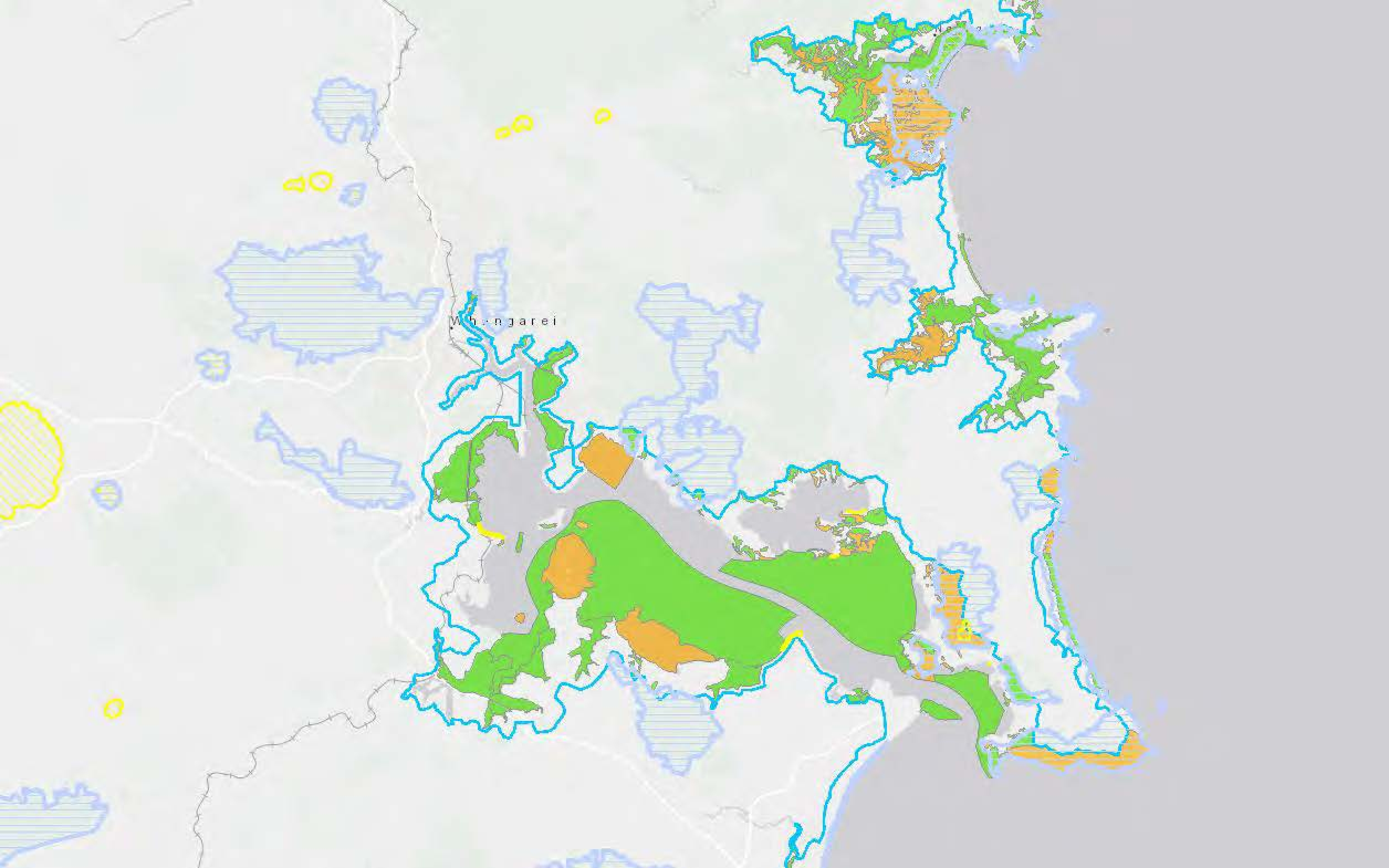
Marine Management Areas

- MM1 (Protection)
- MM2 (Conservation)
- MM3 (Marine Farms)
- MM4 (Mooring)
- MM5 (Port Facilities)
- MM6 (Wharves)

Layers

Operational Layers

- Regional Policy Statement
  - Mapsheets
  - Outstanding Natural Landscapes
  - Outstanding Natural Features
  - Coastal Environment
  - Natural Character
    - High Natural Character
    - Outstanding Natural Character


Whangarei

Annexure Eleven: The Operative Northland Regional Policy Statement 2016 Cited Provisions

Table 1 below lists the Operative Northland Regional Policy Statement cited Objectives. **Table 2** lists the cited Policies and **Table 3** lists the cited Methods.

Objective	Description
3.2	Improve the overall quality of Northland's fresh and coastal water with a particular focus on: a. Reducing the overall Trophic Level Index status of the region's lakes; b. Increasing the overall Macroinvertebrate Community Index status of the region's rivers and streams; c. Reducing sedimentation rates in the region's estuaries and harbours; d. Improving microbiological water quality at popular contact recreation sites, recreational and cultural shellfish gathering sites, and commercial shellfish growing areas to minimise risk to human health; and; e. Protecting the quality of registered drinking water supplies and the potable quality of other drinking water sources; Objective 3.2 addresses the following issues: 2.1 Fresh and coastal water 2.2 Indigenous ecosystems and biodiversity 2.6 Issues of significance to tangata whenua - natural and physical resources 2.8 Natural character, features/ landscapes historic heritage Objective 3.2 is achieved by the following policies: 4.1 Integrated catchment management 4.2 Region-wide water quality management 4.3 Region-wide water quantity management 4.4 Maintaining and enhancing indigenous ecosystem and species 4.5 Identifying the coastal environment, natural character, outstanding natural features, outstanding natural landscapes, and historic heritage resources 4.6 Managing effects on natural character, features / landscapes and heritage 4.7 Supporting management and improvement **Explanation:** *Objective 3.2 seeks an overall improvement in the quality of Northland's fresh and coastal water. This recognises that improvement is both desired by the community and necessary for the long-term sustainable management of water resources and its associated uses and values.* *Overall improvement is to be achieved through the five specific outcomes listed in the objective, which address the main contaminants of concern and the uses and values that they impact as identified in Issue 2.1.* *On its own the objective does not require that water quality be improved in every water body. It will be implemented primarily through regional plans by way of objectives for fresh and coastal water quality and policies and methods to achieve them.* *The Trophic Level Index (TLI) is an indicator used to assess the water quality (health) of lakes in New Zealand. The TLI is calculated using four water quality parameters: Total Nitrogen, Total Phosphorus, water clarity and algal biomass. In general, the higher the TLI score the poorer the quality of water in the lake. While the TLI primarily assesses the ecological health of the lake it also has implications for natural character, recreational and amenity values.*

The Macro-invertebrate Community Index (MCI) is an indicator used to assess the health of rivers and streams. It is based on the numbers and types of aquatic animals such as insects, worms and snails present within a water body. It provides a score that indicates water quality. Generally, an MCI score of less than 80 indicates poor water quality and a score of greater than 119 indicates excellent water quality.

Annual sedimentation rates are routinely measured in a number of Northland's estuaries and are a good measure of coastal water quality, as well as water quality in contributing catchments.

Parts (d) and (e) of the objective seek site-specific outcomes to reduce risks to human health. The sites will be identified and addressed through regional plans.

3.4

Safeguard Northland's ecological integrity by:

a. Protecting areas of significant indigenous vegetation and significant habitats of indigenous fauna;
b. Maintaining the extent and diversity of indigenous ecosystems and habitats in the region; and;
c. Where practicable, enhancing indigenous ecosystems and habitats, particularly where this contributes to the reduction in the overall threat status of regionally and nationally threatened species.

Objective 3.4 addresses the following issues:
2.1 Fresh and coastal water
2.2 Indigenous ecosystems and biodiversity
2.6 Issues of significance to tangata whenua-natural and physical resources
2.8 Natural character, features/ landscapes historic heritage

Objective 3.4 is achieved by the following policies:
4.1 Integrated catchment management
4.2 Region-wide water quality management
4.3 Region-wide water quantity management
4.4 Maintaining and enhancing indigenous ecosystem and species
4.5 Identifying the coastal environment, natural character, outstanding natural features, outstanding natural landscapes, and historic heritage resources
4.6 Managing effects on natural character, features / landscapes and heritage
4.7 Supporting management and improvement

Explanation: *Safeguarding and enhancing the ecological integrity of indigenous ecosystems is vital for the diversity and abundance of indigenous species. It is also important if the services that indigenous ecosystems provide, such as the water purification function of wetlands, are to be maintained.*

This objective seeks to at least maintain the extent and diversity of indigenous ecosystems and habitats in the region. This is to be achieved through a combination of protection and enhancement activities and processes.

Part (c) of the objective seeks an overall reduction in the threat status of threatened and at risk species. This applies to the management of activities that affect indigenous ecosystems and activities that impact on indigenous species living outside them.
In Northland, reduced indigenous biodiversity is due to both a loss of area and a loss of ecological condition. Currently the threats resulting from pest species and

	reduced connectivity are considered greater than loss in overall area, although the latter is still important (for example with wetlands, very low fertility heathlands including gumlands, old growth forests, broadleaf forest, sand dunes and shrublands). *To date, voluntary efforts have been central to slowing down the decline in condition and area. Landowner and community stewardship takes many forms including the active management of pests, covenanting of significant natural areas, indigenous revegetation, habitat creation and good management practices in production environments.* *However, regulation, including the use of permitted activity rules is necessary, as a backstop. Key regulatory methods to achieve the objective include the protection of significant natural areas, and controls on subdivision, use and development including discharges to water, water takes, and vegetation clearance.* *Regulation should include incentives to encourage subdivision, use and development involving restoration and protection of ecosystems and indigenous biodiversity.* *For safeguarding water and its ecosystems, the level of protection will be determined on a catchment-by-catchment basis, by establishing freshwater objectives and coastal water quality classifications.*
3.5	Northland's natural and physical resources are sustainably managed in a way that is attractive for business and investment that will improve the economic wellbeing of Northland and its communities. Objective 3.5 addresses the following issues: 2.1 Fresh and coastal water 2.3 Infrastructure and economic activities 2.6 Issues of significance to tangata whenua - natural and physical resources Objective 3.5 addresses the following issues: 4.1 Integrated catchment management 4.2 Region-wide water quality management 4.3 Region-wide water quantity management 6.1 Efficient and effective planning **Explanation:** *The way we manage our natural and physical resources (including infrastructure), particularly through regulation, is important to the economy. It directly affects how markets, and individuals and businesses in those markets, operate and allocate their resources.* *Northland has the second to lowest level of Gross Domestic Product per capita of New Zealand's 16 regions, 35% below the national average. Additionally, the Northland economy has recently been hit hard by the combined effects of the global economic recession and two significant climatic events creating a large increase in the number of unemployed people. To improve our wellbeing (especially our economic wellbeing) Northland needs to attract and retain large and small-scale investment. The dispersed nature of Northland and the geographical spread of unemployment mean that small or medium-size investment can have significant positive impacts.* *We need people and businesses to choose Northland as a place to invest, and our economic development needs to be aligned with environmental outcomes. Many*

	economic activities rely on the character and quality of Northland's natural environment and similarly it is a major attraction for people, investors and businesses.
3.7	Recognise and promote the benefits of regionally significant infrastructure, (a physical resource), which through its use of natural and physical resources can significantly enhance Northland's economic, cultural, environmental and social wellbeing. Objective 3.7 addresses the following issues: 2.3 Infrastructure and economic activities 2.4 Regional form 2.6 Issues of Significance to Tangata Whenua (natural and physical resources) Objective 3.7 is achieved by the following policies: 5.3 Regionally significant infrastructure **Explanation:** *Northland needs to provide for regionally significant infrastructure. Quality regionally significant infrastructure can attract business and investment to the region, making Northland better able to compete in the national economy, as well as helping to protect health and safety and provide other important social and community functions. Regionally significant infrastructure may however have adverse effects on the environment.* *It is important therefore to set the overall integrated direction at the regional level promoting recognition of these benefits alongside the need to avoid, remedy or mitigate adverse effects. Such a framework must however also recognise that the constraints of infrastructure provision mean that adverse effects cannot always be practicably avoided or internalised.* *To ensure that the benefits of regionally significant infrastructure can be fully realised, it is also important to recognise the long-term needs of infrastructure providers to operate, maintain and enhance assets.* *Recognition and promotion of the benefits of regionally significant infrastructure includes avoiding the unplanned overloading of essential infrastructure.*
3.8	Manage resource use to: a. Optimise the use of existing infrastructure; b. Ensure new infrastructure is flexible, adaptable, and resilient, and meets the reasonably foreseeable needs of the community; and; c. Strategically enable infrastructure to lead or support regional economic development and community wellbeing. Objective 3.8 addresses the following issues: 2.3 Infrastructure and economic activities 2.4 Regional form Objective 3.8 is achieved by the following policies: 5.1 Regional form 5.2 Effective and efficient infrastructure **Explanation:** *This objective recognises that upgrades to existing infrastructure and the building of new infrastructure are costly activities and resources are limited, so it is important to get the best out of existing infrastructure. This includes using*

demand management tools to manage the need for new infrastructure by making resource consumption more efficient.

