APPENDIX 15

ASSESSMENT OF MARINE ECOLOGICAL EFFECTS

SHIPYARD & DRY DOCK FACILITY AT MARSDEN POINT

ASSESSMENT OF MARINE ECOLOGICAL EFFECTS

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2 ABBREVIATIONS

AEE	Assessment of environmental effects
BHD	Backhoe dredger
BHM	Benthic health model
CD	Chart datum
CMA	Coastal marine area
CSD	Cutter suction dredger
DO	Dissolved oxygen
EIANZ	Environment Institute of Australia and New Zealand
FTAA	Fast Track Amendment Act 2024
MSL	Mean sea level
NRC	Northland Regional Council
NSDF	Northport Shipyard and Drydock Facility
NZCPS	New Zealand Coastal Policy Statement
OHEZ	Outer harbour and entrance zone
OTP-MB	One Tree Point to Marsden Bay
RPN	Regional Plan for Northland
RPS	Regional Policy Statement
SEA	Significant Ecological Area
TSHD	Trailing suction hopper dredger
WQMU	Water quality management unit

3 EXECUTIVE SUMMARY

The Ministry of Business, Innovation and Employment is seeking consent under the Fast-track Approvals Act 2024 for the development and operation of a shipyard and dry-dock abutting the western side of the existing Northport port facility at Marsden Point, Whangārei Harbour. The project includes a reclamation, vessel haul-out system, and associated wharf structures, dredging, and supporting infrastructure.

Key components of the project include:

- reclamation of approximately 9.7ha;
- a 'cutout' to the reclamation where a vessel haul-out system is to be located, being a floating drydock or potentially shiplift or other lifting mechanism;
- construction of a piled wharf structure to accommodate vessels either temporarily (before/after haul out), or for extended periods where works not requiring haul out can be undertaken;
- capital and maintenance dredging associated with construction and ongoing operation of the marine maintenance operations facility, including a berth pocket and a vessel turning basin to provide for safe navigation;
- fixed plant and buildings to accommodate marine maintenance activities and materials;
- sufficient working & laydown areas for marine maintenance operations, including the ability to transfer vessels to hardstand;
- access to and around the marine maintenance operations facility, including a landside area for staff carparking;
- public access around the edge of the reclamation to a public fishing platform.

The final design will be confirmed during the detailed design phase.

This report assesses marine ecological effects associated with reclamation, dredging, marine structures and operational stormwater discharges. It does not assess biosecurity effects, avifauna effects, or marine mammal effects, which are addressed in separate technical assessments.

Description of the existing environment

Whangārei Harbour is approximately 24 km in length, and has a surface area of around 100 km^2, of which, 58% is intertidal. It has a mean depth of 4 m and a maximum depth of 31 m near Marsden Point. Intertidal sediments in the mid and outer harbour are predominantly sandy, with sediments becoming muddier in the upper harbour. Subtidal sediments around the harbour entrance consist of large areas of gravel-shell lag, interspersed with sand. Intertidal sediments around Northport are predominantly sand, except for the area immediately west of the port, which is muddy sand. Subtidal sediments around Northport consist of sand or gravelly sand.

Monitoring and assessments indicate that sediment concentrations of copper, lead and zinc frequently exceed guideline values in the upper reaches of the harbour but are typically low in the mid to outer harbour, where the port is situated. Sediment nitrogen and phosphorus concentrations are also high in the upper harbour and low in the mid to outer harbour. Similarly, water quality improves down the harbour, with sites near the harbour entrance having the best quality.

Whangārei Harbour has been, and continues to be, subject to significant coastal development and anthropogenic stressors, including Whangārei township, Northport, Port Whangārei, Marsden Point oil refinery,[1] marine farms, and multiple marinas, boat ramps and moorings. Sedimentation from land run-off is a major historical and ongoing issue, with an average harbour-wide sedimentation rate of 3.4 mm/year over the last 50–100 years. The main channel of the harbour has been extensively dredged to maintain navigable depths, and further dredging around the harbour entrance is contemplated. The harbour is also a popular recreational destination that, among other things, is used for recreational boating, fishing and shellfish harvesting.

Reviews of the ecological habitats and communities of Whangārei Harbour show that the harbour supports diverse and ecologically important marine communities. Approximately 35% of the harbour is designated as a Significant Ecological Area (SEA), with the One Tree Point–Marsden Bay (OTP-MB) SEA situated adjacent to the western side of Northport. Among other things, the SEA contains seagrass beds and sandflats that provide important feeding habitat for shorebirds. A marine reserve is present across the channel from Northport around Motukaroro Island.

Seagrass was historically abundant in Whangārei Harbour and historically covered around 10–14 km^2 of the harbour. By 1970, it had virtually disappeared from the harbour, but since 1999 it has been expanding in intertidal areas. Around 6 km^2 of seagrass was estimated to be present in the harbour in 2016. Extensive seagrass beds are now present on the intertidal flats between One Tree Point and Northport, and small patches are also present within the proposed reclamation area.

Whangārei Harbour sustains a diverse assemblage of benthic taxa and communities. Benthic communities in the upper sections of Hatea and Mangapai Rivers are clearly distinct and typical of those found in upper estuary systems. Further out into the harbour, the community patterns are more diverse. Harbour-wide data from 2012 suggested that the intertidal benthic community in Marsden Bay was similar to communities found at other sites around the harbour. Finer-scale intertidal sampling around Northport has shown that benthic macrofaunal diversity is relatively high, with variation along and down the shore, and minor community-level differences between the western and eastern sides of Northport. Subtidal sampling indicated that infaunal and epifaunal macroinvertebrate diversity is very high around the port, with areas of dense shell, macroalgae meadows, and diverse communities of encrusting organisms. Those habitats are likely to provide shelter, refuge and food for a variety of invertebrates and fish.

Cockles are widespread in Whangārei Harbour and are particularly abundant around the outer harbour (Marsden Bay, McLeod Bay, Snake Bank and MacDonald Bank). Small cockles were found at moderate to very high abundances on the mid shore across the entire length of Marsden Bay, with the highest densities found near the entrance to Marsden Cove

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[1] The Marsden Point refinery has recently ceased refining activities and has converted to an import and distribution terminal only. Refining NZ is now known as Channel Infrastructure.

Marina. Quantitative sampling conducted around Northport found that 70–75% of stations on the mid to lower shore contained more than 100 cockles/m².

Pipi are present at several sites in the mid to outer harbour, with the highest densities inside the harbour found in Marsden Bay. Pipi were previously commercially harvested from Marsden and Mair Banks just outside of the harbour entrance, but commercial harvesting has been prohibited since 2011 and 2014, respectively, due to low biomass levels. A bed of juvenile pipi exists up to 300 m west of Northport in the mid-shore zone, with mean densities of around 300 pipi/m² within this ~300 × 50 m band.

A large variety of fishes utilise Whangārei Harbour. Fish communities around Northport appear to be similar to those that inhabit nearby reef areas. Leatherjackets, red moki, spotty, sweep, triplefins, kingfish, jack mackerel, two-spot demoiselle, and goatfish were commonly observed around the rock revetments of Northport.

Assessment of Ecological Effects

The assessment of potential marine ecological effects (excluding biosecurity issues and effects on birds and mammals) of the proposed development considers the potential for effects at three scales:

1. Marsden Bay;
2. The One Tree Point to Marsden Bay Significant Ecological Area (OTP-MB SEA);
3. The outer harbour and entrance zone (OHEZ).

Effects on intertidal habitats and communities

Marsden Bay contains a diverse macrofaunal community with over 100 taxa reported. The composition of the intertidal macrofaunal community within the reclamation footprint is similar to the upper to mid shore community found throughout Marsden Bay. Other features within the proposed reclamation footprint include a small area of mangroves in the southeast corner and discrete patches of seagrass scattered throughout intertidal and shallow subtidal areas. Numerous burrows, excavation mounds, ray feeding pits, bird foraging, and tracks of mobile macrofauna within the footprint area indicate high levels of biological activity in the mid-lower tide band. A juvenile pipi bed is present in the mid shore zone on the western side of Northport, with mean densities of around 300/m² within a ~50 m wide band extending around 300 m from the current revetment. The pipi bed straddles the eastern boundary of the OTP-MB SEA, the reclamation footprint of the proposed drydock, and the footprints of the proposed bird roost, and consented Northport bird roost. Moderate to very high abundances of small cockles also occur on the mid shore across the entire length of Marsden Bay, with representative densities in the proposed reclamation area.

The reclamation footprint also contains a small patch of mangroves (covering around 0.03 ha in 2024) and seagrass (covering around 0.16 ha in 2024). Seagrass is listed as an “At Risk” species under the New Zealand Threat Classification System (NZTCS) due to the seagrass population being very large, but subject to low to high ongoing or predicted decline. It is a native, non-endemic species that is secure overseas, with populations experiencing extreme fluctuations.

The proposed reclamation and bird roost will permanently eliminate 5.36 ha of intertidal habitat in Marsden Bay (including around 3.36 ha of the SEA) and associated ecological values (summarised above). In addition, dredging of the pocket berth will convert 0.2 ha of intertidal habitat to subtidal habitat. Overall, 4.61% of intertidal habitat within Marsden Bay, 3.11% within the SEA, and 0.92% within the OHEZ will be permanently lost through reclamation and the direct effects of dredging.

The intertidal habitat within the proposed reclamation footprint is considered to have high ecological values: a ranking that is consistent with, and reflects, the RPN identification of OTP-MB as a significant ecological area. Overall, the most relevant systems for the assessment of effects on intertidal sediment habitats and macrofauna are considered to be Marsden Bay and the OTP-MB SEA. For those systems, the proposed shipyard and drydock facility will lead to a high magnitude of effect on pipi, moderate effects on mid-low tide areas displaying high ecological activity, low effects on seagrass and other intertidal values, and negligible effects on mangroves. Effects on pipi and mid to low tide habitats are considered to be particularly important. In accordance with the EIANZ guidelines, the overall level of effect is therefore ranked as high to very high (i.e., a significant level of effect Marsden Bay and the OTP-MB SEA under RMA planning/legal framework).

Effects on subtidal habitats and communities

Subtidal habitats around the port contain:

- a variety of physical features;
- macroalgae meadows, with a diverse, but low biomass, assemblage of macroalgae species growing on subtidal shell and sediments;
- a variety of biogenic habitats and habitat-forming species, including horse mussels, green-lipped mussels, scallops, dog cockles, seagrass, sponges, ascidians, rhodoliths, dead shell and worm beds;
- very diverse assemblages of benthic macroinvertebrates.

Habitats within the proposed shipyard and drydock reclamation and dredging areas include bare sand and shell gravel (some with numerous small holes of unknown origin – possibly worm tubes, shellfish siphons, and/or crustacean burrows), dense patches of red algae (some with dense aggregations of turret or horn shells), scattered sponges, and scattered to moderate densities of starfish. Video transects near the proposed entrance to the pocket berth also recorded footage of seafloor areas completely covered with a variety of sessile organisms, including sponges, bryozoans, hydroids and macroalgae. Isolated kelp and sparse patches of subtidal seagrass have also been recorded in that area (subtidal seagrass beds are known to be very important fish nurseries in northern New Zealand estuaries, especially for snapper and trevally).

The proposed reclamation will permanently eliminate around 4.6 ha of shallow[2] subtidal habitat within Marsden Bay that supports a high-value seabed community. Around 0.57 ha of that area is within the Marsden Bay SEA. Consequently, 5.19% of subtidal habitat and associated ecological values within Marsden Bay and 0.88% within the SEA will be permanently lost.

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[2] Offshore area defined using a combination of LINZ chart datum, 5 m depth contour and the outer margin of Northport wharf, in the area between One Tree Point and Northport.

All biota living on the seafloor are likely to be removed during dredging, and significant changes are expected in the benthic community that recolonises the dry-dock pocket berth, which is likely to become a quiescent, shady water body. The pocket berth is likely to accumulate fine sediments and contaminants, and macroalgae growth on the seafloor is likely to be limited by shade and a reduced flux of nutrients compared to surrounding areas. The lack of current and increased deposition is also likely to produce low diversity seafloor communities mainly comprised of tolerant infaunal species, and lacking the large, habitat-forming epibiota, that are common in the surrounding channel areas. However, tolerant fouling species are likely to colonise drydock structures, and macroalgae may grow on structures near the surface.

High value benthic communities and habitats will also be removed during dredging of the navigation channel, and sediment plumes and deposition are expected to affect communities and habitats beyond dredging sites. While ecological recovery will occur within the dredge basin, the combined effects of removing existing habitat and biota, reduced current speeds, reduced light, and potentially, the loss of shell gravel, are expected to produce a community that has lower abundance and diversity values, and that is less productive than the one existing prior to dredging.

The limited extents of backhoe dredger (BHD) and cutter suction dredger (CSD) plumes, and intermittent nature of dredging by trailing suction hopper dredger (TSHD), along with proposed plume monitoring, turbidity triggers, and management actions will limit the magnitude of offsite ecological effects of dredging. Ecological values affected by dredging plumes are expected to return to pre-existing levels relatively quickly (probably in the order of months).

Effects on reef habitat and biota

A reef community has developed on the existing port revetment. Reclamation will eliminate around 509 m of existing rock revetment and create around 617 m of rock revetment. All biota that cannot, or does not, move from the existing revetment structure will be smothered during reclamation. In the medium term (5–10 years), those effects will be offset by the colonisation of a new revetment by a similar reef assemblage. The piles underneath the suspended deck and around the drydock berth pocket will also provide additional hard structures for reef species to colonise. Given that: the existing revetment is an artificial construction; recovery will gradually occur; and more habitat will be created than lost; the effect of reclamation on reef habitat and biota is assessed as low immediately, and positive in the medium to long term at all scales.

Effects on fish

Whangārei Harbour has a relatively diverse fish assemblage. A variety of reef species common to northern New Zealand are likely to utilise the subtidal area around the port. Intertidal areas in the OTP-MB SEA provide important feeding areas for fish, and the presence of numerous ray feeding pits in the intertidal area west of Northport shows that the area is a common feeding ground for rays. Overall, the proposed reclamation footprint and area to be dredged have high ecological values for fish. This ranking is consistent with and reflects the RPN identification of OTP-MB as a significant ecological area.

The proposed reclamation will permanently eliminate around 5.36 ha of intertidal and 4.6 ha of subtidal benthic habitat. Around 509 m of revetment habitat will be lost, but 617 m will be created. The effects of dredging are largely already provided for under Northport's current capital and maintenance dredging consent.

However, while the proposed activities will affect important habitat for fish, impacts on fish, per se, are expected to be low and temporary, because:

- The species potentially affected are able to move to other areas.
- Fish populations are unlikely to be limited by habitat or resource availability because fishing (carried out under the Fisheries Act) has reduced the populations of targeted species to levels well below those historically occurring.
- None of the fish potentially affected are Threatened or At Risk species.
- More revetment habitat will be created than lost, and recovery of the revetment habitat is expected to occur in around 5 years.

Overall, the effect of disturbing or losing important fish habitat within the dredging and reclamation footprints is assessed as low at all scales.

The effects of discharging of chemical stressors and toxicants.

Assuming that

- High risk areas for contaminants will be hydraulically separated from standard stormwater areas and all process water from them will be diverted to trade waste.
- The quality of stormwater runoff from the remaining dry-dock areas will be similar to or better than runoff from Northport (because of the proposed pre-treatment and it won't include runoff from log yards).
- Adequate measures can be put in place to monitor and ensure early responses to increasing trends in contaminants and/or exceedances of standards for contaminants in stormwater discharges and the CMA.

The effects of contaminant discharges from the proposed dry-dock facility are not expected to cause adverse ecological effects.

Cumulative effects

In addition to the effects of the MBIE proposed shipyard and dry-dock facility, Northport have consent to carry out new dredging of around 61 ha of subtidal habitat (the MBIE proposal overlaps that area), and reclamation of around 7.6 ha of intertidal and 9.4 ha of subtidal habitat on the eastern side of the port. Northport also have consent to construct a bird roost within the OTP-MB SEA covering around 0.54 ha of intertidal habitat. However, that bird roost will be replaced by the proposed drydock roost. The combined consented, but yet to be implemented, Northport activities therefore directly affect around 79 ha of coastal habitat. Channel Infrastructure also have consent to dredge around 40 ha of subtidal habitat within the OHEZ, although given the transition from refinery to import and distribution terminal, it may be unlikely that these consents are given effect to. In combination, if all of those activities were implemented, around 2.1 % of the total intertidal area and 5.9% of the total subtidal area of the OHEZ would be directly affected by dredging or reclamation. The overall cumulative effects on subtidal sediment habitats and biota are therefore ranked from high to very high at the SEA, Marsden Bay and OHEZ levels (i.e., a significant level of effect on the SEA, Marsden Bay and OHEZ under RMA planning/legal framework).

Note that risks associated with dredging plumes can be reduced by:

- minimising sediment suspension and dispersal through the selection of dredging methods;
- using best practice methods such as real-time turbidity monitoring and triggers to maintain the effects of dredging plumes within acceptable limits (e.g., Napier Port 2019 and as required in Northport's consent).

The overall effect of reclamation on reef habitat and biota at all scales is considered to be low immediately, and positive in the medium to long term. The effects of disturbing or losing important fish habitat within the dredging and reclamation footprints are also assessed as low at all scales (a "less than minor" effect under the applicable RMA planning/legal framework).

Levels of cumulative effects are summarised in Table 1.

Recommendations

If consent is granted it is recommended that conditions are included that require real time monitoring of dredging plumes, and the responses of intertidal and subtidal ecological communities and habitats to dredging and unanticipated physical changes beyond the reclamation footprint. Monitoring has been proposed in the draft environmental monitoring and management plan for capital dredging, which addresses this recommendation.

Table 1. Summary of individual effects of the proposed development at the scale of: the outer harbour and entrance zone (OHEZ); Marsden Bay; and One Tree Point to Marsden Bay Significant Ecological Area (OTP-MB SEA).

Potential effects	System		
	OHEZ	Marsden Bay	OTP-MB SEA
Effects on intertidal sediment habitats and macrofauna	High	High to very high	Very high
Effects on subtidal habitat and benthic macrofauna	Very High	Very high	High
Effects on fish	Low	Low	Low
Effects on reef habitat	Low and positive in medium to long term	Low and positive in medium to long term	Low and positive in medium to long term
Effects of chemical stressors and toxicants	Very low	Very low	Very low

4 BACKGROUND

The Ministry of Business, Innovation and Employment (MBIE) is seeking consent under the Fast-track Approvals Act 2024 ("FTAA"), for the development and operation of a shipyard and drydock facility abutting the western side of the existing Northport port facility at Marsden Point, Whangārei Harbour. The project includes a reclamation, vessel haul-out system, and associated wharf structures, dredging, and supporting infrastructure (Figure 1 to Figure 2).

Key components of the project include:

- reclamation of approximately 9.7ha;
- a 'cutout' to the reclamation where a vessel haul-out system is to be located, being a floating drydock or potentially a shiplift or other lifting mechanism;
- construction of a piled wharf structure to accommodate vessels either temporarily (before/after haul-out), or for extended periods where works not requiring haul out can be undertaken;
- dredging stage one: capital and maintenance dredging associated with construction and ongoing operation of the marine maintenance operations facility, including a berth pocket and a vessel turning basin to provide for safe navigation;
- dredging stage two: capital dredging to ensure sufficient volume of dredge spoil is available to construct both the NDD and Northport's Vision for Growth development;
- fixed plant and buildings to accommodate marine maintenance activities and materials;
- sufficient working & laydown areas for marine maintenance operations, including the ability to transfer vessels to hardstand;
- access to and around the marine maintenance operations facility, including a landside area for staff carparking;
- public access around the edge of the reclamation to a public fishing platform.

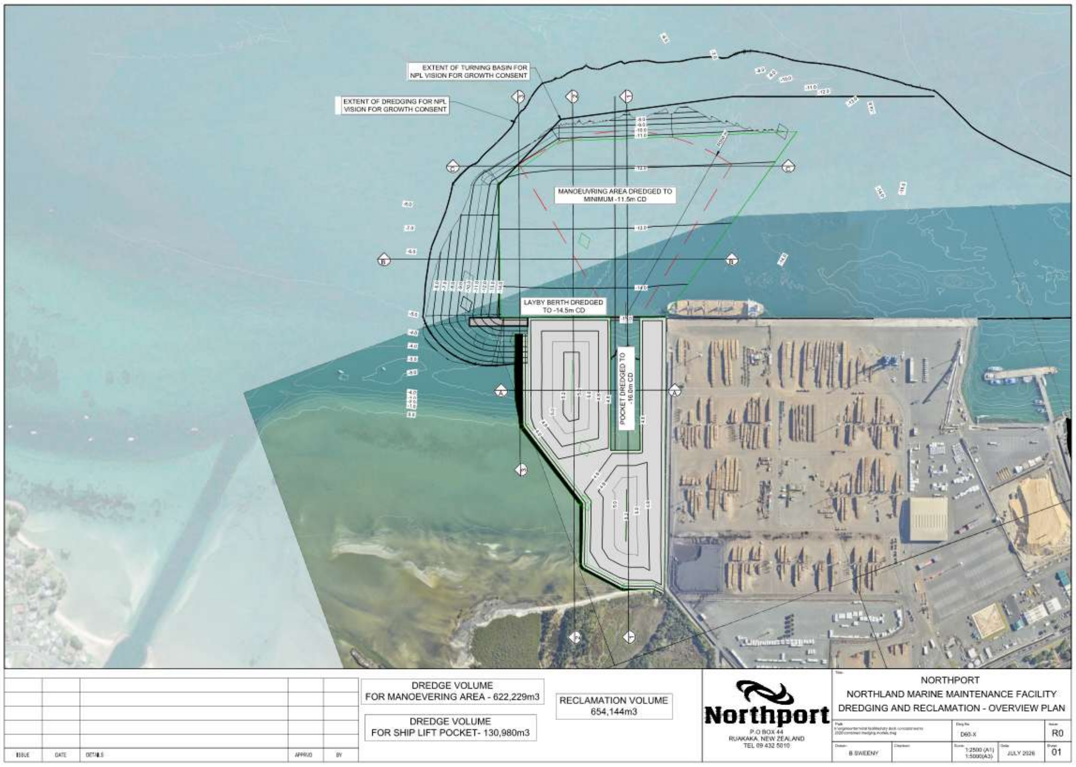
The marine maintenance operations facility is to provide vessel maintenance, repairs, and servicing, including but not limited to cleaning, painting, and repair of commercial and naval vessels, including Cook Strait ferries and Royal New Zealand Navy logistics vessels, along with other vessels such as international freight vessels and super yachts. The facility has design capacity to accommodate vessels ~50 m to 230 m in length with a displacement between 500 t and 28,000 t. The facility will be based on normal working hours of 7 am–6 pm, but the capacity to operate 24/7/365 where required, subject to appropriate restrictions on noise-generating activities.

The location of the facility has been carefully selected for functional and operational requirements, including the need for deep water access, sheltered harbour conditions, proximity to existing port services, sea and land transport links, and integration with established and proposed marine and land-based industrial infrastructure. The facility will be designed to separate process water and associated contaminants produced in high-risk ship maintenance areas, from the Northport stormwater system and to prevent them from being discharged directly to the coastal marine area. Standard stormwater runoff from roofs, roads, accessways and low-risk hardstand areas will be collected and pre-treated before discharge to the extended Northport stormwater canal and pond system. High-risk areas will be hydraulically separated from standard stormwater areas. Operational wash-water and process runoff from high-risk areas will be captured, buffered and treated where required, before discharge to the Whangārei District Council wastewater network under trade waste approval, or removed to another authorised disposal pathway.

The project is listed in Schedule 2 of the Fast-track Approvals Act 2024 as having significant regional or national benefits, with the final design to be confirmed during the detailed design phase. This assessment primarily relates to the reclamation of 9.7 ha on the western side Northport, the dredging of the drydock berth pocket, and the construction of a suspended deck.

Figure 1: Drawing of the proposed drydock and shipyard facility to the west of Northport (drawing from Beca).

Figure 2. The proposed drydock and shipyard facility reclamation and dredging areas relative to chart datum (figures provided by Beca).



4.1 DEVELOPMENT SETTING

The proposed reclamation activities will extend existing wharf facilities around 370 m westward of Northport. Surrounding CMA to the north and east of the proposed dredging and reclamation areas have already been highly modified by similar development, including Northport's consented channel and berth dredging of around 64 ha (excluding batter slopes), and around 33 ha of reclaimed land used to create the existing hardstand and wharf facilities. Northport also have consent to reclaim 17 ha to the east of the current port structures, build additional wharf structures, and dredge an additional 61 ha. These structures are yet to be built.

Other developments in the immediate area include: facilities associated with the former Marsden Point Oil Refinery (now an import/distribution terminal) approximately 250 m to the east; Marsden Cove Marina approximately 850 m to the west; and Marsden Bay township around One Tree Point.

4.2 SCOPE AND PURPOSE OF THIS REPORT

This report assesses the potential marine ecological effects of the proposed MBIE development on the existing environment (excluding biosecurity issues and effects on birds and marine mammals) by:

- consolidating and reviewing available technical information on the values and condition of the proposed development site and the broader ecological system, so that the scale of effect can be characterised in relation to the size and sensitivity of the relevant area of indigenous biodiversity;

- identifying potential ecological effects of the proposed development on the existing environment;
- assessing the ecological significance of effects at local and harbour-wide scales;
- considering and assessing the potential for adverse effects of the proposed development to compound the adverse effects of other activities on the harbour system, and the ecological significance of those cumulative impacts.

In relation to the scope and context of this assessment, we have been advised that:

a. The Project overlaps with a Significant Ecological Area (SEA) that is mapped in the RPN. The OTP-MB SEA comprises shallow intertidal and subtidal sandy soft-bottom habitats. The shellfish and seagrass communities, and associated benthic invertebrates within the SEA are described as being major food sources for shorebirds, and significant nursery and feeding areas for many coastal fish species. While no separate approvals are required specifically on account of the SEA, effects of the Project on the SEA will need to be carefully assessed and managed, in a context where SEAs are subject to a relatively stringent RMA planning framework.

b. Other SEAs are delineated in the surrounding Whangarei Harbour including:
    - the Snake Bank SEA, which is situated northwest of the Project site;
    - the Northeastern Bays SEA, which at Whangarei Heads and encompasses subtidal areas, rocky coast, and sand banks; and,
    - the Mair Bank/Marsden Bank SEA, which encompasses estuarine sand banks at the harbour entrance.

c. The project slightly overlaps with the Government purpose wildlife at Blacksmiths Creek (historically the area of the spit, now part of the intertidal area). A concession is sought accordingly.

d. The project is well outside from the Whangarei Harbour Marine Reserve at Motukaroro Island, which is on the northern shores of the harbour entrance.

In addition to the individual effects of the proposed development, the assessment needs to consider the cumulative effects of other future activities, including those of relevant permitted activities and unimplemented resource consents on the existing environment. Cumulative effects include two components:

1. effects arising/building up over time (e.g., an ongoing point-source discharge of contaminants); and
2. effects arising in combination with other effects.

They include the effects of the proposed activity in combination with any "existing" effects, arising from existing uses, permitted activities, and consented and probable uses.

In relation to the scope and context of the assessment, Policy D.2.18(5) of the Regional Plan for Northland (RPN) provides for potential adverse effects to be assessed using a system-wide approach (e.g., the OTP-MB SEA, Marsden Bay or outer harbour entrance zone), which recognises that the scale of the effect of an activity is proportional to the size and sensitivity of the area of indigenous biodiversity.

Under the current legal framework, the effects of a proposed activity should be assessed against the environment that exists at the time the application is made. In this case, the existing environment includes, among other things, the natural features of the harbour system, and past changes and modifications including existing port development and operations, the Marsden Cove residential/marina development, and more distant developments such as Portland Cement, Port Nikau, and Whangārei Town Basin. The existing environment also includes activities that have gained consent and are likely to be implemented in the future, such as:

- Northport's consented eastern expansion; and,
- dredging to deepen and realign the commercial shipping channel by Channel Infrastructure (noting earlier comment on likelihood of these consents being implemented, given the transition from refinery to import and distributiom terminal).

5 GENERAL DESCRIPTION OF THE HARBOUR

5.1 PHYSICAL CHARACTERISTICS

Whangārei Harbour is one of 11 Northland estuaries larger than 1,000 ha. It is the largest of the eight east coast estuaries within that group (by surface area, total volume and tidal prism at spring high tide—see Hume et al. 2016). The harbour is formed from a shallow drowned valley approximately 24 km in length, and has a surface area of around 10,400 ha, of which, 58% is intertidal. It has a mean depth of 4 m and a maximum depth of 31 m near Marsden Point (Morrison 2003; Hume et al. 2016).

Figure 3. Key features of Whangārei Harbour.

The geology of the northern shore differs substantially from the southern shore. This is reflected in the morphology of the harbour, with the northern shore surrounded by steep, volcanic and greywacke landforms, with a series of open and semi-enclosed bays. In contrast, the southern shore contains shallow tidal creeks and rivers extending into coastal flats underlain by undifferentiated mélange, mud and sand deposits (Edbrooke & Brook 2009).

The morphology of the outer harbour and entrance is particularly complex. The flood tide deltas (i.e., Calliope and Mair Banks) sit to the north and south of the entrance channel, respectively, with Calliope being partially, and Mair largely, exposed at low tide. Inside the harbour entrance, the channel is split by Snake Bank to the south and MacDonald Bank to the north, with the main channel running south of Snake Bank and a secondary channel leading to Pārua Bay running between the two deltas. Pārua Bay, on the northern shore of the harbour, is a sheltered, depositional inlet that opens to the outer harbour through a relatively narrow entrance. A shallow shell bank historically traversed the main channel between One Tree and Manganese Points, effectively delineating the outer and mid harbour. However, a cut through the shell bank was made during channel dredging in 1969 (Morrison 2003).

The mid-harbour section is a rectangular-shaped water body, around 8.5 km long and 4 to 5 km wide, with large intertidal and shallow subtidal flats, and a relatively large blind channel running between the main channel and the northern shore. The main channel in the mid-harbour has three defined reaches (Shell Cut, Tamaterau, and Wellington), with depths varying from around 6–16 m. Deeper sections are associated with a series of “holes” in the Wellington Reach. The main channel splits around Limestone Island, with the northern upper harbour branch diverging to head north up Hātea River, past Otaika and Limeburners Creeks, Whangārei Port and Whangārei township. The southern upper harbour branch becomes Mangapai River, passing Portland and Tokitoki Creek before branching and terminating as a series of small tidal creeks.

5.1.1 SEDIMENTS

Harbour-wide surveys (Griffiths 2012b; Lundquist & Broekhuizen 2012; Griffiths & Gilbert 2025) indicate that intertidal sediments in the mid and outer harbour are predominantly sandy, with sediments becoming muddier in the upper harbour and Pārua Bay (Figure 4). Intertidal sediment samples obtained from around Northport show that they predominantly consist of sand, except for samples collected immediately west of the port, which consisted of muddy sand (Figure 6; Spyksma & Brown 2018). Less information is available for subtidal sediments in the mid to upper harbour, but the entrance has been well studied. Black et al. (1989) produced a simplified map of seabed substrates[3] prior to Northport being developed. It showed large subtidal areas of clean and algae-encrusted, gravel-shell lag, interspersed with areas containing sand waves, sand ripples and shelly sand (Figure 5). More recent (post-development) sampling indicates that sediments in the outer channel between Northport and Home Point tend to be coarse, with averages of around 20% gravel and 80% sand, with a higher proportion (50%) of gravel around Home Point (West 2016). Subtidal sediments around Northport also consist of sand or gravelly sand (Figure 6; Ahern 2020b).

Apart from moderately elevated concentrations of the key urban stormwater contaminants (copper, lead and zinc) in the upper harbour sediments near Whangārei, sediment concentrations of heavy metals in the harbour are generally low and below the NRC standards for sediment quality. The exceptions to this were: elevated chromium concentrations at one site (Waikaraka on the northern, mid-harbour shore) that exceeded the TEL guideline; and nickel at three sites, of which, one slightly exceeded the TEL guideline (Waiharohia Canal in the upper harbour[4]) and two exceeded the DGV (the NRC Waikaraka site, and a site sampled by Spyksma and Brown (2018) next to Northport). Griffiths (2012b) highlighted that there are no known point-source discharges of nickel or chromium to the harbour, and suggested that elevated concentrations of these metals at some sites may be due to high levels in surrounding catchment soils. Similarly, the highest sediment concentrations of organic carbon, nitrogen and phosphorus have generally been recorded in upper harbour sites in the Hātea River, and to a lesser extent Mangapai River, with the occasional site having elevated concentrations in the mid and outer harbour (Griffiths 2012b). Relatively low sediment concentrations of these three indicators have been recorded around Northport (Spyksma & Brown 2018).Similarly, the highest sediment concentrations of organic carbon, nitrogen and phosphorus have generally been recorded in upper harbour sites in the Hātea River, and to a lesser extent Mangapai River, with the occasional site having elevated concentrations in the mid and outer harbour (Griffiths 2012b). Relatively low sediment concentrations of these three indicators have been recorded around Northport (Spyksma & Brown 2018).

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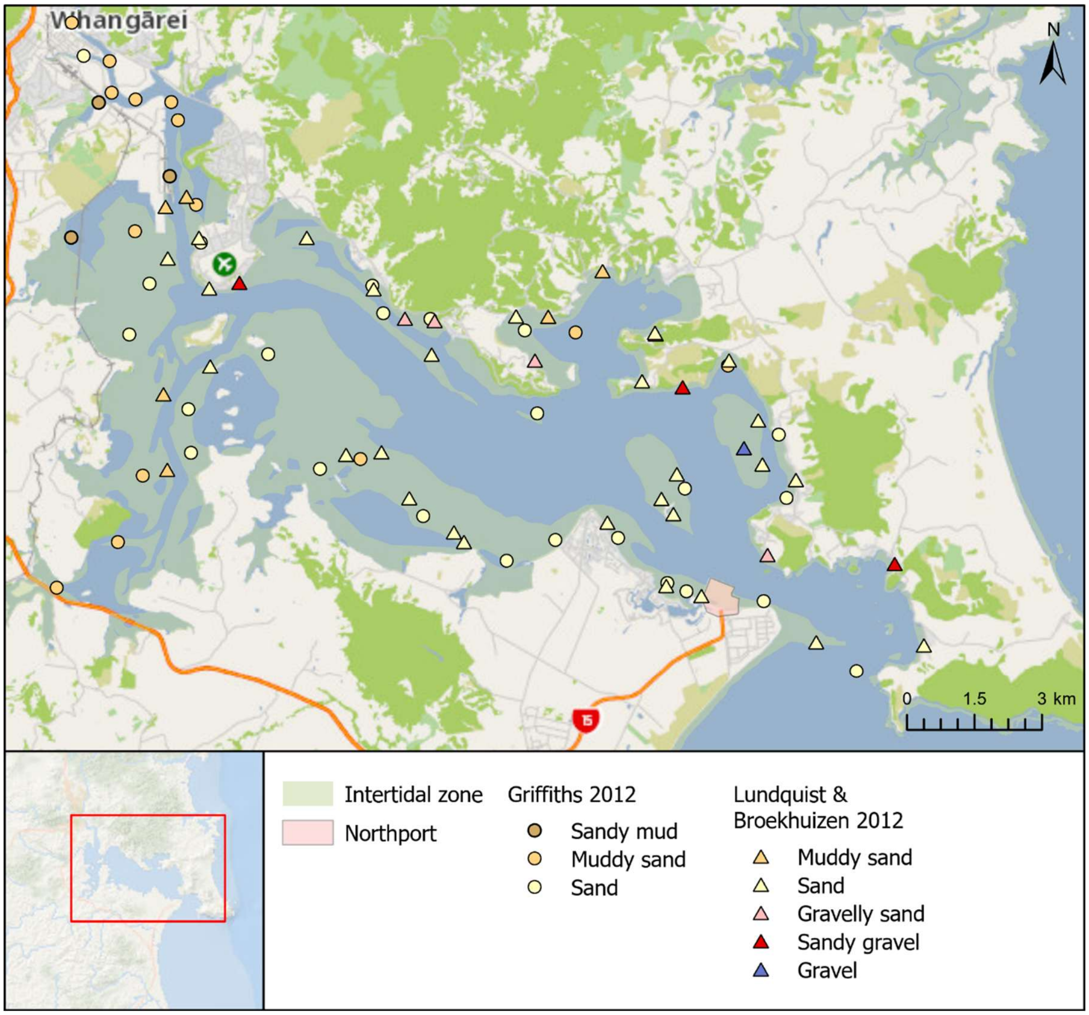
[3] By integrating information from photographic and underwater video surveys, side scan imagery, diver observations and sediment analysis.

[4] Chromium concentrations were below the TEL guideline in subsequent NRC monitoring of the Waiharohia Canal site in 2014 and 2016, but the Waikaraka site has not been resampled (Bramford 2016).

Figure 4. Intertidal sediment types in Whangārei Harbour, adapted from NRC data collected between 2021 and 2025[5], and Lundquist and Broekhuizen (2012). Note that the sand fraction in the NRC assessment also included gravel.



[5] Downloaded from [Environmental data hub - Northland Regional Council]

Figure 5. Simplified map of bottom substrates based on the integration of photographic and underwater video surveys, side scan imagery, diver observations and sediment analysis (from Black et al. (1989)).. Simplified map of bottom substrates based on the integration of photographic and underwater video surveys, side scan imagery, diver observations and sediment analysis (from Black et al. (1989)).

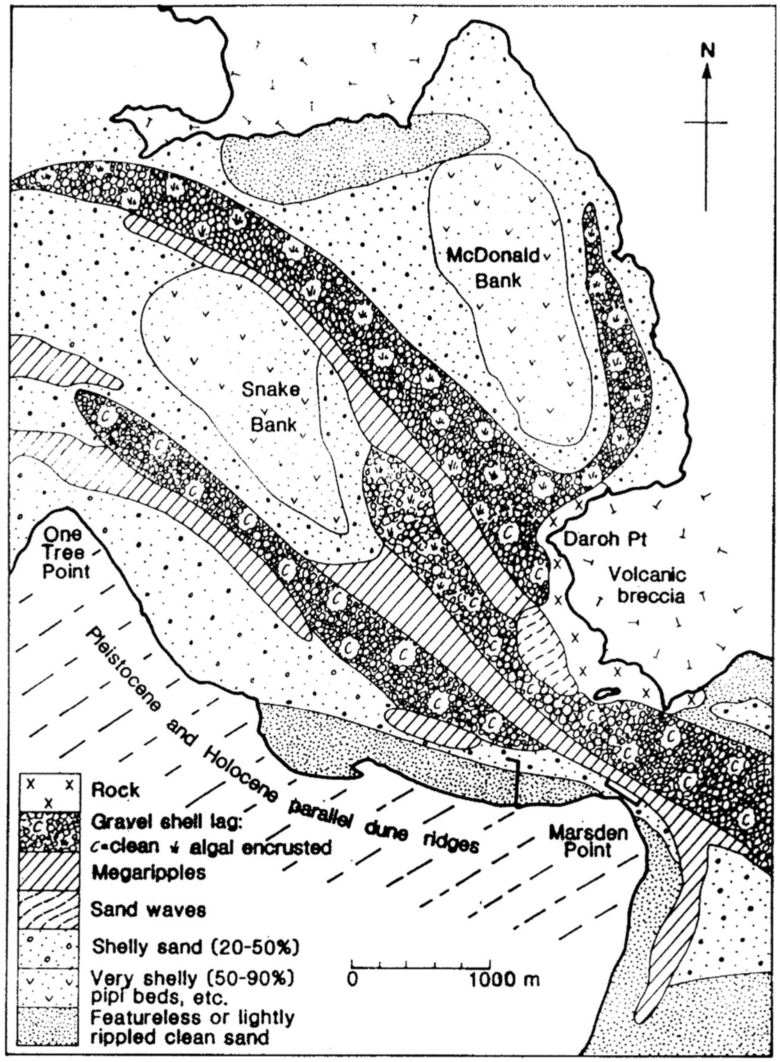


Figure 6. Sediment characteristics in intertidal and subtidal sites in Marsden Bay sampled by 4Sight (from Griffiths 2012b; Spyksma & Brown 2018; Ahern 2020a).