Behaviour change through initiatives such as promoting resource efficiency in households and businesses (for example, energy efficient technology and appliances, efficient urban design principles such as passive solar heating and improved transport options) can significantly reduce or manage demand. This has a number of benefits, for example, the efficient use of energy minimises the pressure on energy generation and distribution and reduces business and household energy costs, improves transport energy efficiency and reduces greenhouse gas emissions. Additional co-benefits include improved mobility, improved health in insulated homes and increased comfort of commercial buildings.

Strategic planning for land use can also reduce demand on infrastructure such as public transport and reticulated water, as well as ensuring existing infrastructure can continue to operate efficiently by avoiding effects from incompatible activities. Where new or upgraded infrastructure is proposed, opportunities to use sustainable materials and practices should be explored.

Infrastructure should, as a principle, have sufficient flexibility, adaptability and resilience to meet the reasonably foreseeable needs of the future. Part of this objective therefore seeks to help future-proof infrastructure for long-term use and ensure it can more efficiently adapt to changing technological, operational, economic, environmental and social conditions.

Infrastructure can also be an important tool in promoting economic development and community wellbeing. Part of maximizing the value of infrastructure and ensuring its effectiveness is planning for the right infrastructure in the right place at the right time. This objective aims to ensure that planning for infrastructure is targeted to areas and sectors where it will have the most impact.

Population projections, environmental monitoring trends, anticipated economic development and social indicators (like social deprivation and access to drinking water) could be used to develop critical thresholds for ensuring infrastructure adequately meets the reasonably foreseeable needs of the community. By following this approach, the objective aims to improve the overall affordability and effectiveness of infrastructure.

There is also a need to integrate strategic infrastructure planning between Northland and other regions, including Auckland. To his end, infrastructure can often be used to achieve multiple outcomes. For example:

- *A well-functioning and effective transport system can improve business efficiency, innovation, competition and trade, support concentrations of economic activities and facilitate a mobile and flexible work force.*
- *An effective broadband fibre network can provide economic benefits through new and innovative ways of doing business, access to new markets, improving communication and enhancing access to information and educational opportunities.*
- *A well-coordinated water storage system and reticulation network can provide water for multiple purposes including domestic and municipal supply, irrigation and the needs of industry.*

3.9	Northland's energy supplies are secure and reliable, and generation that benefits the region is supported, particularly when it uses renewable sources. Objective 3.9 addresses the following issues: 2.3 Infrastructure and economic activities Objective 3.9 is achieved by the following policies: 5.1 Regional form 5.3 Regionally significant infrastructure 5.4 Renewable energy **Explanation:** *Northland's relatively low rate of generation, coupled with the vulnerability of energy supply through Auckland and the network within Northland, is detrimental to the social and economic wellbeing of the region. For example, Northland has a number of industries that rely on a secure supply of energy such as the Marsden Point oil refinery, primary production activities such as dairying and horticulture and other industrial and commercial activities, including manufacturing and processing. Diverse sources of energy generation in Northland will give the region security and provide economic, social and environmental benefits. The region also needs to reduce its reliance on fossil fuels by promoting the development of renewable energy sources.* *Renewable electricity generation is a national priority and the government has set a target to produce 90% of our electricity needs from renewable sources by 2025. The Government has produced a National Policy Statement on Renewable Electricity Generation to promote and guide the development of renewable electricity generation. This objective seeks in part to give effect to this National Policy Statement.* *A robust transmission grid and distribution network is essential to fully realise the benefits of increased energy generation within the region and between Northland and the rest of the country. To support a robust transmission grid and distribution network, Regional Policy Statement and plan provisions should enable the ongoing use, maintenance and development of electricity infrastructure as well as avoiding adverse effects from incompatible activities.* *Small and community-scale renewable electricity generation can provide security and resilience as well as reducing pressure on the national grid and regional distribution network.* *There is also the potential in the region to use renewable energy sources (for example, from biomass and geothermal resources) to generate heat and reduce demand on traditional electricity generation sources. The Government has a target to significantly increase the amount of energy per year of energy from woody biomass or direct use geothermal additional to that used in 2005.* *Although we must reduce our reliance on them, secure sources of non-renewable energy such as oil and gas will be needed to support key industries in Northland for the foreseeable future. To this end, key oil and gas pipelines in Northland along with the Marsden Point Oil Refinery should be recognised as being regionally significant infrastructure.*
3.10	Efficiently use and allocate common natural resources, with a particular focus on: a. Situations where demand is greater than supply; b. The use of fresh water and coastal water space; and;

c. Maximising the security and reliability of supply of common natural resources for users.

Objective 3.10 addresses the following issues:
2.1 Fresh and coastal water
2.3 Infrastructure and economic activities

Objectives 3.10 is achieved by the following policies:
4.1 Integrated catchment management
4.2 Region-wide water quality management
4.3 Region-wide water quantity management
4.8 Efficient use of coastal water space

Explanation: *Common resources are critical to Northland's economy. To ensure maximum benefit is gained from available resources, it is vital that they are allocated and used efficiently.*

At present there is no charge for the right to use common resources, the right to use them is allocated on the first 'first in, first served' basis and in some cases, there is minimal obligation to demonstrate reasonable use. As a consequence, there is little incentive for users to minimise wastage or use only as much as they really need. Where the demand or pressure on a resource is low, this isn't generally a problem. However, it can be a significant problem where demand outstrips supply. Freshwater and coastal water space, for example, are resources that are under significant pressure in certain areas and in some cases demand is known to be exceeding supply.

Efficient use may involve:
a. *Avoiding wastage*;
b. *Using the most efficient available technology*;
c. *Linking use with availability (for example, encouraging water storage to lessen demand for water extraction); and*
d. *Reusing resources (for example using treated waste and process water for irrigation).*

Efficient allocation may involve:
a. *Ensuring the processes to allocate the resource are efficient, by selecting the optimal mechanism for the circumstance (the optimal mechanism will vary depending on the circumstances; in some instances, it might be peer-led allocation, such as water sharing groups, while in other instances it might be purely random allocation, such as a ballot)*;
b. *Allocating scarce resources to the highest value uses, taking into account fairness and equity, recognising the difficulty of valuing some uses, and that values can change over time*;
c. *Providing an appropriate balance between providing users certainty of allocation over time, the community retaining the ability to adjust allocations to improve outcomes and allowing new users to have an opportunity to gain an allocation where the resource is already fully allocated*
d. *Ensuring efficient use (for example, through enforcement or incentives);*
e. *Taking into account environmental, economic, social and cultural interests, and how these may change over time; and*
f. *Providing an allocation where the rights and responsibilities of the user are clearly defined*

	"Demand and supply" is used in this objective to refer to the situation where there is a limited resource and the demand is in excess of the limited resource.
3.12	Tangata whenua kaitiaki role is recognised and provided for in decision-making over natural and physical resources. Objective 3.12 addresses the following issues: 2.5 Issues of significance to tangata whenua – participation in resource management Objective 3.12 is achieved by the following policies: 8.1 Participation is decision-making, plans, consents and monitoring 8.2 Iwi and hapu managements plans 8.3 Maori land and returned treaty settlement assets **Explanation:** *Tangata whenua are the kaitiaki of their traditional taonga, while the regional and district councils have delegated authority from the Crown to manage Northland's natural and physical resources.* *In keeping with the partnership principles of the Treaty of Waitangi and the Resource Management Act 1991 (sections 6(e), 7(a) and 8), the regional and district councils must provide for tangata whenua involvement in resource management, particularly where it affects their taonga.* *Tangata whenua involvement in resource management can also add value to resource management. For example, it can help to build relationships, provide different sources of information and knowledge, and provide a longer term perspective of resource management.*
3.13	The risks and impacts of natural hazard events (including the influence of climate change) on people, communities, property, natural systems, infrastructure and our regional economy are minimised by: a. Increasing our understanding of natural hazards, including the potential influence of climate change on natural hazard events; b. Becoming better prepared for the consequences of natural hazard events; c. Avoidinginappropriatenewdevelopmentin10and100yearfloodhazard areas and coastal hazard areas d. Not compromising the effectiveness of existing defences (natural and man-made); e. Enabling appropriate hazard mitigation measures to be created to protect existing vulnerable development; and f. Promoting long-term strategies that reduce the risk of natural hazards impacting on people and communities g. Recognising that in justified circumstances, critical infrastructure may have to be located in natural hazard-prone areas. Objective 3.13 addresses the following issues: 2.6 Issues of significance to tangata whenua- natural and physical resources 2.7 Natural Hazards Objectives 3.13 is achieved by the following policies: 7.1 Development in natural hazard-prone areas 7.2 General risk reduction policies

Explanation: *Under the RMA, people must be able to provide for their social and economic wellbeing; however, this needs to be balanced against the risk to people, property and infrastructure from natural hazard events. This objective seeks to minimise the risks and impacts of natural hazard events by, amongst other things, not compromising the effectiveness of existing defences (natural and man-made) and avoiding inappropriate development in hazard-prone areas.*

There is an increasing amount of information that shows which areas in Northland are prone to damage from natural hazards and this enables informed assessments about the risk to people and property from natural hazards. Part (a) of this objective seeks to further increase our understanding of natural hazards (for example, by identifying and mapping new flood and coastal hazard areas). This work will be ongoing and is integral to minimising the risks and impacts of natural hazard events.

There is existing development within hazard-prone areas and enabling appropriate hazard mitigation measures to be created will help minimise the risks and impacts on these vulnerable communities.

Risk reduction is often less costly than the social and economic impact of the physical damage and potential loss of life caused by natural hazards.

Risk reduction measures may include:

a. *Encouraging a change in land use to less vulnerable activities;*
b. *Considering the benefits of managed retreat, particularly where the costs of protection works exceed the benefits (primarily as a response to coastal erosion but also relevant to properties that are repeatedly inundated by floods)*;
c. *Enhancing natural or artificial protection measures (for example, dunes and stopbanks)*
d. *Increasing river channel capacity to reduce flood risk; and;*
e. *Not developing hazard-prone areas*

Climate change is explicitly included within this objective because under section 7 of the RMA, councils must have particular regard to the effects of a changing climate on their communities. Climate change is projected to have a significant impact on the risk from natural hazards by changing some of the hazard drivers (for example, sea level rise may lead to greater coastal erosion / inundation and an increase in high intensity short duration rainfall events could lead to more flash floods and land slips).

While there is some uncertainty over the possibility, extent and timing of climate change effects, when assessing natural hazard risk, councils should use the latest national guidance and the best available information on the impacts of climate change on natural hazard events. The Ministry for the Environment's latest set of national guidelines on climate change is already being used for planning purposes in Northland (for example, the projections for sea level rise and storm rainfall increase are reflected in the tsunami and flood modelling undertaken by the regional council). These guidelines have been accepted as a prudent approach to risk assessment in recent court cases because the future state of the environment is relevant in considering the effects of a proposal.

This objective seeks to ensure that risk posed by natural hazard events does not increase as a result of human activity. Certain human activities can increase the risk associated with natural hazards, particularly where those activities modify,

	reduce, remove or otherwise compromise existing defences against hazards such as dune systems, coastal vegetation, wetlands, flood plains and estuaries. *Activities that could compromise the effectiveness of existing defences include infilling of flood plains resulting from earthworks (this reduces the volume available to attenuate flood flows), raising roads and highways, vegetation clearance or the creation of impermeable surfaces (this leads to increased run-off) and the diversion of floodwater associated with structures erected on overland flow paths or in high velocity areas of flood plains.*
3.14	Identify and protect from inappropriate subdivision, use and development; a. The qualities and characteristics that make up the natural character of the coastal environment, and the natural character of freshwater bodies and their margins; b. The qualities and characteristics that make up outstanding natural features and outstanding natural landscapes; c. The integrity of historic heritage Objective 3.14 addresses the following issues: 2.1 Fresh and coastal water 2.3 Indigenous ecosystems and biodiversity 2.6 Issues of significance to tangata whenua –natural and physical resources 2.8 Natural character, features / landscapes and historic heritage Objectives 3.14 is achieved by the following policies: 4.1 Integrated catchment management 4.2 Region-wide water quality management 4.3 Region-wide water quantity management 4.4 Maintaining and enhancing indigenous ecosystems and species 4.5 Identifying the coastal environment, natural character, outstanding natural features, outstanding natural landscapes, and historic heritage resources 4.6 Managing effects on natural character, features / landscapes and heritage 4.7 Supporting management and improvement **Explanation:** *The objective identifies matters that are central to the sustainability objectives of the Resource Management Act 1991 (RMA). Regional and district councils must recognise and provide for the protection of these resources from inappropriate subdivision, use and development as a matter of national importance under sections 6(a), (b) and (f) of the RMA. The New Zealand Coastal Policy Statement 2010 (NZCPS) reinforces these duties and requires regional policy statements and plans to identify where this protection is needed.* *The objective does not seek absolute protection in all cases, as in many circumstances individual elements of these resources (for example, a specific landscape unit) can accommodate a degree of modification. The level of protection will depend on the values if these areas.* *Legal obligations aside, these resources are very important for Northland's unique character and sense of place and they contribute to our social, economic and cultural wellbeing.* *To protect these areas, they must first be identified and then managed.* *Using a regionally-consistent approach to identify and protect the areas listed in the objective will:*

	• *Provide certainty that the requirements of the RMA and NZCPS are being met throughout the region;* • *Provide certainty that the values which contribute to Northland's unique sense of place are protected to a defined standard and that the activities which are of most concern are addressed;* • *Limit the duplication and associated costs and inefficiencies which arise when individual councils address these matters in isolation;* • *Avoid the potential for conflicting provisions across council boundaries;* • *Provide the basis for community-wide agreement on what is regionally significant in relation to those matters listed in the objective; and* • *Provide certainty for landowners and developers as to where these areas are.* *For the purposes of the Regional Policy Statement, historic heritage is as defined in s2, RMA.*
3.15	Maintain and / or improve; a. The natural character of the coastal environment and fresh water bodies and their margins; b. Outstanding natural features and outstanding natural landscapes; c. Historic heritage d. Areas of significant indigenous vegetation and significant habitats of indigenous fauna (including those within estuaries and harbours); e. Public access to the coast; and f. Fresh and coastal water quality by supporting, enabling and positively recognising active management arising from the efforts of landowners, individuals, iwi, hapū and community groups. Objective 3.15 addresses the following issues: 2.1 Fresh and coastal water 2.2 Indigenous ecosystems and biodiversity 2.5 Issues of significance to tangata whenua – participation in resource management 2.6 Issues of significance to tangata whenua –natural and physical resources 2.8 Natural character, features / landscapes and historic heritage Objectives 3.15 is achieved by the following policies: 4.2 Region-wide water quality management 4.3 Region-wide water quantity management 4.4 Maintaining and enhancing indigenous ecosystems and species 4.7 Supporting management and improvement **Explanation:** *The objective identifies elements of Northland's environment that have been identified in other objectives as being fundamental to the region's unique character, and / or the most vulnerable to the effects of inappropriate subdivision, use and development. They tend be those natural and physical resources valued most by communities and / or given particular weight under the Resource Management Act 1991 (RMA). These elements therefore require special attention and the RMA provides for controls over the use of land (through district and regional plan rules) to manage impacts on them.* *Rules can be effective in protecting these resources from the adverse effects of inappropriate subdivision, use and development. However, rules are less effective for remedying or preventing other adverse effects not associated with development, such as those from pest plants and animals. The management of these effects is often best done through the work of individuals and communities.*

For example, Northland is particularly susceptible to ongoing pressures and risks that cannot realistically be remedied through rules. These include:

- *Impacts of pest organisms;*
- *"Legacy effects" resulting from reduced extent of riparian vegetation and wetlands and subsequently elevated sediment and nutrient loads;*
- *Reduced diversity / extent of native habitat;*
- *Limited public access to and along the coast in some areas; and*
- *Costs to maintain, manage and / or restore historic heritage.*

These effects (on their own and in combination) reduce natural character, indigenous biodiversity, water quality, and aesthetic and amenity values and without intervention, may continue to degrade the quality of Northland's environment.

Appropriate subdivision, use and development can be the most effective means to achieve on-going management and improvement of these resources and can provide opportunities to address ongoing impacts / risks and result in net positive effects that may not otherwise occur. Landowners and community groups are generally best placed to undertake active management because:

- *Councils have limited resources and do not have the capacity for the day-to-day on-site management that is often required, particularly for managing pest plants and animals;*
- *While rules may go some way to maintaining special areas, maintenance enhancement cannot be compelled by rules and relies on motivated people;*
- *Landowners have the ability to make decisions on how to use their land;*
- *Landowners, iwi, hapū and communities are better placed to use local knowledge, networks and resources; and*
- *Communities and iwi, hapū have a better idea of what they want and / or need regarding the matters listed.*

Another issue is that landowners (particularly rural landowners) are often faced with the costs of active protection and / or enhancement of these areas on their land for what is in effect the wider public benefit and in these cases support / recognition is warranted. Therefore, the objective does not seek to 'compensate' landowners where land use restrictions apply; rather, the intention is to assist those who wish to actively manage and / or enhance aspects of the environment over and above the requirements of the RMA. The use of public resources (like rates, council staff time) and incentives to assist and encourage individuals and community groups can be justified where:

- *It helps councils to achieve their functions and duties under the RMA; and*
- *The social, cultural, economic or environmental benefits for the public are greater than the costs of the public investment.*

Table 1: The Operative Northland Regional Policy Statement cited Objectives

Policy	Description
4.2.1	Improving overall water quality. Improve the overall quality of Northland's water resources by: a. Establishing freshwater objectives and setting region-wide water quality limits in regional plans that give effect to Objective 3.2 of this regional policy statement; b. Reducing loads of sediment, nutrients, and faecal matter to water from the use and development of land and from poorly treated and untreated discharges of wastewater; and; c. Promoting and supporting the active management, enhancement and creation of vegetated riparian margins and wetlands. **Explanation:** *There is a need to better prevent and control diffuse source discharges, run-off and leaching from the use and development of land so that the overall quality of the region's fresh and coastal waters is improved. In addition, it is important that there is continued investment in addressing discharges of wastewater, particularly from municipal systems. Reducing loads of the sediments, nutrients, and faecal matter will be central to meeting catchment-specific objectives and limits.* *There are also potential efficiencies to be realised in terms of water quality. Capacity for additional discharges as part of further land use intensification may only be possible if existing contaminant loads are reduced.* *Riparian vegetation and wetlands play an important role in maintaining and improving water quality by trapping and treating sediments and nutrients, improving dissolved oxygen concentrations and reducing temperatures through shading, and providing important habitat for aquatic species.*

4.4.1 (1) In the coastal environment, avoid adverse effects, and outside the coastal environment avoid, remedy or mitigate adverse effects of subdivision, use and development so they are no more than minor on:

a. Indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;
b. Areas of indigenous vegetation and habitats of indigenous fauna, that are significant using the assessment criteria in Appendix 5;
c. Areas set aside for full or partial protection of indigenous biodiversity under other legislation.

(2) In the coastal environment, avoid significant adverse effects and avoid, remedy, or mitigate other adverse effects of subdivision, use and development on:

a. Areas of predominantly indigenous vegetation;
b. Habitats of indigenous species that are important for recreational, commercial, traditional or cultural purposes;
c. Indigenous ecosystems and habitats that are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass, northern wet heathlands, coastal and headwater streams, floodplains, margins of the coastal marine area and freshwater bodies, spawning and nursery areas and saltmarsh.

(3) Outside the coastal environment and where clause (1) does not apply, avoid, remedy or mitigate adverse effects of subdivision, use and development so they are not significant on any of the following:

a. Areas of predominantly indigenous vegetation;
b. Habitats of indigenous species that are important for recreational, commercial, traditional or cultural purposes;
c. Indigenous ecosystems and habitats that are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass, northern wet heathlands, coastal and headwater streams, floodplains, margins of the coastal marine area and freshwater bodies, spawning and nursery areas and saltmarsh.

(4) For the purposes of clause (1), (2) and (3), when considering whether there are any adverse effects and/or any significant adverse effects:

a. Recognise that a minor or transitory effect may not be an adverse effect;
b. Recognise that where the effects are or may be irreversible, then they are likely to be more than minor;
c. Recognise that there may be more than minor cumulative effects from minor or transitory effects.

(5) For the purpose of clause (3) if adverse effects cannot be reasonably avoided, remedied or mitigated then it may be appropriate to consider the next steps in the mitigation hierarchy i.e. biodiversity offsetting followed by environmental biodiversity compensation, as methods to achieve Objective 3.4.

Explanation: *Policy 4.1 seeks to protect important indigenous ecosystems and habitats and maintain the diversity of indigenous species. The policy reflects Policy 11 of the New Zealand Coastal Policy Statement 2011, which applies in the coastal environment, and takes into account the decision of the Supreme Court in King Salmon (Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd [2014] NZSC 38).*

The management approach has a tiered protection structure. Policy 4.4.1(1) provides the highest level of protection to ecosystems, habitats, and species (biological values) most at risk of irreversible loss, with the appropriate management response being to avoid adverse effects in the coastal environment and to ensure there are no more than minor effects elsewhere.

Areas of significant indigenous vegetation and significant habitats fall within this first tier and the criteria to identify these areas are provided in Appendix 5.

Policy 4.1 (2) and (3) provides a lower level of protection for ecosystems, habitats, and species at a lesser risk of loss. It covers the coastal environment and elsewhere.

It should be noted that Policy 4.1 (2) and (3) are broader in scope than section 6(c) of the Resource Management Act, which requires the protection of areas of significant indigenous vegetation and significant habitats of indigenous species as a matter of national importance. This is because in Northland many such habitats have been degraded, so there is a greater need to give some protection to the valued habitats that remain extant.