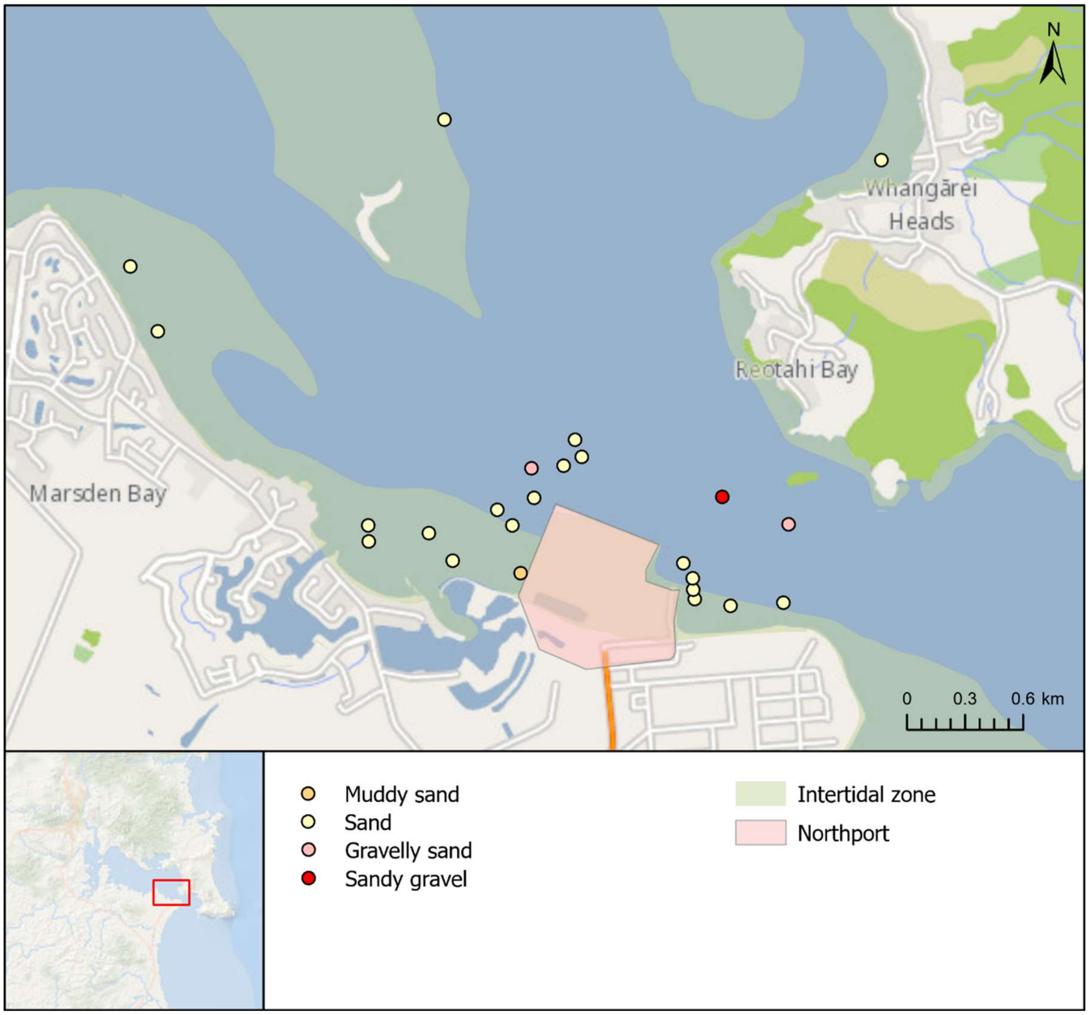
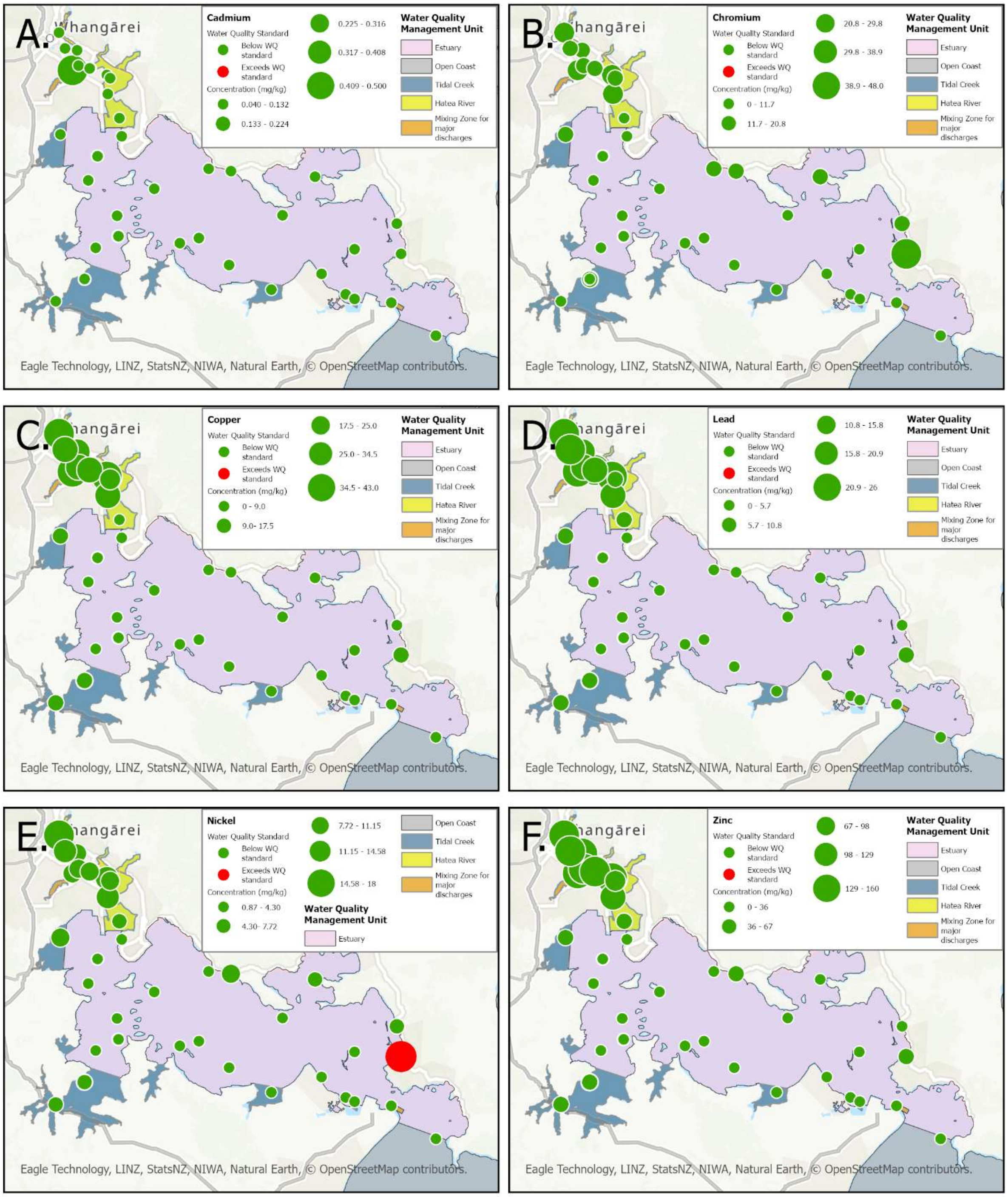


Figure 7. Bubble plots showing sediment concentrations of: A) cadmium; B) chromium; C) copper; D) lead; E) nickel; and F) zinc in Whangārei Harbour (data obtained from NRC's Environmental data hub[6] – also see Griffiths & Gilbert 2025). Bubble colours indicate whether concentrations were below (green) or exceeded (red) NRC standards for sediment quality.



[6]https://www.nrc.govt.nz/environment/environmental-data/environmental-data-hub/

5.1.2 WATER QUALITY

Harbour water quality is affected by diffuse urban and agricultural runoff, and point-source discharges that, actually or potentially, include wastewater, stormwater, landfill leachate, antifoulants and other contaminants. Water quality is also influenced by natural, physical characteristics. River inputs have a strong influence on water quality in the upper harbour, whereas outer harbour sites are more influenced by tidal exchange with coastal waters.

Northland Regional Council currently monitor coastal water quality at 12 sites in the Whangārei Harbour (Figure 8). Previously reported results indicated that water quality improves down the harbour, with sites near the harbour entrance having the best quality. Sites in the upper harbour (upstream of Port Whangārei) generally had high concentrations of faecal coliforms, phosphorus, and nitrogen, and high turbidity. In comparison, sites near the harbour entrance had very good water quality, with significantly lower values for all the above indicators (Tweddle et al. 2011; Griffiths 2015; Griffiths 2021).

For water management purposes, the RPN includes water quality standards for five coastal Water Quality Management Units (WQMU): 1) Hātea River; 2) Tidal Creek; 3) Estuary; 4) Open Coast; and 5) Mixing Zones for Major Discharges. The sea around the proposed shipyard falls within the Estuaries WQMU (Figure 8), with the standards for that unit provided in Table 2.

Five sites are monitored in the Whangārei Harbour Estuary WQMU: Kaiwaka Point, Portland; Tamaterau, One Tree Point; and Mair Bank. Between the 2014 and 2024 calendar years:

- The dissolved oxygen (DO) standard has been breached once (minimum annual concentrations below the standard at Kaiwaka Point in 2021).
- The ammoniacal nitrogen standard has been breached nine times (median annual concentrations above the standard at Kaiwaka Point in 2015–2018, 2020, & 2023, and at Portland in 2015, 2018 & 2020).
- The total oxidised nitrogen standard has been breached two times (median annual concentrations above the standard at Kaiwaka Point in 2016 and 2020).
- The total nitrogen standard has been breached three times (median annual concentrations above the standard at Kaiwaka Point in 2016, 2020 and 2023).
- The total phosphorus standard has been breached three times (median annual concentrations above the standard at Kaiwaka Point in 2015, 2016 and 2021).
- The copper standard was less than the laboratory non-detect limit (NDL) prior to mid-2019, so laboratory results during that period always exceeded it (Figure 12). After NDL limits were reduced, the copper standard was occasionally exceeded at the upper Estuary sites and infrequently exceeded at the One Tree Point and Mair Bank sites.
- The zinc standard was infrequently exceeded at all sites. (Figure 12).

Table 2: Regional Plan for Northland coastal water quality standards.

Attribute	Units	Compliance Metric	Hātea River	Tidal Creeks	Estuaries
Dissolved oxygen	mg/L	Annual median	>6.2	>6.3	>6.9
		Minimum	4.6		
Temperature	°C	Maximum change	3		
pH	pH units	Annual minimum	7.0		
		Annual maximum	8.5		
Turbidity	NTU	Annual median	<7.5	<10.8	<6.9
Secchi depth	m	Annual median	>0.8	>0.7	>1.0
Chlorophyll-*a*	mg/L	Annual median	<0.003	<0.004	<0.004
Total phosphorus	mg/L	Annual median	<0.119	<0.040	<0.030
Total nitrogen	mg/L	Annual median	<0.860	<0.600	<0.220
Nitrate-nitrite N	mg/L	Annual median	<0.580	<0.218	<0.048
Ammoniacal-N	mg/L	Annual median	<0.099	<0.043	<0.023
Copper	mg/L	Maximum	0.0013		
Lead	mg/L	Maximum	0.0044		
Zinc	mg/L	Maximum	0.015		
Faecal coliforms	MPN/100 ml	Median	n/a		≤14
		Annual 90th percentile	n/a		≤43
Enterococci	Enterococci /100 ml	Annual 90th percentile	≤500	≤200	≤200

Figure 8: Water quality management units in the Regional Plan for Northland, and NRC State of the Environment water quality monitoring sites.

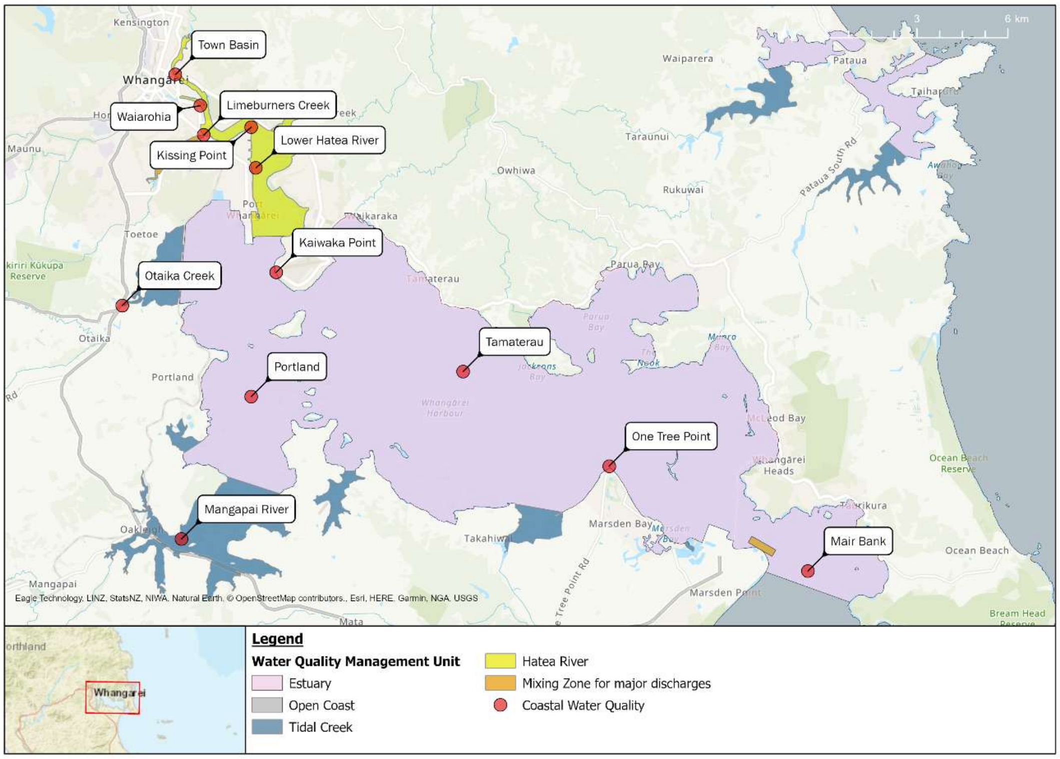


Figure 9: Median annual (Jan–Dec) chlorophyll-*a* concentrations at sites within the Whangārei Harbour Estuary WQMU. The NRC water quality standard is provided for reference.

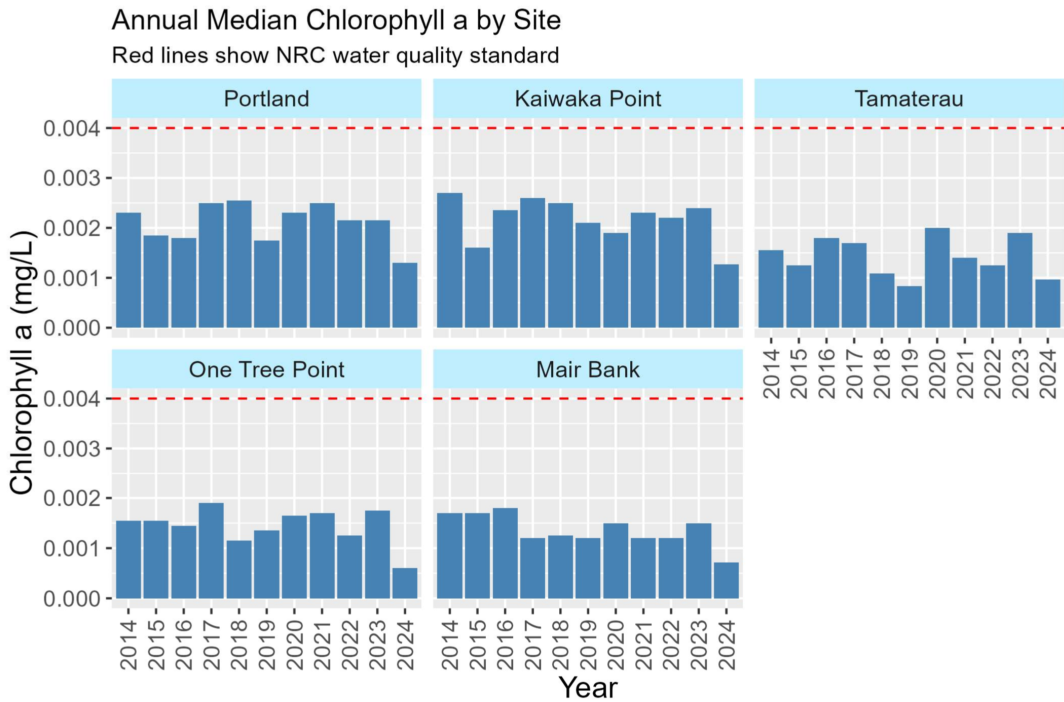


Figure 10: Median annual (2014–2024) concentrations of: A) ammoniacal-N; B) total oxidised nitrogen; C) total nitrogen; and D) total phosphorus relative to the RPN water quality standards.

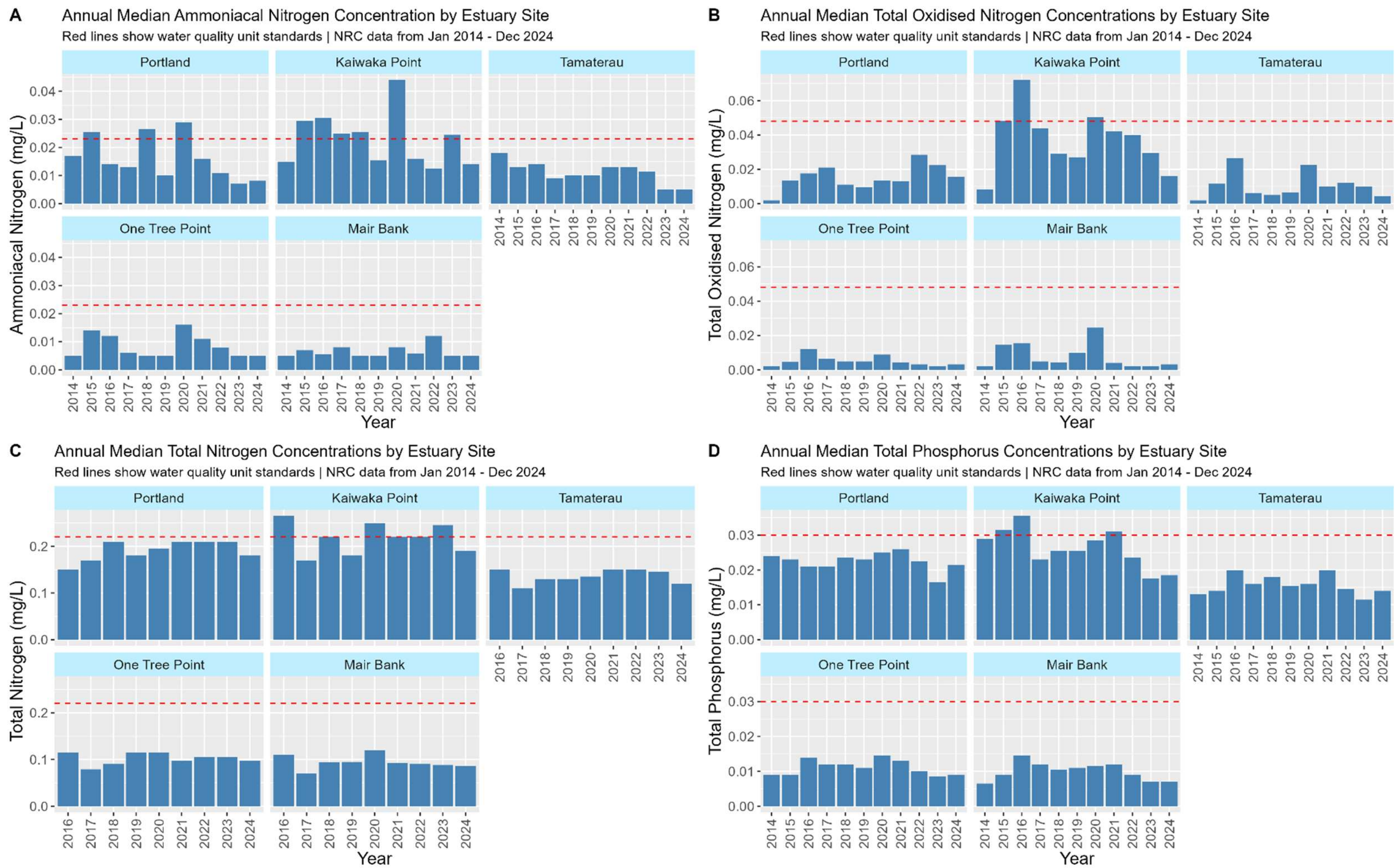


Figure 11: Median/minimum annual results (2014–2024) for: A & B) dissolved oxygen; C) turbidity; and, D) Secchi depth relative to the RPN water quality standards.

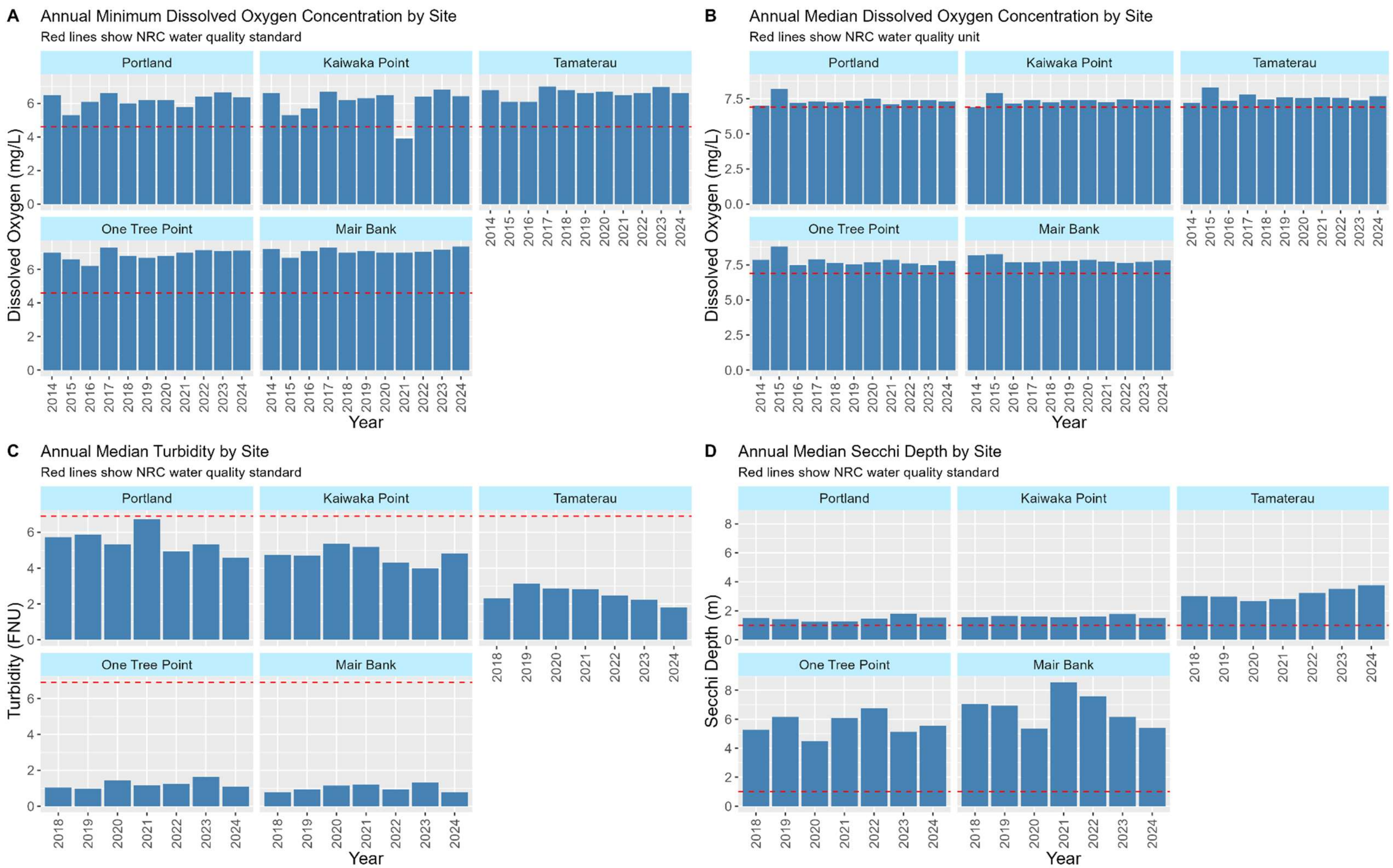
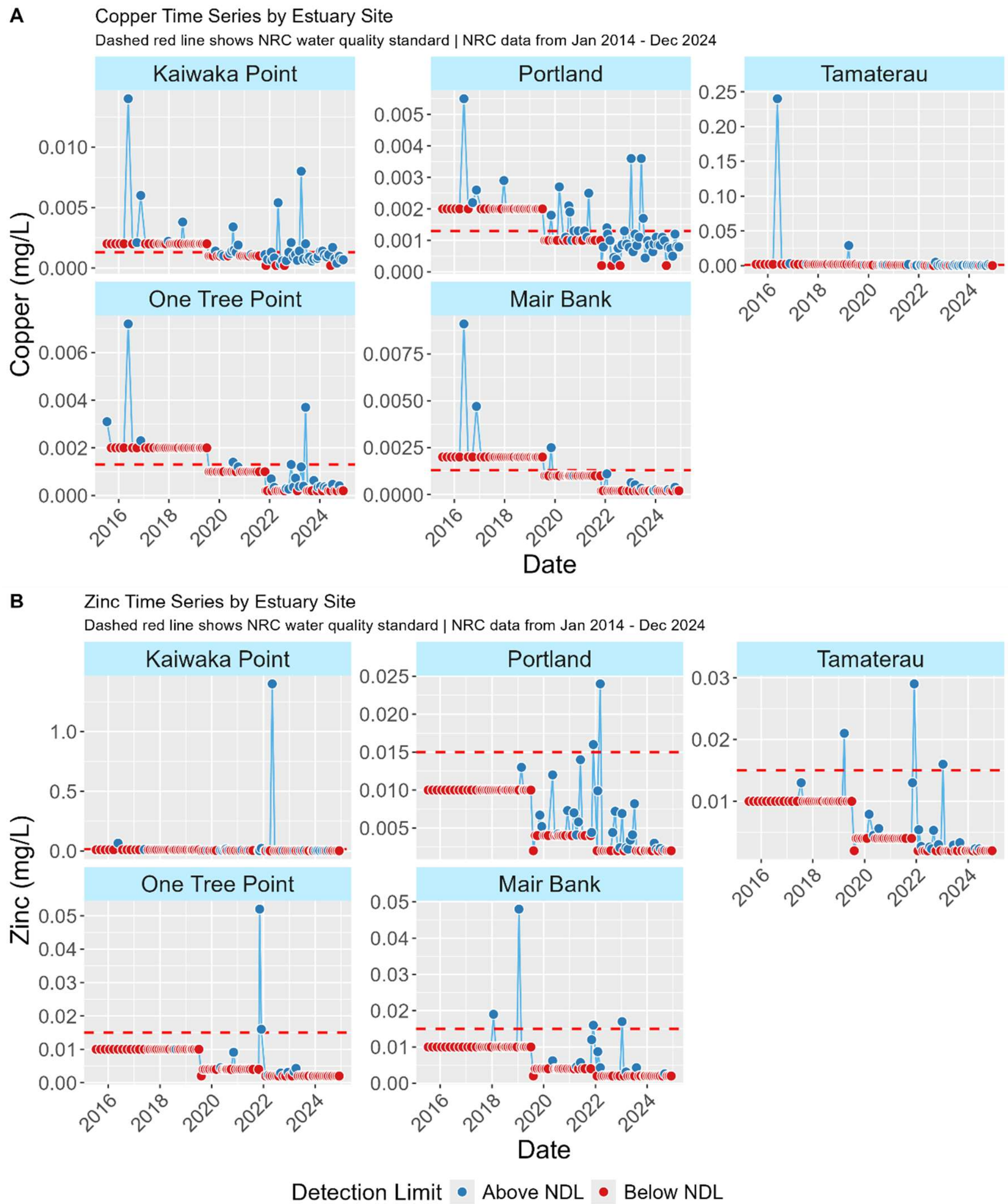


Figure 12: Measured A) total recoverable copper; and, B) zinc concentrations at NRC monitoring sites within the Whangārei Estuary WQMU.



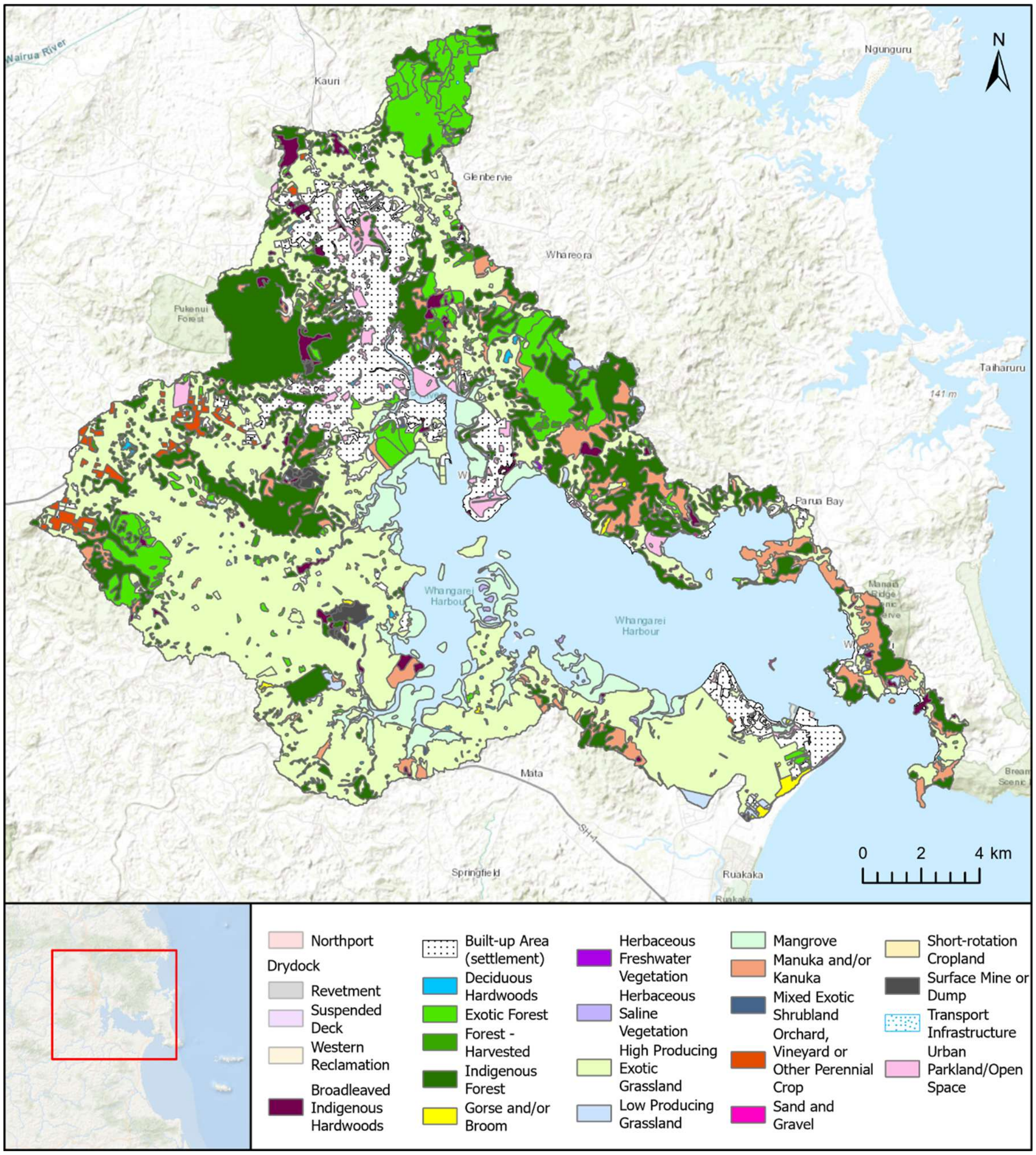
Whangārei Harbour has been, and continues to be, subject to significant coastal development and anthropogenic stressors. Overall, the harbour catchment has an area of around 297 km^2, with the main land uses including pasture (high producing exotic grassland, 45%), indigenous forest (19%), urban areas (10%), and exotic forests (7%) (Figure 13). Sedimentation from land run-off is a major historical and on-going issue, with an average harbour-wide sedimentation rate of 3.4 mm/year over the last 50–100 years (Swales et al. 2013).

Historically, between the 1920s to late 1970s, around 3 million m^3 of sediment fines (of which, 90% were under 10 μm in diameter) from the Portland Cement Works were disposed of in the harbour (Millar 1980). An additional 2 million m^3 of channel dredging material was deposited at various harbour locations in the 1960s (Dickie 1984). That included around:

- 754,000 m^3 of dredged sediment being pumped onto Snake Bank and the Takahiwai shoreline, reportedly raising Snake Bank from a low mudbank to a permanent high tide shellbank;
- 144,500 m^3 of sediment being dumped at the entrance to Pārua Bay;
- the creation of a chain of six islands off the end of Port Whangārei, which have subsequently been washed away and submerged.

Changes in sediment accumulation rates and sediment sources have been determined from the analysis of dated cores. The upper harbour has now been substantially infilled with eroded catchment soils, leading to mud being transported further downstream and accumulating in the northern bays and inlets. Cores show that sediment in Pārua Bay rapidly accreted on intertidal flats between the mid-1920s to early 1950s (averaging 12 mm per year). Accretion has since reduced to 2.9 mm per year, most likely due to tidal inundation and the associated supply of sediment being restricted as the seabed infilled (Swales et al. 2015). The cores appear to show that habitats in the lower harbour started to be impacted by mud from the upper harbour around the mid-1950s (Swales et al. 2015). In Munro Bay, mud has been accumulating at around 3 mm per year since the 1950s, and a 15 cm thick mud layer now covers the original shell-rich sand (Swales et al. 2013).

Figure 13. Landuses in the Whangārei Harbour catchment. Data from New Zealand Land Cover Database (LCDB) 6.0 (Landcare Research, Creative Commons 3.0 NZ).



As indicated above, the main channel of the harbour has been extensively dredged over many decades. Throughout much of the 20th century, dredging was carried out to maintain navigable depths through to Onemama Point, Portland and Port Whangārei (Morrison 2003). The channel from Thumb Point to Whangārei was dredged in 1969, and included a cut through the shell bank between Thumb and Manganese Points (Morrison 2003). More recently, dredging has been carried out, or is contemplated, to provide and maintain access to Channel Infrastructure, Northport and Marsden Cove Marina. This includes:

- dredging of 1.7 million m^3 in 2002 to create Northport's Berths 1 and 2;[7]
- dredging of 350,000 m^3 to create Northport's Berth 3;[7]
- Northport capital and maintenance dredging consents for the turning basin around the port (see **Error! Reference source not found.**);
- Channel Infrastructure capital dredging consents of approximately 3 million m^3, plus ongoing maintenance dredging, to deepen and realign the entrance to the harbour (NRC 2018a, although given the transition from refinery to import and distribution terminal, it may be unlikely that all of those activities are given effect to).

Other significant coastal activities (Figure 14) include the development and operation of:

- Channel Infrastructure jetties (noting the former refinery is now an import and distribution terminal);
- Northport;
- Port Whangārei;
- Marsden Cove Marina, Whangārei Marina, Riverside Drive Marina, Whangārei Cruising Club, Port Nikau Marina (partially developed) and Okara Marina (partially developed). The new Okara Marina involved the reclamation of more than 4,500 m^2 (NRC 2019a).The new Okara Marina involved the reclamation of more than 4,500 m^2 (NRC 2019a).
- Pārua Bay boat ramps and mooring area;
- Golden Cement Works Wharf;
- an oyster farm in Pārua Bay;
- the construction of a railway line across the tidal flats near Ōtaika Creek;
- various slipways, boat ramps and coastal structures such as seawalls.

The harbour is also a popular recreational destination and is used for recreational boating, fishing, and shellfish harvesting (including recreational scallop dredging in the past; see Sections on Fish and Kaimoana shellfish for more information).

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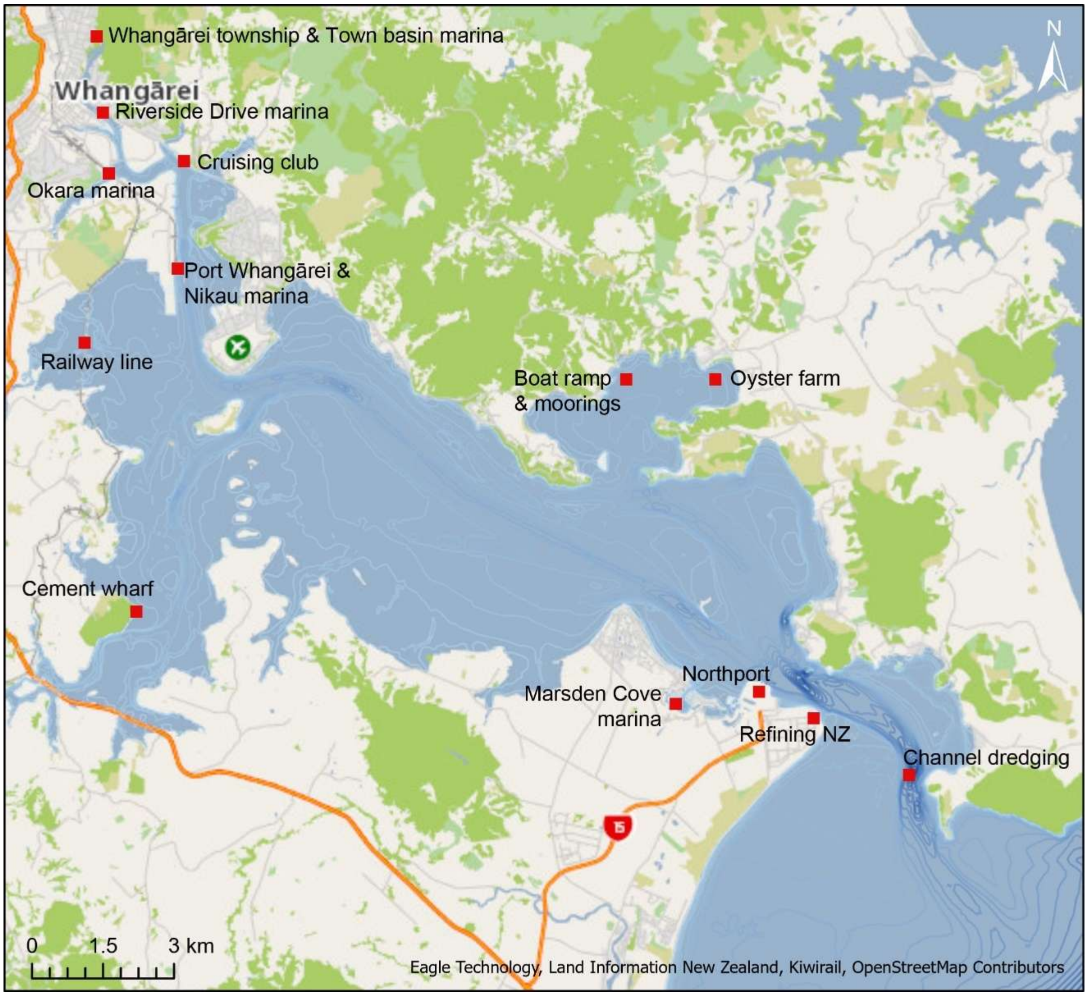
[7] https://www.heronconstruction.co.nz/Case+Studies/Northport+Wharf+Development+Berths+1+2+and+3.html

Figure 14. Existing and consented significant coastal developments and activities in Whangārei Harbour.



5.2 SIGNIFICANT ECOLOGICAL AREAS

Reviews of the ecological habitats and communities of Whangārei Harbour show that the harbour supports diverse and ecologically important marine communities. Approximately 35% of the harbour is delineated as a Significant Ecological Area (SEA) (Figure 15) in the RPN. The ecological values of the SEAs are briefly summarised below (from Northland Regional Council 2015).The ecological values of the SEAs are briefly summarised below (from Northland Regional Council 2015).

North-eastern Bays (Area A)—covers the northern bays across the channel from Northport and encompasses the MacDonald and Calliope Banks. The rocky coastal areas have a diverse rocky reef community, including some exceptional sponge communities off Motukaroro Island, which is part of the Whangārei Harbour Marine Reserve. The soft sediment area contains beds of scallops (*Pecten novaezelandiae*), horse mussels (*Atrina zelandica*) and cockles (*Austrovenus stutchburyi*). Seagrass beds (*Zostera muelleri*) are present on the two banks.

Mair Bank (Area B)—covers Mair and Marsden Banks at the southern entrance to the harbour. The banks provide regionally and nationally significant shellfish habitat, and until 2014, supported the largest commercial harvest of pipi (*Paphies australis*) in the country (see section on pipis for more detail).

One Tree Point to Marsden Bay (Area C)—is directly adjacent to the existing western boundary of Northport. The area comprises shallow intertidal and subtidal sandy soft-bottom habitats that are flushed with considerable oceanic waters on incoming tides, as well as the nutrients and plankton of the harbour waters. In the subtidal part of this area, in most years, scallops can be found there. Seagrass beds are returning to this area. These shellfish and seagrass communities and associated benthic invertebrates are a major food source for shorebirds and a significant nursery and feeding area for many coastal fish species.

Snake Bank (Area D)—is an important shellfish habitat and feeding area for shorebirds. The bank supported the commercial harvest of cockles until 2012 (see section on cockles for more details).

Takihiwai to Hewlett Point (Area E)—covers an extensive area upstream of One Tree Point. The large intertidal flats contain the largest area of seagrass in the harbour, as well as cockle beds, mangroves and saltmarsh habitats. Horse mussel beds are present in the subtidal areas. Overall, these habitats support a diverse benthic and fish community.

Pārua Bay West (Area F)—covers the western bay of Pārua Bay. The area contains a diverse and healthy shellfish community and patches of seagrass, providing an important habitat for shorebirds and fish.

Tamaterau to Maganese Point (Area G)—contains a mixture of fringing rocky reef and soft sediment habitats that support a diverse shellfish, invertebrate and fish community.

Waikaraka Mangrove area (Area H)—contains a representative mangrove forest habitat. This SEA also encompasses the Waikaraka part of the Whangārei Harbour Marine Reserve.

Matakohe Island (Area I)—surrounds Matakohe Island and contains a variety of substrates and habitats including sand, mud, coarse gravel, saltmarsh and mangroves. Small shellfish beds exist in the intertidal areas, and the area provides an important habitat for shorebirds and fish.

Portland tidal flats and Onerahi flats (Areas J & K)—are muddy/sandy tidal flats that support significant shellfish beds. The shellfish beds are important feeding areas for shorebirds and fish.

Figure 15. Regional Plan for Northland Significant Ecological Areas and locations of the Whangārei Harbour Marine Reserve (Waikaraka and Motukaroro) in Whangārei Harbour.

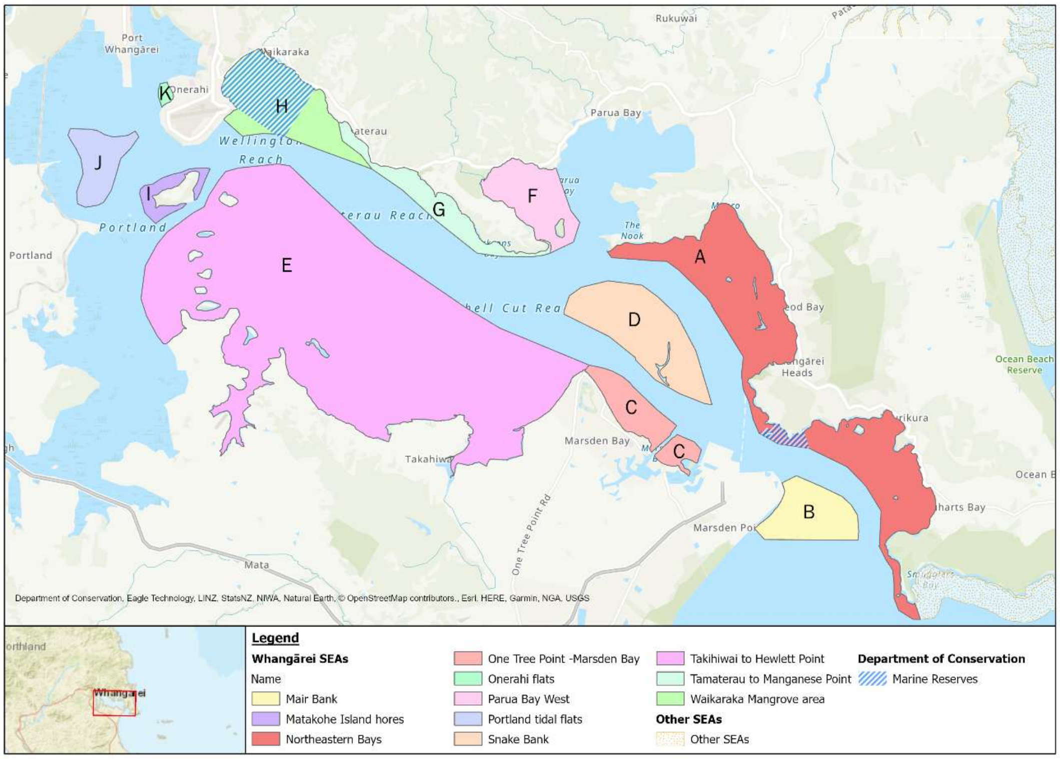


Figure 16. Examples of substrates and biota observed in the One Tree Point to Marsden Bay SEA: A–B) sandy substrates; C) abundant cockle shells on the surface; D) dense seagrass and red algae; E) dense seagrass and abundant bubble shells (*Bulla quoyii*, see arrows); F) a large flock of royal spoonbills (*Platalea regia*).