4.5.2 The Regional Policy Statement Maps of high and outstanding natural character and outstanding natural features and outstanding natural landscapes identify areas that are sensitive to subdivision, use and development. The maps of these areas identify where caution is required to ensure activities are appropriate. However, suitably qualified assessment at a site or property-specific level can be used to demonstrate lesser (or greater) sensitivity to particular subdivision, use and development proposals given the greater resolution provided.

Explanation: *The Regional Policy Statement Maps of high and outstanding natural character, outstanding natural features and outstanding natural landscapes identify those areas where caution is required to ensure subdivision, use and development is appropriate. They have been developed using the best information available and ground tested where practicable. This policy recognises that despite best endeavours, the maps may not always be accurate at individual property or site-scale. Therefore, qualified site or property specific assessment at greater resolution and accuracy may be able to demonstrate that the values are not present or are of less (or more) significance than depicted on the maps or that a lesser (or greater) degree of sensitivity and / or caution is warranted in relation to specific proposals. However this does not equate to relitigation of the maps or a requirement to amend maps.*

4.5.3 Historic heritage resources (areas, places, sites, buildings, or structures either individually or as a group) are identified taking into account one or more of the following criteria:

a. Archaeological and / or scientific importance: the resource contributes significantly to our understanding of human history or archaeological research;
b. Architecture and technology: the structure or building is significant due to design, form, scale, materials, style, period, craftsmanship, construction technique or other unique element / characteristic;
c. Rarity: the resource or site is unique, uncommon or rare at a district, regional or national level;
d. Representativeness: the resource is an excellent example of its class in terms of design, type, use, technology, time period or other characteristic;
e. Integrity: the resource retains a high proportion of its original characteristics and integrity compared with other examples in the district or region;
f. Context: the resource forms part of an association of heritage sites or buildings which, when considered as a whole, become important at a district, regional or national scale;
g. People and events: the resource is directly associated with the life or works of a well-known or important individual, group or organisation and / or is associated with locally, regionally or nationally significant historic events;
h. Identity: the resource provides a sense of place, community identity or cultural or historical continuity;
i. Tangata whenua: the resource place or feature is important to tangata whenua for traditional, spiritual, cultural or historic reasons; and
j. Statutory: the resource or feature is recognised nationally or internationally, including: a World Heritage Site under the World Heritage Convention 1972; is registered under the Historic Places Act 1993; or is recognised as having significant heritage value under a statutory acknowledgement or other legislation.

Explanation: *Historic heritage resources that meet the criteria under Policy 4.5.3 warrant protection from inappropriate development in accordance with section 6(f) of the RMA. These are the historic heritage resources to be identified in regional and district plans. The decision on which other heritage features (that do not meet the criteria in this policy) to include in plans is left to individual councils. The criteria used are based on those developed by the New Zealand Historic Places Trust. The term historic heritage has the same meaning as the definition in section 2 of the Resource Management Act.*

4.6.1, limbs (1) and (3)	(1) In the coastal environment: a. Avoid adverse effects of subdivision use, and development on the characteristics and qualities which make up the outstanding values of areas of outstanding natural character, outstanding natural features and outstanding natural landscapes; b. Where (a) does not apply, avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of subdivision, use and development on natural character, natural features and natural landscapes. Methods which may achieve this include i. Ensuring the location, intensity, scale and form of subdivision and built development is appropriate having regard to natural elements, landforms and processes, including vegetation patterns, ridgelines, headlands, peninsulas, dune systems, reefs and freshwater bodies and their margins; and ii. In areas of high natural character, minimising to the extent practicable indigenous vegetation clearance and modification (including earthworks / disturbance, structures, discharges and extraction of water) to natural wetlands, the beds of lakes, rivers and the coastal marine area and their margins; and iii. Encouraging any new subdivision and built development to consolidate within and around existing settlements or where natural character and landscape has already been compromised.; (2) Outside the coastal environment avoid significant adverse effects and avoid, remedy or mitigate other adverse effects (including cumulative adverse effects) of subdivision, use and development on the characteristics and qualities of outstanding natural features and outstanding natural landscapes and the natural character of freshwater bodies. Methods which may achieve this include: a. In outstanding natural landscapes, requiring that the location and intensity of subdivision, use and built development is appropriate having regard to, natural elements, landforms and processes, including vegetation patterns, ridgelines and freshwater bodies and their margins; b. In outstanding natural features, requiring that the scale and intensity of earthworks and built development is appropriate taking into account the scale, form and vulnerability to modification of the feature; c. Minimising, indigenous vegetation clearance and modification (including earthworks / disturbance and structures) to natural wetlands, the beds of lakes, rivers and their margins. (3) When considering whether there are any adverse effects on the characteristics and qualities 9 of the natural character, natural features and landscape values in terms of (1)(a), whether there are any significant adverse effects and the scale of any adverse effects in terms of (1)(b) and (2), and in determining the character, intensity and scale of the adverse effects: a. Recognise that a minor or transitory effect may not be an adverse effect; b. Recognise that many areas contain ongoing use and development that: i. Were present when the area was identified as high or outstanding or have subsequently been lawfully established ii. May be dynamic, diverse or seasonal; c. Recognise that there may be more than minor cumulative adverse effects from minor or transitory adverse effects; and d. Have regard to any restoration and enhancement on the characteristics and qualities of that area of natural character, natural features and/or natural landscape. **Explanation:** *This policy seeks to manage adverse effects on natural character, landscape and natural features. It specifies the level of protection to be achieved for the resources in question. It applies a hierarchy of protection based on context and value following the direction in Policies 13 and 15 of the New Zealand Coastal Policy Statement (NZCPS) and s6 of the Resource Management Act (RMA). In effect, the policy states the level or scale of effect that is inappropriate for the resource in question.* *Policy 4.6.1 gives effect to the NZCPS, taking into account the decision of the Supreme Court in King Salmon (Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd [2014] NZSC 38)*

This approach is also specifically contemplated in Objective 2 and Policies 13(1)(d) and 15(d) of the NZCPS that direct regional policy statements and plans to identify where protection of natural character, natural features and landscapes is required (and by default, where it is not) and what forms of use and development would be inappropriate in those areas (and, by inference, forms of use and development which are appropriate in those areas).

4.6.2 (1) Protect the integrity of historic heritage resources that have been identified in plans in accordance with Policy 4.5.3 and Method 4.5.4(3):

a. By avoiding significant adverse effects of subdivision, use and development and avoiding, remedying or mitigating other adverse effects (including cumulative adverse effects) on historic heritage in the following way:
   i. Requiring careful design and location of subdivision, use and development to retain heritage buildings and other physical elements of historic heritage and where practical enhance public use and access;
   ii. Restricting the demolition / relocation of and / or inappropriate modifications, additions or alterations to physical elements of historic heritage;
   iii. Recognising that the integrity of many historic heritage resources relies on context and maintain these relationships in the design and location of subdivision, use and development;
   iv. Recognising the collective value of groups of heritage buildings, structures and / or places, particularly where these are representative of Northland's historic settlements, architecture or periods in history and maintain the wider character of such areas; and
   v. Restricting activities that compromise important spiritual or cultural values held by Māori / Mana Whenua and / or the wider community in association with particular heritage places or features.

(2) Despite the above:

a. Clause 1 does not apply where natural hazards threaten the viability of regionally significant infrastructure and / or public health and safety; or
b. Regionally significant infrastructure proposals that cannot meet 4.6.2(1) may still be appropriate after assessment against the matters in Policy 5.3.3(3).

Explanation: *This policy reflects the direction in section 6(f) of the Resource Management Act (RMA) that historic heritage is to be protected from inappropriate subdivision, use and development. This policy sets out the level of protection to be provided for historic heritage that meet the criteria in Policy 4.5.3. It states that significant adverse effects on these historic heritage resources are to be avoided (in other words significant adverse effects on these historic heritage resources are inappropriate). It also sets out the means by which the integrity of these resources is to be protected. However, the policy provides exceptions from the protection sought in certain circumstances. These circumstances are those where the intent of the RMA as a whole is better served by providing for certain activities given the wider benefits of doing so. The case for these exceptions would need to be demonstrated through plan change or consent processes.*

4.7.1 In plan provisions and the resource consent process, recognise and promote the positive effects of the following activities that contribute to active management:

a. Pest control, particularly where it will complement an existing pest control project / programme;
b. Soil conservation / erosion control;
c. Measures to improve water quality in parts of the coastal marine area where it has deteriorated and is having significant adverse effects, or in freshwater bodies targeted for water quality enhancement;
d. Measures to improve flows and / or levels in over allocated freshwater bodies;
e. Re-vegetation with indigenous species, particularly in areas identified for natural character improvement;
f. Maintenance of historic heritage resources (including sites, buildings and structures);
g. Improvement of public access to and along the coastal marine area or the margins of rivers or lakes except where this would compromise the conservation of historic heritage or significant indigenous vegetation and / or significant habitats of indigenous fauna;
h. Exclusion of stock from waterways and areas of significant indigenous vegetation and / or significant habitats of indigenous fauna;
i. Protection of indigenous biodiversity values identified under Policy 4.4.1, outstanding natural character, outstanding natural landscapes or outstanding natural features either through legal means or physical works;
j. Removal of redundant or unwanted structures and / or buildings except where these are of historic heritage value or where removal reduces public access to and along the coast or lakes and rivers;
k. Restoration or creation of natural habitat and processes, including ecological corridors in association with indigenous biodiversity values identified under Policy 4.4.1, particularly wetlands and / or wetland sequences;
l. Restoration of natural processes in marine and freshwater habitats.

Explanation: *This policy recognises that regulation is typically only effective at preventing adverse effects and that other more proactive means are required if ongoing pressures / risks or 'legacy' effects are to be remedied. Appropriate subdivision, use and development can provide an opportunity to address risks or remedy ongoing legacy effects and the policy seeks that these beneficial effects be given due weight in decision-making. The policy therefore states that items listed are to be seen as positive effects when assessing subdivision, use and development proposals, particularly where they target such pressures / risks in high value areas that may not otherwise be addressed.*

4.7.3 Except where in conflict with established uses promote rehabilitation and restoration of natural character in the manner described in Policy 4.7.1 in the following areas:

a. Wetlands, rivers, lakes, estuaries, and their margins;
b. Undeveloped or largely undeveloped natural landforms between settlements, such as coastal headlands, peninsulas, ridgelines, dune systems;
c. Areas of high natural character;
d. Land adjacent to outstanding natural character areas, outstanding natural features, and outstanding natural landscapes;
e. Remnants of indigenous coastal vegetation particularly where these are adjacent to water or can be linked to establish or enhance ecological corridors; and
f. The areas or values identified in Policy 4.4.1 (protecting significant areas and species).

Explanation: *This policy seeks restoration of natural character by encouraging the activities in Policy 4.7.1 in locations where there are likely to be the most gain and potential benefit. However, the policy excludes those areas where protection of natural character is not required as provided in Policy 4.6.1(3) or where this would conflict with established uses such as mineral extraction, infrastructure or primary production. This is because it is counterproductive to promote restoration efforts where they would be undermined or frustrated in the long-term.*

4.8.1 (1) Only consider allowing structures, the use of structures and other activities that occupy space in the common marine and coastal area where:

a. They have a functional need to be located in the common marine and coastal area, unless the structure, use or activity is consistent with Policy 4.8.1(2);
b. It is not feasible for the structure, the use or the occupation of space to be undertaken on dry land (land outside the common marine and coastal area), unless it is consistent with Policy 4.8.1(2);
c. It is not feasible to use an existing authorised structure; and
d. The area occupied is necessary to provide for or undertake the intended use.