6 MARINE ECOLOGICAL VALUES

Ecological values were assessed through:

- a desktop review and analysis of available information and data,
- additional data gathering and analysis, including:
    - a rapid intertidal survey of Marsden Bay;
    - a comprehensive, quantitative survey of benthic macrofauna in Marsden Bay; and,
    - a video survey of subtidal habitats around Northport.

6.1 COASTAL VEGETATION

Specific and general habitat and ecological values of Whangārei Harbour have been assessed in multiple scientific studies since the 1970s. Mangroves are the most conspicuous marine plant in the harbour, with dense stands covering a large proportion of the southern and upper harbour shores. They are more restricted on the northern shore and east of Takahiwai Stream (whose mouth is around 2 km west of One Tree Point) (Figure 18 & Figure 19). Mangroves provide a habitat for a variety of native animals, including several species of fish, birds and insects, but few species are dependent on them. The only species that are dependent on mangroves are: banded rail (*Hypotaenidia philippensis*) (Bell & Blayney 2017), which has an 'At Risk: Declining' conservation status; and two endemic insects (a moth and a mite), whose larvae are only found on mangroves (Morrisey et al. 2007). In the North Island, banded rail only utilise mangroves that adjoin saltmarsh vegetation as they require saltmarsh for roosting and nesting (Bell & Blayney 2017)[8]. Mangroves are also thought to provide a temporary habitat when they are submerged for juvenile parore, short-finned eels, and grey mullet (Morrisey et al. 2007).

Mangrove extent in the harbour has increased from around 1,008 ha[9] in 1942 to 1,587 ha in 2004 (Smith McNaught Whangarei Ltd 1976; Kerr 2010; Griffiths 2012b; DOC 2014). The expansion of mangrove forests is largely due to sedimentation, which has led to similar changes in many other northern harbours (Hauraki Gulf Forum 2020). The potential for future expansion is likely to be modulated by the balance between future sea level rise and wave climate (which will limit seaward expansion) and sediment accumulation (which will promote seaward expansion) (see Swales et al. 2008). However, changes in coastal processes at specific sites may lead to localised changes.

The proliferation of mangroves has coincided with a significant reduction in the extent of saltmarsh vegetation, with only very small pockets of natural saltmarsh now remaining. The original extent of saltmarsh vegetation is uncertain, but it was estimated to decrease from: around 556 ha in 1942; to 189 ha in 1985; to 56 ha in 2004; and down to 23 ha in 2015 (Parrish 1984; Kerr 2010; Griffiths 2012b; DOC 2014; NRC 2019b). Much of the original saltmarsh in the harbour was reportedly destroyed by drainage and reclamation (Mason & Ritchie 1979). A few small stands of mangroves are present just west of Northport, and Blacksmith's Creek (situated between Northport and Marsden Cove) contains a diverse

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[8] Effects on banded rail are addressed in the avifauna report accompanying this application.

[9] Note that the accuracy of this estimate was questioned by May (1984).

mosaic of estuarine, freshwater and terrestrial vegetation, including saltmarsh and mangrove forest (Lux et al. 2007). A 2006 assessment indicated that ecological units within the Blacksmith's Creek wetland/saltmarsh system included:

- mangrove shrubland (83%) and sea rush–oioi rushland (5%) in the estuarine areas;
- a glasswort herbfield on a shellbank (<1%);
- kanuka shrubland (10%), marsh clubrush sedgeland (<1%), and manuka–harakeke flaxland on alluvium (<1%); and,
- watercress (*Polygonum sp.*) and bachelor's button (*Baumea articulata*) herbfield in the stream channel (<1%);
- the presence of sea blite (*Suaeda novae–zelandiae*), which is a regionally significant plant species.

Seagrass (*Zostera muelleri*) was also historically abundant in Whangārei Harbour. Aerial photographs from 1942–1968 show that seagrass covered around 10–14 km^2 of the harbour (Figure 17), but by 1970 it had virtually disappeared (Reed et al. 2004). Suggested factors involved in the loss of seagrass include increased turbidity and smothering from sediment disposal in the harbour and sediment run-off, and pollution from sewage, industrial spills and urban run-off (Reed et al. 2004). However, the actual causes are uncertain, and significant recovery has occurred over the last two decades. In 1999, small pockets of seagrass were recorded at a few sites (Reed et al. 2004); by 2010, there was around 0.38 km^2 of seagrass in the harbour (DOC 2014); and by 2016, there was around 6 km^2 of seagrass in the harbour (Figure 18; Matheson et al. 2017; Tan et al. 2020).

Seagrass is abundant on the intertidal flats between One Tree Point and Northport (Lohrer 2021; Poynter 2021; Figure 19–Figure 21), including patches within, and near, the proposed development area. Historically, seagrass covered most of the sandflat areas in Marsden Bay (Figure 17). Aerial images from 2004 to 2024 indicate that the distribution and spatial extent of seagrass beds in that area have been highly variable over relatively short periods of time (Figure 20, also see Appendix B in Spyksma and Brown (2018)). Similarly, high levels of temporal variability have been reported in other regions, such as the northern Manukau Harbour, where a significant increase in seagrass extent occurred between 2013 and 2021 (Kelly 2021), and the central Kaipara Harbour, where conversely, a significant decline in seagrass extent occurred between 2010 and 2019 (Kelly 2020).

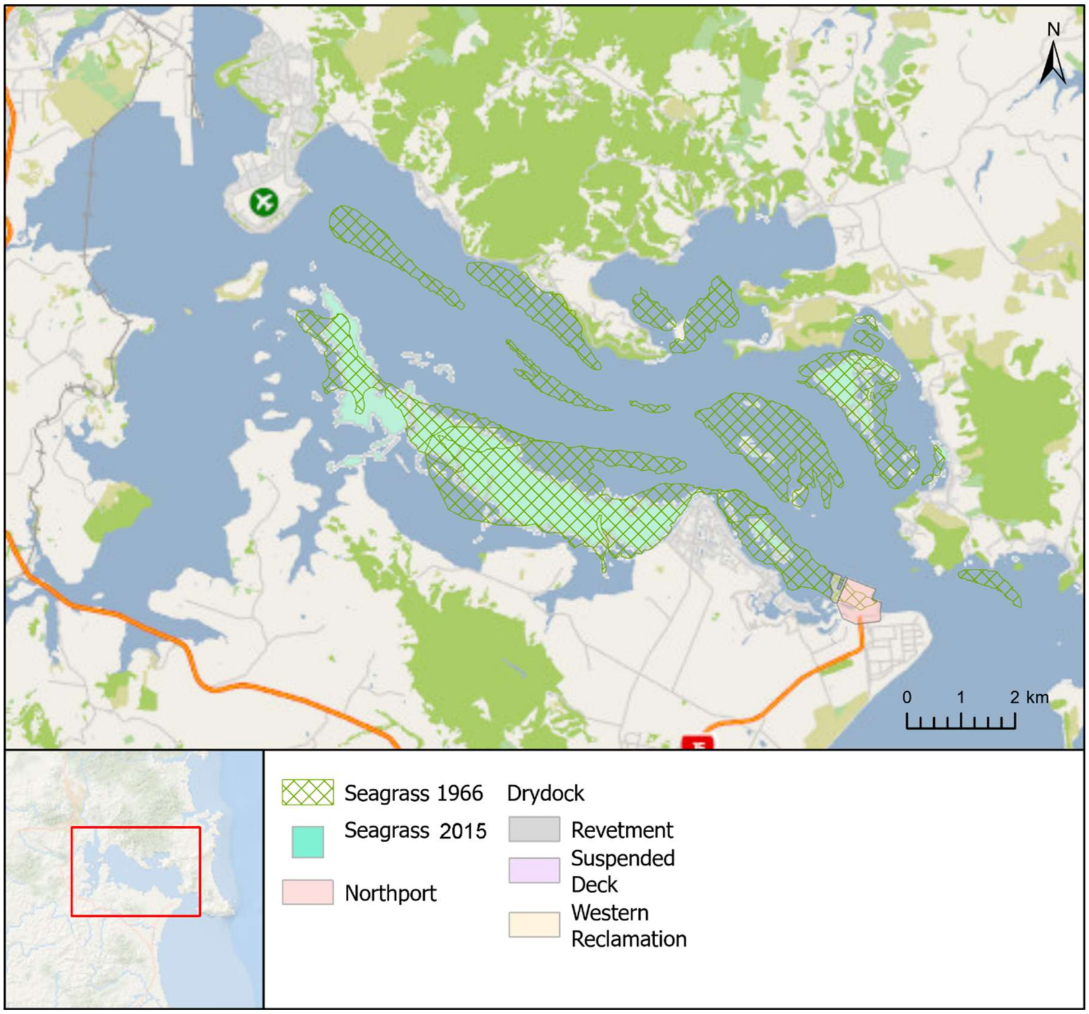
Seagrass beds can support diverse macrofaunal communities, and of the 25 intertidal sites sampled in Whangārei by Griffiths (2012b), the seagrass bed at Takahiwai contained the highest diversity and abundance of macrofauna. Subtidal (but not intertidal) seagrass beds are also known to be an important nursery habitat for juvenile fish (Morrison et al. 2007; Morrison et al. 2014a).

6.1.1 THREATENED OR AT RISK SPECIES

Seagrass is listed as an "At Risk" species under the New Zealand Threat Classification System (NZTCS) due to the seagrass population being very large, but subject to low to high ongoing or predicted decline. The NZTCS includes the following qualifier for seagrass:

- it is a non-endemic[10] species that is secure overseas; and,
- the seagrass population experiences extreme fluctuations (de Lange et al., 2017).

Figure 17. Extent of seagrass in Whangāri Harbour in 1966 and 2015. Extent in 1966 is from Morrison (2003), and extent in 2015 is from NRC (2020).



[10] Endemic species are those that are only found in New Zealand. Native species include endemic species and those that arrived in New Zealand without human assistance. Many native species, including seagrass, naturally occur in other parts of the world.

Figure 18: Recent extents of coastal vegetation (excluding macroalgae) in Whangārei Harbour. Data from NRC: seagrass data from 2015 to inform the Regional Plan; mangrove and saltmarsh data to inform Regional Plan Mediation Changes.

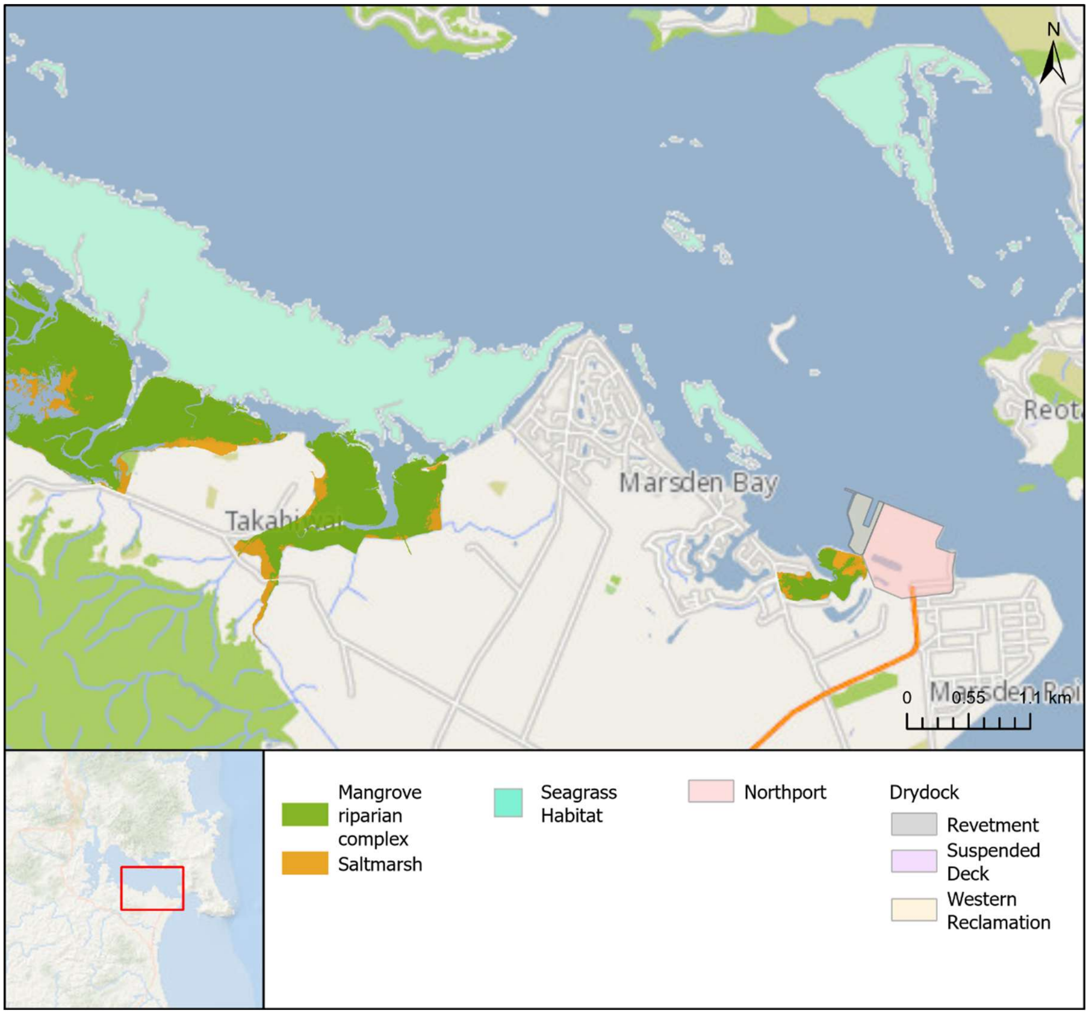


Figure 19: Recent extents of coastal vegetation (excluding macroalgae) near Northport. Data from NRC: seagrass data from 2015 to inform the Regional Plan; mangrove and saltmarsh data to inform Regional Plan Mediation Changes.

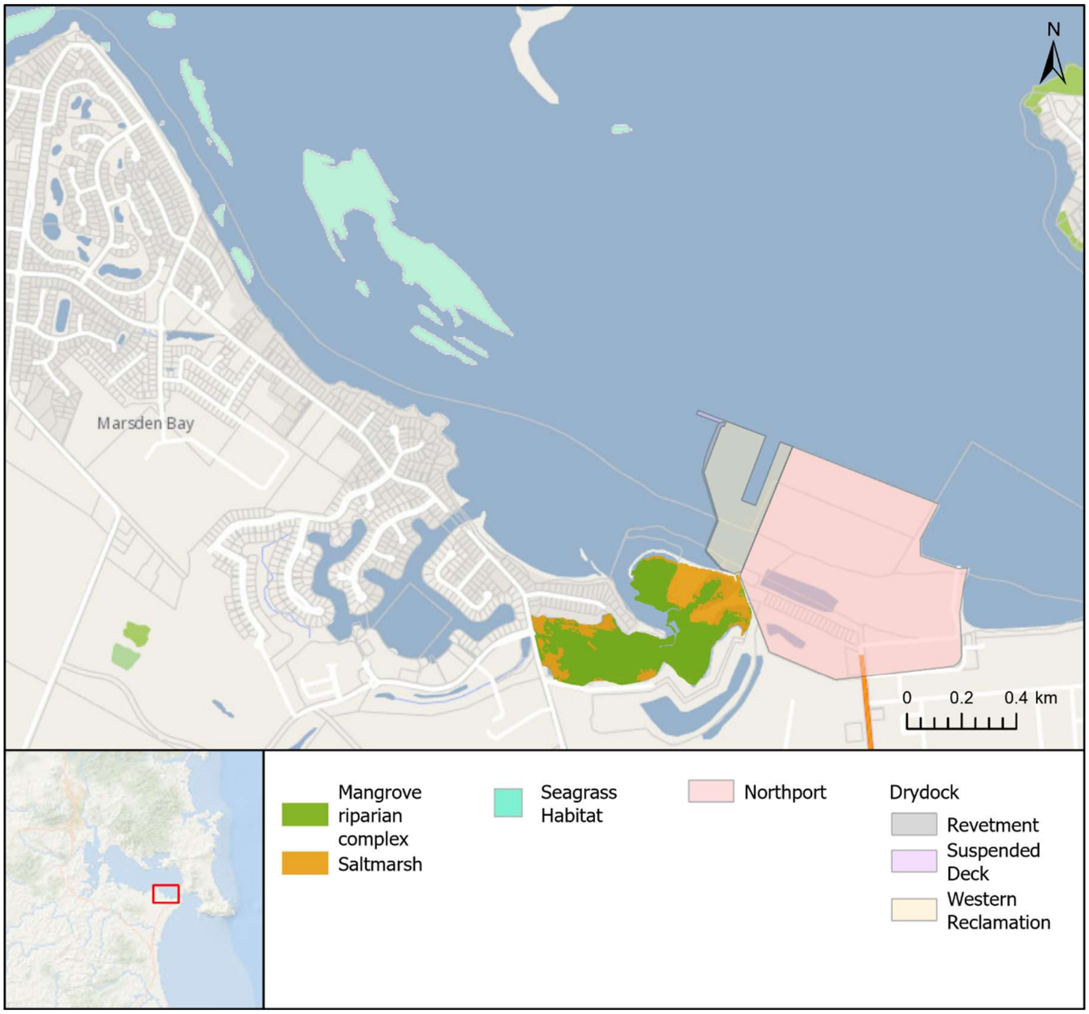


Figure 20: Images showing changes in seagrass extent within Marsden Bay in 2004[11], 2015[12] and 2025[13].

[11] LINZ Data Service, Northland 0.75m Rural Aerial Photos (2004)
[12] LINZ Data Service, Northland 0.4m Rural Aerial Photos (2014–2016)
[13] LINZ Data Service, Northland 0.3m Rural Aerial Photos (2023–2025)

Figure 21. Photos of intertidal coastal vegetation around Marsden Bay: A–B) seagrass patches east of Northport; C–E) extensive seagrass beds west of the Marsden Cove channel; F) the green alga, Ulva sp. G–H) red algae beds west of the Marsden Cove channel.

6.2 MACROALGAE

Natural rocky habitats and associated macroalgae communities are a relatively minor feature of Whangārei Harbour. Intertidal and subtidal reef surveys in the outer harbour and surrounding Bream Bay area indicate they contain typical macroalgae assemblages, with seaweed species including *Corallina officinalis* and common brown algae such as *Carpophyllum angustifolium*, *C. flexuosum*, *C. maschalocarpum, C. plumosum, Ecklonia radiata, Sargassum sinclarii* and *Hormosira banksia* (Morrison 2003). Natural rocky reef is not present in the Northport area, but port revetments provide hard structures similar to natural reefs. A subtidal survey of those revetments indicates that they have been colonised common macroalgae including *E. radiata, S. sinclairii, C. flexuosum, Dictyota kunthii, Hildenbrandia* sp., *Colpomenia* sp., *Ralfsia* sp., crustose coralline algae and various species of red turfing algae (Spyksma 2018).

Potentially, of more significance are the macroalgae communities of sediment habitats, known as 'macroalgal meadows'. Black et al. (1989) identified and produced a simplified map showing large subtidal areas with algae-encrusted, gravel-shell lag in the outer harbour (Figure 5). A more recent and detailed macroalgae survey recorded 118 macroalgae taxa growing on intertidal and subtidal soft sediments at six sites in the outer harbour, including One Tree Point, Mair Bank and Reotahi Bay (across the channel from Northport) (Neill and Nelson (2016); see Figure 21 F–H for examples). Although algae biomass was low, the number of taxa collected from these sites represented around 28% of the known regional flora across all habitat types. The study demonstrated that: Figure 21 F–H for examples). Although algae biomass was low, the number of taxa collected from these sites represented around 28% of the known regional flora across all habitat types. The study demonstrated that:

- areas of low algal biomass can still have a high diversity of taxa;
- macroalgal communities were highly variable in space and time; and,
- algal diversity increased towards the mouth of Whangārei Harbour.

Macroalgae meadows were one of the key ecological features observed in video footage obtained from the underwater video survey around Northport (see Section 6.3.2).

6.2.1 THREATENED OR AT RISK SPECIES

Four of the 119 macroalgae taxa recorded in the outer Whangārei Harbour by Neill and Nelson (2016) have been listed as "At Risk: Naturally Uncommon" under the New Zealand Threat Classification System (NZTCS) (Nelson et al. 2019). They are:

- *Microdictyon mutabile*, an endemic green seaweed that inhabits the mid to low intertidal on sheltered, gently sloping rocks in northern New Zealand. The seaweed forms bushy, turfing pads over the substrate in open (sunny) locations (Adams 1994; Wilcox 2018; Nelson 2020). Wilcox (2018) describes it as a "common and characteristic seaweed of the eastern shores of Auckland" that is present all year round and is commonly epiphytic on coralline algae (*Corallina officinalis*). He identifies Auckland locations where it occurs as Rangitoto Island, Howick, Birkenhead, Archilles Point, Point Resolution (Parnell), Torpedo Bay (Devonport), The Tor (Waiake Beach), Stanmore Bay, Army Bay (Whangaparāoa), Flat Rock

(Tawharanui), Motutapu Island, Motuihe Island, The Noises, Hobbs Bay (Tiritiri Matangi Island), Great Barrier Island, and Kaikoura Island.

- *Aeodes nitidissima*, a red seaweed that occupies low intertidal and subtidal rocky habitats on open coasts and sheltered harbours of northern North Island (Wilcox 2018; Nelson 2020). In the intertidal zone, it typically grows in intertidal runnels (Wilcox 2018). It is unclear whether *A. nitidissima* is an endemic species (Nelson 2020), as it has also been reported in Tasmania and South Australia (Scott 2012; Fowles et al. 2018). However, further work is required to confirm whether specimens from Australia and New Zealand are the same species, and to determine the morphological and ecological boundaries of this species (Russell et al. 2009). In Auckland, it is mostly found in the inner Hauraki Gulf, though specimens have been obtained along the eastern coast of the Auckland Region, apart from offshore islands. Particularly abundant populations have been recorded from Browns Island and on boulder beaches between Ōrere Point and Kaiaua (Wilcox 2018).
- *Feldmannia mitchelliae*, a filamentous brown seaweed that is little known and poorly studied in New Zealand (Nelson 2020), but is fairly common on the east coast of Auckland and widespread internationally (Wilcox 2018; Guiry 2020a). For instance, in a study of epiphytic algae growing on seagrass in the Mediterranean Sea, *F. mitchelliae* was found to be one of the two most common species, and one of the two species with the highest percent cover. It was also one of the two most common species to arrive in Oregon and Washington on recognisable marine debris from the 2011 Japan tsunami (Hansen et al. 2019). In New Zealand, *F. mitchelliae* is known to grow on other seaweeds, seagrass, stones, shells, and mooring ropes. On occasion, nuisance quantities have been reported growing as thick skeins on top of intertidal seagrass in Whangārei Harbour, and on Neptune's necklace (*Hormosira banksia*) south of Bay of Islands (Nelson et al. 2015). Microscopic examination is required to identify specimens of this species (Nelson 2020).
- *Hincksia granulosa*, a filamentous brown seaweed that is little known and poorly studied in New Zealand (Nelson 2020), but is widespread internationally, particularly in temperate seas (Hewitt et al. 1999; Guiry 2020b). This species has been observed floating on other buoyant seaweeds and plastics, and research suggests that its international distribution may be related to dispersal on floating substrata (Macaya et al. 2016). In New Zealand, it has also been reported on the hull of a fishing vessel (Piola & Conwell 2010), and is known to grow on other seaweeds and marina pontoons (Wilcox 2018). Hull fouling has also been proposed as a potential vector for its presence in Port Phillip Bay, Australia (Hewitt et al. 2004). Microscopic examination is required to identify specimens of this species (Nelson 2020).

All of these species are tagged with the qualifier "Data Poor". In relation to that qualifier, the NZTCS manual (Townsend et al. 2008) encourages Expert Panels to make every effort to assign a taxon to a threat category rather than list it as 'Data Deficient', and then use 'Data Poor' (DP) to indicate the uncertainty about the listing due to the lack of data.

6.3 BENTHIC SOFT-SEDIMENT COMMUNITIES

6.3.1 INTERTIDAL COMMUNITIES

6.3.1.1 GENERAL SETTTING

Variation in the composition of benthic macroinvertebrate communities throughout Whangārei Harbour was examined using NRC baseline monitoring survey data from 2012 (Griffiths 2012b). Macrofaunal samples were obtained from 38 intertidal/shallow subtidal sites[14]. Raw data from that survey were obtained from NRC and analysed to characterise benthic macrofaunal communities in Whangārei Harbour and determine how community composition varied throughout the harbour[15]. All intertidal and shallow subtidal macrofaunal communities were combined for the analyses.

Overall, 139 taxa were obtained, including 55 polychaete taxa, 39 molluscan taxa, 29 crustacean taxa, and minor contributions from other taxa groups. Numbers of taxa and individuals in pooled site samples varied around the harbour, and while patterns in the upper harbour were discernible (low to moderate diversity, with high numbers of individuals in the uppermost reaches of Hātea and Mangapai Rivers), patterns from the mid and outer harbour sites were more variable (Figure 23). This was reflected in the results of multivariate analyses using average taxa counts from each sampling site that distinguished two distinct macrofauna site clusters in Hātea and Mangapai Rivers, which contained both intertidal and shallow subtidal sites (clusters b & d in Figure 23). However, four intertidal sites in the central part of the upper harbour clustered with two subtidal mid-harbour sites, and intertidal sites in Pārua and McLeod Bays (cluster g). Other clusters in the mid to outer harbour included:

- cluster f, which included three upper intertidal sites on the broad sand flats of Takahiwai Bay on the southern, mid-harbour shore;
- cluster h, which included eight intertidal sites situated close to channels in the outer (4 sites, including all 3 in Marsden Bay), mid (3 sites), and upper (one site) harbour;
- cluster c, which included two subtidal sites, one in Pārua Bay and one in Munroe Bay on the northern shore;
- cluster a, which included two subtidal sites (Snake Bank and Manganese Point);
- cluster e, which consisted of a single intertidal site off Rat Island.

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[14] Three replicate samples were collected from each site using a 150 mm diameter by 150 mm deep cores and sieved to 500 µm.

[15] Data were analysed using standard univariate analyses and multivariate methods including non-metric multidimensional scaling (nMDS), cluster, similarity profile (SIMPROF), and similarity percentages (SIMPER) analyses (using Primer-e V7). Results are presented in spatial and data plots. Where applicable multivariate analyses were carried out using square root transformed data and Bray-Curtis similarity for resemblance estimates.

Figure 22: Bubble plots showing variation in a) numbers of taxa, and b) numbers of individuals in pooled benthic macrofaunal samples (n = 3 cores per site). Data provided by NRC.

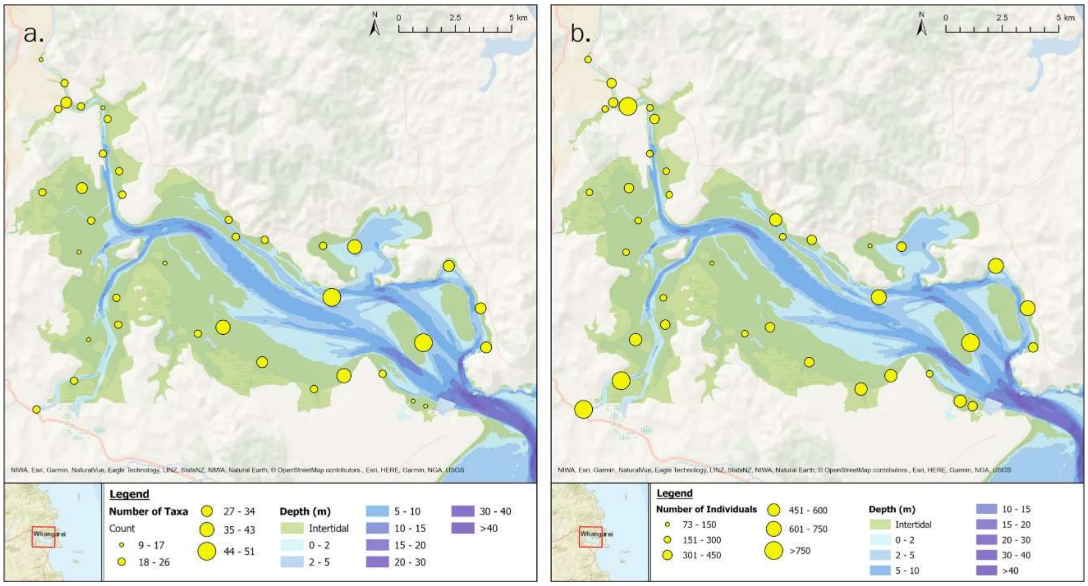
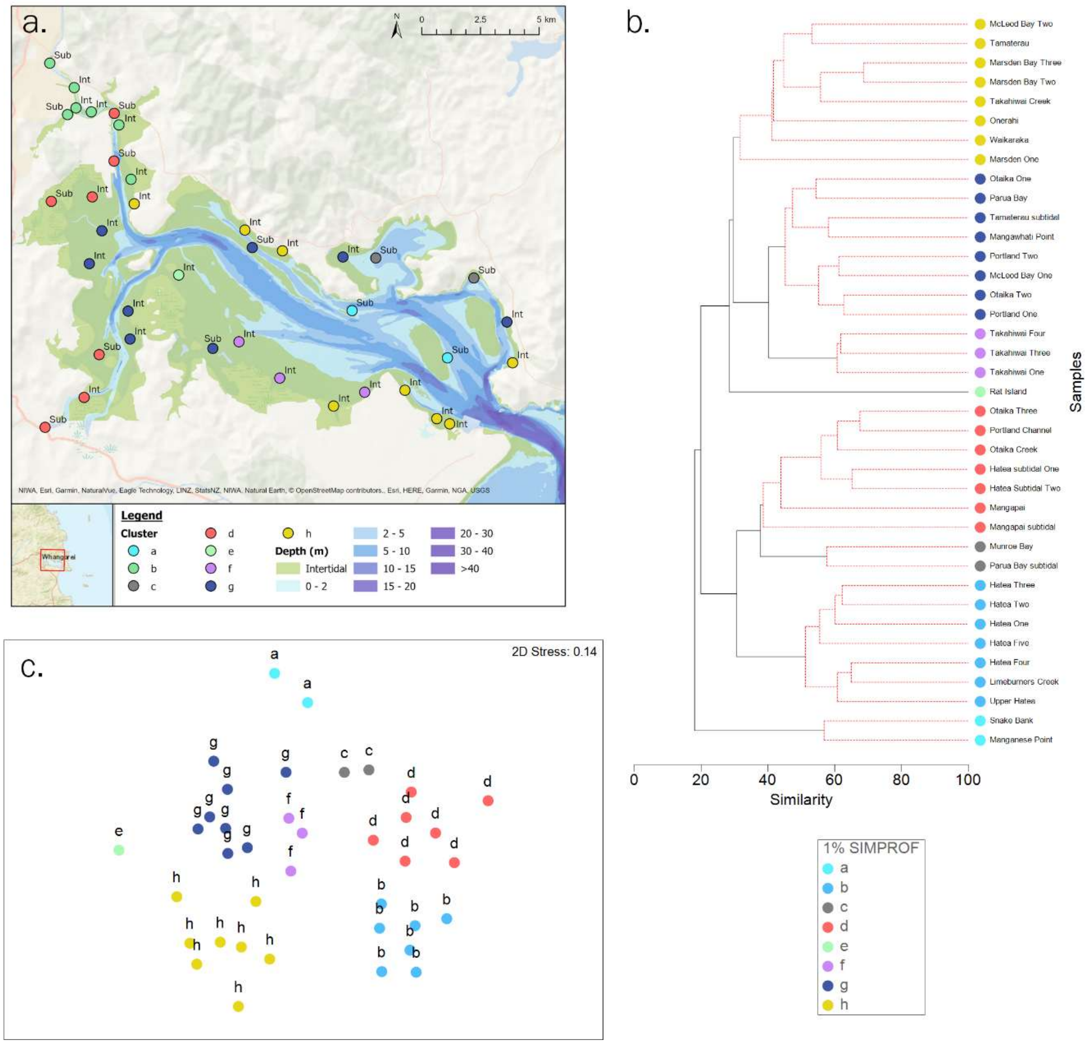


Figure 23: Results of multivariate analyses of macrofaunal community composition of NRC harbour-wide macroinvertebrate data (see Griffiths 2012b), showing a) the spatial distribution of significant (1%) clusters (i.e., sites with similar community composition); and the results of analyses used to identify those clusters, including b) cluster and similarity profile analyses, and c) non-metric multidimensional scaling. Intertidal (Int) and subtidal (Sub) sites are labelled in the map.



A one-way analysis of variance of $\log_{10}$ transformed taxa and individuals[16] in pooled samples from these clusters detected that there were statistically significant differences among clusters ($p < 0.0001$). Tukey's honestly significant difference tests indicated that sites from cluster h (which contained the intertidal sites closest to Northport) contained significantly fewer taxa than those in clusters a, f and c ($p < 0.05$), but more taxa than cluster e. No significant differences were detected in the mean number of individuals between cluster h and other clusters, except for cluster e, which had lower numbers (Figure 24).

Overall, pooled samples from cluster h contained 59 taxa, of which 29 were polychaetes, 12 were crustaceans, 16 were molluscs, and the remaining 8 taxa came from 5 other groups.

[16] Transformation was needed to meet the assumption of equal variance.

Counts of individual taxa varied substantially among sites, both within and between clusters. Among the molluscs, nut shells had the highest total counts, followed by cockles, pipi and wedge shells. Cluster h also had the highest mean counts of cockles and pipi. Numbers were patchy, but high counts of both species were obtained from sites near Northport in Marsden Bay. Highest counts of nut shells occurred in Takahiwai Bay (cluster f) and in the central part of the upper harbour (cluster g). Wedge shell numbers were also highest in the central part of the upper harbour (cluster g) and beside Rat Island (cluster e, Figure 25).

Northport is adjoined by the OTP-MB SEA. An overlay of the site clusters on a map of the NRC coastal SEAs, indicates that all three sampling sites within OTP–MB SEA belong to cluster h, and that four other SEAs also include cluster h sites (Figure 26). None of the taxa obtained from the Marsden Bay sites were unique to those sites.

Figure 24: Mean (± S.E.) numbers of: a) taxa; and, b) individuals in multivariate community clusters of NRC harbour-wide macroinvertebrate data (see Griffiths 2012b).

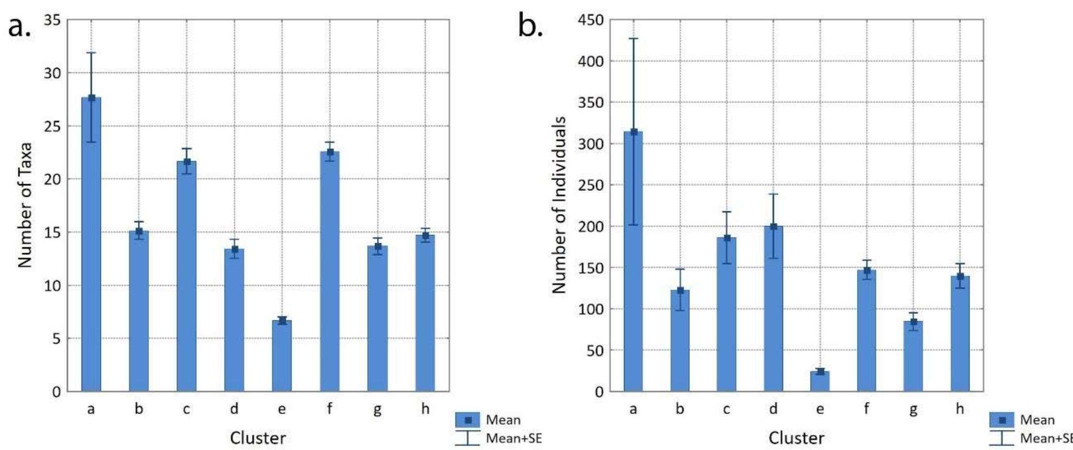


Figure 25: Mean (± S.E.) counts of: a) nut shells *Linucula hartvigiana*; b) cockles *Austrovenus stutchburyi;* c) pipis *Paphies australis;* and, d) wedge shells *Macomona liliana* in multivariate community clusters of NRC harbour-wide macroinvertebrate data (see Griffiths 2012b).

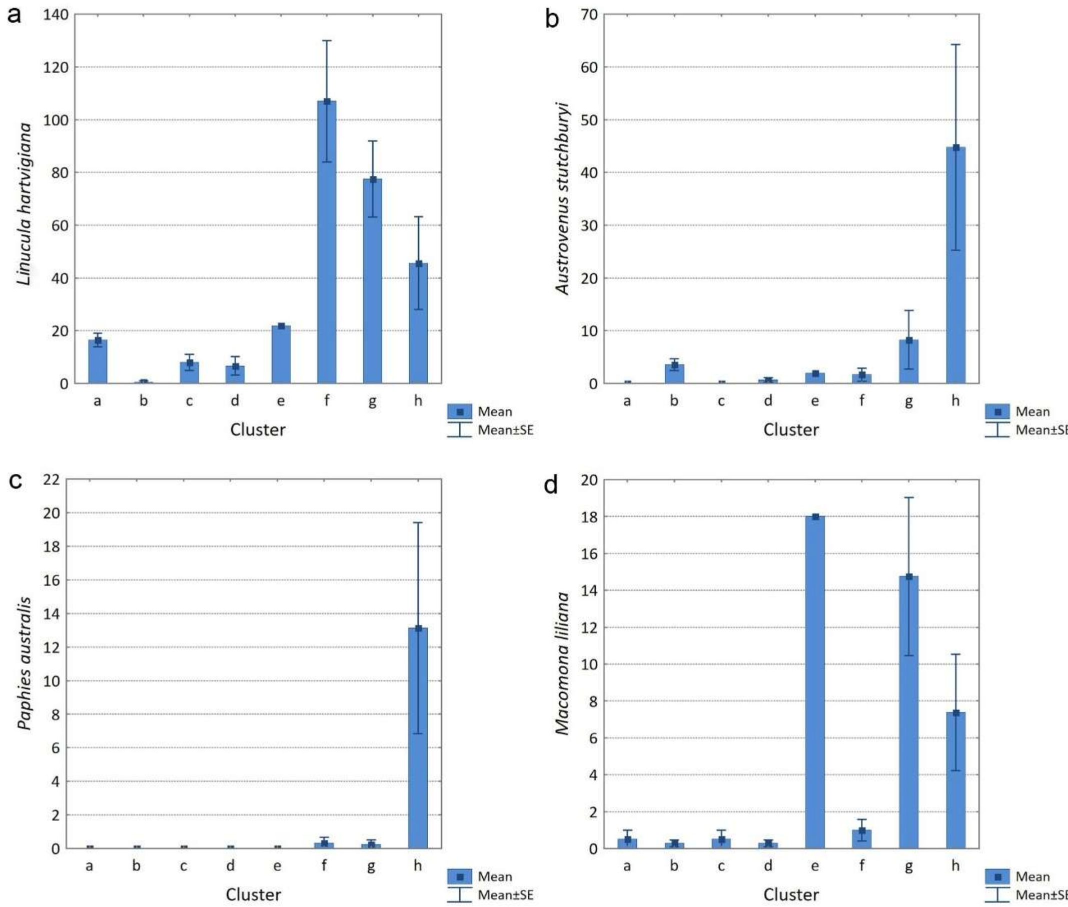
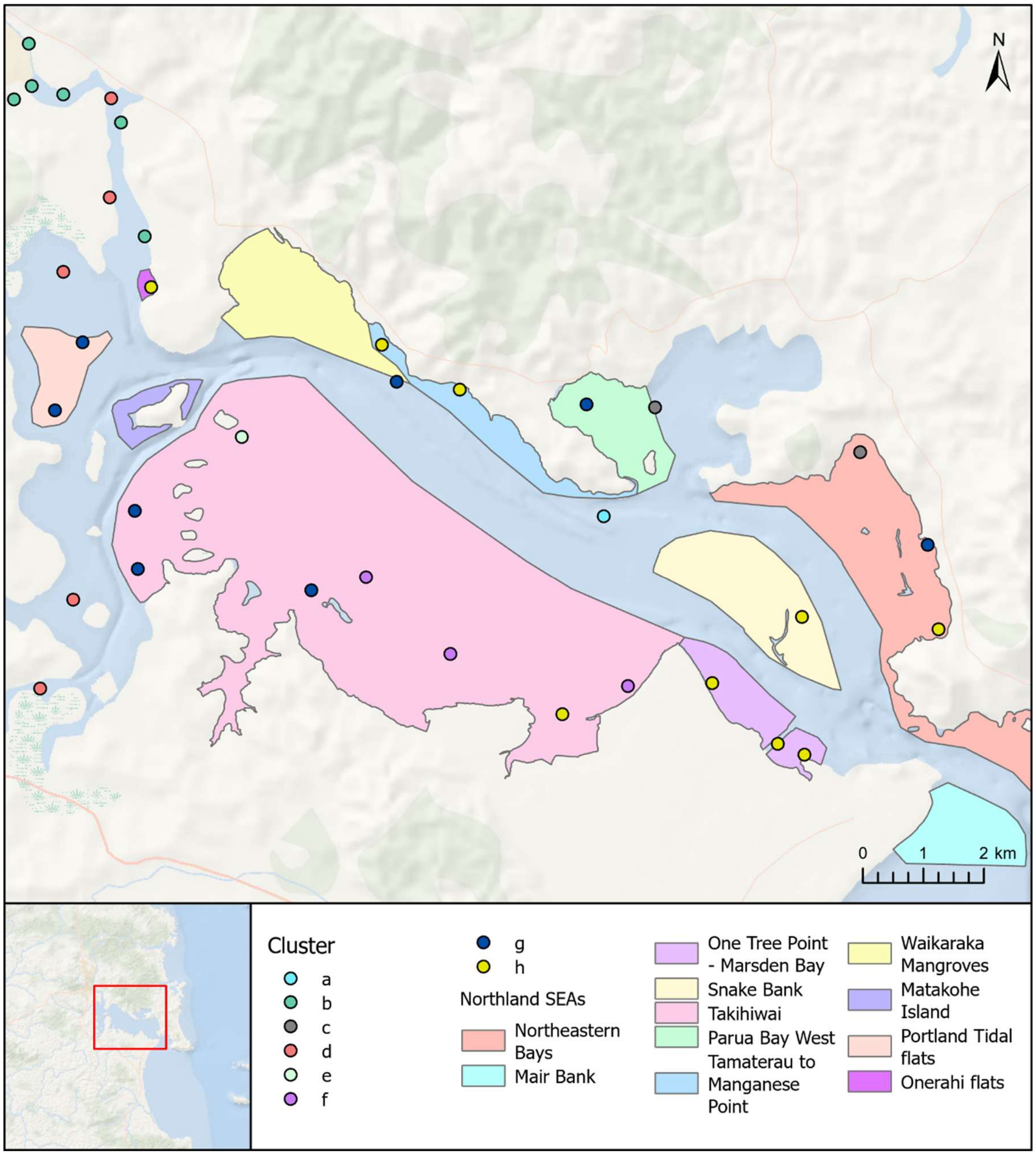


Figure 26: Map of multivariate site clusters of NRC harbour-wide macroinvertebrate data (see Griffiths 2012b), overlaid on significant ecological areas from the NRC coastal plan.