(2) Occupation of space and structures (and their use) that are contrary to Policy 4.8.1(1) (a) and (b) may be appropriate where they will make a significant positive contribution to the local area or the region.
(3) If the public are excluded from using a structure or common marine and coastal area, the exclusion is:

a. Only for the time period(s) and the area necessary to provide for or undertake the intended use; or
b. Necessary to ensure the integrity of the structure; or
c. Necessary to ensure the health and safety of the public.

Explanation: *This policy directs decision-makers to ensure the occupation of space in the common marine and coastal area is efficient. It considers whether there is a functional need to occupy space in the common marine and coastal area and the area occupied is necessary for the activity Additionally, there are some structures that functionally necessitate restrictions on public access (such as for health and safety reasons and to protect the integrity of structures).*

Activities like restaurants, residential dwellings, transmission lines and cafe□s may be located in the common marine and coastal area if they make a significant contribution to the local area or region.
To clarify, this policy is in effect a gateway test: if an activity doesn’t conform to the policy then it should not be allowed. However, if an activity conforms to this policy, its environmental effects and any other relevant policies also need to be considered before determining whether it should be allowed.

4.8.3 When determining the expiry date for coastal permits to occupy space in the common marine and coastal area, particular regard will be had to:

a. The security of tenure for investment (the larger the investment, the longer the consent duration);
b. Aligning the expiry date with other coastal permits to occupy space in the surrounding common marine and coastal area;
c. The reasonably foreseeable demands for the occupied water space by another type of activity (the greater the demands, the shorter the consent duration); and
d. Certainty of effects (the less certain the effects the shorter the consent duration).

Explanation: *This policy sets out the main factors to be considered in determining expiry dates for coastal permits, to promote efficient use and allocation of coastal water space.*

Security of tenure is important for investment. Larger investments tend to require longer consent durations to get the pay-back (such as profit or recreational benefit) necessary to make the investment worthwhile. Aligning consent expiry dates for activities in the same area makes it administratively easier to process resource consent renewals and examine efficient allocation.

Coastal water space is a public asset. It is important to balance providing security of tenure with providing the community the opportunity to adjust the allocation to improve outcomes and allowing new users the opportunity to use the space.

Consent duration can be a way of dealing with uncertain effects. The effects may be environmental, economic, social or cultural. For example, if an applicant purports a particular positive effect which has a significant bearing on the granting of resource consent, a short-term consent duration could be used to address any uncertainty about the claims of the positive effect.

4.8.4 Recognise activities which provide a net gain in environmental and / or public benefit from persons occupying space in the common marine and coastal area.

Explanation: *The common marine and coastal area is a public resource. This policy recognises activities where they provide an environmental benefit and / or public benefit. These benefits could be in the form of, for example, a coastal occupation charge, financial contribution, contribution of jobs for locals or increased income for the local community region and extends to national benefits.*

<table>
<tr><td>5.1.2</td><td>Enable people and communities to provide for their wellbeing through appropriate subdivision, use, and settlements and avoids sprawling or sporadic patterns of development;

a. Consolidates urban development within or adjacent to existing coastal settlements and avoids sprawling or sporadic patterns of development;
b. Ensures sufficient development setbacks from the coastal marine area to;
i. maintain and enhance public access, open space, and amenity values; and
ii. allow for natural functioning of coastal processes and ecosystems;
iii. allow for natural functioning of coastal processes and ecosystems;
c. Takes into account the values of adjoining or adjacent land and established activities (both within the coastal marine area and on land);
d. Ensures adequate infrastructure services will be provided for the development; and
e. Avoids adverse effects on access to, use and enjoyment of surf breaks of national significance for surfing.

Note: in determining the appropriateness of subdivision, use and development, all policies and methods in the Regional Policy Statement must be considered, particularly policies relating to natural character, features and landscapes, heritage, natural hazards, indigenous ecosystems and fresh and coastal water quality.

Explanation: Northland's unique coastal environment has a range of landscape, seascape and recreational qualities that make it a popular place for development. Most of our existing settlements are located in the coastal environment and this is also where most development in Northland is occurring. The coastal environment is of huge economic importance to the region (for example, tourism and aquaculture) and our coast is an attribute that sets us apart from other regions. Northland has one of the longest coastlines of any region in the country.

Inappropriate subdivision, use or development can compromise the special values that attract people to our coast and make it less desirable. This policy provides strategic direction for development of the coastal environment, recognising that there is particular pressure for development within this environment and that there are potential effects of development that are distinctive to this sensitive environment. For reasons such as these – and to give effect to the New Zealand Coastal Policy Statement 2010 (particularly Policies 4, 6, 7 and 16) – managing development in the coastal environment needs particular attention and therefore specific policy direction in the Regional Policy Statement (RPS).

Land use conflicts and adverse cultural and environmental effects (such as deterioration of coastal water quality) will increase if land use planning in the coastal environment does not evolve to keep up with the demand for subdivision and development. Consequently, this policy includes requirements for subdivision and development in the coastal environment over and above the regional guidelines in Appendix 2. Having this policy direction in the RPS will result in less ad-hoc development within the coastal environment and maintain existing amenity values, ensuring that the special qualities of the coastal environment are not degraded.</td></tr>
<tr><td>5.1.3, limb (c)</td><td>Avoid the adverse effects, including reverse sensitivity effects of new subdivision, use and development, particularly residential development on the following:

a. Primary production activities in primary production zones (including within the coastal marine area);
b. Commercial and industrial activities in commercial and industrial zones;
c. The operation, maintenance or upgrading of existing or planned regionally significant infrastructure; and
d. The use and development of regionally significant mineral resources.

Explanation: This policy recognises that there are certain activities and land (zones) that should be protected from the adverse effects of new subdivision, use and development because of their importance to Northland's economy. Essentially, the only impacts that councils can manage are those from incompatible subdivision, development and land use. Consequently, this policy only applies to avoiding</td></tr>
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	the adverse effects of new subdivision and development on already established land uses and activities. In line with Objective 3.6 (viability of important economic activities), avoidance is the appropriate standard because any lesser requirement would not achieve the related objective. This policy gives district councils the flexibility to re-zone primary production land for other uses (like residential) and therefore this policy would not apply to the new zoning. *Land is arguably Northland's most significant economic asset because of the primary production sector (forestry, dairying, horticulture) along with the actual and potential value of mineral and renewable energy resources. Northland only has a finite amount of land. Inappropriately located new residential subdivision and other types of development have the potential to constrain existing productive uses of land. This is widely known as reverse sensitivity.*
5.2.1	Encourage development and activities to efficiently use resources, particularly network resources, water and energy, and promote the reduction and reuse of waste. **Explanation:** *This policy provides for the wise use of resources, including infrastructure. It recognises that more efficient use of resources means we can get more value out of resources and the infrastructure that is used to carry those resources. This approach can be applied to both large and small users of resources – indeed the positive effect of smart resource use by large numbers of small consumers (householders) is likely to be significant.* *The types of measures that could be promoted include, but are not limited to, effective siting of development to maximise use of resources (such as sunlight or existing wastewater infrastructure) and either providing or future-proofing the ability to harness natural resources (for example, solar energy). Technologies that have the potential to optimise resource consumption such as green roofs, rain gardens, renewable energy technologies, rainwater storage, and grey water recycling techniques can also be promoted. Consideration should be given to appropriate incentives or economic instruments to encourage efficient use of resources.* *The Regional Form and Development Guidelines in Appendix 2 contribute to the implementation of this policy.* *It also links to inter-regional consideration of resource use and infrastructure.*
5.2.2	Encourage the development of infrastructure that is flexible, resilient, and adaptable to the reasonably foreseeable needs of the community. **Explanation:** *The intention of this policy is to ensure long-term consideration is given to the provision of new infrastructure. This policy complements Policy 5.2.1, which encourages wise resource use. Where new infrastructure is needed to satisfy demand, or where existing infrastructure is coming to the end of its life, consideration must be given to the long-term future need and demand for that infrastructure. The benefits of doing this are that it may be cheaper to make small extra capacity allowances at an early stage of development rather than expensive retrofitting if development overtakes infrastructure capacity. Alternatively, a flexible platform could be provided that allows for easy expansion. Efficient planning for infrastructure will also decrease the likelihood of disruption to users from maintenance or upgrading.*
5.2.3	Promote the provision of infrastructure as a means to shape, stimulate and direct opportunities for growth and economic development. **Explanation:** *This policy is about infrastructure-led growth. It is well recognised that effective growth cannot occur without planning for infrastructure; however, the smart use of infrastructure can actually create opportunities for growth and development. This approach is useful where resources are limited, where there are areas of deprivation and where value can be added to existing activities with the right leverage and investment.* *To realise this policy, 'smart' infrastructure provision must be informed by an understanding of where the opportunities for growth lie including any 'trigger points'. Planning for different types of infrastructure can*

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<tr><td></td><td>often take place separately. This policy encourages comprehensive planning, tying together the various different plans that include or rely on infrastructure planning to maximise effort.

Again, there is the potential to look inter-regionally as well as within the region for opportunities to improve economic wellbeing.</td></tr>
<tr><td>5.3.1</td><td>The regional and district councils shall recognise the activities identified in Appendix 3 of this document as being regionally significant infrastructure.

Explanation: The purpose of this policy is to identify regionally significant infrastructure. This will allow:
Regionally significant infrastructure to be protected from adverse effects, including those caused by new use and development t(Policy 5.1.3). Placing controls on incompatible activities locating nearby will allow established regionally significant infrastructure to be effectively maintained, operated and upgraded. Where new regionally significant infrastructure is approved, for example, by way of a resource consent, it will ensure that other activities do not compromise its future construction.
The benefits of a new proposal to be promoted and weighed against any adverse effects (Policies 5.3.2 and 5.3.3).
In determining the list of regionally significant infrastructure, the following matters have been considered:
Whether the activity is listed in section 2 of the Resource Management Act 1991 (RMA) as ‘infrastructure’.
The extent of public benefit arising from the activity and the nature of these benefits. Generally these will be direct benefits - for example, network electricity infrastructure supplying a large community, allowing people to meet their energy needs. In certain cases however indirect benefits may be significant - for example, network electricity infrastructure supplying a key industrial site that employs a large number of workers, allowing people in the community to meet their employment needs.
Cross boundary or cross community impacts. Some activities need to operate over long distances, for example, linear infrastructure such as pipelines, transmission lines and roading corridors. Other activities provide important network ‘hubs’, for example, ports and airports.
Direction from national policy statements. Recognising the significance of electricity transmission lines, for example, gives effect to the National Policy Statement Electricity Policy Statement and provides support for its development. Policy 5.1.3 provides support for its secure operation.
The difficulty of repairing or replacing the facility if it is compromised. Infrastructure can be a large capital investment and the larger and more significant the infrastructure, the longer it will take to repair or replace if its functionality is compromised.
Additionally, although the list in the RMA provides the basis for most regionally significant infrastructure identified in the Regional Policy Statement, it is recognised that because of their benefits, there are some significant social and community facilities that need to be recognised as regionally significant infrastructure. The Marsden Point Oil Refinery has been separately identified given its status as a unique and nationally important facility.</td></tr>
<tr><td>5.3.2</td><td>Particular regard shall be had to the significant social, economic, and cultural benefits of regionally significant infrastructure when considering and determining resource consent applications or notices of requirement for regionally significant infrastructure.

Explanation: The intent of this policy is to assist regionally significant infrastructure when it comes to the overall judgement to be made in terms of section 5 of the Resource Management Act 1991(RMA), during the resource consent process, by providing clear recognition of the social, economic, and cultural benefits of regionally significant infrastructure.</td></tr>
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5.3.3, limbs (2) and (3)	(1) Allow adverse effects arising from the establishment and operation of new regionally significant infrastructure and the re-consenting of existing operations where: a. The proposal is consistent with Policies 4.4.1(1), 4.4.1(2), 4.6.1(1)(a), 4.6.1(1)(b), 4.6.1(2) and 4.6.2 (1); b. The proposal does not result in established water quality limits or environmental flows and / or levels being exceeded or otherwise could lead to the over-allocation of a catchment (refer to Policy 4.1.1); c. Damage to and / or loss of the relationship of iwi with ancestral sites, sites of significance, wāhi tapu, customary activities and / or taonga is avoided or otherwise agreed to by the affected iwi or hapū; and d. In addition to the matters outlined in (1)(a)–(c)above, other adverse effects are avoided, remedied or mitigated to the extent that they are no more than minor. (2) Allow adverse effects arising from the maintenance and upgrading of established regionally significant infrastructure wherever it is located, where: a. The adverse effects whilst the maintenance or upgrading is being undertaken are not significant; and b. The adverse effects after the conclusion of the maintenance or upgrading are the same or similar to before the activity being undertaken. (3) When managing the adverse effects of regionally significant infrastructure decision makers will give weight to: a. The benefits of the activity in terms of Policy 5.3.2; b. Whether the activity must be recognized and provided for as directed by a national policy statement; c. Any constraints that limit the design and location of the activity, including any alternatives that have been considered which have proven to be impractical, or have greater adverse effects; d. Whether the proposal is for regionally significant infrastructure which is included in Schedule 1 of the Civil Defence Emergency Management Act as a lifeline utility and meets the reasonably foreseeable needs of Northland. e. The extent to which the adverse effects of the activity can be practicably reduced. Such an assessment shall also take into account appropriate measures, when offered, to provide positive effects, either within the subject site or elsewhere provided that the positive effects accrue to the community of interest and / or resource affected; and f. Whether a monitoring programme for any identified significant adverse effects with unknown or uncertain outcomes could be included as a condition of consent and an adaptive management regime (including modification to the consented activity) is used to respond to such effects. g. Whether the infrastructure proposal helps to achieve consolidated development and efficient use of land. **Explanation:** *This policy provides more certainty to proposals for regionally significant infrastructure. It is designed to be flexible and recognises the trade-offs and adaptions that could be made along with practical restrictions that often accompany planning for infrastructure. It will assist regionally significant infrastructure when it comes to the overall judgement to be made in terms of section 5 of the Resource Management Act 1991 (RMA), for example, the determination of resource consents under RMA section 104, and plan development. Policy 5.3.3 takes into account the decision of the supreme court in King Salmon (Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd [2014] NZSC 38).* *The first part of the policy deals with proposals that are consistent with policy addressing important resources elsewhere in the Regional Policy Statement (RPS) or adverse effects on matters of national importance, and where there are minor adverse effects on other matters. Often the establishment of regionally significant infrastructure will have some minor adverse effects which may not be able to be fully avoided or internalised. Additionally, once established, regionally significant infrastructure has an ongoing need to operate, including the use of any resources necessary to allow that asset to function. It is appropriate therefore to provide for these proposals in a straightforward manner, allowing any minor*

	adverse effects where they remain, where otherwise consistent with policy addressing important resources elsewhere in the RPS or adverse effects on matters of national importance. *The second part of the policy supports maintenance and upgrading activities by recognising that these are important to the ongoing resilience of regionally significant infrastructure, for example, by improving its ability to function. It also recognises that despite efforts to avoid or internalise adverse effects, some may remain through the duration of the activity, although often adverse effects will be the same or similar to the existing baseline once the work is concluded. It is appropriate therefore to provide for these proposals in a straightforward manner wherever they are located.* *The third part of the policy provides particular guidance on matters to be considered when assessing proposals or developing plan provisions for regionally significant infrastructure. This includes consideration of the practical restrictions faced by regionally significant infrastructure, which should include recognition of route or site selection processes undertaken by infrastructure providers to minimise adverse effects. Consideration of positive effects could include instances where the offsetting of adverse effects is proposed (such as biodiversity offsets).*
7.1.3, limbs (d), (e) and (f)	Within areas potentially affected by coastal hazards over the next 100 years (including high risk coastal hazard areas), the hazard risk associated with new use and development will be managed so that: a. Redevelopment or changes in land use that reduce the risk of adverse effects from coastal hazards are encouraged; b. Subdivision plans are able to identify that building platforms are located outside high risk coastal hazard areas and these building platforms will not be subject to inundation and / or material damage (including erosion) over a 100-year timeframe; c. Coastal hazard risk to vehicular access routes for proposed new lots is assessed; d. Any use or development does not increase the risk of social, environmental or economic harm (from coastal hazards); e. Infrastructure should be located away from areas of coastal hazard risk but if located within these areas, it should be designed to maintain its integrity and function during a hazard event; f. The use of hard protection structures is discouraged and the use of alternatives to them promoted; and g. Mechanisms are in place for the safe storage of hazardous substances. **Explanation:** *Coastal hazards result from the interaction of natural coastal processes with human activities and structures. Coastal hazards can adversely affect the health, wellbeing and safety of people and communities, as well as the local economy. Northland has one of the longest coastlines in the country and a high proportion of our developed areas are within the coastal environment. Locating new development too close to the coast runs the risk of it being adversely affected by coastal hazards such as erosion or inundation by storm surges or tsunami events.* *The overall intent of this policy is to give effect to the New Zealand Coastal Policy Statement 2010 (NZCPS) by enabling people to provide for their social and economic wellbeing through appropriate subdivision, use and development within areas potentially affected by coastal hazards.* *When implementing this policy, areas potentially affected by coastal hazards should be taken to include:* • *Existing coastal hazard 2 areas in district plans; and* • *Areas where there is potential for harm to people or damage to property as a result of coastal inundation (including coastal storm surge and wave run-up and tsunami inundation) or erosion by wave action or currents over a 100- year timeframe.* *High risk coastal hazard areas are those locations that have been assessed at high or extreme risk from the effects of coastal hazards over a planning horizon of 50 years. These areas are currently identified as coastal hazard 1 areas in district plans.* *As required by the NZCPS, this policy seeks to ensure new use or development in areas potentially affected by coastal hazards will not increase the risk of social and economic loss or harm.*

	In high risk coastal hazard areas, the preferred long-term approach is to move from mitigation to discouraging future development. This is why the policy ensures that new subdivision plans are able to identify that building platforms are located outside high risk areas. *Outside of high risk areas, this policy seeks to ensure new subdivision plans can identify that building platforms will not be subject to inundation and or material damage over a 100-year timeframe. This is to mitigate the damage to buildings from a 1% Annual Exceedance Probability event (storm or tsunami) as well as 100-year incremental coastline change due to erosion.* *This policy also encourages redevelopment or changes in land use that can reduce the risks of adverse effects from coastal hazards. This could be achieved through a combination of reducing the likelihood of damage and / or reducing the consequences of a hazard event. The policy also directs that infrastructure should be located away from coastal hazard areas where practicable. However, it recognises that there is a functional need for some infrastructure to be located within hazard areas (such as to service communities). When this occurs, the infrastructure should be designed to maintain its integrity during a hazard event so that its ability to service communities will not be compromised.*
7.1.4, limb (f)	In 10-year and 100-year flood hazard areas and coastal hazard areas, mitigation measures to reduce natural hazard risk to existing development will be encouraged. These may include one or more of the following: a. Designing for relocatable or recoverable structures (when changing existing buildings); b. Providing for low or no risk activities within hazard-prone areas; c. Providing for setbacks (from rivers/ streams or the coastal marine area); d. Managed retreat by relocation, removal, or abandonment of structures; e. Replacing or modifying existing development without resorting to hard protection structures (see Policy 7.2.2); or f. Protecting, restoring or enhancing natural defences against natural hazards (see Policy 7.2.1). **Explanation:** *This policy acknowledges that existing development has already occurred within known hazard-prone areas and that the risk to people and property from natural hazard events should be reduced to provide for community safety and wellbeing. This policy describes the types of activities that may help prevent or reduce the risk from hazards, which will help to build community resilience to hazard events.* *The policy directly gives effect to Policy 25 of the New Zealand Coastal Policy Statement 2010, which seeks to avoid re-development or change in land use that would increase the risk of adverse effects from coastal hazards. It also encourages re-development or changes in land use that would reduce the risk of adverse effects from coastal hazards, including managed retreat and designing for relocation from hazard events. It is considered that these principles are sound and can be applied to all land which is prone to flood hazards within Northland – not just land subject to coastal hazards.*
7.1.5, limb (1)	New regionally significant infrastructure and critical infrastructure: (1) Must be designed to maintain, as far as practicable, its integrity and function during natural hazard events; and (2) May be considered appropriate to locate within flood and coastal hazard areas, even if it cannot meet policies 7.1.2 or 7.1.3 provided: a. There is a need to be located within the flood hazard and / or coastal hazard area; and b. infrastructure providers have demonstrated that the proposed location within the hazard area is the most appropriate (taking into account social, cultural, and economic costs and benefits) to service the needs of the community; and c. An engineer's assessment identifies the potential for the infrastructure to exacerbate flood and erosion hazard risk on neighbouring properties, and where the assessment shows that risk will be exacerbated; the assessment must outline ways this risk can be minimised.

	Explanation: *Although there are overlaps between what constitutes critical infrastructure and what constitutes regionally significant infrastructure, there are differences. The definition of regionally significant infrastructure encompasses a broader range of facilities, including some that do not meet the Civil Defence Emergency Management Act definition of critical infrastructure (they are not necessarily deemed as being vital to maintain in the event of a natural hazard). The full range of infrastructure should be included here however because of its overall importance for the long-term economic and social wellbeing of Northland.* *This policy seeks to ensure that new regionally significant infrastructure and critical infrastructure is designed to maintain its integrity and function during a natural hazard event. Thisisbecausethistypeofinfrastructureisoftenessentialtothesocialand economic wellbeing of communities and so its ability to service communities should not be compromised.* *This policy seeks to ensure that this infrastructure is not located in areas subject to significant natural hazard risk – that is, in 10-year and 100-year flood hazard areas and within coastal hazard areas. However, the policy also recognises that in some circumstances, such infrastructure can be located within flood and coastal hazard areas, even if it cannot meet all relevant provisions of the associated policies (such as location of existing related infrastructure, availability of land, economic factors or engineering problems). In these instances, infrastructure providers will need to demonstrate that there is a need for the infrastructure to be located within the hazard area and that the proposed location is the most appropriate to service the community's needs.* *Additionally, when such infrastructure is proposed to be located in a hazard area, an assessment must be made to identify the potential for the development to exacerbate flood and erosion hazard risk on neighbouring properties (for example, an assessment of the potential of the development to divert flood flow onto neighbouring properties). This should ensure that any increase in risk to neighbouring properties is minimised.* *This policy applies to new regionally significant and critical infrastructure – it does not apply to any upgrades and / or maintenance of existing regionally significant and critical infrastructure.*
7.1.6	When managing subdivision, use and development in Northland, climate change effects will be included in all estimates of natural hazard risk, taking into account the scale and type of the proposed development and using the latest national guidance and best available information on the likely effects of climate change on the region or district. **Explanation:** *Scientists predict that the expected impacts of climate change will include rising temperatures, sea-level rise, changing rainfall patterns and increased storminess. Climate change is projected to have a significant impact on the risk profile of natural hazards by changing some of the hazard drivers (for example, sea level rise may lead to greater coastal erosion and / or inundation and an increase in high intensity, short duration rain events could lead to more flash floods).* *Preparing for climate change now and recognising its potential influence on natural hazard events will help ensure that our communities can continue to provide for their social, cultural and economic wellbeing and become more resilient to the effects of a changing climate. Adapting now will help ensure our economy and infrastructure remains viable and that Northland is less vulnerable to the costs and adverse impacts of a changing climate. The requirement to take into account national guidance and the best available information on the likely effects of climate change on the region or district will ensure that when national guidance is updated / modified, this information will be used rather than relying on a specific requirement / figure that could quickly become out-dated.*
7.1.7, limb (7)	1) The district councils shall notify a plan change to incorporate finalised flood hazard maps into district plans in the first relevant plan change following the operative date of the Regional Policy Statement or within two years of the Regional Policy Statement becoming operative, whichever is earlier. Additionally, the district councils shall incorporate new flood and coastal hazard maps into district plans as soon as practicable after such areas have been investigated, defined and mapped by the regional council.