6.3.1.2 MARSDEN BAY, INCLUDING THE PROPOSED RECLAMATION AREA

Northport recently obtained detailed data on intertidal benthic communities within Marsden Bay, including within the proposed reclamation and bird roost areas. Benthic surveys carried out for Northport have included:

- A December 2017 survey (Spyksma & Brown 2018), that included sampling of six sites on the western[17], two sites on the eastern sides of Northport, and a reference site near One Tree Point. Sixteen, 13 cm sediment core samples from each site were sieved through a 2 mm mesh and processed in situ (macroinvertebrate species were

[17] Between Northport and the access channel to Marsden Cove.

identified and counted, while sizes of cockle, pipi and wedge shells were also measured). Eight samples from each site were sieved through a 0.5 mm mesh, preserved and sent to a taxonomist for sorting, and taxa identification and enumeration.

- A December 2020 survey (Knue & Poynter 2021), using the same methods as the 2017 survey, but with two additional sites within the proposed reclamation area.
- A June 2022 survey (Kelly & Sim-Smith 2022) involving the collection of 83 sediment core samples throughout Marsden Bay and Northport's eastern reclamation area. At each sampling station, a single 13 cm diameter × 15 cm deep core was obtained, sieved to 0.5 mm, preserved in isopropyl alcohol, and sent to an experienced taxonomist for sorting, identification, and enumeration.
- November 2021 rapid qualitative and quantitative surveys of pipi and cockle numbers in Marsden Bay. The qualitative survey involved the ranking of cockle and pipi numbers in mid to lower intertidal zone from 0 (absent) to 5 (very high) at 54 stations west of the Marsden Cove access channel to One Tree Point, and on the eastern side of Northport. For the quantitative survey of pipi and cockle numbers, at a further 18 stations between Northport and the Marsden Cove access channel were sampled using a 13 cm diameter corer. Samples were sieved using a 4 mm sieve, pipis and cockles were sorted and counted, and pipi lengths were measured.

Data gathered through those surveys were considered to be both relevant, and sufficient for assessing the potential effects of current application. Accordingly, no further sampling was carried out for this assessment.

Results from sampling carried out in December 2017 (Spyksma & Brown 2018), could not be directly compared with those from 2020 because different service providers were used for the ecological sample processing, and clear differences were apparent in the taxonomic resolution, and potentially, species identifications. Therefore, only the 2020 data (Knue & Poynter 2021; processed by the Cawthron Institute) were used for the following analyses.

In 2020, sites on the western and eastern sides of the port were sampled, including:

- sites within Northport's consented eastern reclamation area;
- sites from the mid and lower shore, west of Northport;
- a remote reference site near One Tree Point.

Overall, the intertidal sandflats surrounding the port were characterised by high benthic diversity and low to moderately high total numbers of individuals (13 to 597 individuals per sample in 2020). Polychaete worms were the most abundant and diverse taxa group (45 taxa, 9,048 individuals), followed by crustaceans (31 taxa, 4,395 individuals) and molluscs (26 taxa, 664 individuals). Similar to NRC's broader harbour sampling, taxa were patchily distributed with high abundances at some sites and low or zero counts at others (see Figure 30 for examples).

Non-metric multidimensional (nMDS) scaling plots of 2020 data (Figure 28) indicated that although there was overlap in the composition of intertidal communities sampled at the finer scale, discernible differences were still apparent. However, the relatively high stress value (0.16) suggested that care needs to be taken in the interpretation of the nMDS plot. Cluster and similarity profile analyses of averaged taxa counts were therefore carried out to identify statistically significant differences among site clusters (Figure 29). Dissimilar communities included:

- the community at one site east of the port differed from the other eastern site, and from those on the western side of the port;
- communities from western mid and low-shore sites differed; and,
- the remote reference site near One Tree Point differed from sites closer to the port.

Similar levels of taxa diversity were obtained in intertidal samples from five stations in Marden Bay (n=1) and Mair Bank (n=4)[18] (Kerr & Grace 2016), which contained a total of 97 taxa. Polychaetes, oligochaetes, and/or molluscs tended to be the most abundant taxa groups, but relative abundances varied considerably among sites. The Marsden Bay site was notable for having higher counts of bivalves and cnidarians, which is presumed to have mainly been due to the presence of cockles and an associated anemone *Anthopleura aureoradiata*.

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[18] Five samples were obtained from each station using methods similar to those in the other studies described.

Figure 27: Bubble plots with examples showing variation in the abundance of taxa, including: a) shrimps from the order Tanaidacea; b) amphipods from the family Atylidae; c) polychaetes from the family Syllidae; d) the polychaete *Prionospio* sp.; e) *Austrovenus stutchburyi* (cockles); and f) *Macomona liliana* (wedge shells) (data from Knue and Poynter 2021).

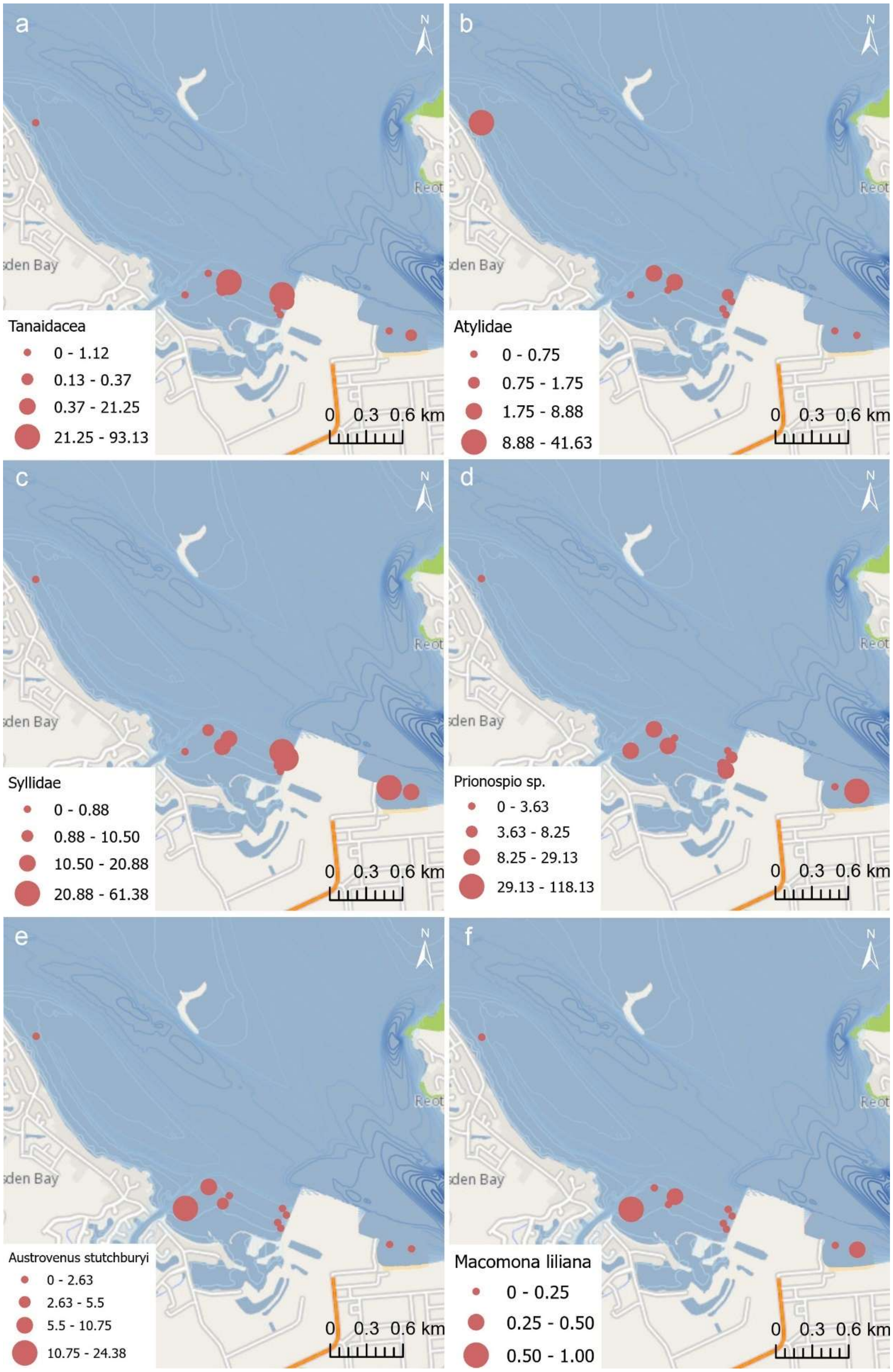


Figure 28: Non-metric multidimensional scaling plots of 2020 intertidal macrofaunal data with samples coloured by a) groups of sites categorised by position relative to the port and tidal elevation, and b) sampling site. Vector plots of Pearson's correlations for key taxa are provided (data from Knue & Poynter 2021).

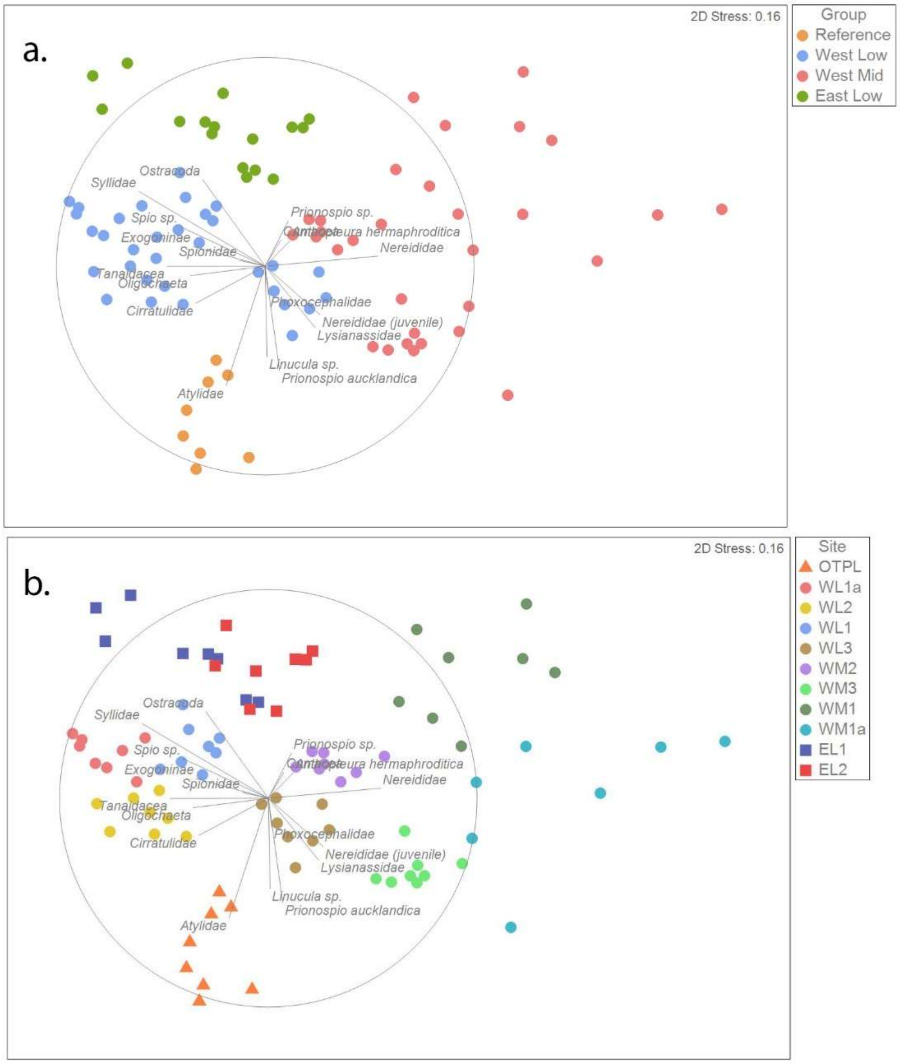
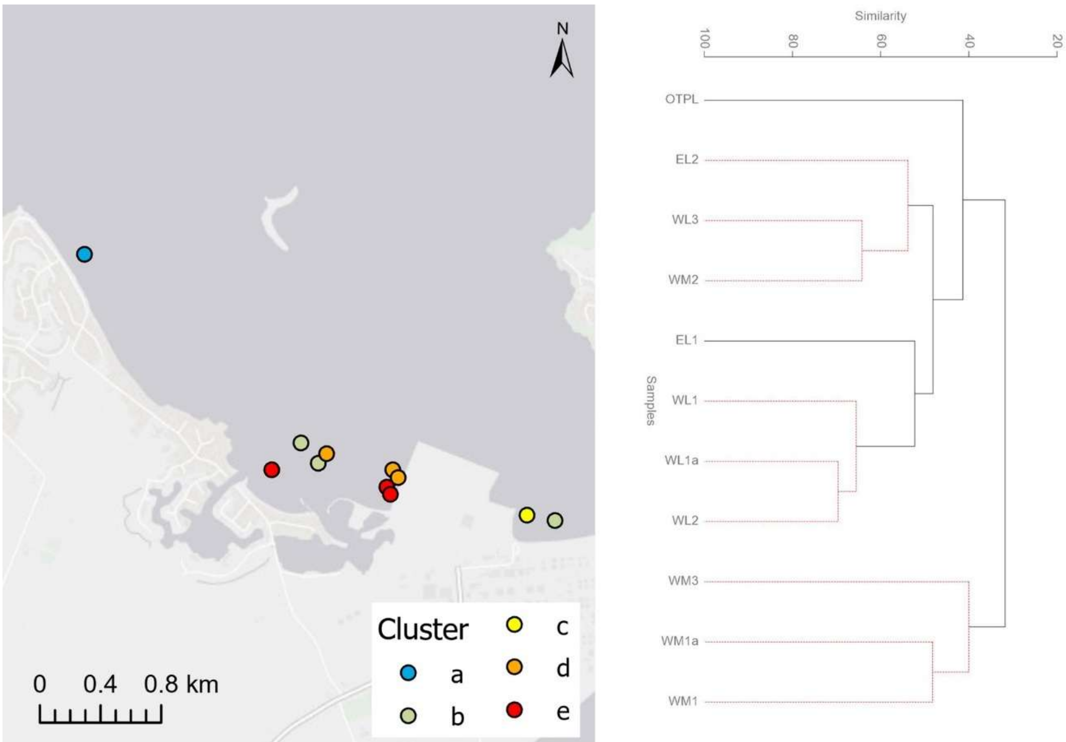


Figure 29: Intertidal site clusters with similar benthic community composition, identified using cluster and similarity profile analysis (data from Knue & Poynter 2021).



Additional information on marine communities and habitats around Northport was obtained by Coast and Catchment (Kelly & Sim-Smith 2022) to fill specific knowledge gaps, or update and expand the coverage of existing information. This included:

- Obtaining updated and expanded information on infaunal macroinvertebrates in Marsden Bay to:
    - support the assessment of effects on avifauna,
    - support an assessment of the effects of constructing a proposed bird roost on intertidal ecology; and,
    - to expand the coverage of existing datasets;
- Obtaining new information on subtidal epibenthic communities around Northport to fill a knowledge gap.

The quantitative survey of the distribution of intertidal macroinvertebrate infauna in Marsden Bay involved the collection of benthic ecological samples from the area between One Tree Point and the Channel Infrastructure (Marsden Refinery) wharf using a stratified random design (Kelly & Sim-Smith 2022). Sampling effort was based on the size of the following intertidal zones:

- One Tree Point to the Marsden Cove Channel (One Tree Point and Channel west in Figure 30);
- Marsden Cove Channel to Northport (Channel east and Northport west in Figure 30);

- Northport's consented eastern reclamation area (Eastern reclamation in Figure 30);
- the area between the consented eastern reclamation area and the Channel Infrastructure wharf (Channel Wharf in Figure 30).

Eighty samples were initially allocated across these zones, with three additional samples being allocated to the area between Northport's consented eastern reclamation area and the Channel Infrastructure wharf to achieve a minimum of five samples per zone (total n = 83).

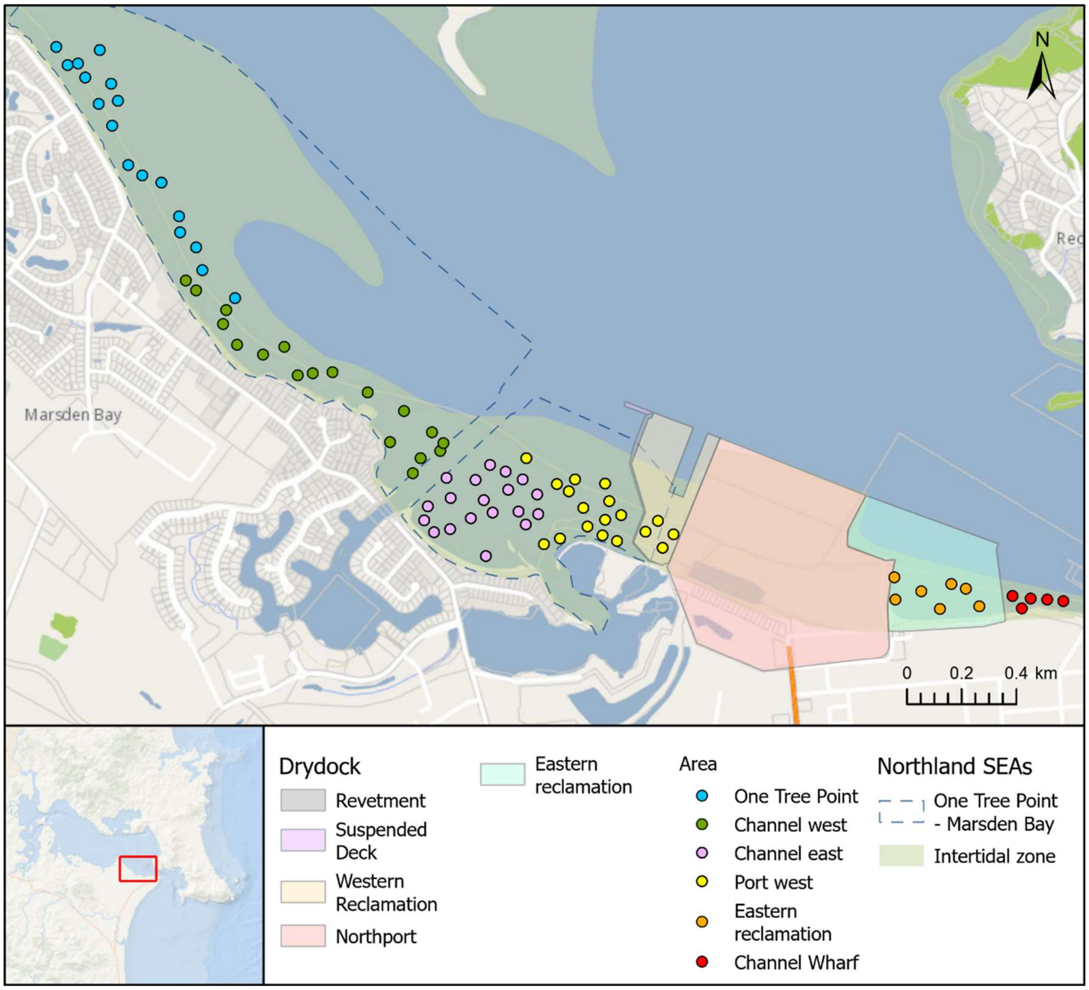
Sampling was carried out between 13 and 14 June 2022, near a low spring tide. At each sampling station, a single 13 cm diameter × 15 cm deep core was obtained, sieved to 0.5 mm, preserved in isopropyl alcohol, and sent to an experienced taxonomist for sorting, identification, and enumeration.

Total numbers of taxa and total counts of individuals were determined for each sampling station, and the results were mapped in ArcGIS using a combination of point and interpolated heat maps produced through Kriging. Clusters with similar macroinvertebrate communities were also identified using multivariate analyses (see below), and differences in numbers of taxa and individuals among those clusters were examined using univariate plots and one-way ANOVA in Statistica (v12).

Non-metric multidimensional scaling (MDS) agglomerative hierarchical and non-hierarchical (kRCluster) cluster analyses, similarity profile tests (SIMPROF), analysis of similarities (ANOSIM), and analysis of similarity percentages (SIMPER) were used to examine variation in overall community composition and to identify the key taxa involved in determining overall spatial patterns (using Primer-E ver.7). Count data were square-root transformed prior to analysis, with the analyses based on Bray Curtis similarities.

Note that each point in the MDS plots represented the macrofaunal community at one sampling station and that communities represented by points plotted close together are more similar than communities represented by points further apart.

Figure 30. Stations sampled in the July 2022 quantitative survey of benthic macrofauna in Marsden Bay.



Ninety-seven taxa and 10,952 individual macroinvertebrate specimens were obtained from the 83 Marsden Bay core samples. Bubble plots and heat maps of taxa numbers (Figure 31) and individual counts (Figure 32) show that the diversity and abundance of macroinvertebrates varied across the survey area with marked differences apparent between intertidal sites on the western and eastern sides of Northport. The number of taxa in core samples was uniformly high on the western side of the port compared to the eastern side. Numbers of individuals were also higher on the western side, but counts varied along the shore.

Similarly, total counts of specimens from major taxa groups displayed substantial variation across the survey area, with stations on the eastern side tending to have lower counts (Figure 33–Figure 35). Multidimensional scaling and agglomerative hierarchical cluster analysis with similarity profile tests identified 13 statistically significant clusters that displayed variation along and down the shore (Figure 36). Community composition in core samples taken from the eastern side of Northport varied and became more dissimilar from the communities obtained from western cores towards the east.

Four broader groupings[19] were determined using non-hierarchical kmeans-clustering (Figure 37):

1. Communities in upper to mid-shore stations on both sides of Northport (Cluster A, which included four stations within the footprint of the proposed reclamation).
2. Communities in stations associated with raised sand/shell ridges on both sides of Northport (Cluster B).
3. Communities in easternmost stations (Cluster C).
4. Communities in low-shore stations on the western side of Northport (Cluster D).

Analysis of similarities detected statistically significant differences in community composition between all four kmeans clusters ($P<0.001$). One-way ANOVA and Tukey's Honestly Significant Difference tests showed that the overall number of taxa and individuals[20] varied significantly among all kmeans clusters ($P<0.01$), with the Cluster C sites (Port reclamation east zone) having the lowest values for both indicators (Figure 39). While not specifically tested, the presence of seagrass appeared to have little effect on overall community composition (Figure 31–Figure 35). Treeplots of the taxa explaining 95% of the similarity among stations within each cluster (based on SIMPER analysis) highlight marked differences between the eastern and western sides of Northport, and between ridge (cluster B) and other communities (Figure 38). Notably, pipi (*Paphies australis*) made a substantial contribution to the ridge community cluster. Greater numbers of taxa were required to produce 95% similarity in the Upper to mid-shore (A) and Lower shore (D) clusters, due to those clusters containing more diverse assemblages with less dominance by individual, or a few taxa.

Cockles were common throughout most of the survey area, but were not obtained from cores east of Northport's consented eastern reclamation (Figure 40A & Figure 41). Small pipi were also common, but numbers were generally low. Relatively high mean counts of small pipi ≤5 mm in size were obtained from a few stations east and west of Northport, but numbers were patchy (Figure 40 & Figure 42). Further information on cockle and pipi abundance is provided in Section 6.4.

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[19] Other grouping numbers were examined, but four clusters appeared to provide the best discrimination between down-shore and long-shore habitats, noting that additional variation is nested within each cluster.

[20] Data were $\log_{10}+1$ transformed prior to analysis to meet assumptions of normality and equal variance.

Figure 31: Bubble plots and interpolated (by Kriging) heat maps of the number of macroinvertebrate taxa obtained from core samples in Marsden Bay.

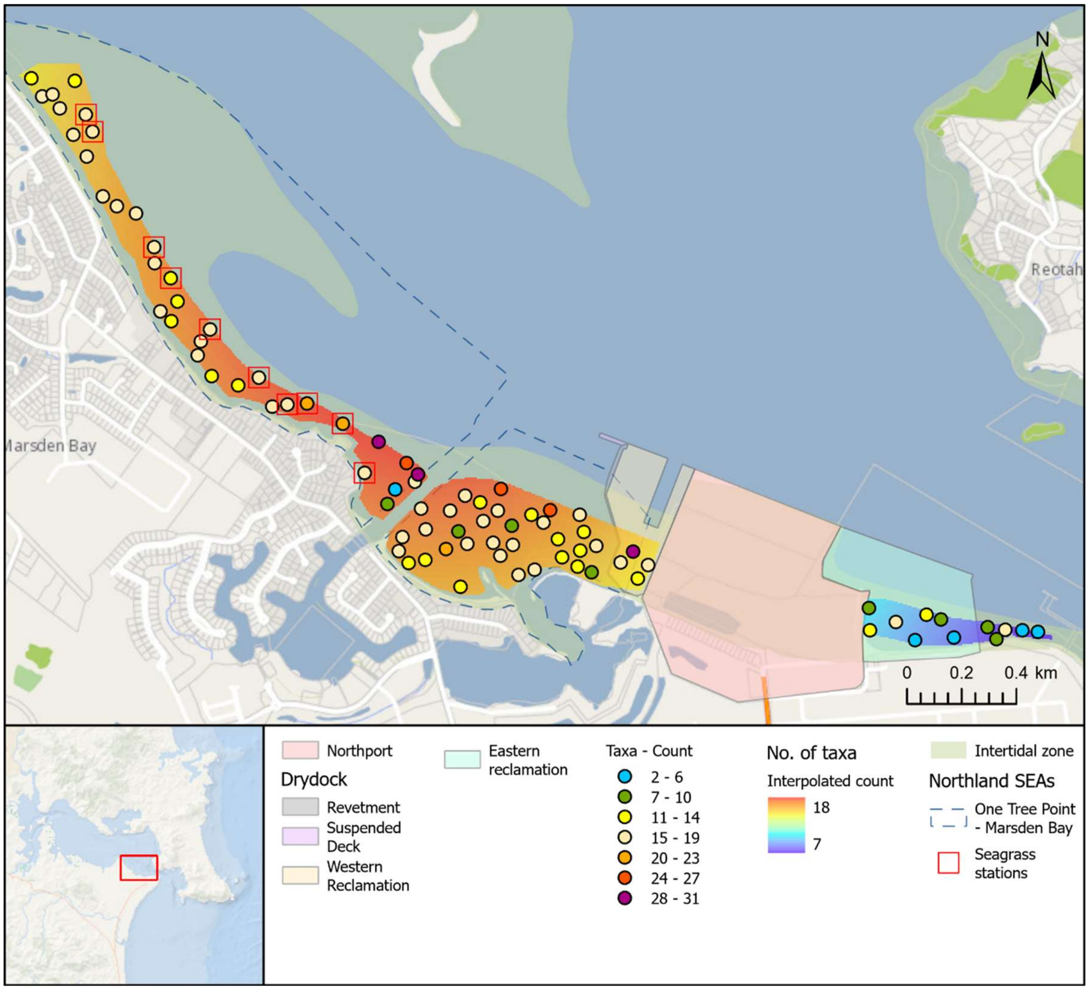


Figure 32: Bubble plots and interpolated (by Kriging) heat maps of total counts of all macrofauna obtained from core samples in Marsden Bay.

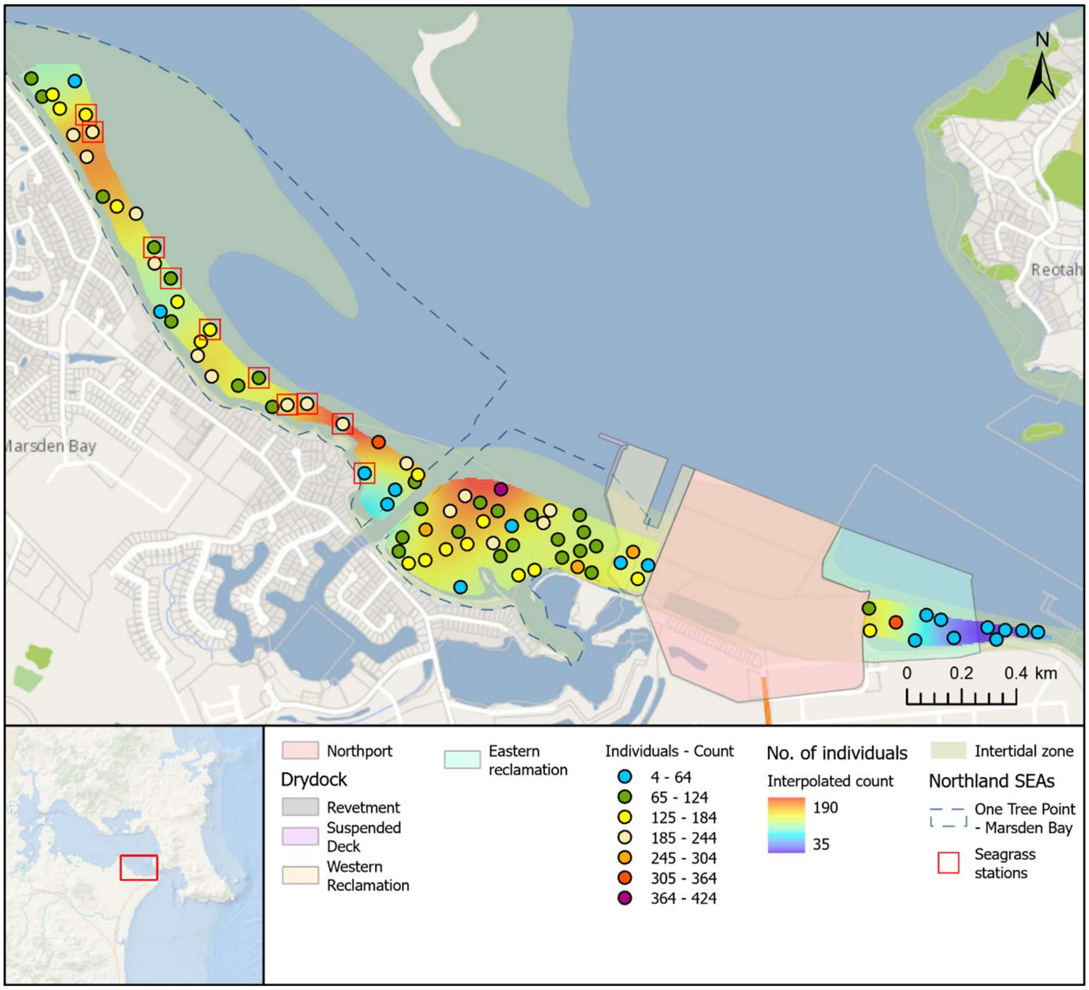


Figure 33: Heat maps showing spatial variation in total counts of: A) bivalves; and, B) gastropods.

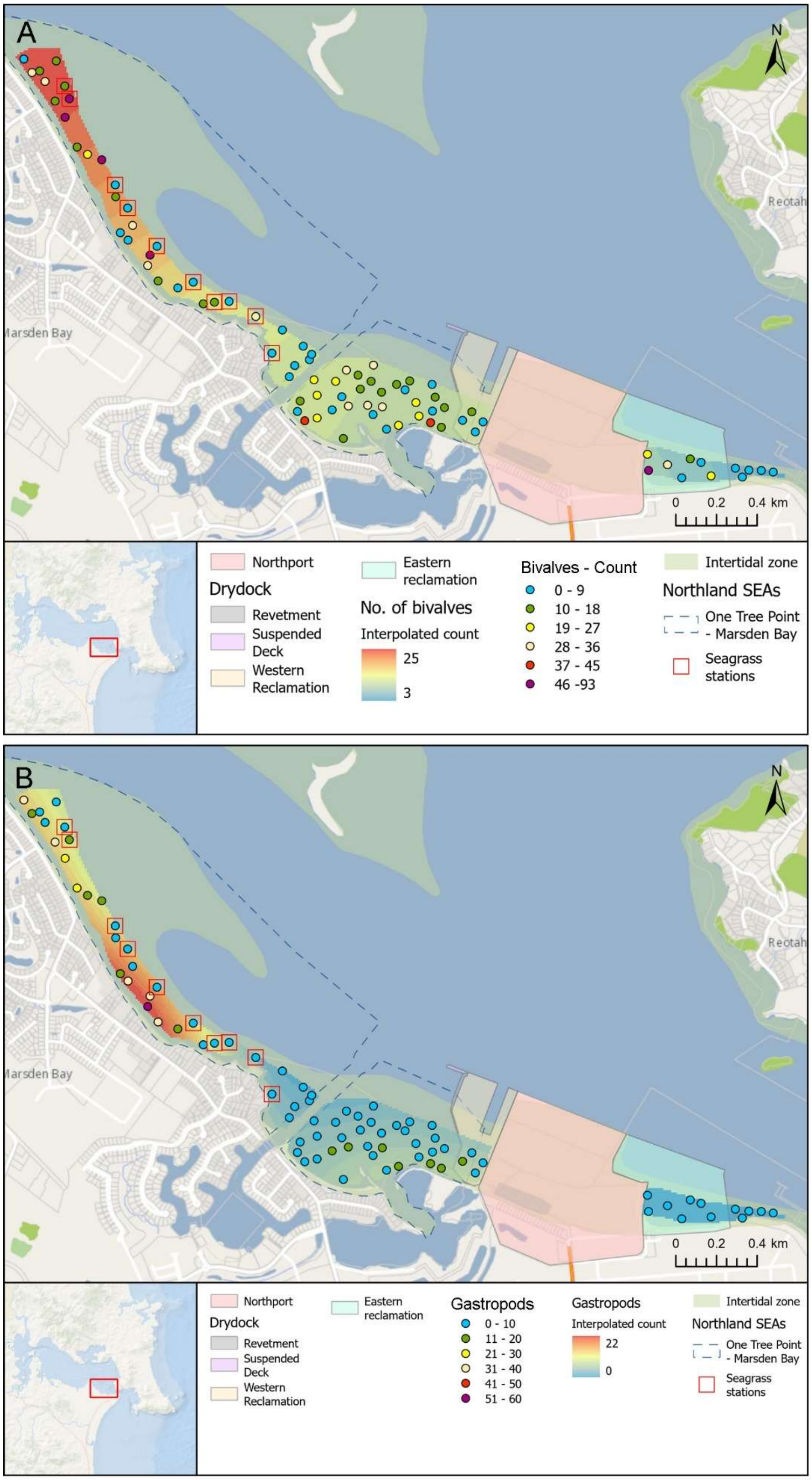
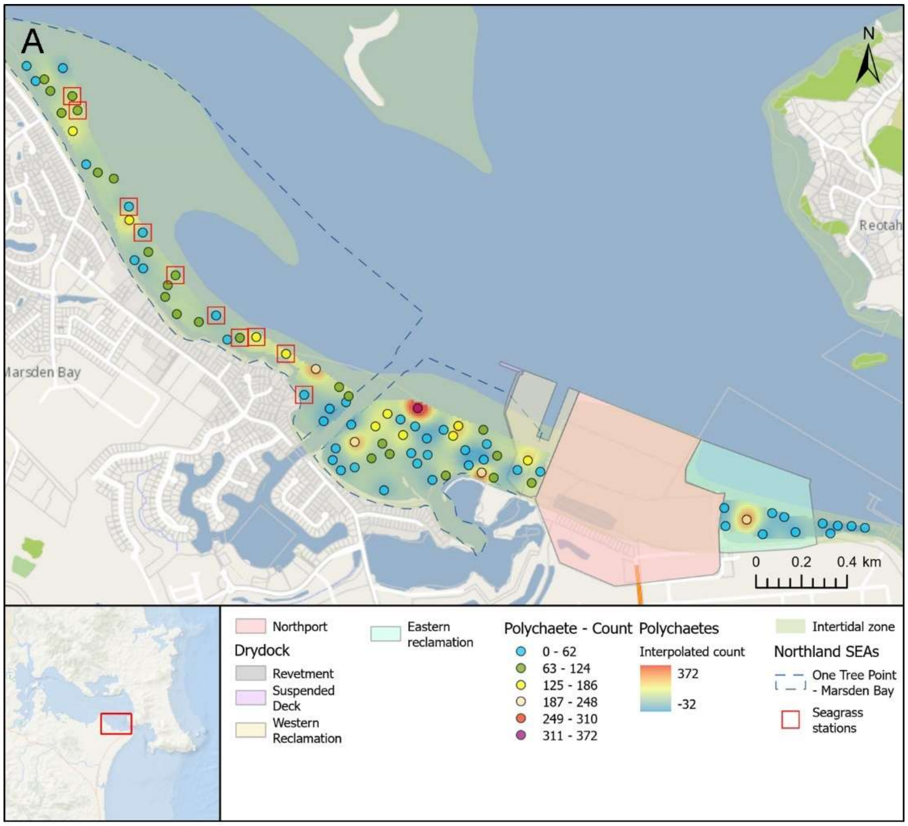


Figure 34: Heat maps showing spatial variation in total counts of A) polychaetes, and B) amphipods.



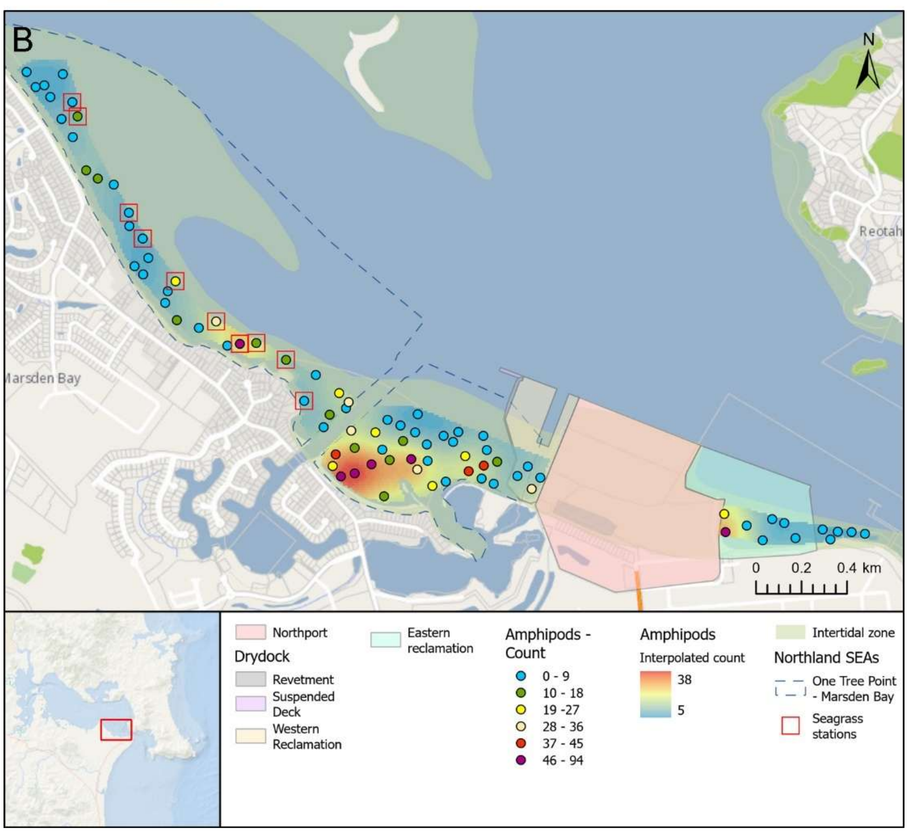


Figure 35: Heat maps showing spatial variation in total counts of A) isopods; and, B) cumaceans.

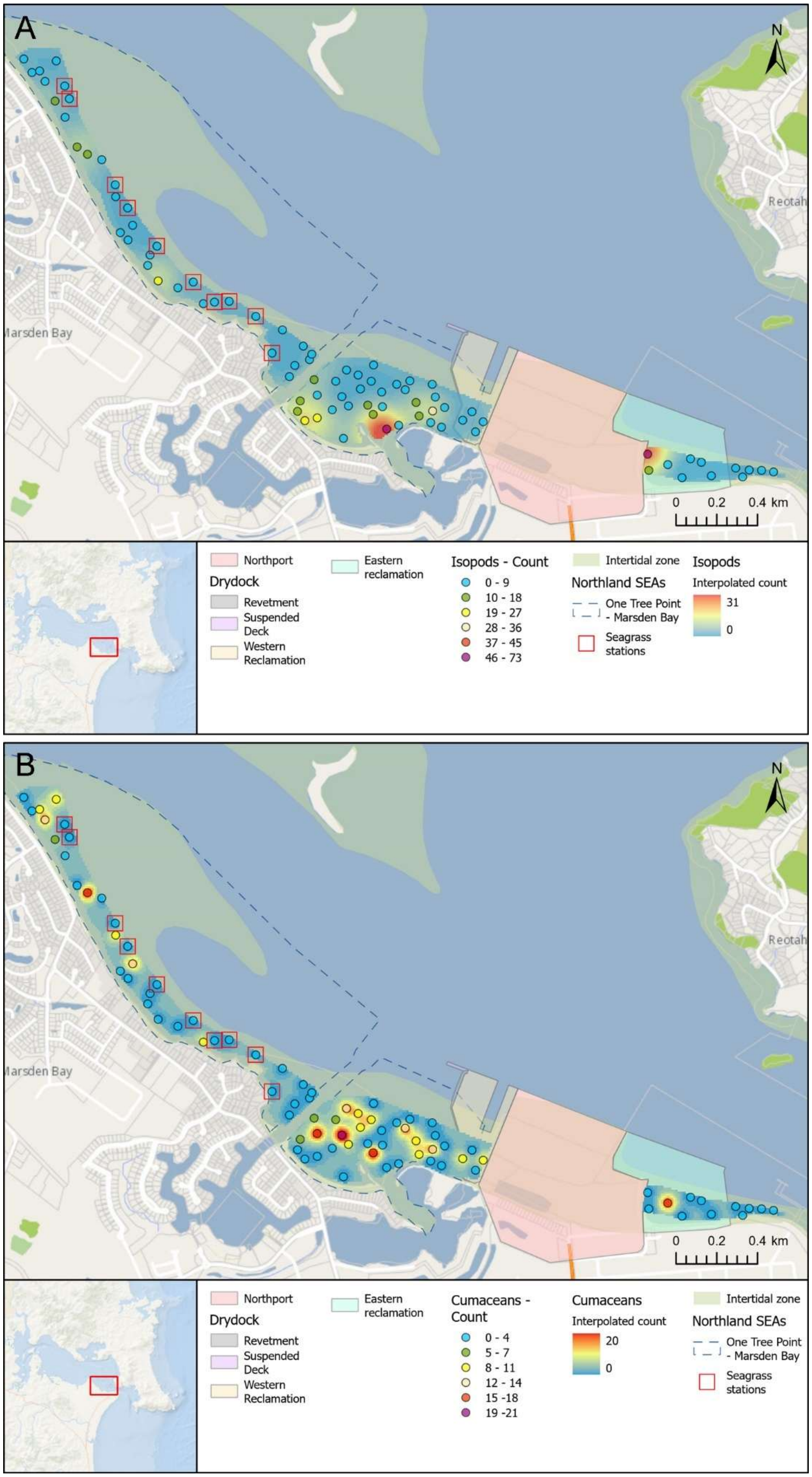
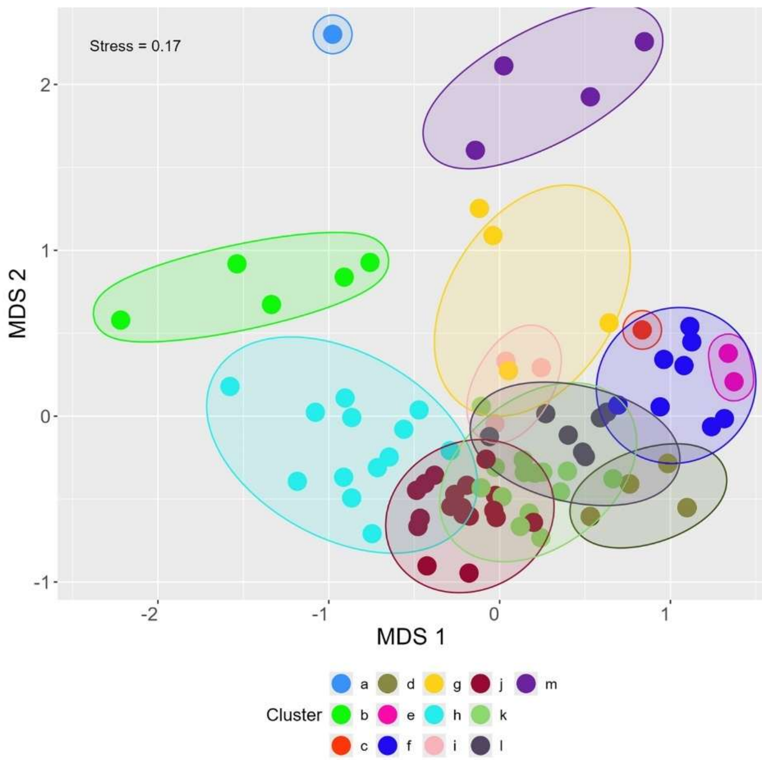


Figure 36: Multidimensional scaling plot and map showing macroinvertebrate community clusters identified using agglomerative hierarchical cluster analysis and similarity profile testing. Stations containing seagrass are highlighted by red squares in the map.



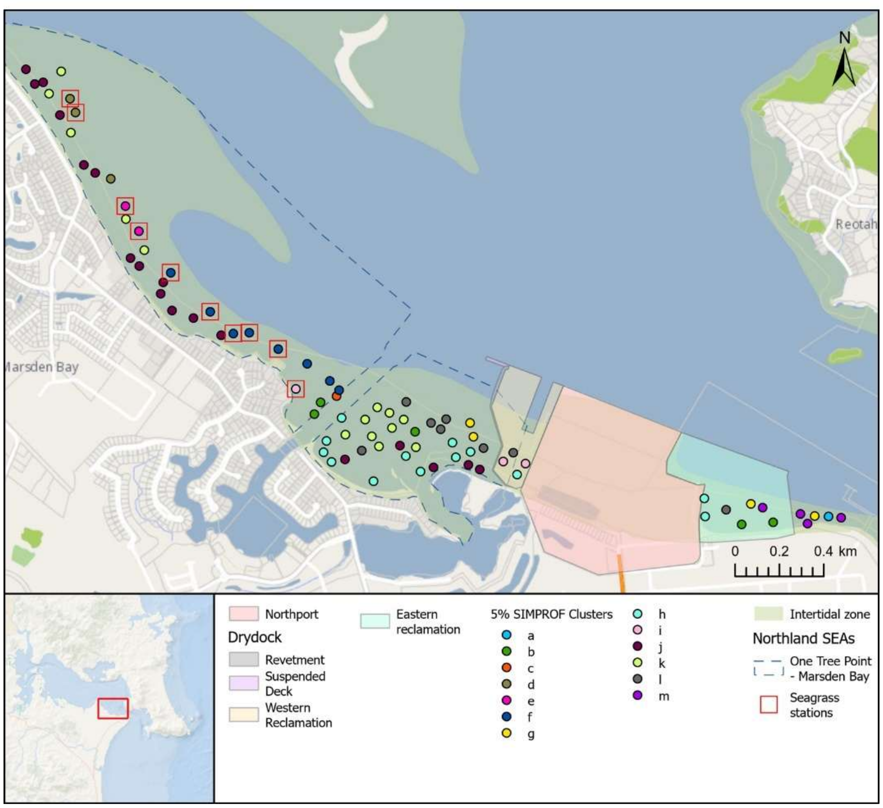
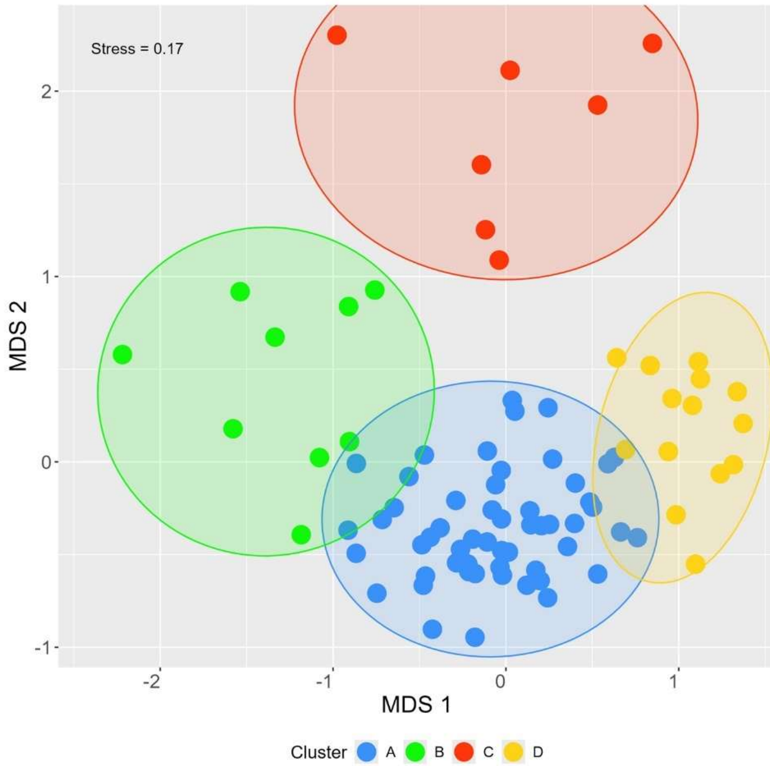


Figure 37: Multidimensional scaling plot and map showing macroinvertebrate community clusters identified using non- agglomerative kR Clustering with 4 groups specified. Stations containing seagrass are highlighted by red squares in the map.



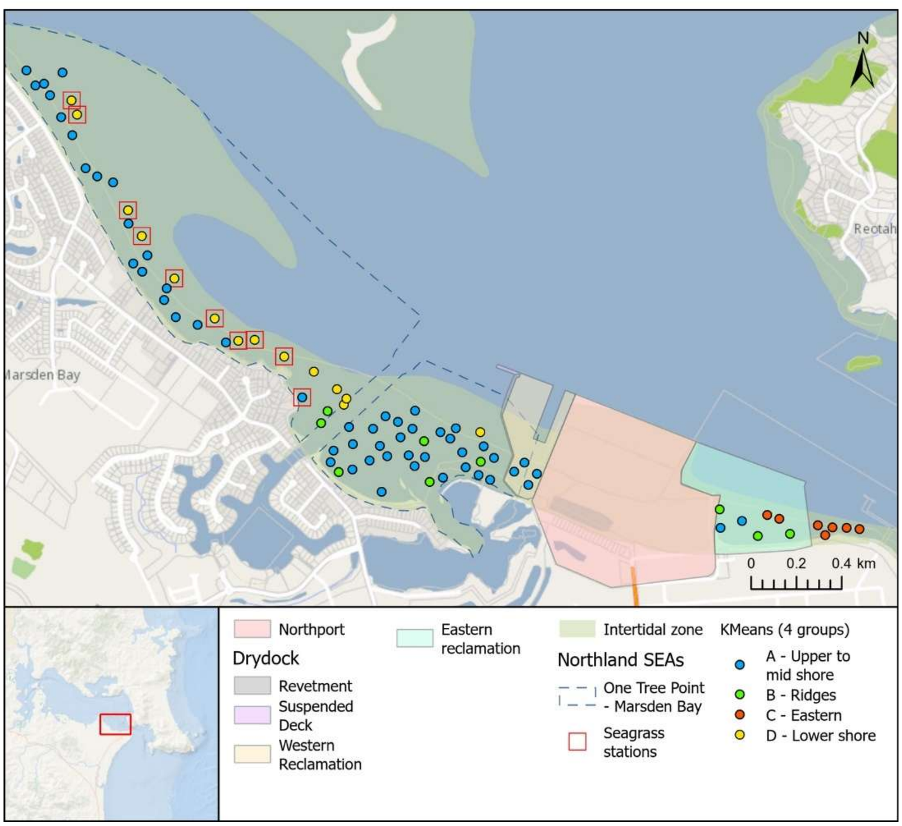


Figure 38: Treeplot representation of community composition, showing mean counts of taxa that explained 95% of similarity among stations within the four kmeans cluster groups (A to D). Taxa names and mean counts per sampling station are provided. Box sizes and lettering are proportional to mean counts. Consistent box colours are used for taxa in each plot.

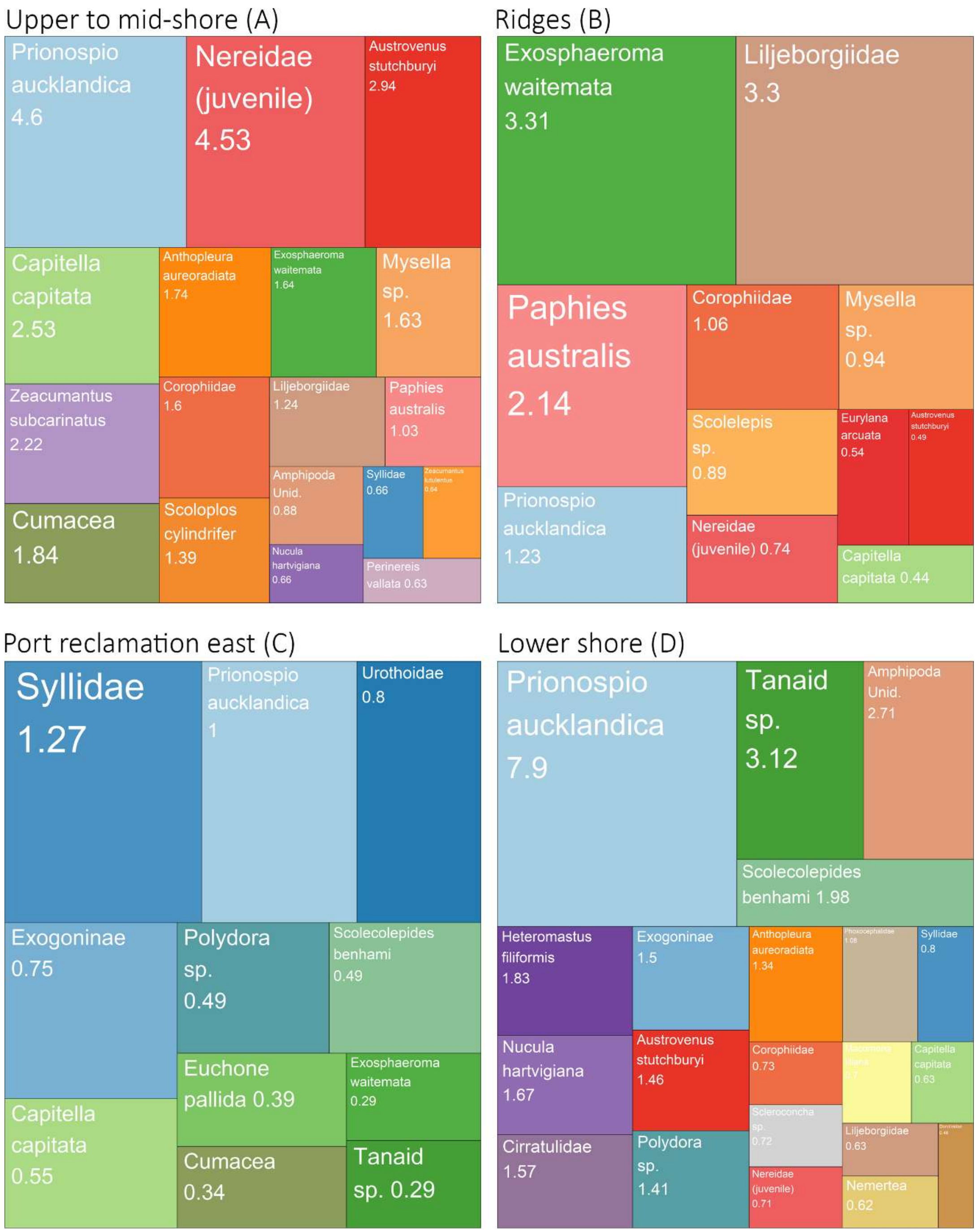


Figure 39: Plots of mean (± 95% C.I.) numbers of A) individuals; and, B) taxa in samples within Kmeans clusters A to D.

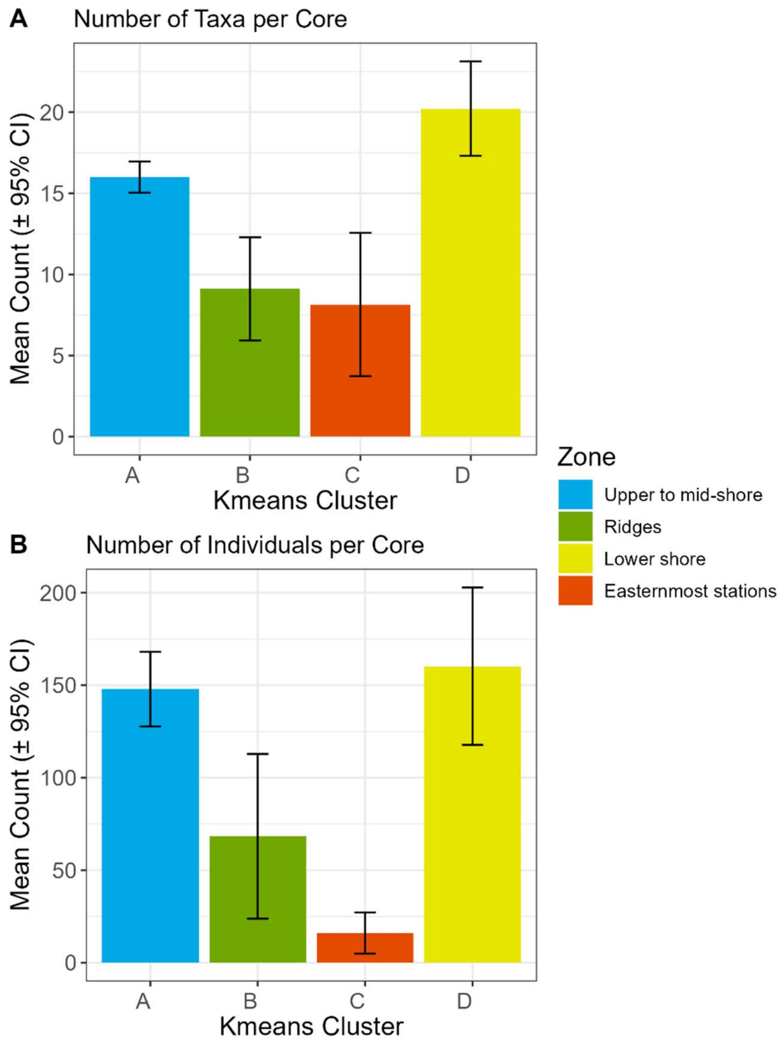


Figure 40: Variation in the abundance and size distributions of: A) cockles and B) pipis in areas along Marsden Bay (see Figure 30 for the extents of each area).

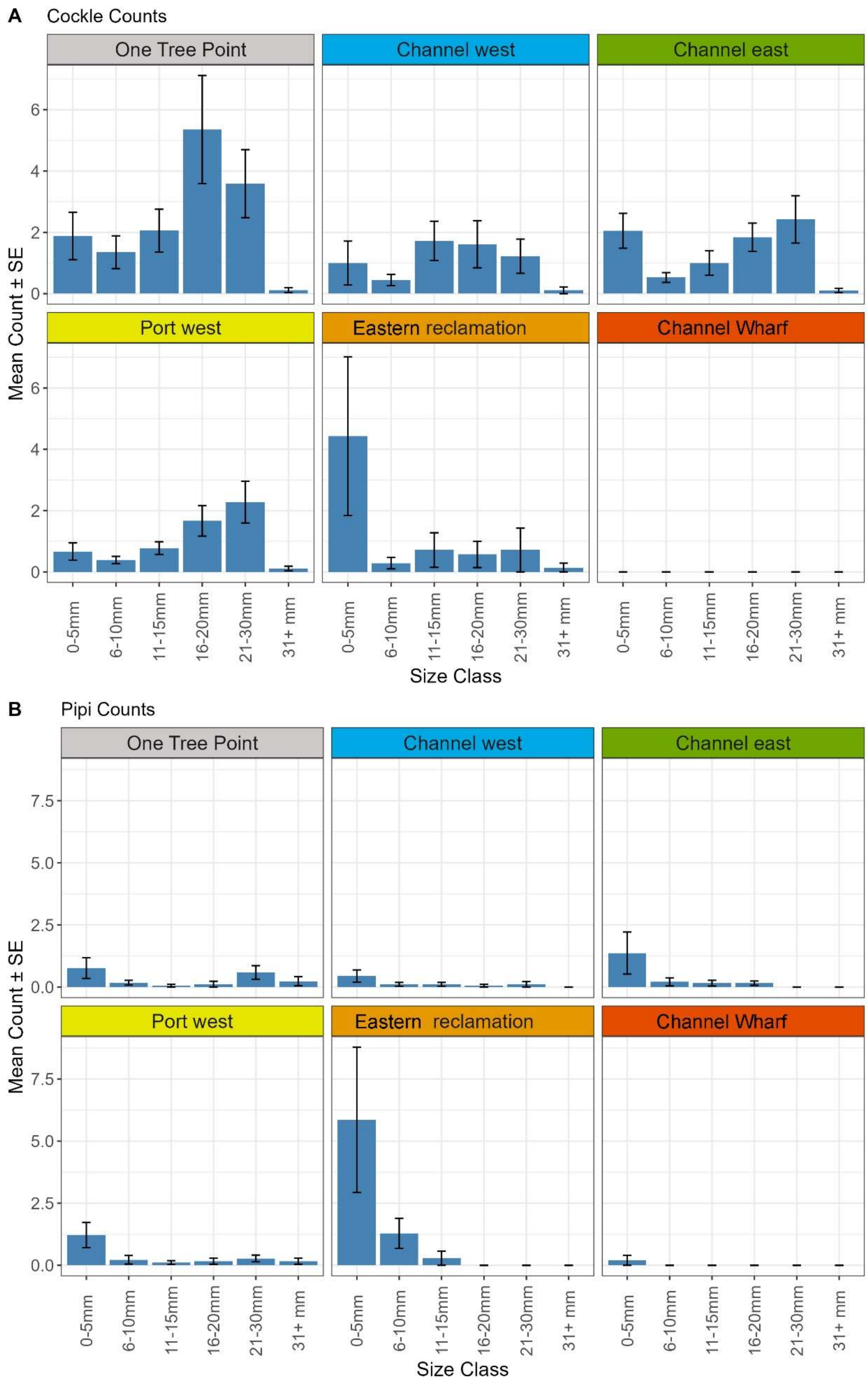


Figure 41: Variation in the mean abundance per core of cockles: A) <20 mm; and B) >20 mm in size.

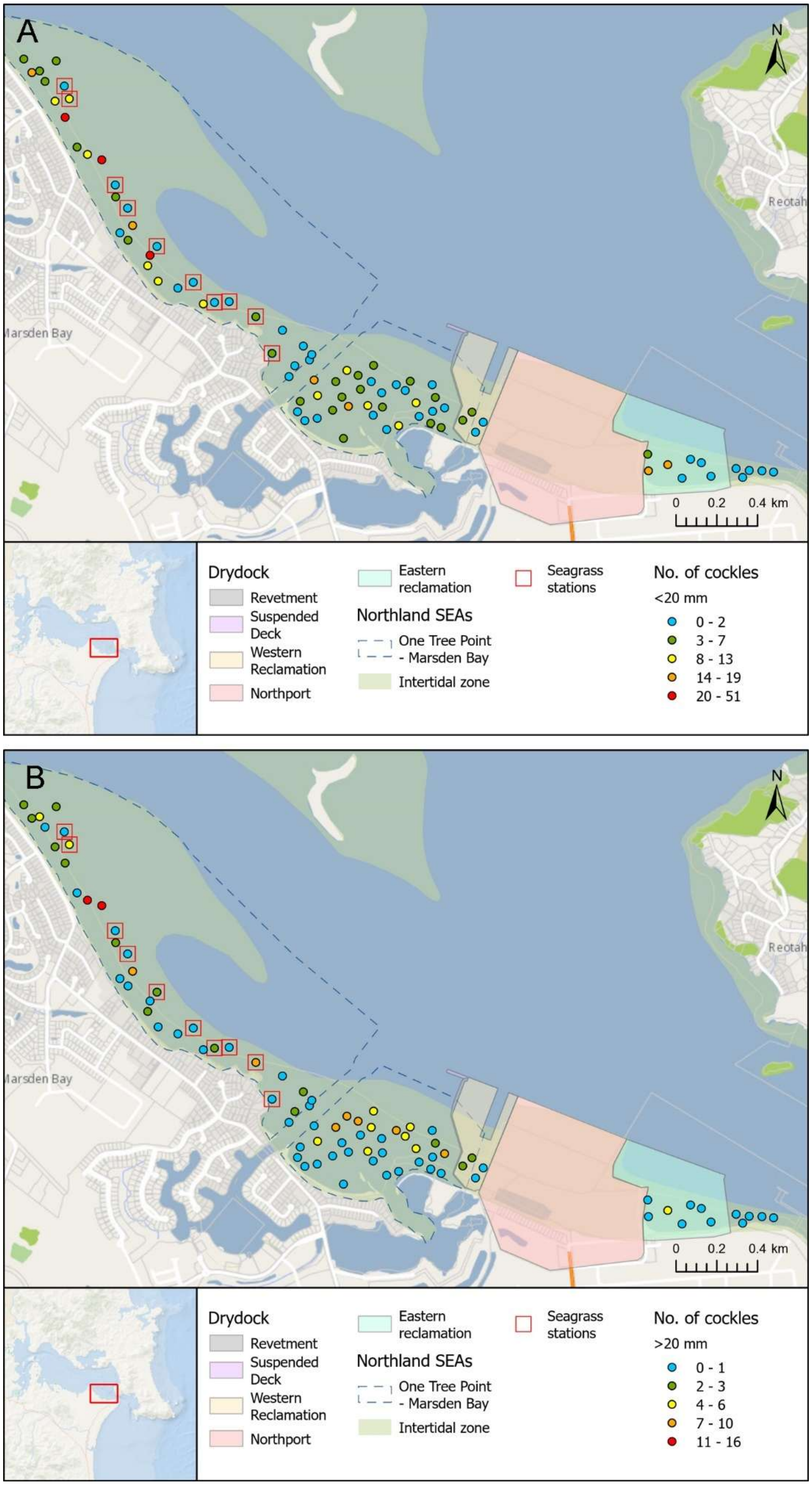
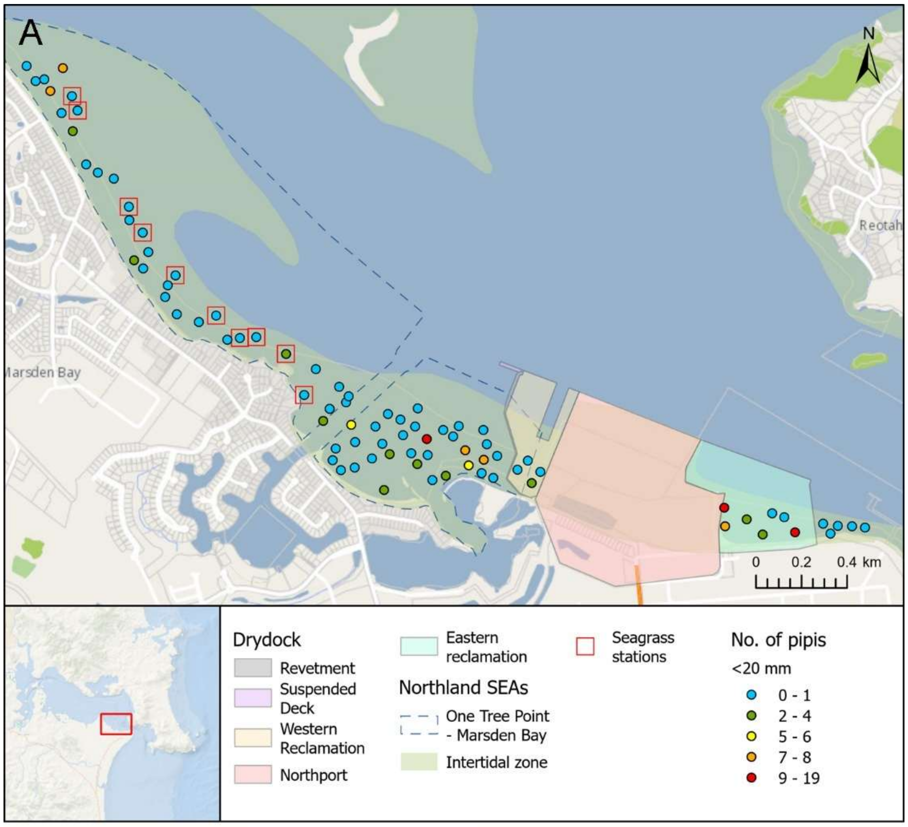
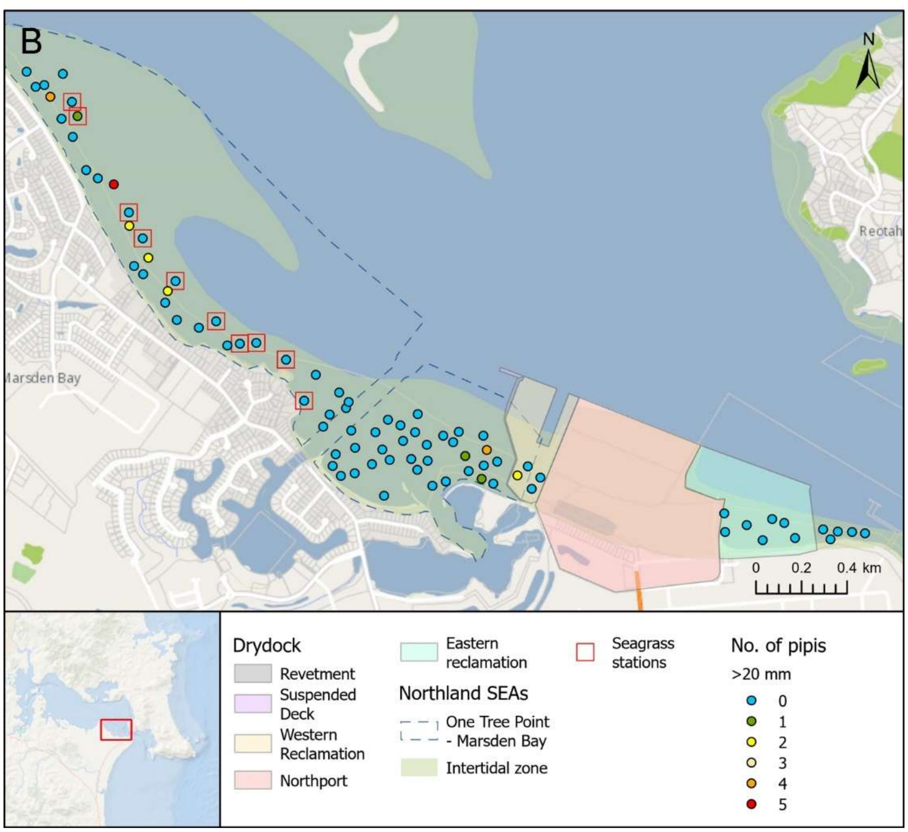


Figure 42: Variation in the mean abundance per core of pipi: A) <20 mm; and B) >20 mm in size.





6.3.1.3 THREATENED OR AT RISK SPECIES

One top shell gastropod identified as *Cantharidus* sp. was recorded by 4Sight at one intertidal station in the proposed reclamation area in 2020 (Knue & Poynter 2021), and one bivalve identified as *Mysella* sp. was recorded in the upper intertidal.

The NZTCS database contains five, At Risk, species of *Cantharidus*, including *Cantharidus* sp. A (NMNZ M.59506), *Cantharidus* sp. B (NMNZ M.131607), *Cantharidus antipodum hinemoa, Micrelenchus burchorum*[21], and *Cantharidus festivus*. All are naturally uncommon and range-restricted. The distribution of these five species are as follows:

- *C. festivus*—Three Kings Islands, Cape Reinga, and the Far North, 13–88 m (Marshall 1998);
- *M. burchorum*—Three Kings Islands, Middlesex Bank and King Bank, 7–805 m (Marshall 1998);
- *C. antipodum*—Otago, Southland, Stewart Island, Snares, Campbell, Auckland and Antipodes Islands (Spurgeon no date);
- *Cantharidus* sp. 1 (i.e., species A)—Great Island, Three Kings Islands (https://collections.tepapa.govt.nz/);
- *Cantharidus* sp. 2 (i.e., species B)—Three Kings Islands, North Cape, Spirits Bay, Bay of Islands, Poor Knights Islands (https://collections.tepapa.govt.nz/).

In contrast, other New Zealand species of *Cantharidus* are very common, including *Micrelenchus purpureus*[22] and *Cantharidus opalus*. Both species commonly occur on or below seaweeds, such as those growing on revetments and piles around Northport and are widely distributed in New Zealand. Based on:

- the restricted ranges of the five At Risk *Cantharidus* species, which are not near Whangārei;
- the rarity of the At Risk species; and
- the likelihood that *Cantharidus purpureus* and *Cantharidus opalus* are common in the area;

it is extremely unlikely that the top shell obtained from Marsden Bay was one of the At Risk species.

Similarly, only one specimen of the At Risk, and yet to be named, *Mysella* sp. 1 (M.051502) has been recorded in the Te Papa mollusc collection, with that being obtained from Pelorus Sound, Marlborough. The NZTCS lists it as naturally uncommon and range-restricted. The Checklist of Living Mollusca from the New Zealand Exclusive Economic Zone lists ten species of *Mysella* (Spencer et al. 2016), with species such as *Mysella hounselli* known to occur in the Whangārei region (e.g., Cummings et al. (1994)). Given that, and the fact that the species obtained from

[21] Previously *Cantharidus burchorum*

[22] Previously *Cantharidus purpureus*

Marsden Bay was distant from the known range of *Mysella* sp. 1, and was common throughout the upper intertidal zone of the area surveyed (Figure 43), it appears extremely unlikely that the *Mysella* species obtained is the At Risk species.

Figure 43: Counts of *Mysella* sp. obtained from individual 13 cm diameter by 15 cm deep core samples (sieved to 0.5 mm) in June 2022.

6.3.2 SUBTIDAL COMMUNITIES

6.3.2.1 SUBTIDAL INFAUNAL COMMUNITIES

Subtidal infaunal (sediment-dwelling) communities around the port were sampled using an 8.2 L Ponar grab by 4Sight for Northport in 2019 and 2020 (Ahern 2020b; Knue 2021). Samples were obtained from either side of Northport, the dredging areas, and from surrounding areas that are unlikely to have been previously dredged (Mark Poynter, 4Sight pers. com.). Grab samples (n = 47) were split into quarters, with one quarter being sieved to 0.5 mm, preserved and sent to the Cawthron Institute for macrofauna sorting, identification and enumeration. Results indicated that the seabed around the port contains a very diverse assemblage of benthic macroinvertebrates, with a total of 198 taxa obtained from the 47 samples (mean number of taxa = 35.5 ± 1.9 S.E.). Remarkably similar numbers of taxa were obtained in two previous subtidal surveys of the outer harbour/harbour entrance:

- Kerr and Grace (2016) obtained 197 taxa from 11 stations (5 samples per station);
- West and Don (2016) obtained 189 taxa from 17 stations (1 sample per station).

In the Northport surveys, counts of individuals displayed a skewed distribution with a sample median of 284 and 10th and 90th percentiles of 81 and 799, respectively. Pielou's evenness varied among samples, but most samples had moderate to high Shannon diversity (Figure 44). Counts of many taxa were very patchy, with over a quarter (57 taxa) being obtained from a single sample.

The most diverse taxa groups were molluscs (63 taxa), annelid polychaetes (59 taxa from 28 families), and crustaceans (48 taxa from 28 families, including 21 decapods). The molluscs included 41 bivalves,[23] 14 gastropods (snails), four opisthobranchs (which include taxa like sea hares, sea slugs and nudibranchs), and three chitons. The 20 most abundant taxa included nine polychaetes (particularly *Euchone* sp. and *Spio* sp.), seven small crustaceans (particularly various amphipods, but no decapods), two bivalves, an ascidian, and an oligochaete. Most taxa occurred in low numbers, with combined total counts in pooled samples having a median of eight for individual taxa (10th and 90th percentiles of one and 194, respectively).

Multivariate analyses (nMDS, cluster, and SIMPROF) identified 13 statistically significant clusters amongst sampling stations, but the high stress value for the nMDS plot (0.19) suggested that it did not provide a good representation of the data. Mapping of the clusters indicated that community composition displayed more variation in the offshore, rather than longshore direction, with all sites east and west of Northport in the same cluster.

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[23] Actual taxa numbers may be lower because four taxa were identified as juveniles that could not be assigned to adult taxa.

Figure 44: Indicators of macrofaunal diversity and abundance in subtidal samples obtained around Northport in pooled 2019 and 2020 data (Ahern 2020b, 4Sight, unpublished data): a) number of taxa; b) number of individuals; c) Pielou's evenness; and, d) Shannon diversity.

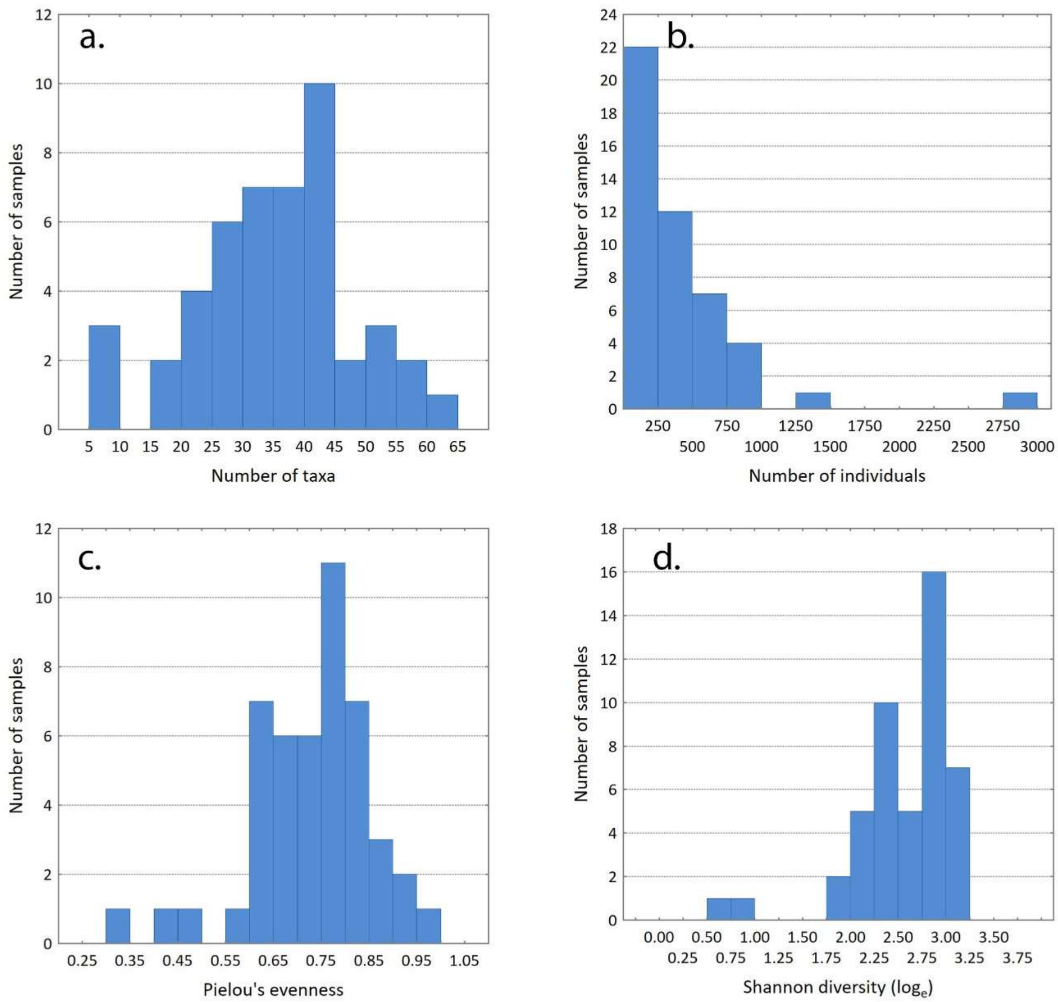
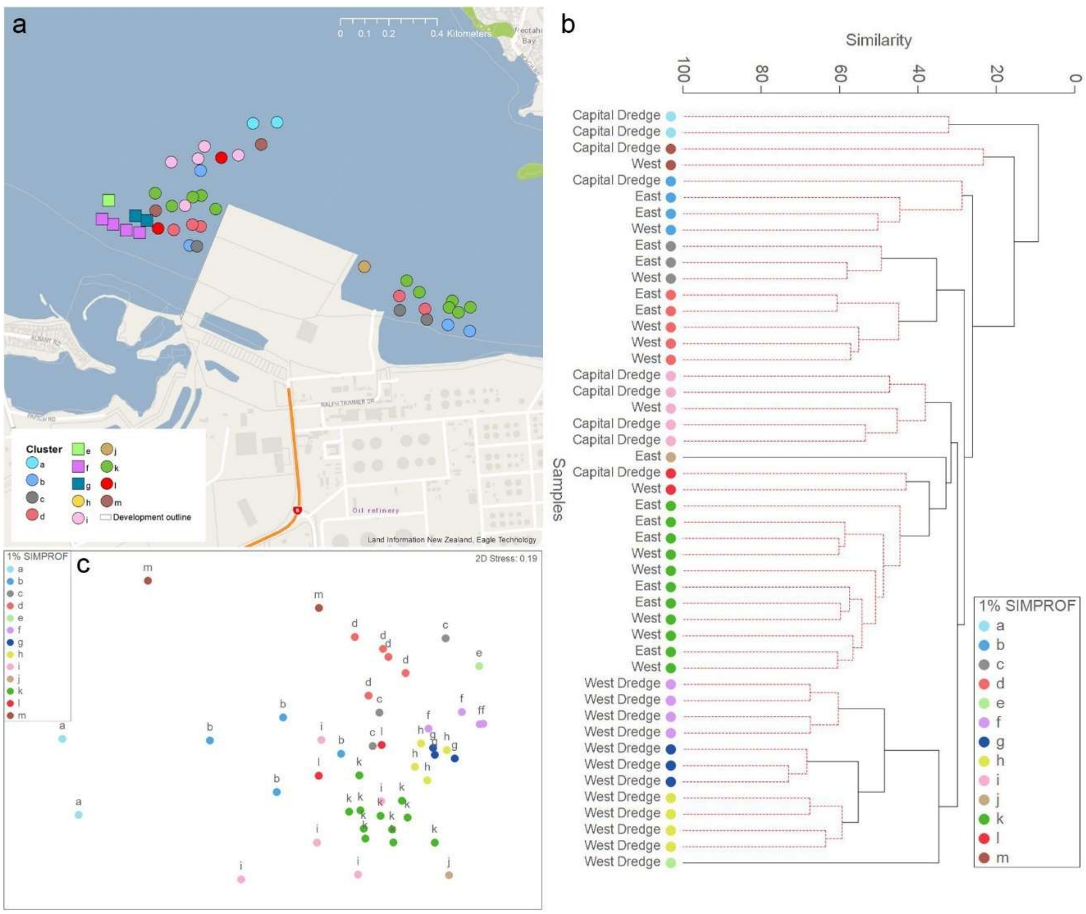


Figure 45: Results of multivariate analyses of macrofaunal community composition in subtidal samples obtained around Northport (pooled 2019 and 2020 data from Ahern (2020b): Results of multivariate analyses of macrofaunal community composition in subtidal samples obtained around Northport (pooled 2019 and 2020 data from Ahern (2020b) and 4Sight, unpublished data), showing: a) the spatial distribution of significant (1%) clusters (i.e., sites with similar community composition); and the results of analyses used to identify those clusters, including b) cluster and similarity profile analyses; and, c) non-metric multidimension scaling. Square stations in the map are 2020 samples, circles are from 2019.