(2) In their respective plans, the regional and district councils shall provide objectives, policies, and methods (including rules) to give effect to Policies 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.1.5 and 7.1.6.

(3) District councils shall set out rules in district plans classifying the following as prohibited or non-complying activities:

a. New subdivision proposals that do not comply with policies 7.1.2 and 7.1.3; and
b. New proposals that do not comply with policy 7.1.2(f).

(4) The regional and district councils shall require an engineer's assessment for new subdivision within 10-year and 100-year flood and coastal hazard areas and for new land use or built development within 10-year flood hazard areas and high risk coastal hazard areas.

(5) The regional and district councils shall ensure that within the coastal environment:

a. Any new habitable dwelling has a minimum floor level of 3.3m above One Tree Point datum on the east coast and 4.3m above One Tree Point Datum on the west coast. New non-habitable buildings will have a minimum floor level of 3.1m above One Tree Point datum on the east coast and 4.1m on the west coast; and
b. An additional allowance for wave run-up shall be assessed over and above the requirements above for exposed east coast locations where ground elevation is less than 5m above One Tree Point datum, and for exposed west coast locations where ground elevation is less than 6m above One Tree Point datum.
c. Clauses (a) and (b) do not apply to:
    i. Non-habitable buildings not designed for habitation or commercial use and where the potential impact of the building being materially damaged or destroyed by a coastal hazard event (including the replacement coast) is minor (e.g. pump sheds, car ports, farm sheds and public toilets); and
    ii. Non-habitable buildings that have a functional need to be located in the coastal marine area (e.g. boastsheds); and
    iii. Network utility infrastructure.

Circumstances where (a) and (b) are not met will be subject to the resource consent process.

(6) Before any new areas are zoned or identified in a district plan in ways that enable intensification of use, district councils shall ensure that the risk of natural hazards are assessed.

(7) The regional and district councils, when setting out objectives, policies, and methods in reginal and district plans, and when assessing resource consent applications, will take into account the latest national guidance and the best available information on the effects of climate change on natural hazards for sea-level rise, drought and storm rainfall intensity.

(8) Where buildings occupied by people, animals and / or hazardous substances in 10-year flood areas and high risk coastal hazard areas have been materially damaged or destroyed by a natural hazard event, the regional council (through the relevant regional plan) will require land use consent for the repair or reconstruction of the building. The regional council will limit its discretion in determining the land use consent to avoiding or mitigating natural hazards.

Explanations: *Method 7.1.7(1) directs the district councils to notify a plan change to incorporate finalised flood hazard maps into district plans within two years of this Regional Policy Statement (RPS) becoming operative. This will be crucial to building community resilience to the risks and impacts of natural hazard events. Additionally, they will be required to incorporate new flood and coastal hazard maps into district plans as soon as practicable after these areas have been defined and mapped by the regional council.*

The method differentiates between finalised flood hazard maps and new flood and coastal hazard maps because the regional council has prioritised the process of flood hazard mapping, focusing first on 26 *catchments identified as having the highest potential flood risk to life, property, infrastructure and assets. Maps for these 'priority' areas have been produced in consultation with local river liaison committees and local residents, using detailed survey data, hydrology assessments and computer modelling to determine the likely extent of flooding. It is important that these maps are incorporated into district plans at the first available opportunity.*

The regional council will support the district councils when implementing this method through providing technical support and advice. The district councils also need to know that the regional council can stand behind the hazard maps they have produced and have confidence that the maps will be as technically sound as possible.

Method 7.1.7(2) directs the regional and district councils to include provisions in their respective plans to give effect to Policies 7.1.1 to 7.1.6. This primarily means mitigating the adverse effects of new subdivision and development in flood hazard areas and coastal hazard areas – the most 'at risk' areas within Northland from natural hazards. It also means directing regionally significant infrastructure and critical infrastructure away from areas most at risk to natural hazards unless there are no reasonable alternative locations.

Method 7.1.7(3) requires the district councils to classify new subdivision, use and development in flood and coastal hazard areas that is likely to result in significant risk to life and property as 'prohibited' or 'non-complying' activities in district plans. The presumption is that if applicants can demonstrate compliance with the policy provisions, natural hazard risk should be avoided by appropriate design. If they cannot, the development should not proceed.

Method 7.1.7(4) sets out that the regional and district councils must require an engineer's assessment for new subdivision within 10-year and 100-year flood and coastal hazard areas. It will also require an engineer's assessment for new land use or built development within 10-year flood hazard areas and high risk coastal hazard areas.

This will help district councils determine (under section 106 of the Resource Management Act (RMA)) whether the land is suitable for subdivision and the requirement for an engineer's report, for new land use and built development (within 10-year flood hazard areas and high risk coastal hazard areas), will ensure that the development is suitable and will not increase the risk of harm to neighbouring properties.

Method 7.1.7(5) implements Policies 7.1.3 and 7.1.6 by requiring the regional and district councils to include provisions in their relevant plans to ensure a consistent, region-wide approach is adopted to setting minimum floor levels in the coastal environment for habitable dwellings and non-habitable buildings. Additionally, in recognition of their function and/or the potential low impact of some non-habitable buildings being damaged or destroyed by coastal hazard events, this method outlines that certain non-habitable buildings shall be excluded from these requirements.

These minimum floor levels are based on an analysis of sea level data recorded at east coast and west coast sites in Northland. The assessed 1% Annual Exceedance Probability (AEP) storm- tide level above One Tree Point (OTP) datum is 1.8m for the east coast and 2.8m for the west coast. Additionally, these minimum floor levels incorporate:

- *i) a projection for sea-level rise of 1 metre by 2115, and*
- *ii) the relevant freeboard (0.3 or 0.5 m) stipulated in New Zealand Standard 4404:2010 Land Development and Subdivision Infrastructure which covers uncertainty in the 1% AEP storm-tide level, run-up or overtopping from small waves in areas not deemed to be exposed open-cost areas, and wash from moving vehicles.*

The 1 metre sea-level rise by 2015 is consistent with the sea-level projections of the 3013 Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report. It is the equivalent to the threshold of 0.8 metres by the 2090s that should at least be considered the 2008 Ministry for the Environment Guidance Manual for Local Government: Coastal Hazards and Climate Change. The 1 metre sea-level rise allowance also covers any small increase in storminess leading to somewhat higher storm surges, and takes into account national guidance and best available information. It does not include any *provision for the rise in sea level of an additional several decimeters if the ice-sheets collapse faster than anticipated, as set out in the IPCC 5th Assessment Report.*

The appropriate sea-level rise allowance should be reviewed regularly at no longer than 10 tear intervals, taking into account national guidance and the best available information on the likely effects of climate change on the Northland region.

How minimum floor levels have been derived:

	East coast	West coast
Assessed1% AEP sealevel	1.8m OTP	2.8m OTP
Allowance for Sea Level Rise (to 2115)	1.0 m	1.0 m
Freeboard (habitable dwellings)	0.5m	0.5m
Freeboard (non-habitable buildings)	0.3m	0.3m

The regional and district councils are also required to ensure that an additional allowance for wave run-up is considered in exposed open east coast locations where ground elevation is less than 5m OTPdatum and exposed west coast locations where ground elevation is less than 6m OTP datum. Wave run-up at any coastal locality is quite site-specific, depending on factors such as beach slope, roughness of the beach (sand, gravel or large rocks), wave height, exposure to ocean swell, how close waves can penetrate before breaking and the characteristics of the land above the beach – for example, dunes, cliffs, seawalls, rock revetments, lowlying land or estuarine margins.

Setting minimum floor levels in the coastal environment will ensure that new buildings will be more resilient to coastal hazard events and will give effect to Policy 25 of the NZCPS, which requires councils to avoid increasing the risk of social, environmental and economic harm from coastal hazards, using at least a 100 year planning horizon.

As these are minimum floor levels, the district councils should consider requiring higher minimum floor levels in specific locations if justified including in situations where impacts are likely to have high consequences or where additional future adaptation options are limited. Conversely, if applicants have site specific information/reasons why they consider that these minimum floor level requirements should not apply, they will be required to go through the resource consent process and will need to demonstrate how their development will avoid increasing the risk of social, environmental and economic harm from coastal hazards.

Method 7.1.7(6) implements Policy 7.1.1 by ensuring that natural hazard risk is assessed before areas are re-zoned in ways that enable intensification of use (for example, re-zoning from countryside to residential). This should help ensure that natural hazard risk is minimised and help build community resilience to natural hazard events.

Method 7.1.7(7) requires the regional and district councils to take into account the latest national guidance and best available information on the effects of climate change on natural hazards. The intention of this method is to build resilience to the effects of natural hazards by fully understanding (or as much as possible) the potential influence of climate change on natural hazards. Factoring in climate change 'upfront' is easier than retrofitting development or having to 'mitigate' the effects of events after they have occurred. Method 7.1.7(8) implements Policies 7.1.2 and 7.1.3. As existing lawfully established activities have protection under section 10 of the RMA, this causes limitations for how the district councils can manage existing development – especially existing development – in areas most susceptible to hazard risk (10-year flood hazard areas and high risk coastal hazard areas).

Regional councils are not restricted in the same way because section 10 of the RMA does not apply to regional plans. To reduce risks to people, property and the wider environment, this method requires the regional council to assume responsibility for evaluating the hazard risk and ensure that the right risk reduction measures are used when buildings are materially damaged or destroyed within high risk hazard

	areas. To avoid complications due to this overlap with the district councils, the regional council will investigate transferring its functions back to the relevant district council.
7.2.1	Recognise and protect, restore or enhance natural systems and features that contribute to reducing the impacts of natural hazard events on the built environment. **Explanation:** *Note, in the coastal environment Policy 26 – Natural defences against coastal hazards of the New Zealand Coastal Policy Statement 2010 applies.* *Natural features (like sand dunes, beaches, riparian vegetation, floodplains and wetlands) help to avoid and lessen the effects of natural hazard events. For example, coastal dunes help to mitigate the effects of storm surges by acting as natural protection against inundation and erosion, the retention of vegetation cover in upper catchments helps to protect against landslides / land instability, and the protection of wetlands helps to reduce flood risk and river bank erosion.* *This policy gives effect to Policy 26 of the New Zealand Coastal Policy Statement 2010 – Natural defences against coastal hazards. It requires councils to provide (where appropriate) for the protection of natural features that protect coastal land uses from coastal hazards.* *Protecting or restoring natural features often tends to be more economically viable than building and subsequently relying on hard protection structures. This is because engineered approaches have a limited design life and adopting these 'structural' assets can lock in future generations to continued expenditure to maintain, upgrade or replace such protection. In addition, natural features (such as coastal dune systems) often have high levels of natural character, landscape and amenity values, and are central to the protection and enhancement of indigenous biodiversity. Some also contain important archaeological and cultural sites and are of special value to tangata whenua.* *This policy is not saying that natural features cannot be developed. Rather, their attributes that contribute to minimising the impacts of natural hazard events should not be compromised by inappropriate development.*
8.1.1	The regional and district councils shall provide opportunities for tangata whenua to participate in the review, development, implementation, and monitoring of plans and resource consent processes under the Resource Management Act 1991. **Explanation:** *This policy supports the relationship of tangata whenua with the natural and physical environment by providing opportunities for their input into resource management processes.*
8.1.2	The regional and district councils shall when developing plans and processing resource consents under the Resource Management Act 1991 (RMA): a. Recognise and provide for the relationship of tangata whenua and their culture and traditions with their ancestral land, water, sites wāhi tapu, and other taonga; b. Have particular regard to kaitiakitanga; and c. Take into account the principles of the Treaty of Waitangi including partnership. **Explanation:** *Under the RMA, the regional and district councils have responsibilities to provide for tangata whenua involvement in resource management, particularly where it affects their taonga.*
8.1.3	The regional and district councils shall provide opportunities for the use and incorporation of Mātauranga Māori into decision-making, management, implementation, and monitoring of natural and physical resources under the Resource Management Act 1991.