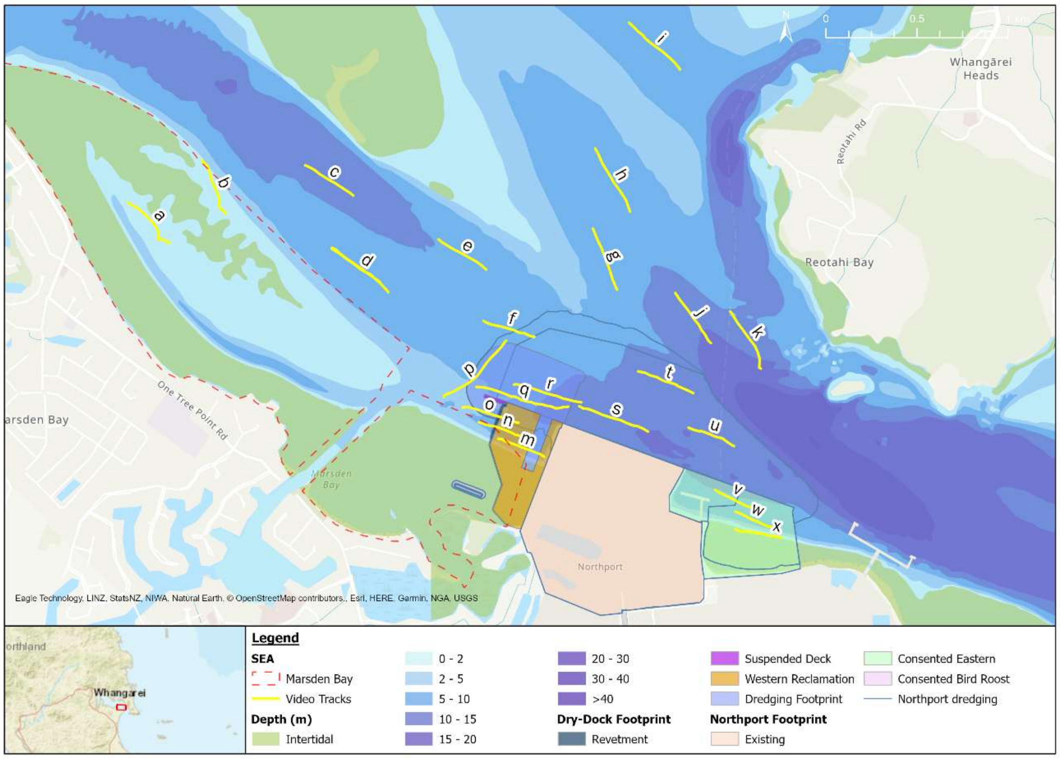
6.3.2.2 SUBTIDAL EPIBENTHIC COMMUNITIES

Available information on the subtidal ecological values of Whangārei Harbour, indicates that the mid to outer harbour contains a variety of physical seabed and biogenic habitats. Habitat-forming macrofaunal species that have been reported include horse mussels *Atrina zelandica*, green-lipped mussels *Perna canaliculus*, large dog cockles *Tucetona laticostata*, sponges, ascidians, and dead shell (Morrison 2003, Parsons et al. 2016). (Available information on the subtidal ecological values of Whangārei Harbour, indicates that the mid to outer harbour contains a variety of physical seabed and biogenic habitats. Habitat-forming macrofaunal species that have been reported include horse mussels *Atrina zelandica*, green-lipped mussels *Perna canaliculus*, large dog cockles *Tucetona laticostata*, sponges, ascidians, and dead shell (Morrison 2003, Parsons et al. 2016). (Figure 82, West & Don 2016). Drop camera surveys carried out for Channel Infrastructure have also found that sites in the east of the harbour mouth contain a mix of sand and shell gravel (, West & Don 2016). Drop camera surveys carried out for Channel Infrastructure have also found that sites in the east of the harbour mouth contain a mix of sand and shell gravel (Kerr & Grace 2016; West & Don 2016), with scallops, green-lipped mussels, octopus, 11-armed starfish, and macroalgae meadows with turret shells (referred to as algae turf) being reported. Drop camera surveys carried out for Channel Infrastructure have also found that sites in the east of the harbour mouth contain a mix of sand and shell gravel (Kerr & Grace 2016; West & Don 2016), with scallops, green-lipped mussels, octopus, 11-armed starfish, and macroalgae meadows with turret shells (referred to as algae turf) being reported.

Additional information on subtidal habitats and epibenthic communities around Northport was obtained using towed underwater video (Kelly & Sim-Smith 2022). Video transects (Figure 46) were approximately 200 m long and included:

- 4 transects from the western side of Northport, that overlapped the proposed shipyard and drydock reclamation and dredging areas (note that the proposed drydock dredging area is contained within Northport's consented, but not fully dredged area);
- 2 transects from within Northport's consented and partially dredged area, which overlapped the proposed drydock turning basin;
- 3 transects from Northport's fully dredged area;
- 3 transects from the eastern side of Northport;
- 9 transects from channel reference areas;
- 2 transects from subtidal areas to the west of the port that aerial photographs suggested contained seagrass beds (Figure 20).

Figure 46: Video transect run lines overlaid on water depths, the proposed drydock area and Northport's consented development area.



Footage from the survey indicated that the ecological values of subtidal seabed habitats and communities around the port were generally high, and largely consisted of patchy and/or contiguous sand and biogenic features including:

- extensive areas of shell;
- macroalgae meadows;
- areas that are almost completely covered with a variety of sessile organisms, including macroalgae, sponges, bryozoans, hydroids and other invertebrates;
- numerous small holes in sediments, which are likely to be worm tubes, shellfish siphons, and/or crustacean burrows.

Large biota observed included the starfish (mainly *Astropecten polyacanthus*), horse mussels, scallops, cushion stars (*Patriella regularis*), anemones, horn shells (likely to be *Maoricolpus roseus*), Mediterranean fan worm (*Sabella spallanzanii*), hydroids and bryozoans (Figure 47 to Figure 53).

Considerable variation was observed in the habitats and communities present in areas surveyed. Transects overlapping the proposed drydock reclamation and dredging areas displayed substantial variation in the characteristics of benthic habitat and diversity values. Three inshore transects (transects m. to o. in Figure 46) contained sand, dense patches of red algae (some with dense aggregations of turret or horn shells), scattered sponges, and scattered to moderate densities of starfish. Isolated kelp[24], and scattered patches of low-density seagrass were also present in that area (Figure 47). A transect, running through the proposed batter slope (Transect p. in Figure 46) appeared to contain coarser sediments with dense beds of red algae, a bed of large red or brown algae, and sand and shell gravel with numerous small holes likely to be formed by worm tubes, shellfish siphons, and/or crustacean burrows (Figure 48).

Clear transitions were also observed along two transects running through the proposed turning basin (Transects q. and r. in Figure 46). The currently undredged area on the western side of the proposed basin contained a mix of sand and shell gravel, with scattered algae, and a variety of other species, including the occasional scallop, starfish, sponges, anemones, and octopus (as indicated by a den, Figure 49). The existing batter slope towards eastern side of the proposed basin consisted of bare sand, while the seafloor of the dredged area below that was almost completely covered with a variety of sessile organisms, including sponges, bryozoans, hydroids and macroalgae (Figure 49). Other parts of Northport's dredged area (Transects s. to u. in Figure 46) contained a mix of sand, scattered and dense shell, and biogenic species such as scattered algae and sponges (Figure 50).

Northport's consented eastern reclamation areas displayed clear changes towards the shore, with habitat in the outermost transect (v. in Figure 46) consisting of sand with little epibiota (Figure 51). Sand with patches of red algae densely packed with turret or horn shells (possibly dead shells occupied by hermit crabs), scattered starfish (*A. polyacanthus*), algae, sponges, and an octopus den were observed inshore of that (w. in Figure 46). While the inshore transect (x. in Figure 46) contained bare sand with numerous cushion stars (Figure 51).

Surrounding reference areas (Figure 52 and Figure 53) also contained a mix of sand and shell gravel habitats with scattered to dense algae beds and localised areas containing sparse seagrass. Notable features that were not observed in the areas previously described above were:

- reasonably high numbers of horse mussels at the eastern end of Transect c.
- a high diversity and abundance of algae in Transect i, together with relatively high numbers of bushy hydroids;
- patches with high densities of anemones in Transect e.

Drop camera surveys carried out for Channel Infrastructure have also found that sites east of the survey area contain a mix of sand and shell gravel (Kerr & Grace 2016; West & Don 2016), with scallops, octopus, 11-armed starfish, macroalgae meadows with turret shells (referred to as algae turf) being reported. However, macroalgae meadows did not appear to be as common a feature. That may be an artefact of the sampling methods used, with the photographs taken only covering small areas of the seabed.

[24] Dense kelp and isolated Mediterranean fan worms were observed along the revetment.

Figure 47. Video stills taken from transects overlapping the footprints of the proposed drydock reclamation, dredged batter area, and pocket basin (Transects m. to o. in Figure 46): A. Patch of sparsely distributed seagrass; B. A comb star amidst a dense patch of red macroalgae; C. Several comb stars on sand; D. A bed of red macroalgae with a high density of turret shells; E. Worm tubes protruding through the surface; F. Macroalgae and a Mediterranean fan worm (arrow) growing on the rock revetment.

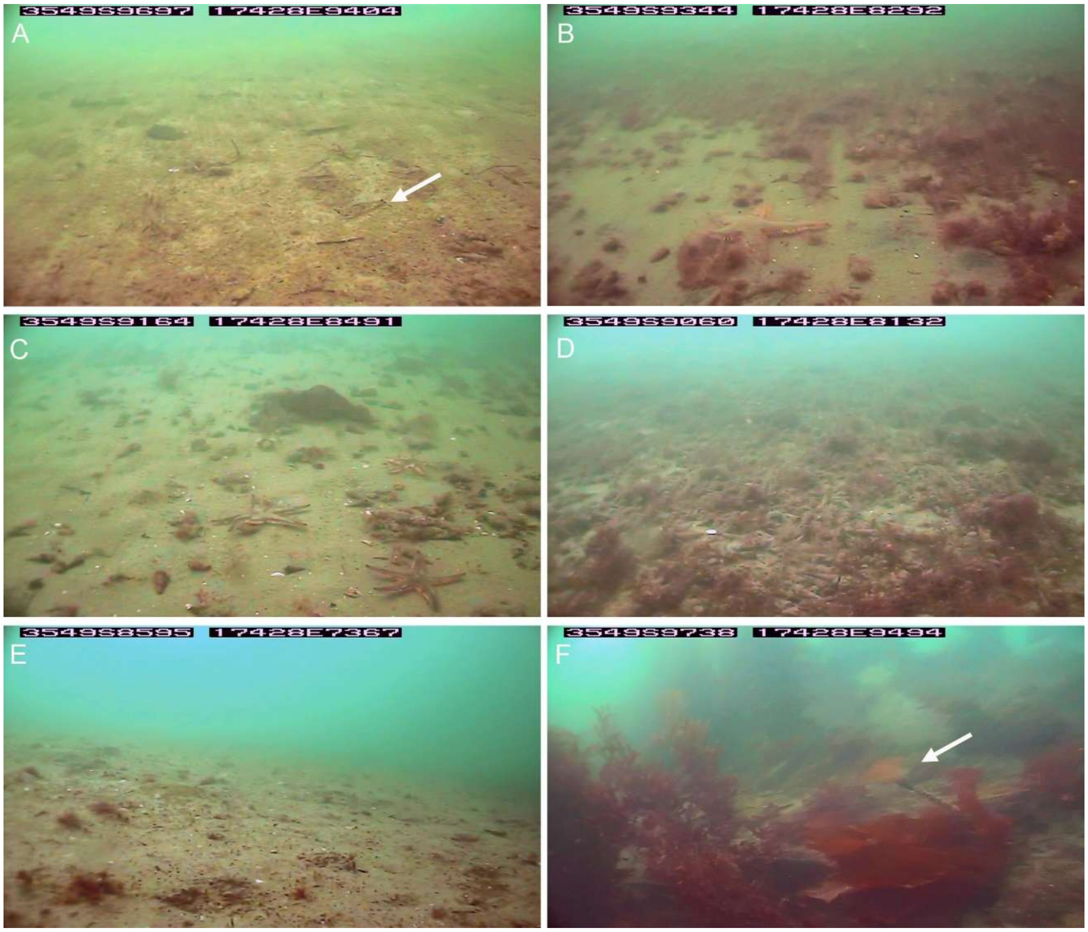


Figure 48. Video stills taken from the proposed drydock's dredged batter area (Transect p. in Figure 46): A. Dense bed of red algae with anemones; B. Bed of scattered, large red or brown algae; C. Shell gravel with numerous tubes or burrows; D. Sand with numerous tubes or burrows and a comb star.

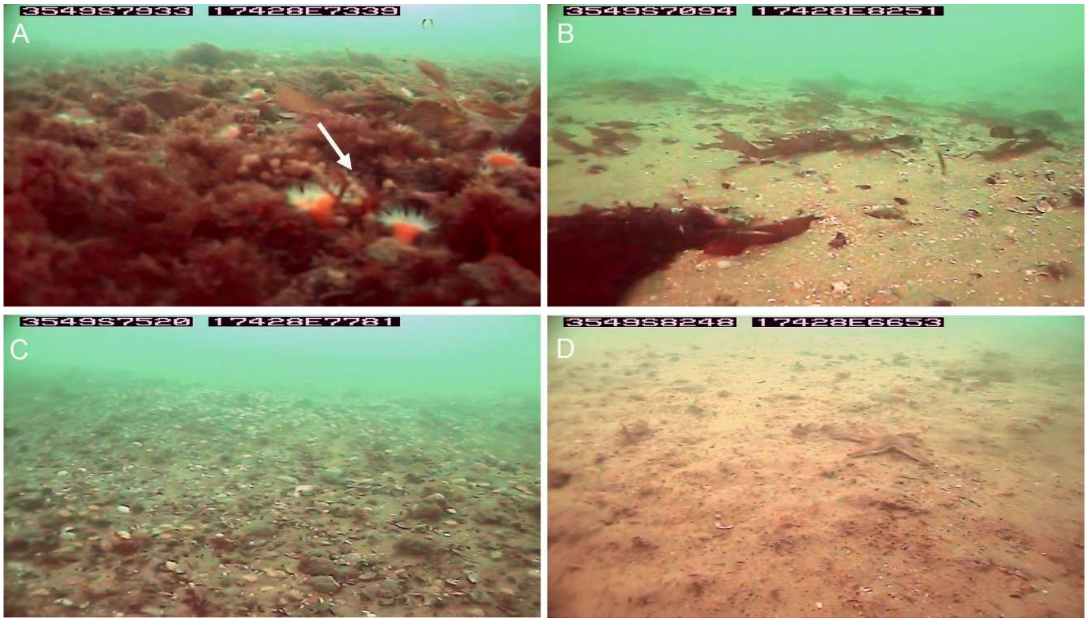


Figure 49. Video stills taken from within the proposed drydock's turning basin and batter slope (Transects q. & r. in Figure 46): A. Sand and shell above the existing batter slope with red algae, an 11-armed starfish (white arrow), small sponge (red arrow) and anemone (green arrow); B. Dense shell with scattered sponges (arrows) above the batter slope; C. Octopus den on sandy habitat with scattered algae above the batter slope; D. Scallops on sandy habitat above the existing batter slope; E. The existing sandy batter slope; F. The boundary between the existing batter slope and the bottom of the dredged basin; G & H. Dense encrusting fauna on dense shell/gravel present at the bottom of the dredged basin.

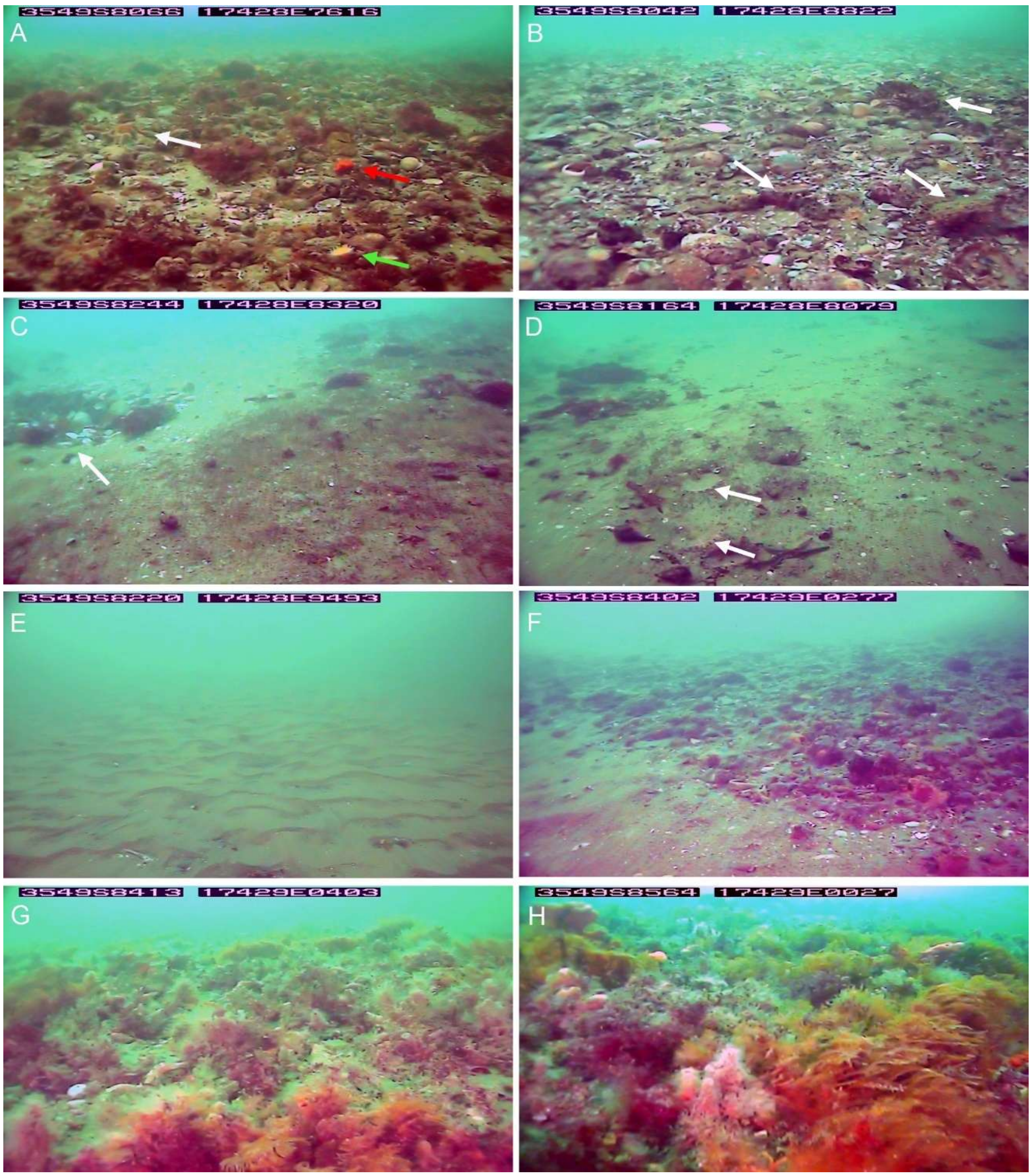


Figure 50. Video stills taken from within the existing dredge area to the north of Northport (Transects s. to u. in Figure 46): A. Bare sand; B. Sand with scattered shell; C. Dense shell gravel; D–E. Various small sponges; F. A leatherjacket (*Meuschenia scaber*).

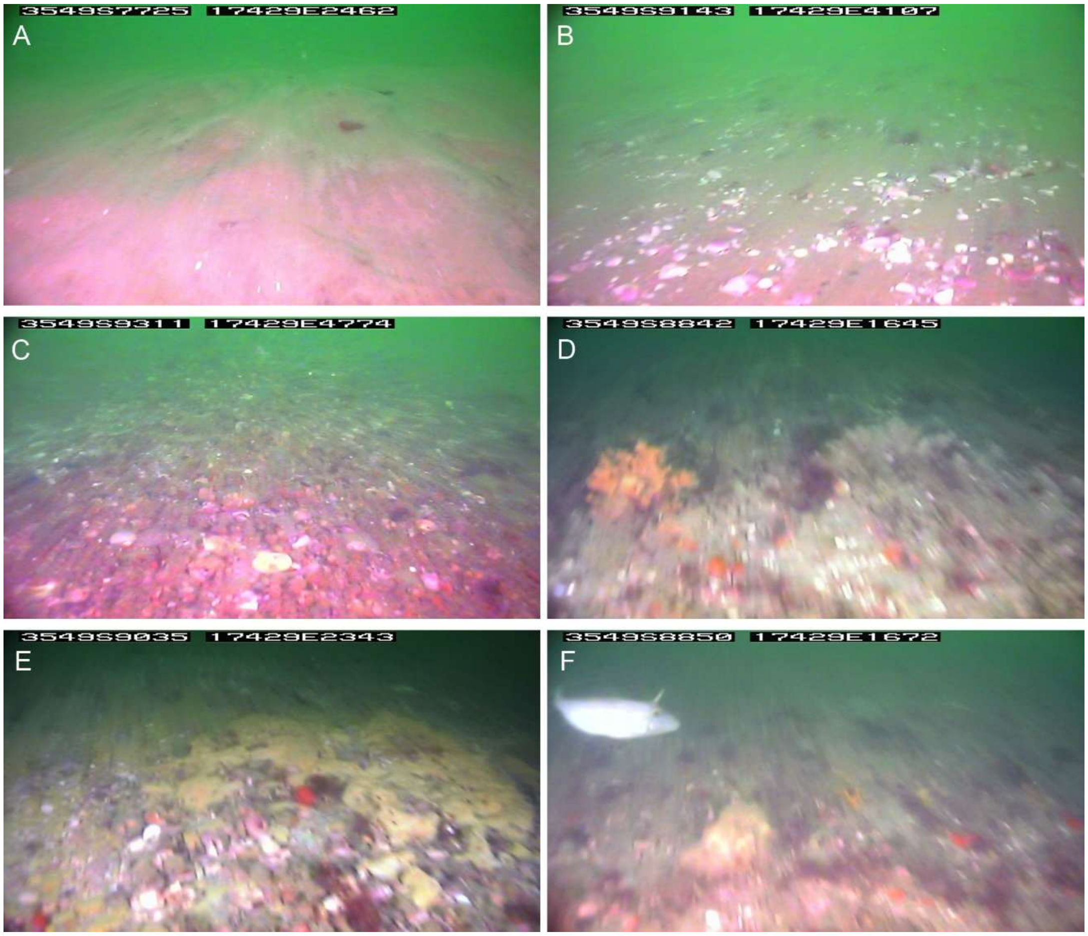


Figure 51. Video stills taken from within Northport's consented eastern reclamation areas: A. Sand with abundant holes caused by an unknown animal in the outer transect (v. in Figure 46). B. Comb star (*Astropecten polyacanthus*, white arrow) and ball sponge (blue arrow) in the central transect (w. in Figure 46); C. A very dense aggregation of horn shells (possibly dead *Maoricolpus roseus* shells with hermit crabs) amongst red algae in the central transect; D. The pest, Mediterranean fan worm (*Sabella spallanzanii*) in the central transect; E. An octopus den surrounded by empty scallop shells in the central transect; F. Cushion stars (*Patiriella regularis*) in the inshore transect (x. in Figure 46).

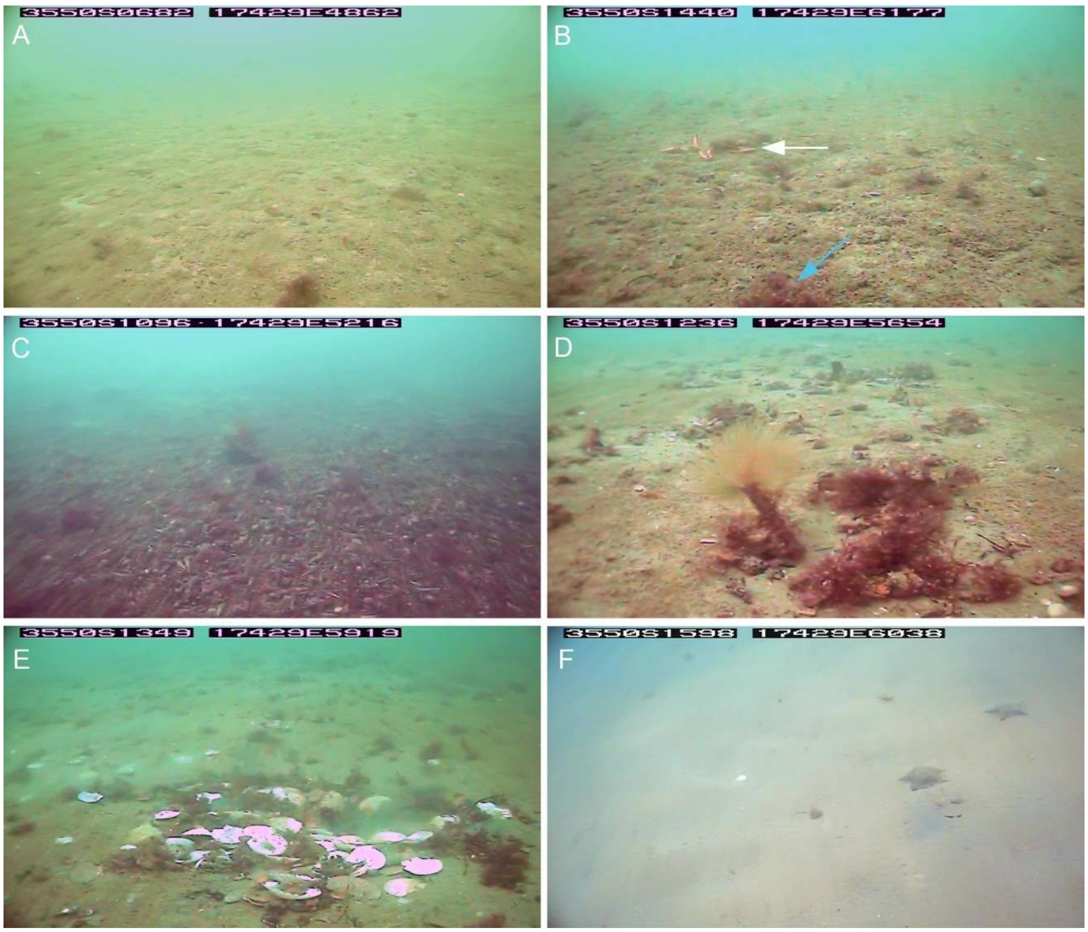


Figure 52. Video stills taken from potential seagrass areas west of the port showing sparse seagrass (Transects a. & b. in Figure 46).

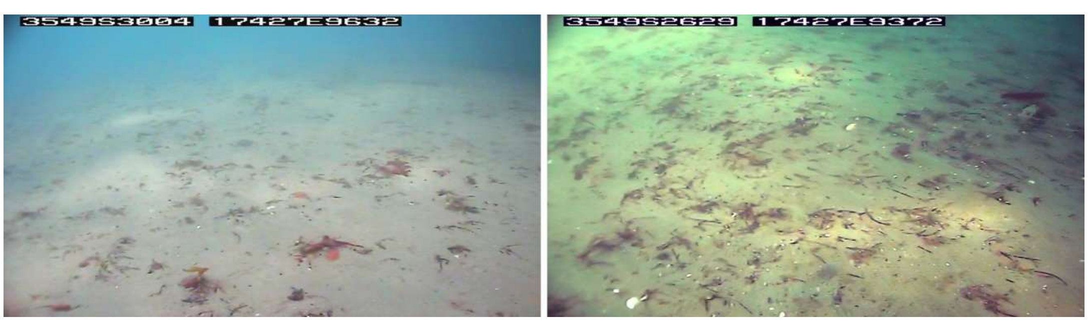
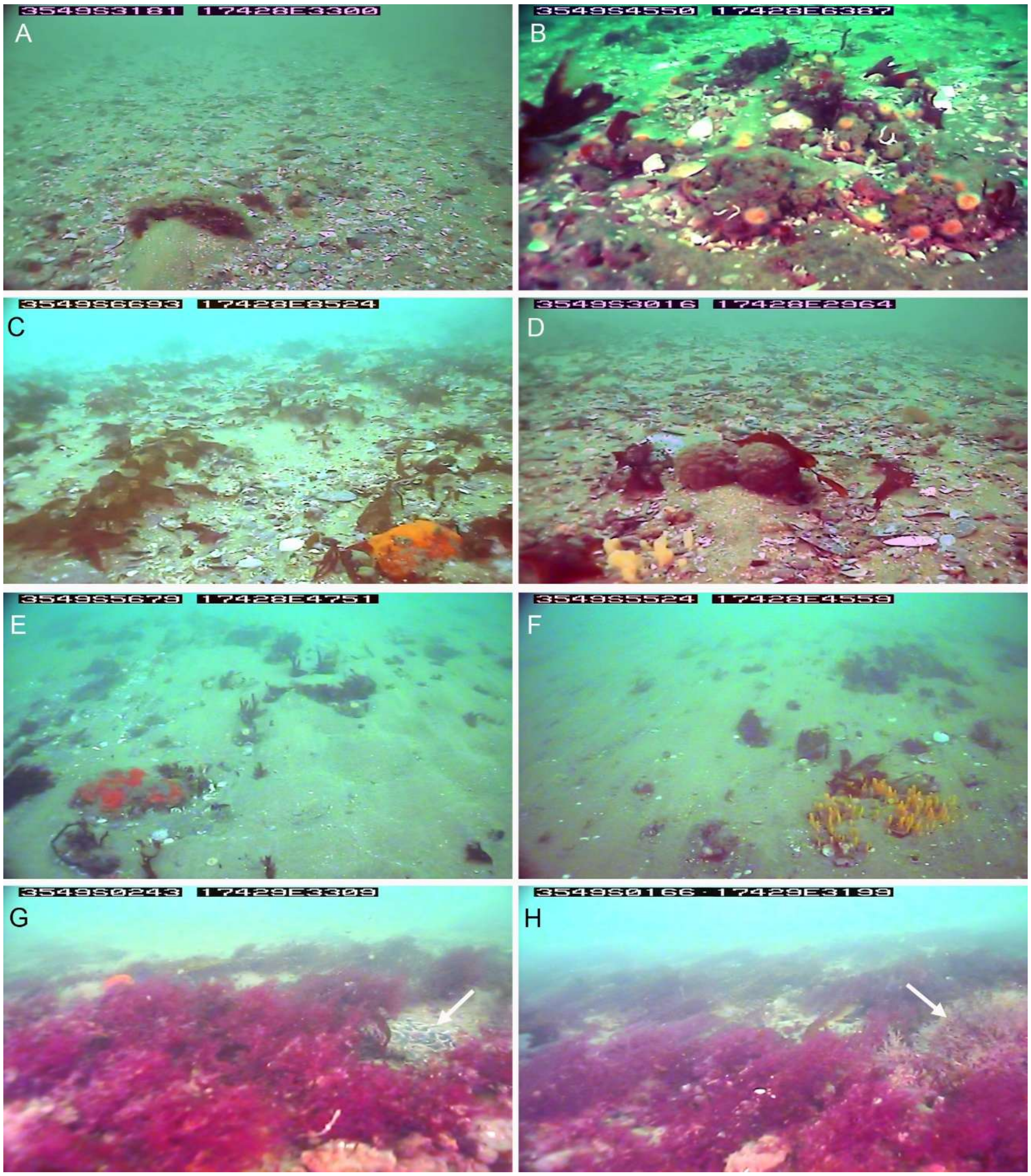


Figure 53. Video stills taken from within the reference areas (Transects c.–e, & g–i. in Figure 46): A. Horse mussel (*Atrina zelandica*); B. Anemones growing on small rocks; C–F. Various sponges and macroalgae; G. Dense red macroalgae and a rigid bryozoan (arrow); H. Dense red macroalgae and a bushy hydroid (arrow).



6.4 KAIMOANA SHELLFISH

6.4.1 COCKLES AND PIPI

Cockles (*Austrovenus stutchburyi*) are widespread in Whangārei Harbour. Early studies report that cockle beds were present throughout most of the lower harbour, with the largest beds found at Snake Bank, McLeod Bay and Parua Bay (Northland Harbour Board 1989). More recently, Griffiths (2012b) found that cockles were present at most sites sampled throughout the harbour, but a small proportion of the population was of harvestable (>30 mm) size. Highest densities were recorded at Marsden Bay and McLeod Bay, and recent sampling near Northport (Knue & Poynter 2021) indicates that cockles remain common in the eastern part of Marsden Bay (Figure 54). (Figure 54).

It is likely that the harbour population has decreased from historic levels due to harvesting pressure and high suspended sediment loads (Cummings & Hatton 2003; Morrison 2003). For instance, commercial harvesting for cockles on Snake Bank had a pronounced effect. Cockle harvesting in that area began in the 1980s, with landings of over 500 t per year obtained in the 1990s. Landings steadily declined from 2000, and the fishery was eventually closed in 2012 due to the low biomass of harvestable cockles (Fisheries NZ 2020). NRC sampling of the Snake Bank, McDonald Bank and Takahiwai cockle populations in 2014 found average densities of 722 cockles/m², 853 cockles/m², and 498 cockles/m², respectively (Landings steadily declined from 2000, and the fishery was eventually closed in 2012 due to the low biomass of harvestable cockles (Fisheries NZ 2020). NRC sampling of the Snake Bank, McDonald Bank and Takahiwai cockle populations in 2014 found average densities of 722 cockles/m², 853 cockles/m², and 498 cockles/m², respectively (Figure 54; Griffiths & Eyre 2014).

Small beds of pipi (*Paphies australis*) were historically found in harbour bays, and a large population existed on Mair Bay (Northland Harbour Board 1989). Pipi were previously commercially harvested from Marsden and Mair Banks (PPI1A) outside of the harbour entrance, with these banks supplying over 99% of the total commercial landings in New Zealand (Pawley 2014). Between 1986 and 2011, 87–326 t were landed per annum from PPI1A. However, both recreational and commercial harvest of pipi at Marsden Bank was prohibited in 2011, and at Mair Bank in 2014, due to low biomass (Fisheries NZ 2020).

Surveys of Marsden and Mair Banks between 2013–2019 have found that pipis had a very patchy distribution, with low numbers of large (>50 mm) pipi. Mean densities across the entire banks were very low and highly variable due to the patchy distribution, varying between 11–729 pipis/m² for Mair Bank, and 17–166 pipis/m² for Marsden Bank (Pawley 2014, 2016; Williams et al. 2017; Shirkey 2019). Surveys of a narrow bank on the eastern edge of Marsden Bank in 2018 and 2024 found highly variable pipi densities, with respective means of 1284 pipis/m² and 120 pipis/m². No large (>50 mm) pipis were found in either survey (Berkenbusch & Neubauer 2018; Berkenbusch & Hill-Moana 2024).

Juvenile pipis are present at several sites in the mid to outer harbour, with the highest densities found at Marsden Bay and the western side of Northport (Figure 55), though very few pipis were of harvestable size (>50 mm) in all areas (Cummings & Hatton 2003; Griffiths 2012b; Shirkey 2019). A small pipi bed (~ 873 m²) is present at the western end of Marsden Bay (Figure 58). Surveys of this bed between 2016 and 2019, found it contained both juvenile and adult pipi (5–50 mm), with mean densities within the main bed fluctuating between 857 and 1929 pipi/m^2 between 2016 and 2019. Lower densities of pipis were also found within the bed buffer area (Williams et al. 2017; Shirkey 2019). The bed was still present in 2021 and 2022 (Howells 2023), and it was also noted during a rapid survey in November 2021 (S. Kelly pers. obs.), but it fell between sampling stations (Figure 58; Kelly & Sim-Smith 2022).

Knue and Poynter (2021) found low mean densities of pipi (9–94 pipis/m^2) at four sites west of Northport, and at high densities at one site (WM1a; 892/m^2) (Figure 55). Most of the pipis were between 10–40 mm in length, with none larger than 50 mm (Knue & Poynter 2021). Additional information on cockles and pipi within Marsden Bay was obtained for Northport by Coast and Catchment (Kelly & Sim-Smith 2022). The presence and extent of edible shellfish on the intertidal sandflats of Marsden Bay were assessed through:

- A rapid qualitative survey of the intertidal area west of the Marsden Cove access channel, and on the eastern side of Northport.
- A quantitative survey of pipi and cockle numbers between Northport and the Marsden Cove access channel, where previous survey results suggested a significant juvenile pipi bed was located.

The surveys were conducted on 8 November 2021. For the rapid qualitative survey, the areas west of the Marsden Cove access channel and on the eastern side of Northport were walked over at low tide. Fifty-four stations in the mid to lower intertidal zone were examined for cockles and pipis, and their abundance was ranked from 0 (absent) to 5 (very high). Notes were made on the presence of seagrass, macroalgae, and other notable features. For the quantitative survey of pipi and cockle numbers, a further 18 stations between Northport and the Marsden Cove access channel were sampled using a 13 cm diameter corer. Samples were sieved using a 4 mm sieve, and the number of pipis and cockles present were counted. Pipi lengths were also measured.

Moderate to very high abundances of cockles were observed on the mid shore across the entire length of Marsden Bay, with the highest densities found near the entrance to Marsden Cove Marina (Figure 56). Almost all the cockles found were below 'harvestable' size. Quantitative sampling conducted around Northport found that 9/12 stations on the mid to lower shore west of Northport contained more than 100 cockles/m^2.

Very few pipi were present along most of Marsden Bay and none were recorded east of Northport. The exception was a large bed of juvenile pipi in the mid shore zone on the western side of Northport, with mean densities of around 300/m^2 within a narrow band (~50 m) that extends around 300 m out from the port revetment. A large proportion of that bed is situated within the footprint of the proposed drydock reclamation and the consented Northport bird roost. All pipis found were less than 35 mm in length (Figure 57).

Figure 54. Mean number of cockles/m² from sites sampled by: Cummings and Hatton (2003) (yellow symbols); Griffiths (2012b) (red symbols); Griffiths and Eyre (2014) (green symbols); and Knue and Poynter (2021) (orange symbols). Size of the symbol shows cockle density. Top map shows the entire harbour and the bottom map shows the area around the drydock.

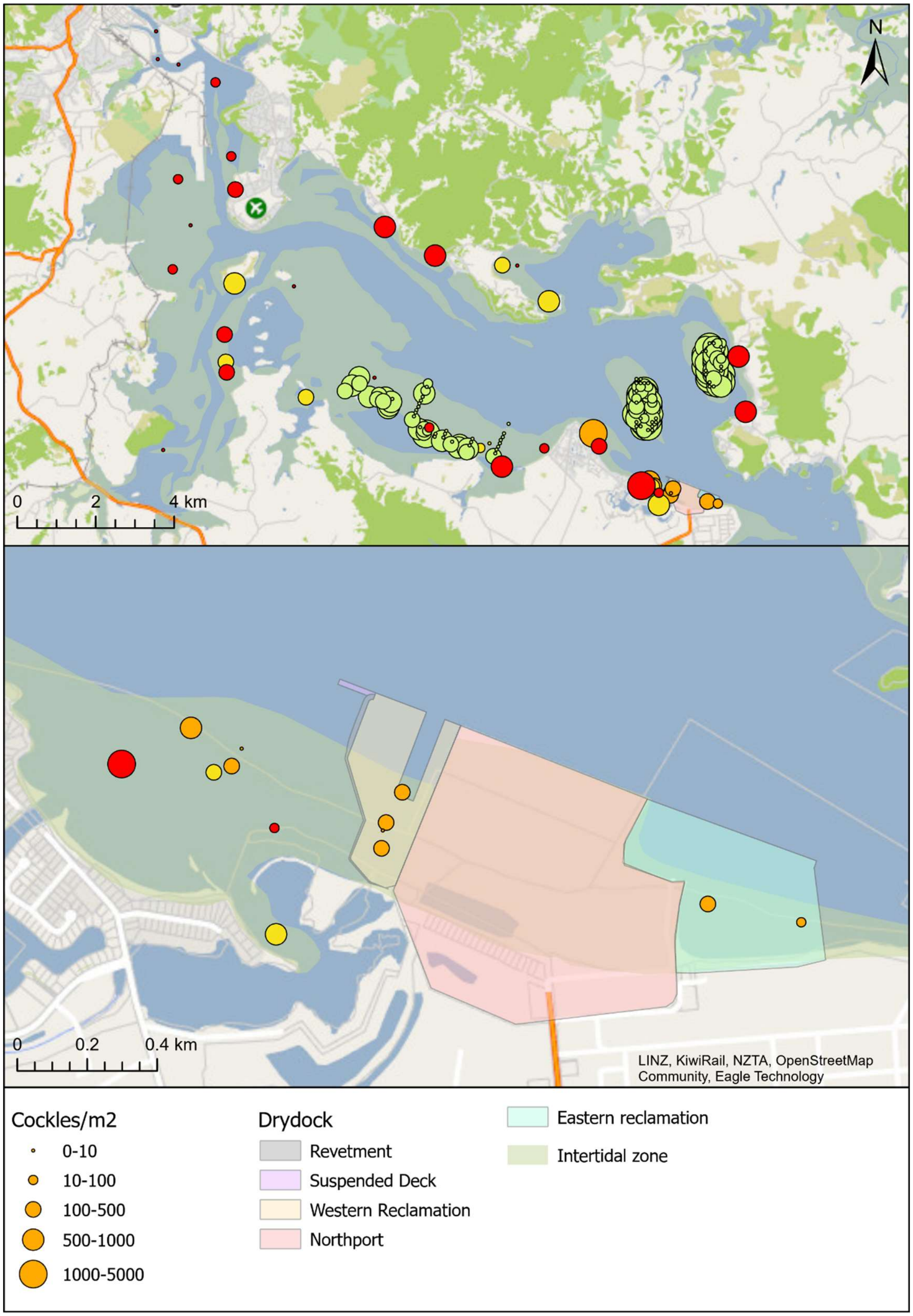


Figure 55. Mean number of pipis/m² from sites sampled by: Cummings and Hatton (2003) (yellow symbols); Griffiths (2012b) (red symbols); and Knue and Poynter (2021) (orange symbols). Size of the symbol shows pipi density. Top map shows the entire harbour and the bottom map shows the area around the drydock.

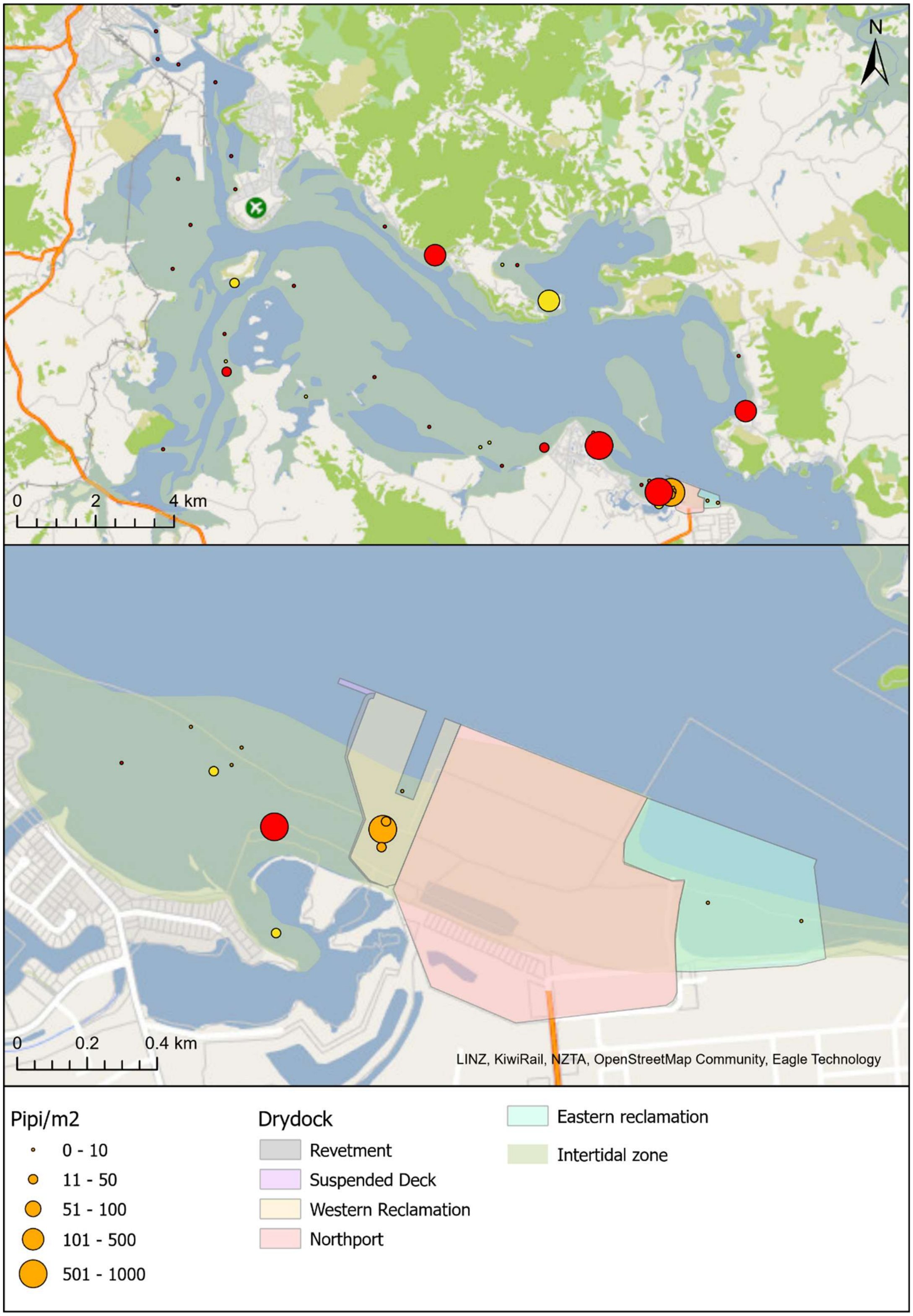


Figure 56. Abundance of cockles in Marsden Bay found in the qualitative and quantitative intertidal surveys conducted in November 2021. The footprints of the proposed drydock development and consented Northport bird roost are overlaid.

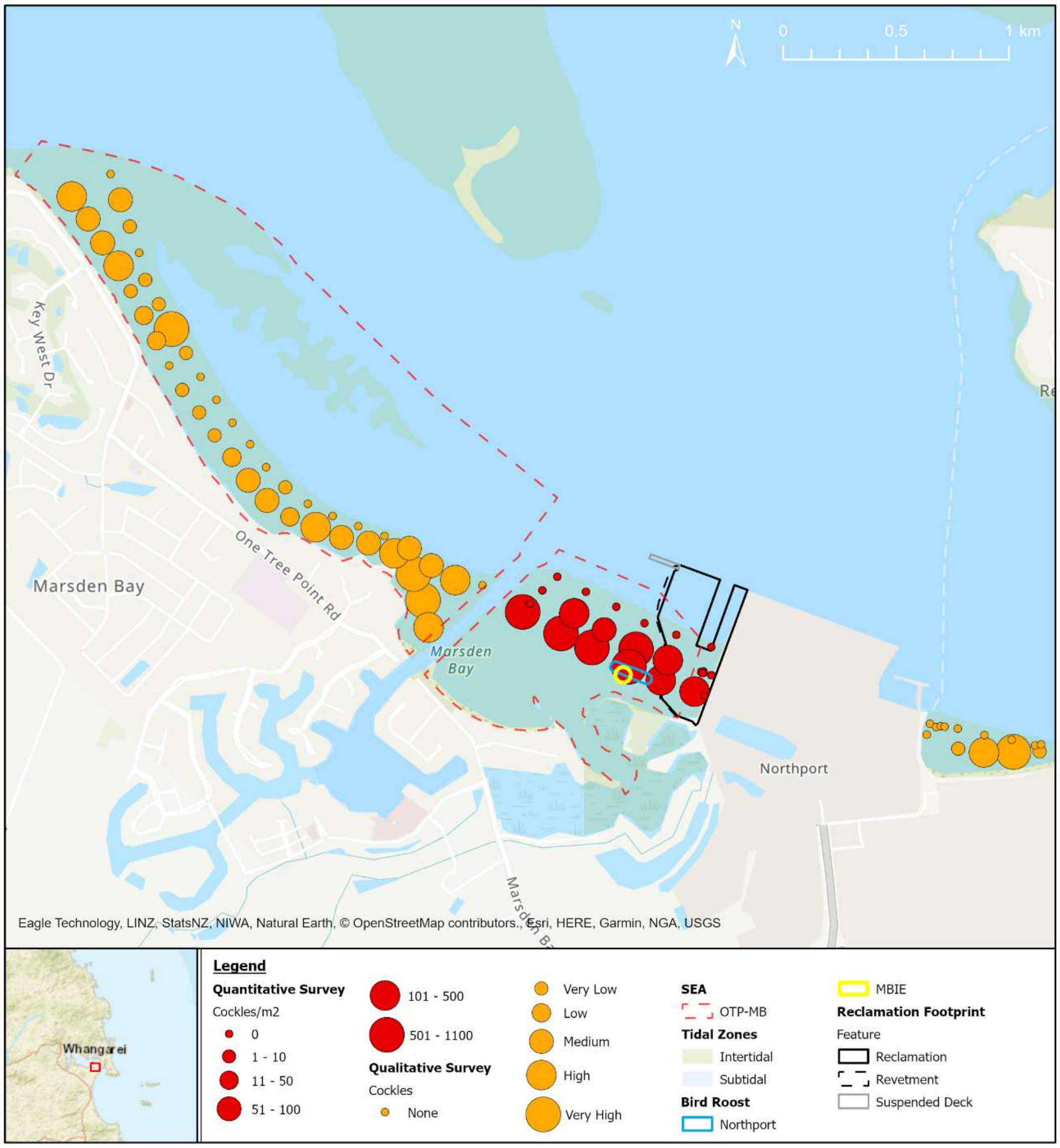


Figure 57. Abundance of pipis in Marsden Bay from the qualitative and quantitative intertidal surveys conducted in November 2021. The footprints of the proposed drydock development and consented Northport bird roost are overlaid.

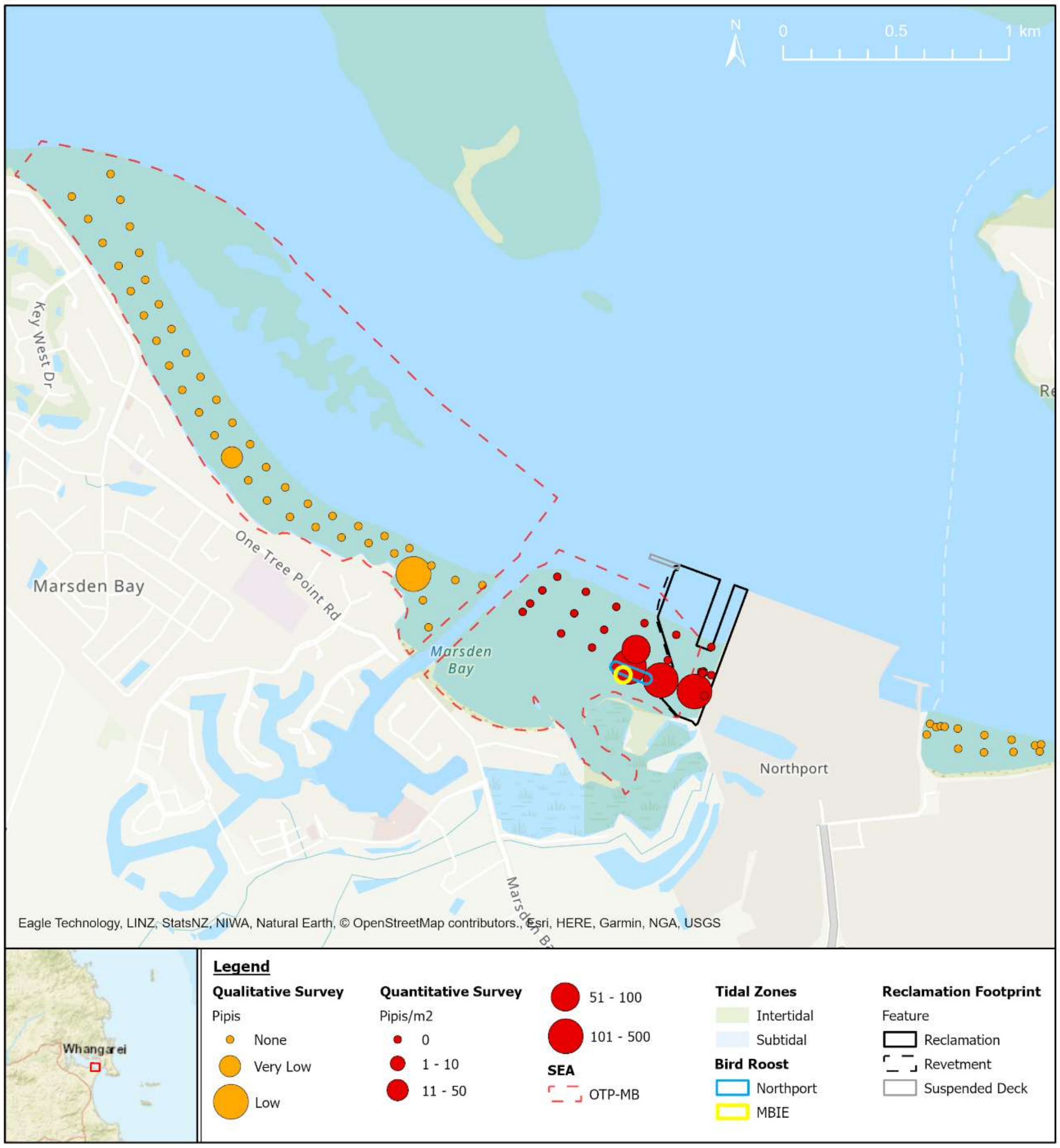


Figure 58: Location of the One Tree Point pipi bed, and the surrounding buffer area surveyed in 2016–2019 by Shirkey (2019) and Williams et al. (2017), and the abundance of pipi found in the 2021 intertidal survey.

6.4.2 SCALLOPS

Large scallop beds (*Pecten novaezelandiae*) are, or were historically, found:

- on the sandflats at Takahiwai;
- in Marsden Bay;
- in Shoal Bay between McDonald and Snake Banks;
- from McLeod Bay along the inside channel as far as Pārua Bay;
- in the channel between Limestone and Rat Islands;
- in bays in, and beyond, the entrance of the harbour from Smugglers Bay to Little Munroe Bay (Mason & Ritchie 1979; Cummings & Hatton 2003; Morrison 2003, Greg Blomfield, Northport pers. com.).

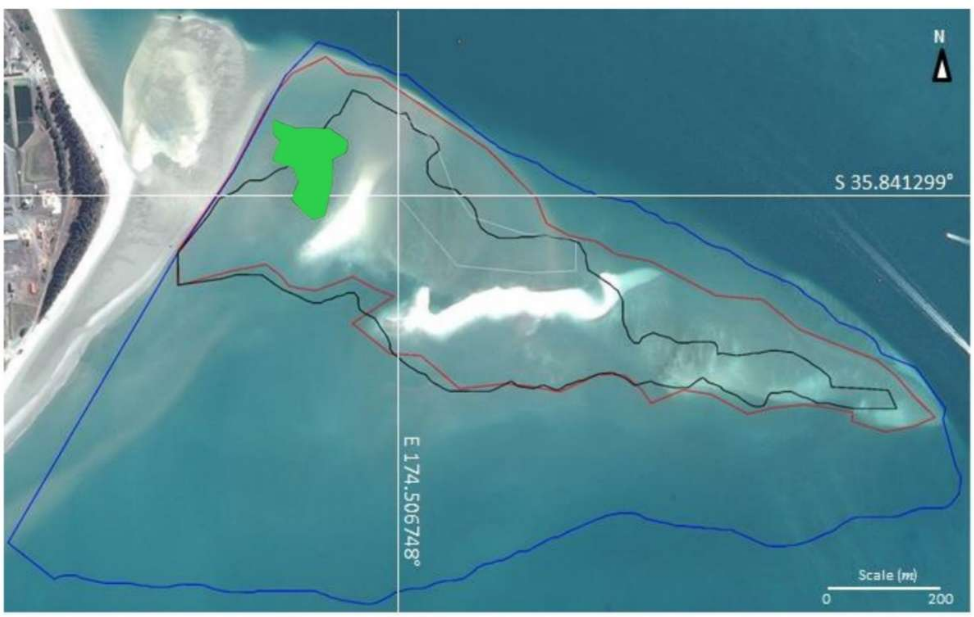
Scallop beds in Smugglers Bay and Urquharts/Taurkiura Bays were surveyed in 2006, 2007 and 2021. Mean densities of legal-sized scallops (>100 mm) were very low and showed little change between 2006–2021, ranging from 0.05–0.05/m^2 at Smugglers Bay and 0.03–

0.05/m^2 at Urquharts/Taurkiura Bays (Williams et al. 2008; Williams 2009; Williams et al. 2024). Recreational scallop dredging has frequently occurred in the harbour around the areas listed above (C. Sim-Smith, pers. obs.), though the Northland scallop fishery was closed on 1 April 2022 to allow stocks to recover (Parker 2022).

6.4.3 GREEN-LIPPED MUSSELS

Green-lipped mussels (*Perna canaliculus*) were reported to have been common in the channel adjacent to Mair Bank, but were commercially dredged and disappeared in the late 1960s (Mason & Ritchie 1979; Morrison 2003). A large mussel bed reappeared on Mair Bank in 2015, which was reported to cover approximately 12,800 m^2 in 2016 (Pawley 2016). However, the bed was intensively harvested, which prompted the local hapu Patuharakeke to implement a rahui over the collection of all shellfish from Mair and Marsden Banks in 2018 (Ministry of Fisheries 2018). Despite the rahui, the bed has almost completely disappeared, with only a few scattered clumps of mussels observed in recent years (Lee 2020; A. Carrington, pers. comm.).

Figure 59. Extent of the mussel bed (green polygon) on Mair Bank in Feb 2016 (Figure adapted from Pawley (2016)).



6.5 REEF COMMUNITIES

Whangārei Harbour contains only a limited amount of reef habitat, with most occurring around the northern coastline towards the harbour entrance. Intertidal reefs within the harbour are characterised by common intertidal species including barnacles (*Chamaesipho columna*), rock oysters (*Saccostrea glomerata*), tubeworms (*Pomatoceros* sp.), *Corallina* sp. algae, and Neptune's necklace (*Hormosira banksia*). Subtidal reef is reported to support various macroalgae, with common species including kelp *Ecklonia radiata*, *Carpophyllum* sp., *Cystophora* sp., and *Sargassum sinclairii*, as well as sponges, green-lipped mussels, kina (*Evechinus chloroticus*) and other common reef invertebrates (Morrison 2003; Kerr 2005; Kerr & Grace 2016). Diverse sponge communities are present within the Motukaroro Island Marine Reserve, and low numbers of sub-legal sized crayfish (*Jasus edwardsii*) have been found in the reserve (Kerr & Moretti 2012; Kerr & Grace 2016). Overall, species assemblages on natural Whangārei reef habitats are typical of those found in north-eastern New Zealand (Morrison 2003).

Revetments along the western and eastern margins of Northport are narrow artificial reefs, with similar habitat and community values to the naturally occurring reefs in the harbour. A narrow band at the base of the intertidal sections of the revetment was found to contain a variety of invertebrates and macroalgae including coralline turf, the brown seaweed *Colpomenia* sp, ascidians, speckled whelks *Cominella adspera*, mudflat top shells *Diloma subrostratum*, Spengler's trumpet shells *Cabestana spengleri* and snakeskin chitons *Sypharochiton pelliserpentis* (Figure 60).

A subtidal survey of the revetments by Spyksma (2018) indicates that they also contained a reef community typical of north-eastern New Zealand, with a similar assemblage to those reported for natural reefs in the harbour. For example, the macroalgae recorded included: *E. radiata*; *S. sinclairii*; *Carpophyllum flexuosum*; *Dictyota kunthii*; *Hildenbrandia* sp.; *Colpomenia* sp.; *Ralfsia* sp.; various species of red turfing algae; and crustose coralline algae. A variety of common sponges, molluscs and echinoderms were also observed growing on the revetments, along with compound and solitary ascidians and polychaetes, including Mediterranean fan worm *Sabella spallanzanii* (a pest species) and the parchment worm *Chaetopterus* sp. A low number of crayfish *Jasus edwardsii,* and a reasonably diverse fish assemblage was also recorded around the revetments, with four species of triplefins and a range of other common reef species that, among others, included silver drummer *Kyphosus sydneyanus*, red moki *Cheilodactylus spectabilis*, silver sweep *Scorpis lineolata*, big eye *Pempheris adspersa* and marble fish *Aplodactylus arctidens*. Other more cosmopolitan species included kingfish *Seriola lalandi*, trevally *Pseudocaranx dentex*, and parore *Girella tricuspidata*.

6.5.1 THREATENED OR AT RISK SPECIES

None of the reef species recorded around the entrance to Whangārei Harbour are listed as threatened or at risk.

Figure 60: The intertidal section of the western revetment: A & B) the rocks at the base of the revetment are encrusted with coralline turfing algae; C) an ascidian and the mudflat top shell *Diloma subrostratum* (arrow); D) squid eggs; E) two speckled whelks *Cominella adspersa* laying eggs and the seaweed *Colpomenia* sp. (arrow); F) two mating Spengler's trumpet shells *Cabestana spengleri* and a snakeskin chiton *Sypharochiton pelliserpentis* (arrow).

6.6 FISH

A large variety of fishes utilise Whangārei Harbour (Table 3). Sixteen species were captured by beach seines from shallow, soft sediment habitats in the harbour. The most common species captured from lower harbour sites were, in decreasing order, yellow-eyed mullet, sand goby, garfish, sand flounder and speckled sole (Morrison 2003).

Larger fish captured from the deeper channels in the harbour include snapper, jack mackerel, parore, rig, eagle rays, grey mullet, sand flounder, trevally, yellow-belly flounder and kahawai (Mason & Ritchie 1979).

A video survey of 19 sites covering a range of habitats (bare sediment, seagrass, horse mussels, sponges, turfing algae and reef) in the mid to outer harbour found that the most common species observed across all habitats were snapper, spotty, trevally, goatfish, leatherjacket and parore. The abundance of post-settlement snapper was significantly higher in biogenic habitats (horse mussels, seagrass and sponges) than bare sediment or reef, suggesting that these habitats are important nursery areas for snapper in the harbour (Parsons et al. 2016).

Brook (2002) surveyed fish assemblages at 119 reef sites around the Northland coast, including six sites on the northern side of the outer harbour between Reserve Point and Home Point, where 33 rocky reef species were recorded. Fish assemblages at five of the outer harbour sites were grouped with other Northland sites classified as having “impoverished species assemblages in sheltered bays, harbours and exposed west coast sites”. These sites were dominated by parore, spotty, and triplefins (common, variable and spectacled). Fish assemblages around Motukaroro Island were different to the other harbour sites, and the site was classified as “moderately diverse assemblages of open coasts”. Common species seen within the Motukaroro Marine Reserve included goatfish, koheru, parore, snapper and spotty (Kerr & Moretti 2012).

Fish communities around Northport appear to be similar to those that inhabit reefs in and around the harbour. Leatherjackets, red moki, spotty, sweep, triplefins, kingfish, jack mackerel, two-spot demoiselle, and goatfish were commonly observed around the rock revetments of Northport. Other species that were occasionally observed included Sandager’s wrasse, butterfly perch, trevally, silver drummer, parore, big eye, slender roughy and marble fish (Spyksma 2018).

Trawl and aerial surveys of Bream Bay show that the most common fish species present in the area are snapper, red gurnard, jack mackerel, blue mackerel, trevally and kahawai Boyd 2025. Bream Bay appears to be a hot spot for red gurnard, with consistently higher catch rates occurring in the bay compared to the rest of the Hauraki Gulf (Kendrick & Francis 2002).

6.6.1 THREATENED OR AT RISK SPECIES

None of the fish species recorded are listed as threatened or at risk.

Table 3. Fish species recorded to occur in Whangārei Harbour. Species that have been observed around Northport are highlighted in blue.

Family	Common name	Scientific name	Observed habitat	Reference
Triakidae	Rig	*Mustelus lenticulatus*	Channels, soft sediment	Mason and Ritchie (1979)
Dasyatidae	Short-tail stingray	*Bathytoshia brevicaudata*	Reef, outer harbour	Kerr and Moretti (2012)
Myliobatidae	Eagle ray	*Myliobatis tenuicaudatus*	Channels, soft sediment	Mason and Ritchie (1979)
Muraenidae	Yellow moray	*Gymnothorax prasinus*	Reef, outer harbour	Brook (2002)
Congridae	Conger eel	*Conger verreauxi*	Reef, outer harbour	Brook (2002)
Clupeidae	Pilchard	*Sardinops neopilchardus*	Shallows, soft sediment, upper harbour	Morrison (2003)
Engraulididae	Anchovy	*Engraulis australis*	Shallows, soft sediment, mainly upper and mid harbour	Morrison (2003)
Retropinnidae	Smelt	*Retropina retropina*	Shallows, soft sediment, upper and mid harbour	Morrison (2003)
Moridae	Rock cod	*Lotella rhacina*	Reef, outer harbour	Brook (2002)
Hemiramphidae	Garfish	*Hyporhampus ihi*	Shallows, soft sediment, whole harbour	Morrison (2003); Parsons et al. (2016)
Trachichthyidae	Slender roughy	*Optivus elongatus*	Reef, revetments, outer harbour	Venus (1984); Brook (2002); Spyksma 2018
Zeidae	John dory	*Zeus faber*	Reef, outer harbour	Brook (2002); Kerr and Moretti (2012)
Sygnathidae	Black pipefish	*Stigmatopora nigra*	Reef, outer harbour	Kerr and Moretti (2012)
Scorpaenidae	Scorpion fish	*Scorpaena papillosus*	Reef, outer harbour	Brook (2002)
Serranidae	Butterfly perch	*Caesioperca lepidoptera*	Reef, revetments, outer harbour	Brook (2002); Spyksma (2018)
	Pink maomao	*Caprodon longimanus*	Reef, outer harbour	Brook (2002)
Carangidae	Koheru	*Decapterus koheru*	Reef, outer harbour	Kerr and Moretti (2012)
	Trevally	*Pseudocaranx dentex*	Channels, soft sediment, reef, revetments, outer harbour	Mason and Ritchie (1979); Brook (2002); Parsons et al. (2016)

Family	Common name	Scientific name	Observed habitat	Reference
	Kingfish	*Seriola lalandi*	Reef, revetments, outer harbour	Kerr and Moretti (2012); Spyksma (2018)
	Jack mackerel	*Trachurus novaezealandiae*	Channels, soft sediment, revetments	Mason and Ritchie (1979); Kerr and Moretti (2012); Spyksma 2018
Arripidae	Kahawai	*Arripus trutta*	Channels, reef, soft sediment, outer harbour	Mason and Ritchie (1979); Kerr and Moretti (2012)
Sparidae	Snapper	*Chrysophrys auratus*	Shallows, channels, soft sediment, reef, whole harbour	Mason and Ritchie (1979); Brook (2002); Morrison (2003); Parsons et al. (2016)
Mullidae	Goatfish	*Upeneicthys lineatus*	Soft sediment, reef, revetments, mid to outer harbour	Brook (2002); Parsons et al. (2016)
Pempheridae	Bigeye	*Pempheris adspera*	Reef, revetments, outer harbour	Venus (1984); Brook (2002); Spyksma 2018
Kyphosidae	Silver drummer	*Kyphosus sydneyanus*	Revetments	Spyksma (2018)
Scorpididae	Sweep	*Scorpis lineolatus*	Reef, revetments, outer harbour	Brook (2002); Kerr and Moretti (2012); Spyksma 2018
	Blue maomao	*Scorpis violaceus*	Reef, outer harbour	Brook (2002); Kerr and Moretti (2012)
Girellidae	Parore	*Girella tricuspidata*	Shallows, channels, soft sediment, reef, revetments, whole harbour	Mason and Ritchie (1979); Venus (1984); Brook (2002); Morrison (2003); Parsons et al. (2016)
Chironemidae	Hiwihiwi	*Chironemus marmoratus*	Reef, outer harbour	Brook (2002); Kerr and Moretti (2012)
Aplodactylidae	Marblefish	*Aplodactylus arctidens*	Revetments	Spyksma (2018)
Cheilodactylidae	Red moki	*Cheilodactylus spectabilis*	Reef, revetments, outer harbour	Brook (2002); Kerr and Moretti (2012); Spyksma 2018
Mugilidae	Yellow-eyed mullet	*Aldrichetta forsteri*	Shallows, soft sediment, whole harbour	Morrison (2003)

Family	Common name	Scientific name	Observed habitat	Reference
	Grey mullet	*Mugil cephalus*	Channels, soft sediment	Mason and Ritchie (1979)
Pomacentridae	Two-spot demoiselle	*Chromis dispilus*	Reef, revetments, outer harbour	Venus (1984); Brook (2002); Spyksma 2018
Labridae	Sandager's wrasse	*Coris sandeyeri*	Revetments	Spyksma (2018)
	Spotty	*Notolabrus celidotus*	Shallows, soft sediment, reef, revetments, whole harbour	Venus (1984); Brook (2002); Morrison (2003); Parsons et al. (2016)
	Purple wrasse	*Notolabrus fucicola*	Reef, outer harbour	Brook (2002); Kerr and Moretti (2012)
	Scarlet wrasse	*Pseudolabrus miles*	Reef, outer harbour	Brook (2002); Kerr and Moretti (2012)
Odacidae	Butterfish	*Odax pullus*	Reef, outer harbour	Kerr and Moretti (2012)
Pinguipedidae	Blue cod	*Parapercis colias*	Reef, outer harbour	Brook (2002)
Tripterygiidae	Spotted robust triplefin	*Forsterygion capito*	Reef, outer harbour	Brook (2002)
	Yellow-and-black triplefin	*Forsterygion flavonigrum*	Reef, outer harbour	Brook (2002)
	Common triplefin	*Forsterygion lapillum*	Reef, revetments, outer harbour	Brook (2002); Spyksma (2018)
	Oblique swimming triplefin	*Forsterygion maryannae*	Reef, revetments, outer harbour	Venus (1984); Spyksma (2018)
	Banded triplefin	*Forsterygion malcolmi*	Reef, outer harbour	Brook (2002)
	Estuarine triplefin	*Forsterygion nigripenne*	Shallows, soft sediment, upper harbour	Morrison (2003)
	Variable triplefin	*Forsterygion varium*	Reef, revetments, outer harbour	Brook (2002); Spyksma (2018)
	Blue-eyed triplefin	*Notoclinops segmentatus*	Reef, outer harbour	Brook (2002)
	Longfinned triplefin	*Ruanoho decemdigitatus*	Reef, outer harbour	Brook (2002)

Family	Common name	Scientific name	Observed habitat	Reference
	Spectacled triplefin	*Ruanoho whero*	Reef, revetments, outer harbour	Brook (2002); Spyksma (2018)
Blenniidae	Crested blenny	*Parablennius laticlavius*	Reef, outer harbour	Brook (2002)
Gobiidae	Bridled goby*	*Arenipobius bifrenatus*	Shallows, soft sediment, upper harbour	Morrison (2003)
	Exquisite goby	*Favonigobius exquisitus*	Shallows, soft sediment, mainly upper and mid harbour	Morrison (2003); Parsons et al. (2016)
	Sand goby	*Favonigobius lentiginosus*	Shallows, soft sediment, mainly mid and outer harbour	Morrison (2003)
Pleuronectidae	Speckled sole	*Peltorhamphus latus*	Shallows, soft sediment, whole harbour	Morrison (2003)
	Yellow-belly flounder	*Rhombosolea leporina*	Shallows and channels, soft sediment, upper and mid harbour	Mason and Ritchie (1979); Morrison (2003)
	Sand flounder	*Rhombosolea plebia*	Shallows and channels, soft sediment, whole harbour	Mason and Ritchie (1979); Morrison (2003)
Monacanthidae	Leatherjacket	*Meuschenia scaber*	Soft sediment and reef, mid to outer harbour	Brook (2002); Parsons et al. (2016)

* Introduced species

6.7 KEY CONCLUSIONS ON BENTHIC COMMUNITIES

In summary, the available data indicates that Whangārei Harbour sustains a diverse assemblage of infaunal and epifaunal benthic taxa and fish communities. Benthic communities in the upper sections of Hātea and Mangapai Rivers are clearly distinct and typical of those found in upper estuary systems. Further out into the harbour, the community patterns are more diverse. Large-scale data from 2012 suggests that the intertidal benthic community in Marsden Bay, including the OTP-MB SEA adjacent to Northport, is similar to that found at sites in other northern, southern and upper harbour SEAs. Those communities were notable for their relatively high counts of pipi and cockles. Finer-scale intertidal sampling (Knue & Poynter 2021) confirmed the area in and around the proposed dry-dock facility contains high benthic diversity with variation along and down the shore. Subtidal sampling also showed that benthic macrofaunal diversity is very high, with epifaunal taxa, including sponges, bryozoans, macroalgae, scallops, horse mussels and octopuses.

7 ASSESSMENT OF ECOLOGICAL EFFECTS

7.1 THE SYSTEM

Potential effects are assessed using a system-wide approach, which recognises that the scale of effects from the proposed activities is proportional to the size and sensitivity of the area of indigenous biodiversity. The consolidation, review, and analysis of existing information illustrates that the harbour ecological system is made up of at least four distinct zones:

- the outer harbour and entrance including flood and ebb tide deltas, a channel complex, and relatively narrow intertidal sandflats;
- Pārua Bay, on the northern shore of the harbour, which is a largely enclosed, sheltered, depositional inlet;
- the mid-harbour between the shell bank that historically traversed the main channel and Limestone Island, with its broad intertidal and subtidal flats, and channel system;
- the sheltered upper harbour, that splits into Hātea and Mangapai Rivers, which narrow upstream and become increasingly influenced by freshwater inputs and adjoining landuses.

The proposed dry-dock sits within Marsden Bay and the broader outer harbour and entrance zone (OHEZ, Figure 61). Marsden Bay stretches from the western edge of Northport to One Tree Point. For the purpose of this assessment, the Marsden Bay intertidal zone was mapped as the area above chart datum using LINZ marine chart data. The extent of the Marsden Bay subtidal zone was defined using a combination of LINZ chart datum contour, the 5 m depth contour and the outer margin of Northport wharf (Figure 62). The upper extent of the intertidal was also clipped to a margin of mangrove forests within Blacksmiths Creek.

The footprint of the proposed shipyard and drydock also overlaps the OTP-MB SEA (Figure 62 and Figure 64). Note that existing information indicates that the values of ecological habitats and communities within the footprint are similarto those within the SEA.

The OHEZ is a physically complex zone subject to strong currents with around 606 ha above chart datum and 1,970 ha below chart datum. It contains diverse physical habitats, extensive areas of biogenic habitat (including extensive shell gravel beds, seaweed meadows, seagrass beds, sponges, horse mussels, scallops, and significant beds of other shellfish). This is reflected in the high diversity of ecological taxa in that zone. The coastal margin and central area of this zone almost completely consist of SEAs (and a marine reserve), with areas that have not been mapped as SEAs mainly consisting of subtidal channels (see Figure 15).

Breakdowns of the spatial extent of the intertidal and subtidal habitat affected by reclamation and Stage I of the proposed shipyard drydock and associated dredging activity are provided in Table 4 and associated maps (Figure 64 & Figure 65). The second stage involves deepening of around 34 ha of subtidal channel covered by existing and proposed[25] Northport dredging consents down to a basin depth of 18 m (i.e. increasing depths by around 2 m to 3.5 m), and slightly increasing the extent of batter slopes by around 0.33 ha (Figure 66).

[25] An application was being processed at the time of writing.

Table 4: Approximate areas in hectares (ha) of proposed and consented drydock reclamation and dredging in the OTP-MB SEA , Marsden Bay and the OHEZ.

Feature	Zone	Area (ha)	Area Inside SEA (ha)	Area Outside SEA (ha)	Total Area (ha)	% of Tidal Zone in SEA	% of Tidal Zone in Marsden Bay	% of Tidal Zone in OHEZ
SEA	Intertidal	109						
SEA	Subtidal	65						
Marsden Bay	Intertidal	116						
Marsden Bay	Subtidal	89						
OHEZ	Intertidal	606						
OHEZ	Subtidal	1970						
Dredging	Intertidal		0.04	0.16	0.20	0.04	0.17	0.03
Dredging	Subtidal		0.00	1.31*	1.31	0.00	1.48	0.07
Dredging	**Combined**		**0.04**	**1.47**	**1.51**	**0.02**	**1.65**	**0.06**
Dry Dock	Intertidal		2.89	2.00	4.89	2.64	4.21	0.81
Dry Dock	Subtidal		0.48	3.85	4.33	0.74	4.88	0.22
Dry Dock	**Combined**		**3.37**	**5.85**	**9.22**	**1.93**	**9.09**	**0.36**
Revetment	Intertidal		0.23	0.00	0.23	0.21	0.20	0.04
Revetment	Subtidal		0.09	0.18	0.27	0.14	0.30	0.01
Revetment	**Combined**		**0.32**	**0.18**	**0.50**	**0.18**	**0.50**	**0.02**
Bird Roost	Intertidal		0.24	0.00	0.24	0.22	0.21	0.04
Total Reclamation	**Intertidal**		**3.36**	**2.00**	**5.36**	**3.07**	**4.61**	**0.89**
	Subtidal		**0.57**	**4.03**	**4.60**	**0.88**	**5.19**	**0.23**
Grand Total	*Combined*		*3.97*	*7.50*	*11.47*	*2.28*	*11.24*	*0.45*

* Excludes the 19.63 ha area covered by Northport's existing dredging consent.

Figure 61: Outer harbour and entrance zone defined for this assessment, with areas above (intertidal) and below (subtidal) chart datum overlaid (based on LINZ bathymetry data). The Marsen Bay SEA and proposed drydock and dredging footprints are shown.

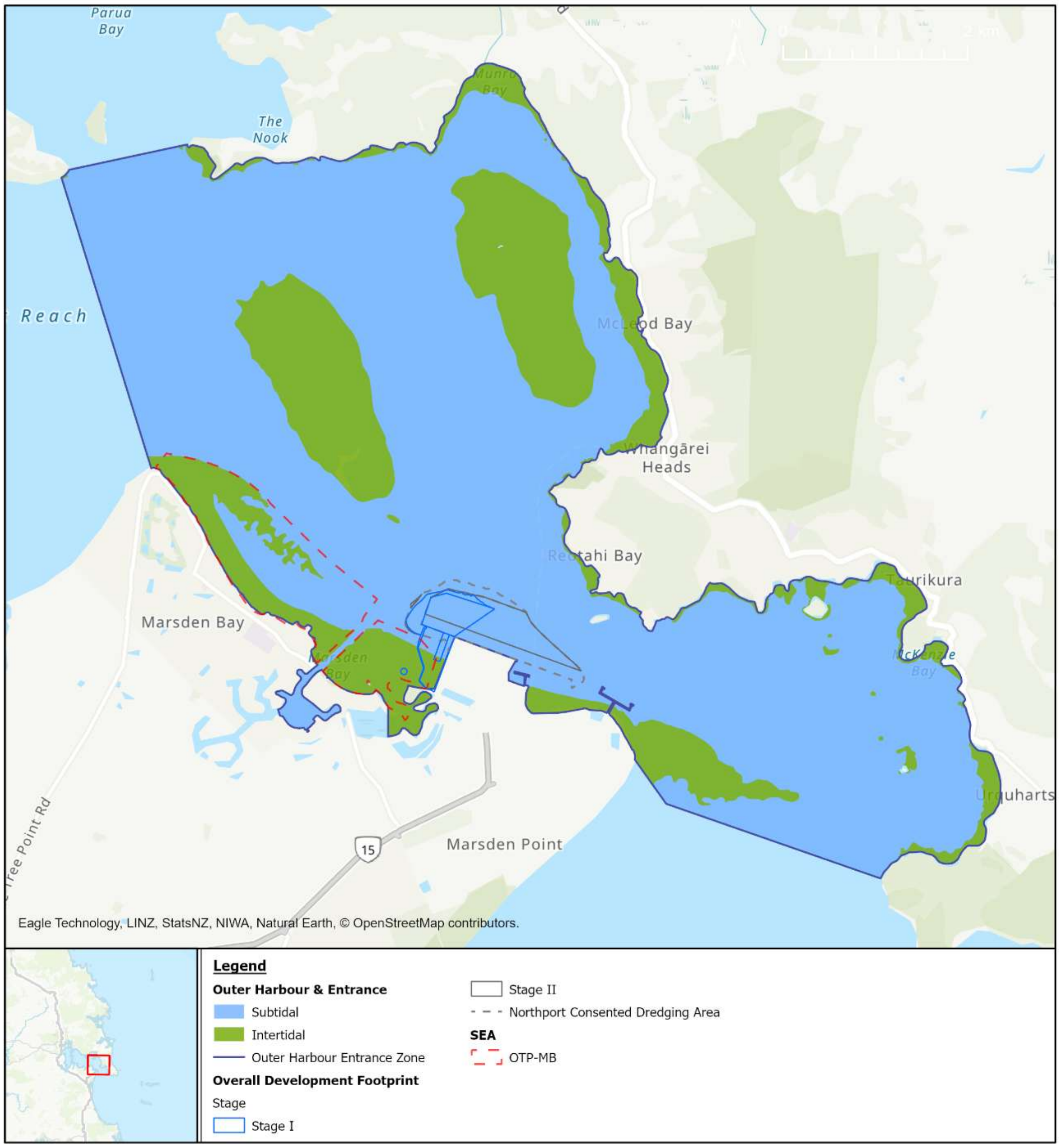


Figure 62: Marsden Bay with intertidal and shallow subtidal areas defined for this assessment overlaid (based on LINZ bathymetry data). The size of each area is provided (hectares rounded to two decimal places). The One Tree Point to Marsden Bay SEA and proposed drydock and dredging footprints are also shown.

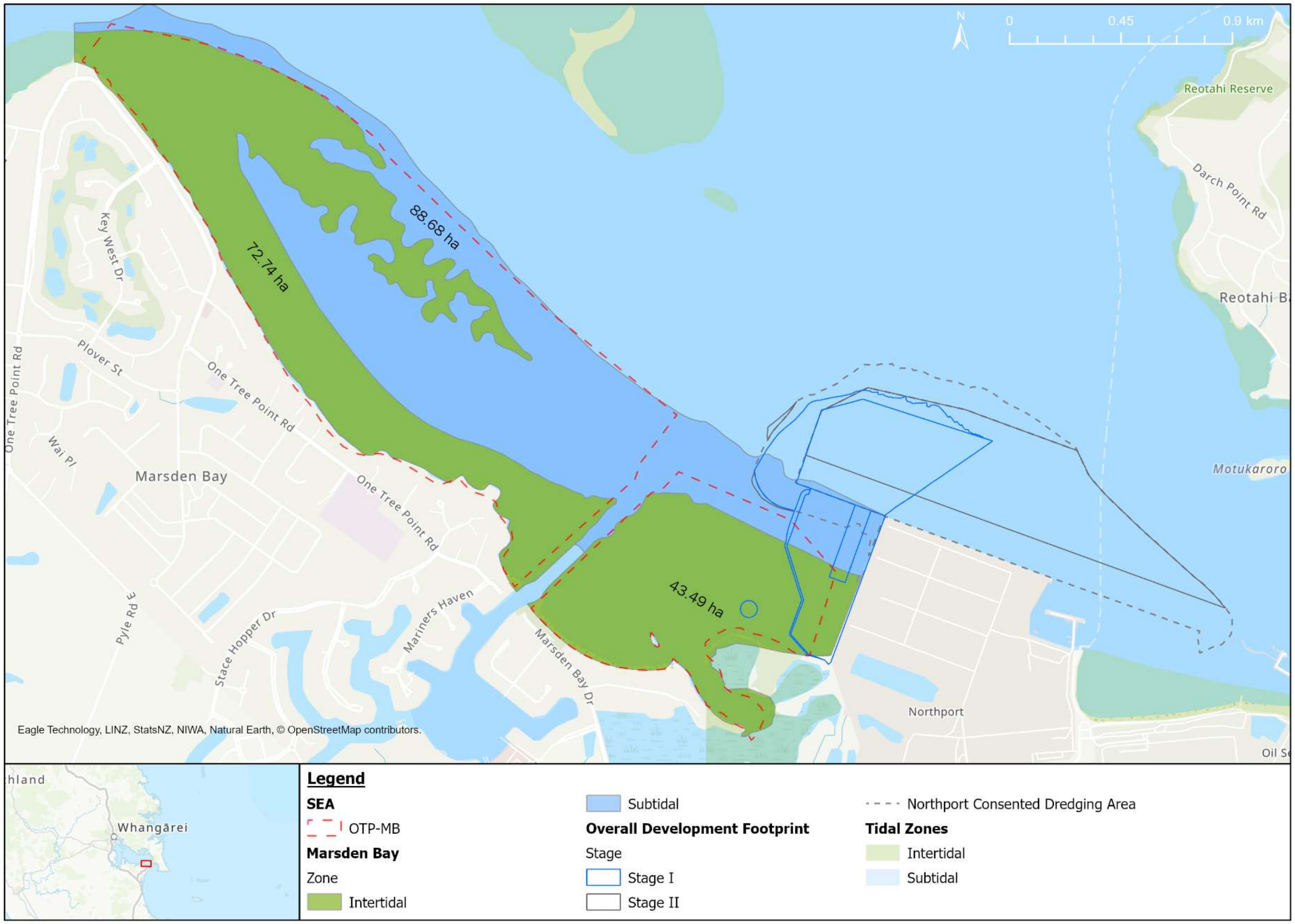


Figure 63: One Tree Point to Marsden Bay SEA showing areas above (intertidal) and below (subtidal) chart datum overlaid (based on LINZ bathymetry data). The proposed drydock and dredging footprints are also shown. The size of each area is also provided (hectares rounded to two decimal places).