	Explanation: *This policy recognises that Mātauranga Māori has a role to play in resource management, and therefore councils should make an active effort to provide opportunities for its inclusion in resource management processes.*
8.1.4	Relevant Māori concepts, values and practices will be clarified through consultation with tangata whenua to develop common understandings of their meaning and to develop methodologies for their implementation. **Explanation:** *A common understating of Māori concepts, values and practices between tangata whenua and councils will assist in integrating kaitiakitanga into Resource Management Act processes.*
8.2.1	The regional council will recognise the value of iwi and hapū management plans in decision-making under the Resource Management Act 1991 and the need to support tangata whenua in the development and implementation of these plans. **Explanation:** *Iwi and hapū management plans provide a vision of how the management and protection of natural and physical resources can be achieved based on cultural and spiritual values of tangata whenua. These plans are useful tools for understanding the concerns of tangata whenua for resource management planning.*
8.3.1	The regional and district councils shall support tangata whenua to have a kaitiaki role in the management of their land, resources, and other taonga. **Explanation:** *Tangata whenua have a special relationship with their ancestral lands. Supporting tangata whenua, as kaitiaki, to identify appropriate practices and customs for the care of their lands, waters, treasures, wāhi tapu, and other taonga is important for sustainable management in Northland. This may include assisting with recording sites of significance to tangata whenua, collaborating with tangata whenua to identify high value natural and physical resources, and providing resources to assist with environmental monitoring.*

Table 2: The Operative Northland Regional Policy Statement cited Policies

Method	Decription
5.1.5, limbs (1)(d) and (1)(e)	1. The regional and district councils shall: a. Give effect to Policy 5.1.1 (a) and (c)-(g) when developing objectives, policies, and methods / rules for plans and when assessing resource consent applications and plan changes; b. Give effect to Policy 5.1.1(b) when considering notices of requirement and resource consent applications in the following centres: i. Mangawhai, Dargaville, Waipū, Whāngārei city, Ruakākā / Marsden Point, Pārua Bay, Paihia, Kerikeri / Waipapa, Kaikohe, and Kaitāia; c. Give effect to Policy 5.1.1(b) when changing, varying, or replacing regional or district plans; d. Give effect to Policies 5.1.2 and 5.1.3 through objectives, policies, and methods / rules in regional and district plans and when assessing resource consent applications; and e. Give effect to Policy 5.1.3 by requiring consultation with relevant infrastructure providers and owners of regionally significant mineral resources when proposed subdivision, land use or development may have an adverse effect on the operation, maintenance or upgrade of regionally significant infrastructure or on the regionally significant mineral resources.

Note: Method 5.1.5(1)(d) and (e) implements regional council obligations under Policy H1 of the National Policy Statement for Renewable Electricity Generation. Therefore, pursuant to Policy H2(b) of that national policy statement, the regional and district councils shall notify a plan change to their plans to give effect to these methods, to the extent that they relate to renewable electricity generation, within 12 months of the Regional Policy Statement becoming operative. Method 5.1.5(1)(d) and (e) also implements regional council obligations under the 2008 National Policy Statement on Electricity Transmission.

2. The district councils shall:

a. Show regionally significant mineral resources in accordance with Policy 5.1.4, in district plan maps, where the existing extraction rates are known, or once the mineral resources are identified by the regional council;
b. Consider applying the Regional Urban Design Guidelines in Appendix 2 to resource consent applications and notices of requirement in locations outside of those already identified in Method 5.1.5(1)(b); and
c. Consider spatially mapping the extent of coastal settlements to give effect to Policy 5.1.2.

3. The regional council will identify surf breaks of national significance, and consider identifying surf breaks of regional significance, in the relevant regional plan.

Explanation:
Method 5.1.5(1)(a) directs the regional and district councils to take into account Policy 5.1.1 (particularly the Regional Form and Development Guidelines in Appendix 2) when developing plan provisions and when assessing resource consent applications and plan changes. It is anticipated that this policy / method package will proactively shape development in Northland by ensuring that the right development occurs in the right place with adequate infrastructure.

Method 5.1.5(1)(b) directs the regional and district councils to implement Policy 5.1.1(b) at the notice of requirement or resource consent stage in certain larger urban areas. The intention of this policy and method package is to improve the form of Northland's built environment.

Method 5.1.5(1)(c) directs the regional and district councils to implement Policy 5.1.1(b) at the plan development stage in all areas of Northland.

Method 5.1.5(1)(d) directs councils to develop plan provisions that give effect to Policy 5.1.2 (coastal environment). There is a degree of flexibility in how future plan provisions may look but they will be required to 'give effect' to Policy 5.1.2. It also directs councils to implement Policy 5.1.3, to ensure that adverse effects (particularly reverse sensitivity effects) of new subdivision, use and development (particularly residential development) are avoided in certain zones. As mentioned in the policy, these zones have been singled out because of their actual and potential contribution to Northland's economy.

Method 5.1.5(1)(e) is in response to concerns that sometimes regionally significant infrastructure providers can be ignored as a potentially adversely affected party. The responsibility for consulting infrastructure providers when a development may affect regionally significant infrastructure lies in the first instance with the applicant.

	Additionally, where the application is publicly notified, it is anticipated that infrastructure providers will be considered affected parties. *Method 5.1.5(2)(a) will help to ensure that regionally significant mineral resources will not be sterilised by the adverse effects of development such as residential subdivision and development. Once these resources become embedded in planning maps, all users of the district plans will be aware of their locations and will be able to plan future developments accordingly.* *Method 5.1.5(2)(b) gives district councils discretion to consider applying the Regional Urban Design Guidelines to resource consent applications outside of those settlements listed in Method 5.1.5(1)(b). They will have discretion on a case-by-case basis to consider applying the guidelines depending on the scale of the development proposed.* *Method 5.1.5(2)(c) gives the district councils discretion to consider spatial mapping of the extent of coastal settlements. This should help to determine the 'appropriateness' of development in the coastal environment (allowing councils, developers and the public to easily ascertain whether the new development is within the mapped extent of the coastal settlement or not).* *Method 5.1.5(3) recognises Policy 16 of the New Zealand Coastal Policy Statement 2010 (NZCPS) regarding protection of the surf breaks of national significance that are listed for Northland in the NZCPS and further, the potential for other surf breaks of regional significance to be considered for protection.*

Table 3: The Operative Northland Regional Policy Statement cited Methods

Annexure Twelve: The New Zealand Coastal Policy Statement Cited Provisions

Objective	Definition
1	To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by: • maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature; • protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and • maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.
2	To preserve the natural character of the coastal environment and protect natural features and landscape values through: • recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution; • identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and • encouraging restoration of the coastal environment.
3	To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment by: • recognising the ongoing and enduring relationship of tangata whenua over their lands, rohe and resources; • promoting meaningful relationships and interactions between tangata whenua and persons exercising functions and powers under the Act; • incorporating mātauranga Māori into sustainable management practices; and • recognising and protecting characteristics of the coastal environment that are of special value to tangata whenua.
4	To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment by: • recognising that the coastal marine area is an extensive area of public space for the public to use and enjoy; • maintaining and enhancing public walking access to and along the coastal marine area without charge, and where there are exceptional reasons that mean this is not practicable providing alternative linking access close to the coastal marine area; and • recognising the potential for coastal processes, including those likely to be affected by climate change, to restrict access to the coastal environment and the need to ensure that public access is maintained even when the coastal marine area advances inland.

Table 1: New Zealand Coastal Policy Statement 2010, Cited Provisions

Annexure Thirteen: The Harbour Masters written approval

NORTHLAND REGIONAL COUNCIL

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9 March 2017

Refining NZ
Private Bag 9024
Whangarei 0148

Attention: Dave Martin

APPROVAL FOR PROPOSED AIDS TO NAVIGATION: CRUDE SHIPPING PROJECT

Thank you for providing information on the changes to aids to navigation which would be required as part of Refining NZ's proposed Crude Shipping Project. I understand that Refining NZ intends to seek resource consents for dredging and disposal, and associated activities (including some changes to Aids to Navigation) to enable fully laden Suezmax tankers to traverse the Whangarei Harbour channel and berth at the Marsden Point refinery.

As you know, I have been involved in scoping studies associated with the project. In particular, I have attended a channel design workshop, a desktop simulation, and a full bridge simulation study. Subsequent to the development of a preferred channel design by Refining NZ, I have been provided with a 'Shipping Channel – Concept Design Report' by Royal Haskoning DHV (consultation draft version, dated 12 November 2016). That report sets out the changes to aids to navigation proposed as part of Refining NZ's Crude Shipping Project. In particular, we refer to section 7 of that report and drawing PA1028-MA-1121 Revision M (Final Concept Design), which are attached to this letter as Appendices A and B respectively.

In summary, proposed changes to aids to navigation consist of the following:

1. Relocating eight of the existing channel marker buoys to accommodate the reconfigured channel alignment.
2. Installing two additional channel marker buoys (one starboard buoy and one port buoy) at channel depth -17.7m RL. This is necessary as the channel becomes longer as it now extends into deeper water.
3. Relocating the existing Fairway buoy to align with the starboard buoy line at channel depth 25.0m RL.
4. Installing a West Cardinal Beacon/Buoy 175m north of existing buoy no. 7 at -15.8m RL to mark the rock outcrop in the vicinity of Home Point.
5. Improvements to the Port Entry Light (PEL) by removing the upper portion of the day shape on the forward lead and installing a day and night light in its place (if not already actioned prior).
6. Installing a set of lead lights in Taurikura Bay to assist with the night time navigation of arriving Suezmax Tankers and other vessels. These leads would define the north south centreline of the proposed reconfigured channel between channel marker buoys 3/6 and channel marker buoy 14.

For the purposes of the rules in Part VI of the operative Northland Regional Coastal Plan, at this stage of the planned development I approve of these proposed changes to aids to navigation as part of Refining NZ's proposed Crude Shipping Project.

I do reserve the right under harbourmaster powers under the Maritime Transport Act 1994, and as chair of the Whangarei Harbour safety committee, to recommend or enforce changes to the proposed for reasons of navigational safety at a later date. However Refining NZ have liaised fully with me over the planned development, and I am comfortable with the proposed plan for aids to navigation at this stage.

Approval for changes to aids to navigation will also be required under the Maritime Transport Act 1994 and subordinate regulations and/or standards. Refining NZ will be required to make application to Maritime New Zealand through the harbourmaster, for such approval, after obtaining the necessary resource consents.

However, and in the meantime, please address any queries regarding this letter or to my approval of the proposed aids to navigation to me.

Harbourmaster
NORTHLAND REGIONAL COUNCIL

Jim Lyle
Regional Harbourmaster
Northland Regional Council