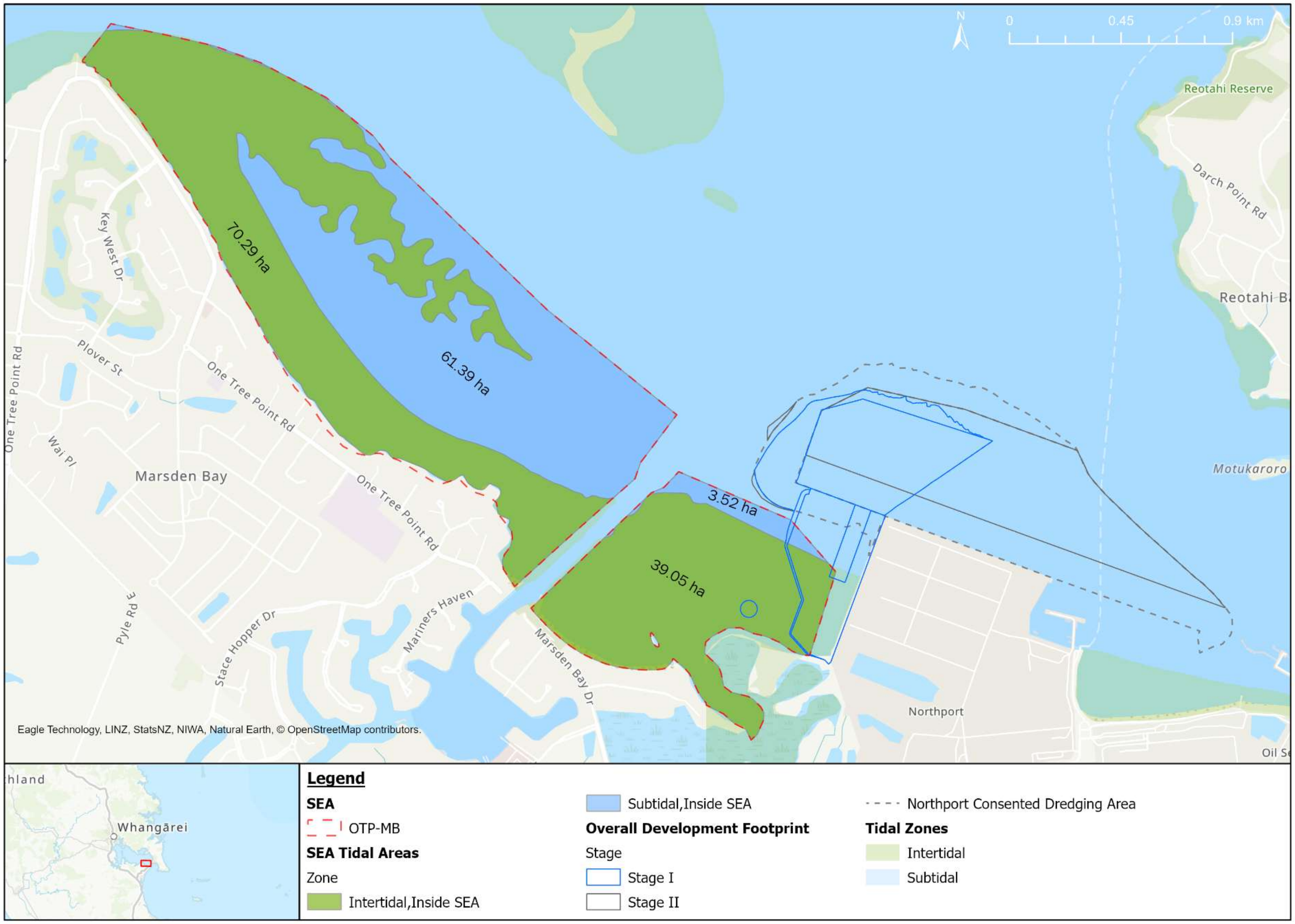


Figure 64: Coverage of ecological zones within Stage I of the proposed drydock reclamation and dredging areas (including the area that overlaps Northport's (NP) consented dredging area). The size of each area is also provided in hectares rounded to two decimal places.

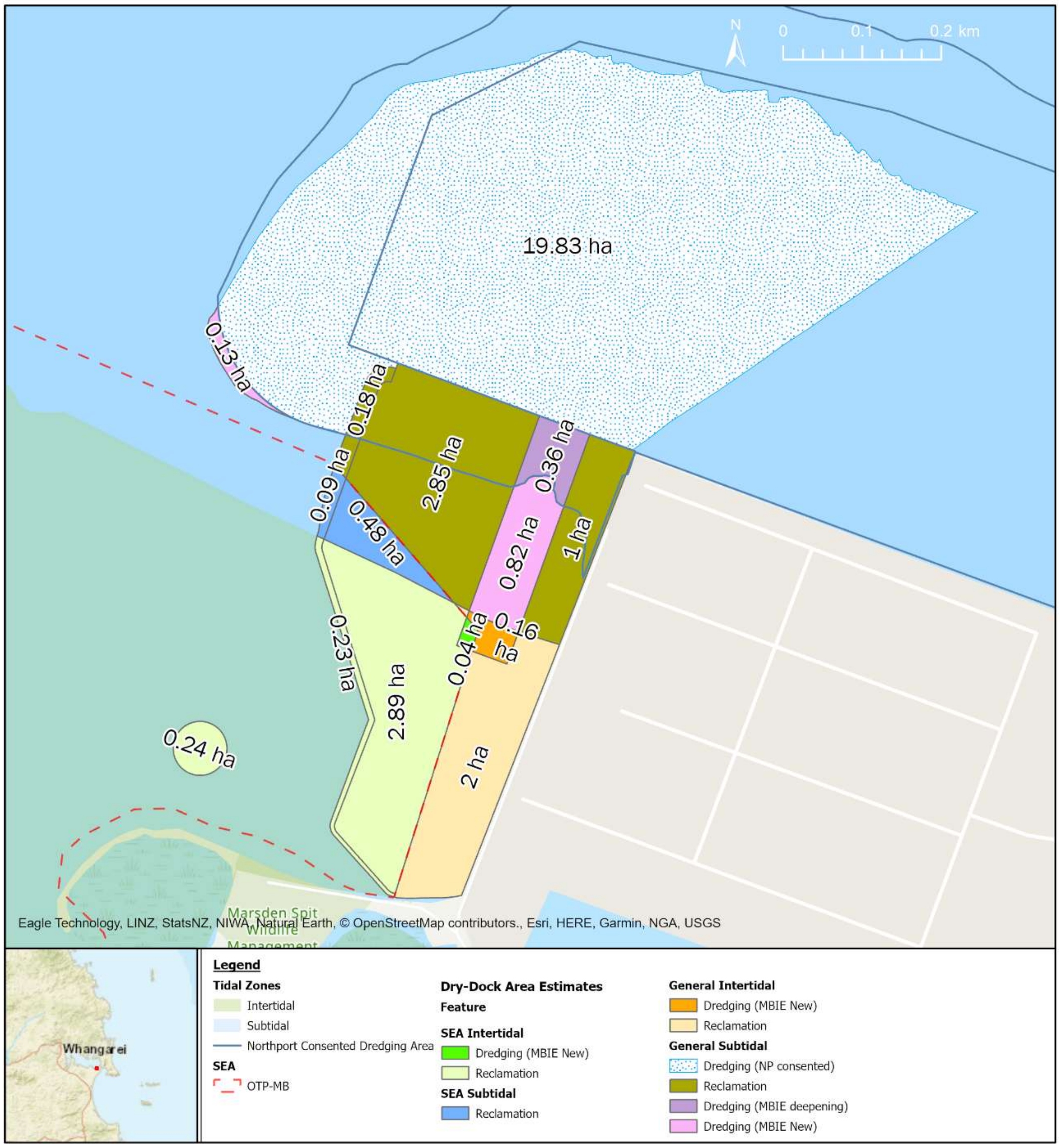


Figure 65: Proposed Stage I dredging layout.

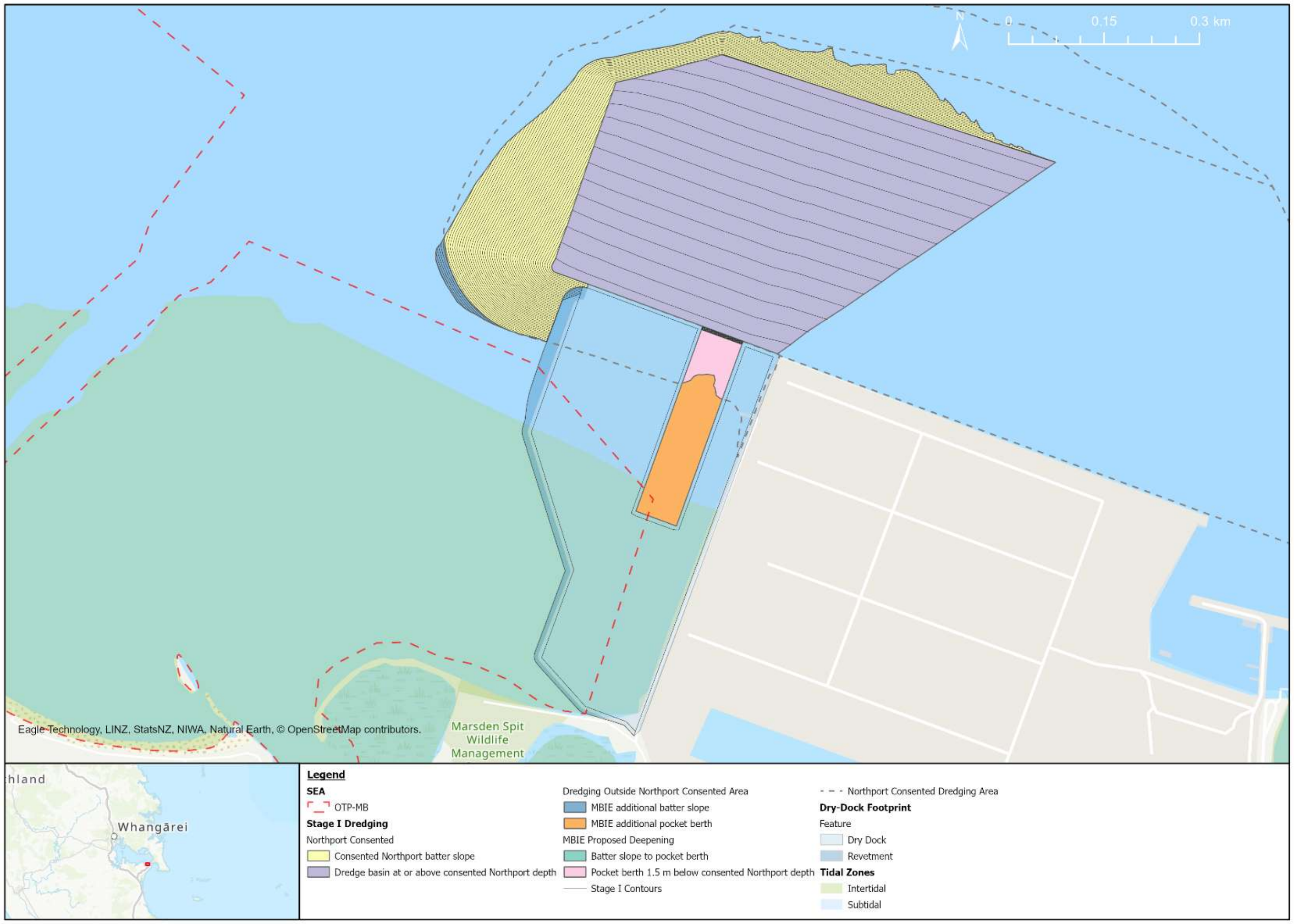
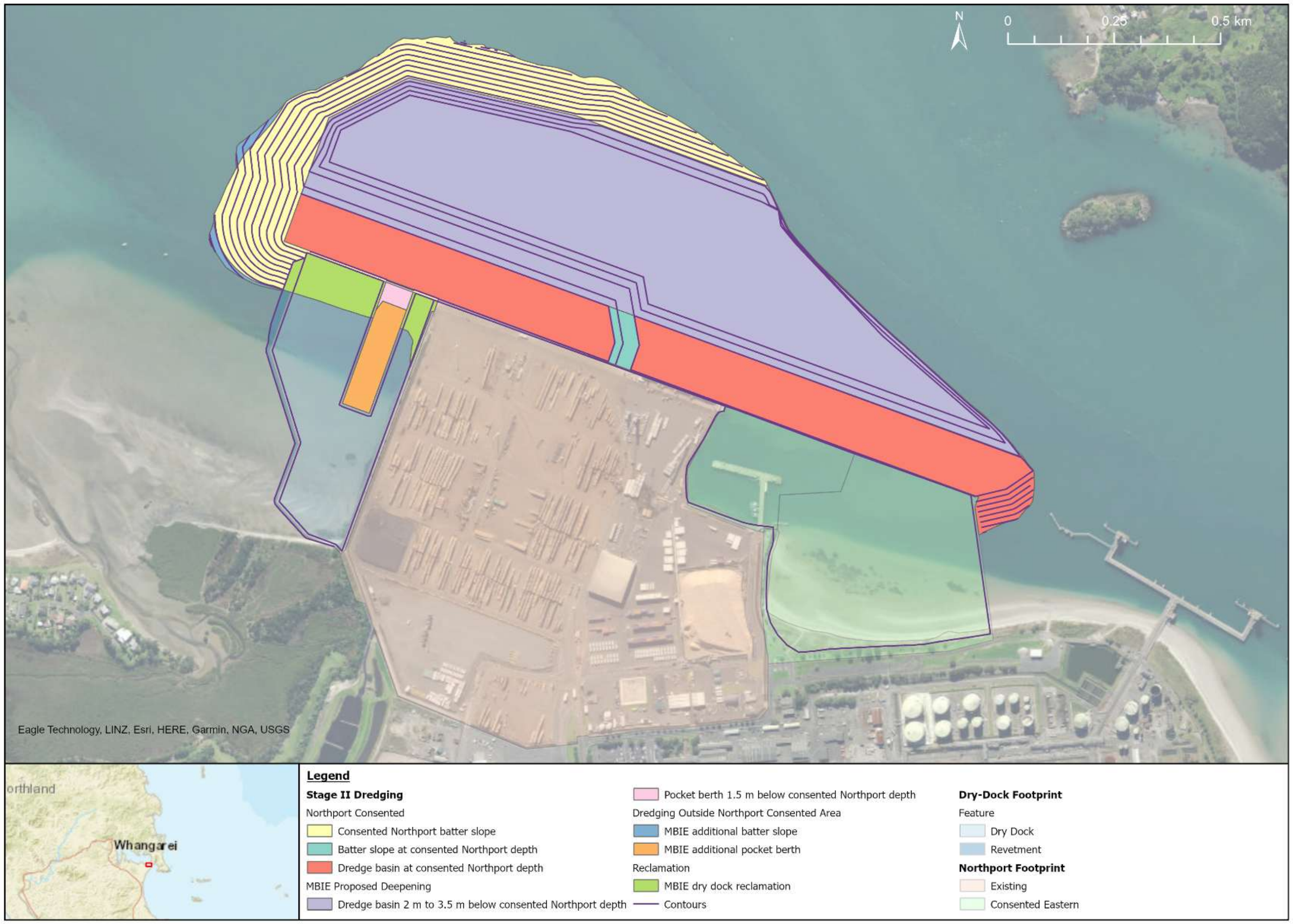


Figure 66: Proposed Stage II dredging layout.



7.2 ASSESSING / RANKING THE SIGNIFICANCE OF EFFECTS

Adverse effects occur along a continuum ranging from no effects on the values of interest to their complete loss. The Environmental Institute of Australia and New Zealand (EIANZ) guidelines rank the level of adverse environmental effects using five categories, which are determined using a matrix of ecological value and magnitude of effect (Roper-Lindsay et al. 2018, Table 5).

The EIANZ guidelines for assessing the magnitude of effect are provided in Table 6. Criteria for ranking ecological values in marine habitats have also been developed by the EIANZ. However, those guidelines were not considered appropriate for this assessment because:

- Metrics used by the guidelines, such as the Auckland Council (AC) or National Benthic Health Model (BHM) were developed using intertidal (not subtidal) data from Auckland that was obtained over a limited time period, and it is not clear how representative or robust the model is for other areas or time periods. Monitoring has shown that scores produced by the BHM can vary over time, even when there has been little discernible change in environmental quality.
- Multiple criteria are used to rank ecological values. However, sites (including Marsden Bay) meet criteria from several rankings (e.g., the surrounding benthic invertebrate community has very high diversity and abundance (i.e., it meets that criteria for a Very High ranking), it contains moderately modified physical habitat (i.e., it meets that criteria for a Moderate ranking), and it does not contain any threatened coastal ecosystems (i.e., it meets that criteria for a Low ranking)).

Ecological values were therefore assessed using information gathered through the literature review, assessments conducted by Coast and Catchment, and expert knowledge.

Quality Planning also provides guidelines for ranking adverse effects for RMA purposes, using six categories. They take into account both the magnitude of effects and their potential to be remedied or mitigated (Quality Planning 2017). Unlike terrestrial and freshwater ecosystems, few practicable and proven options are available for actively remedying or mitigating most marine impacts. We have therefore adopted the EIANZ guideline terminology for assessing the magnitude and level of marine effects in this report (Table 5 & Table 6).

In this report:

- "Low" EIANZ level effects are considered to be a "less than minor" effect under the applicable RMA planning/legal framework;
- "Moderate" level EIANZ effects are considered to straddle a "minor" and "more than minor" range effect under the applicable RMA planning/legal framework;
- "High" to "Very High" level EIANZ effects are considered to be "Significant" effects under the applicable RMA planning/legal framework.

Table 5: Criteria for describing the level of effects (taken from Roper-Lindsay et al. 2018).

	Ecological Value				
Magnitude	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Table 6: Ranking systems developed by the EIANZ (Roper-Lindsay et al. 2018) for assessing the magnitude of adverse environmental effects.

EIANZ guidelines	
Magnitude	Description
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.

7.3 RECLAMATION AND DREDGING – GENERAL

Reclamation and dredging have direct and indirect effects on marine biota. They include:

- Loss of marine habitat and biota living within reclamation and dredging footprints, with associated effects on related values, including ecological biodiversity, productivity, and other environmental services.
- Indirect effects arising from alteration to currents, waves and/or sedimentation patterns.
- The effects of sediment suspension, dispersal, and deposition beyond dredged areas.
- Displacement of species that utilise the reclamation areas, but do not permanently live within them.

- Effects associated with hardening the shoreline around reclamations.
- Construction-related effects associated with establishing temporary staging areas or having machinery working in the CMA beyond the reclamation footprint. Such effects tend to occur immediately after activity starts and recover relatively quickly after activity ceases. Note that we understand physical work will be contained within the reclamation footprint, so direct physical effects beyond that footprint are not expected.

Around 5.36 ha of habitat between mean high-water spring and chart datum and 4.6 ha of habitat below chart datum will be lost beneath the proposed reclamation (including the proposed bird roost).

The proposed development also requires capital dredging to create turning and pocket basins, and to obtain fill for the dry-dock reclamation. Stage 1 involves the dredging of around 20.76 ha of subtidal seabed, of which around 19.63 ha is within an area covered by an existing Northport dredging consent. The second stage involves deepening of around 34 ha of subtidal channel covered by existing and proposed Northport dredging consents down to a basin depth of 18 m (i.e. increasing depths by around 2 m to 3.5 m) and slightly increasing the extent of batter slopes by around 0.33 ha.

Effects associated with the first stage of dredging within the consented Northport area are considered to be part of the existing environment, and therefore, they have been excluded from the assessment of effects for the dry-dock dredging. However, they are included in the assessment of cumulative effects. The first stage of dredging involves an additional 0.2 ha of intertidal habitat (of which around 0.04 ha is within the OTP-MD SEA) that will be dredged for the pocket berth, converting it to subtidal habitat. Consequently, with the consented Northport dredging area excluded, the proposed reclamation and Stage 1 dredging area covers around 11.47 ha (11.24%) of intertidal and shallow subtidal habitat in Marsden Bay, with around 3.97 ha of that area covering around 3.07% of the intertidal and 0.88% of the subtidal habitat within the OTP-MB SEA. Substrates within the proposed reclamation area consist of open, sandy intertidal sediments, sandy/shelly subtidal sediments (see Figure 6, Figure 47 and Figure 70), and a rock revetment running along the western edge of the Northport hardstand. Numerous burrows, excavation mounds, ray pits, and tracks of mobile macrofauna indicate high levels of biological activity in mid to low tide sediments. The area also contains patches of seagrass and a small area of mangroves. Reclamation and the creation of a bird roost will lead to the permanent loss of habitat and biota within their footprints.

Dredging results in the unavoidable loss of surface substrates, epibiota and infauna within the area directly affected. Estimated recovery times of benthic communities following the cessation of dredging depend on the substrates and communities present. Rates of recovery reported in the literature indicate that recovery takes: 6–8 months for muddy communities; 2–3 years for sandy/gravelly communities; and 5–10 years for coarser sediment communities (see Newell et al. 1998 for review). Consequently, regularly dredged areas with coarse sediments are unlikely to fully recover between events. Furthermore, a permanent change in community composition can occur if the characteristics of subsurface substrates that are exposed by dredging differ from the original seabed substrates.

Drydock reclamation and Stage I dredging are also predicted to have consequential impacts on currents (Berthot et al. 2026c, Figure 67). They include reducing current speeds within the dredge footprint and in the lee of the drydock reclamation area. Mean current speeds are predicted to decrease by 18.8% at a modelled site (Site 10) within the Stage I basin, with minor changes of -2.1% to +2.7% at other modelled sites located east and west of the Stage I basin. An ebb tide reduction of approximately 0.2 m/s (0.39 knots) is predicted for a site within the pipi bed in the lee or the proposed drydock (i.e. Site 6), while a substantial increase is predicted along the existing Northport wharf face during ebb tides.

Changes to current speeds become more pronounced after the second stage of dredging is complete and Northport is fully developed (Figure 68). Reductions in current speed of -30.7% to -15.3% are predicted for modelled sites within the expanded dredge basin, and -16% for a site slightly east. Slight increases of 0.8% and 3% are predicted for other modelled sites east and west of the Stage II dredged area. As with Stage I, a reduction in ebb tide current speed is predicted for the site within the pipi bed (Berthot et al. 2026c).

Sediment mobilisation during dredging operations also has the potential to adversely affect marine biota in surrounding areas by increasing turbidity and sediment deposition. The magnitude of off-site effects will depend upon:

- the amount of suspended sediment generated (which depends on factors including dredging methods, sediment characteristics, the duration and timing of dredging, and the amount of sediment dredged);
- dispersal and dilution;
- background concentrations of suspended sediment and turbidity;
- depositional depths;
- sediment quality; and,
- species sensitivity.

High levels of suspended sediment can cause:

- Reduced growth or mortality or a depth restriction of subtidal macroalgae and seagrass due to a reduction in light levels. For example, sediment mobilised during maintenance dredging in Tauranga Harbour was found to increase light attenuation[26] by 46%. However, this was less than the natural variation in light attenuation between high tide and low tide (70%) (Coppede Cussioli 2018).
- Reduced filtration and clearance rates, reduced growth and lower survival of shellfish and other filter feeders. For example, adult pipis, cockles and scallops can continue to feed at high concentrations of suspended sediment for short durations (<1 week), but in the long term, show adverse effects at total suspended sediment (TSS) concentrations of more than 60–70 mg/l, 300–350 mg/l, and 100 mg/l, respectively (Wilber & Clarke 2001; Nicholls et al. 2003; Hewitt & Norkko 2007; Coppede Cussioli 2018). Horse mussels are also sensitive to suspended sediment and show adverse effects on condition at 80 mg/l (Ellis et al. 2002).
- Negative effects on deposit feeders. Concentrations above 300 mg/l for 9 days adversely affected the intertidal wedge shell *Macomona liliana*. After 14 days of high exposure, most wedge shells had died or were lying exposed on the surface (Gibbs & Hewitt 2004).Negative effects on deposit feeders. Concentrations above 300 mg/l for 9 days adversely affected the intertidal wedge shell *Macomona liliana*. After 14 days of high exposure, most wedge shells had died or were lying exposed on the surface (Gibbs & Hewitt 2004).

The adverse effects of terrigenous sediment deposits on intertidal marine biota are well known and include both lethal and sublethal effects (Gibbs and Hewitt 2004). However, the chemical and physical properties of terrigenous sediments differ from marine sediments, and ecological responses are also likely to differ. The deposition of marine sediments in intertidal areas appears to be poorly studied, but it

[26] The reduction in light intensity as it travels through water due to absorption or scattering of photons.

is reasonable to assume that biota in energetic areas (such as Marsden Bay) are adapted to living in dynamic environments where marine sediments are regularly resuspended and redeposited by wave action. Such processes are known to occur in Marsden Bay, where Swales et al. (2013) reported that sediments had a thin surface mixed layer, 0 to 1 cm deep, composed of laminated sands and silts consistent with wave resuspension.

In contrast to the effects of deposition in intertidal areas, there is a considerable amount of information on the effects of depositing marine sediments in subtidal areas. Available information from monitoring and assessment studies generally indicates that those effects are relatively minor and short-lived (e.g., Roberts & Forrest, 1999; Paavo 2007). For example, disposal of muddy spoil in a high-energy area off Aramoana, Otago, was found to result in a change in community composition and a decrease in abundance, but within a month, the fine sediments were dispersed and the macrofaunal community had recovered to the pre-existing state (Paavo, 2007). Similarly, Roberts and Forrest (1999) found that macrofaunal communities subjected to spoil disposal in Nelson recovered within six months, and no long-term, cumulative effects were discernible.

Dredge disposal studies have not found significant difference between disposal and control sites (e.g., West 2010; Edhouse et al. 2014), which may be due to the temporary nature of any impact and the time elapsed between deposition and monitoring. Where significant effects in the benthic community have been found, these are generally related to minor changes in community composition (Halliday et al. 2008; Sneddon & Atalah 2018), and are small in comparison to temporal changes observed across all sites (Sneddon & Atalah, 2018).

It should be noted that the studies referred to above relate to discrete, bulk deposits of dredged material, as opposed to the proposed situation, where sediment is dispersed in plumes and gradually deposited. The proposed drydock also differs in that the areas affected by deposition from dredge plumes contain extensive biogenic habitat, which includes large sessile filter feeders, macroalgae meadows and shell. Those features are likely to be particularly sensitive to high suspended sediment concentrations and smothering. Negative impacts on the health of marine biota may be compounded if contaminants are present in dredged sediments. However, available information indicates this is not an issue in the proposed dredging area (see Section 5.1.1).

The following sections consider the potential for such effects at three scales:

1. The OHEZ system;
2. Marsden Bay; and,
3. The One Tree Point–Marsden Bay SEA.

Figure 67: Modelled current vectors associated with the proposed drydock layout, with changes in current magnitudes compared to existing currents during the peak flood and ebb spring tides overlaid (adapted from Berthot et al. 2026c).

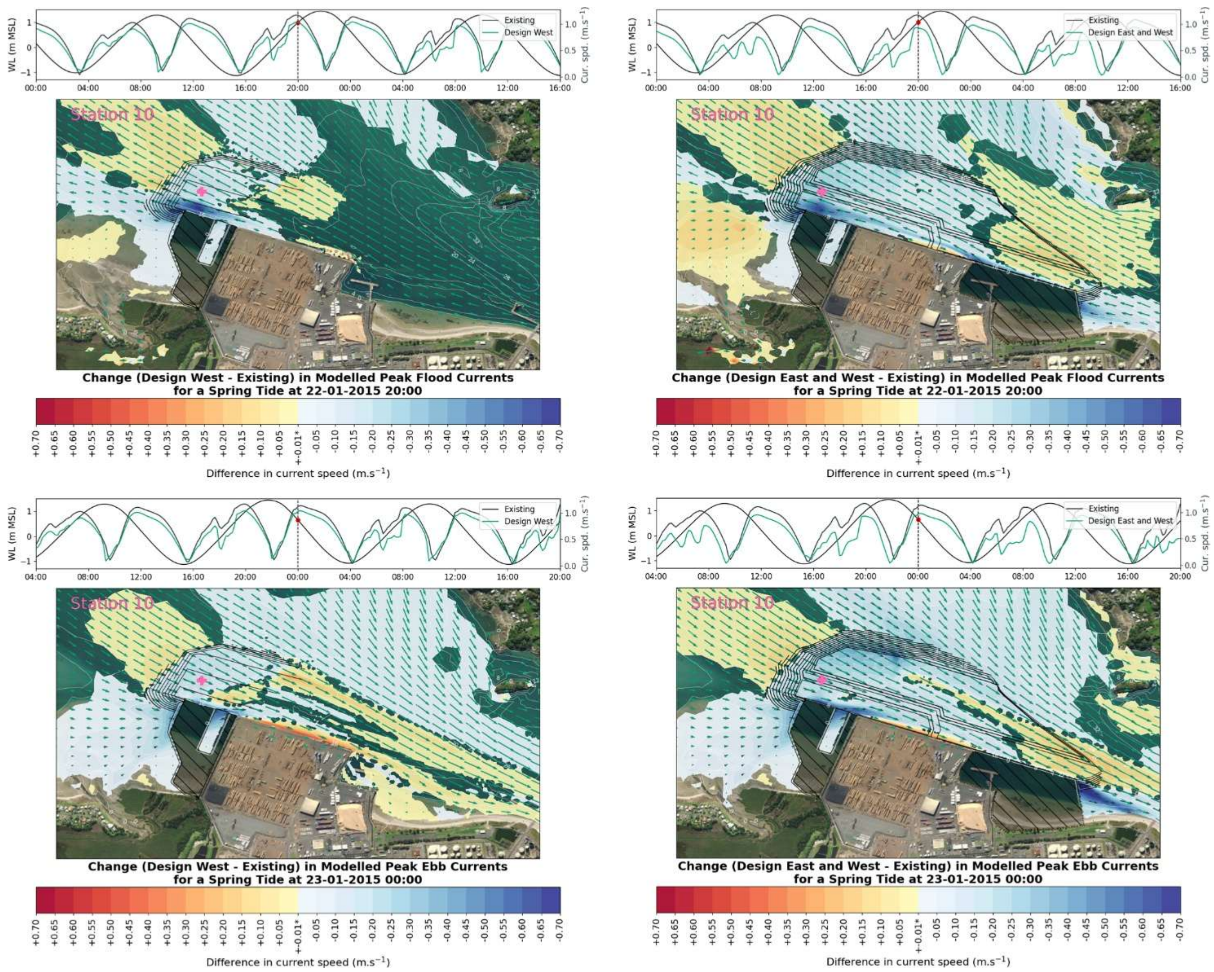
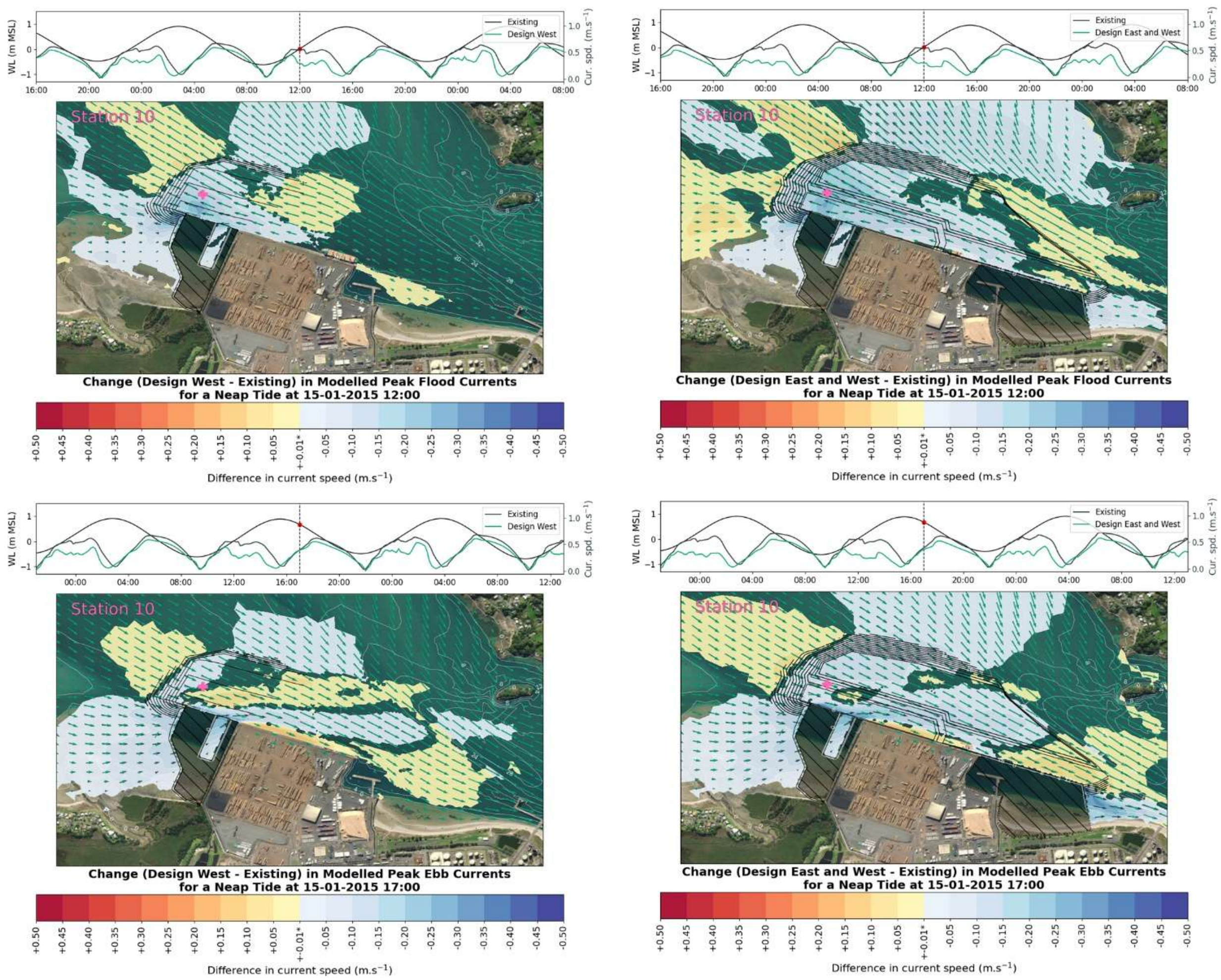


Figure 68: Modelled current vectors associated with the proposed drydock layout, with changes in current magnitudes compared to existing currents during the peak flood and ebb neap tides overlaid (adapted from Berthot et al. 2026c).



7.3.1 EFFECTS ON INTERTIDAL SEDIMENT HABITATS AND MACROFAUNA

7.3.1.1 VALUES

Whangārei Harbour contains around 6000 ha of intertidal habitat.[27] Harbour-wide assessments (Griffiths 2012b; Lundquist & Broekhuizen 2012; Griffiths & Gilbert 2025), suggest that sandy sediments, similar to those in Marsden Bay, comprise a large proportion of that area (see Figure 4). NRC monitoring data (Griffiths 2012a) indicated that intertidal sites in Marsden Bay:

- Had relatively low taxa diversity compared to other sites in Whangārei Harbour (although the number of taxa recorded in the three Marsden Bay sites (n=59) indicates that diversity was still reasonably high).
- Did not contain taxa unique to the Marsden Bay sites.

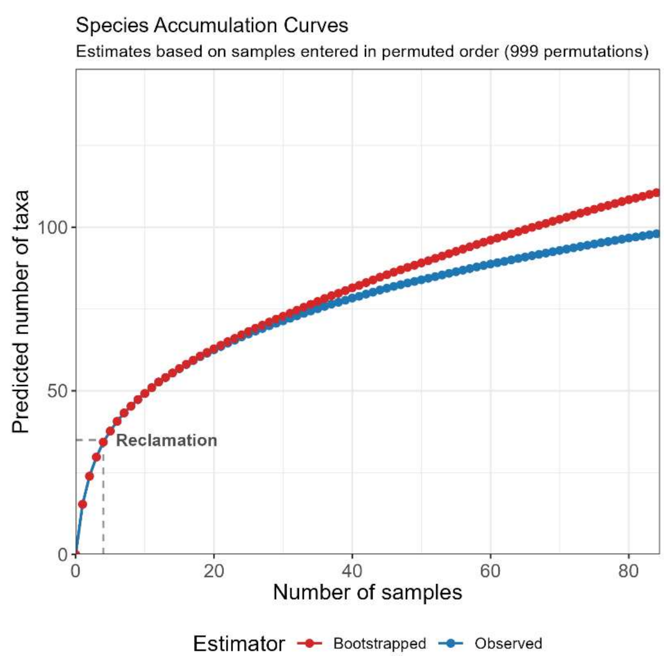
[27] According to Hume et al. (2016) the harbour has a total area of around 10,400 ha of which 58% (i.e. 6032 ha) is intertidal.

- Had a benthic community whose composition was statistically similar to five other sites in the outer, mid and upper harbour, and which together formed a "cluster" of similar sites that had the highest numbers of cockles and pipi in the harbour (compared to the seven other site clusters detected in the harbour). Numbers were patchy, but high counts of both species were obtained from sites near Northport in Marsden Bay.

However, high diversity values were recorded in more intensive Marsden Bay surveys carried out in 2020 (Knue & Poynter 2021) and 2022 (Kelly & Sim-Smith 2022) (see section 6.3.1). They showed that the intertidal flats contain a particularly diverse macrofaunal community (up to 100 taxa reported). The June 2022 survey also provided the most comprehensive dataset of intertidal macrofauna in Marsden Bay (involving the sampling of 84 intertidal stations between One Tree Point and Marsden Point – Section 6.3.1). Thirty-five taxa were obtained from the four samples collected within the proposed reclamation area (c.f. 97 taxa from all 84 sites). Species accumulation curves for Marsden Bay show that 35 taxa from the four reclamation area samples, corresponded well with the number of taxa expected from four samples (i.e. 34.3, see Figure 69). Two of those taxa were not obtained in samples taken from other stations:

- the tunnelling mud crab, *Austrohelice crassa*, which is common in muddy estuarine habitats; and,
- terrestrial fly larvae from the family Dolichopodidae (long-legged flies).

Figure 69: Species accumulation curves obtained from bootstrapped and observed results (999 permutations). Note that bootstrapped results provide estimates of absolute numbers of taxa (i.e. it is an approximation based on the likelihood that some taxa present in Marsden Bay, were not obtained during sampling), while permutation smooths the curve of observed results by repeated randomisation of the order that samples are plotted.



Marine ecological values within the intertidal footprint of the drydock were also viewed during a site visit conducted on 14 May 2026. Features of note included a small area of mangroves in the southeast corner of the proposed reclamation and discrete patches of seagrass scattered throughout intertidal and shallow subtidal areas. Numerous burrows, excavation mounds, ray feeding pits, bird foraging, and tracks of mobile macrofauna also indicated very high levels of biological activity occurred in the mid-lower tide area (Figure 70). Notably, those observations align with the OTP-MB SEA assessment sheet for Whangārei Harbour, which identifies "*shellfish and seagrass communities and associated benthic invertebrates are a major food source for shorebirds and a significant nursery and feeding area for many coastal fish species*" as a value (Northland Regional Council 2015). The existing port revetment also provides rocky habitat for common reef invertebrates, such as rock oysters (*Saccostrea glomerata*) and gastropods, including black nerita (*Nerita melanotragus*) and ridged whelk (*Diacathais orbita*).

Intertidal kai moana shellfish in Marsden Bay include (but may not be limited to) cockles, pipi and oysters.[28] Shellfish surveys (Cummings and Hatton (2003), Griffiths (2012b), Knue and Poynter (2021), Kelly & Sim-Smith 2022) have shown that cockles are common throughout Marsden Bay, but pipi mainly occur at the eastern end of the bay, in and around the proposed reclamation area, and near One Tree Point. High pipi counts have consistently been obtained from those areas. Fisheries surveys also indicate that patchy numbers of pipi occur on Marsden and Mair Banks, with some stations having high numbers (see Section 6.4.1).

The most recent surveys of Marsden Bay conducted in 2021 and 2022 showed that moderate to very high abundances of cockles occur on the mid shore across the entire length of Marsden Bay. Cockle densities within the proposed reclamation were representative of densities found throughout Marsden Bay. However, almost all the cockles found were below harvestable size (see Section 6.4.1). Very few pipi were present along most of the bay. However, juvenile pipi were present in the mid shore zone on the western side of Northport, with mean densities within this narrow bed (~50 m) of around 300/m^2 extending around 300 m out from the port revetment. The pipi bed straddles the eastern boundary of the OTP-MB SEA, the reclamation footprint of the proposed drydock, plus the footprints of the proposed bird roost, and consented Northport bird roost (see Section 6.4.1). High-resolution aerial images taken in 2024[29] show small mangroves (covering around 0.03 ha in 2024) and seagrass (covering around 0.16 ha in 2024) are also growing in and around intertidal areas within the proposed drydock reclamation (Figure 71). As noted earlier, seagrass is listed as an "At Risk" species under the New Zealand Threat Classification System (NZTCS) due to the seagrass population being very large, but subject to low to high ongoing or predicted decline. It is a native, non-endemic species that is secure overseas, with populations experiencing extreme fluctuations (de Lange et al., 2017).

Overall, the information summarised above indicates that the proposed reclamation footprint has high ecological values, which are similar to those in other intertidal areas within Marsden Bay. This ranking is consistent with, and reflects the RPN identification of OTP-MB as a significant ecological area.

[28] Rock oysters were observed during the May 2026 site visit, growing in a narrow band along Northport's revetment – see section 7.3.3.

[29] Composite aerial image "Northland 0.3m Rural Aerial Photos (2023-2025)" produced by NIWA (survey ID 1807) and downloaded from LINZ database.

Figure 70: Habitat types and signs of biological activity within the drydock reclamation footprint: A. sandflats in the mid to upper intertidal showing the small area of mangroves surrounded by seagrass; B. Existing revetment with a boulder face and intertidal and shallow subtidal patches of seagrass along its edge and out into the bay; C. Mid tide trails made by an unidentified gastropod; D. and E. Mid to low tide sediment mounds produced by burrowing macroinvertebrates; and, F. Numerous mid to low tide ray feeding pits (highlighted with arrows).

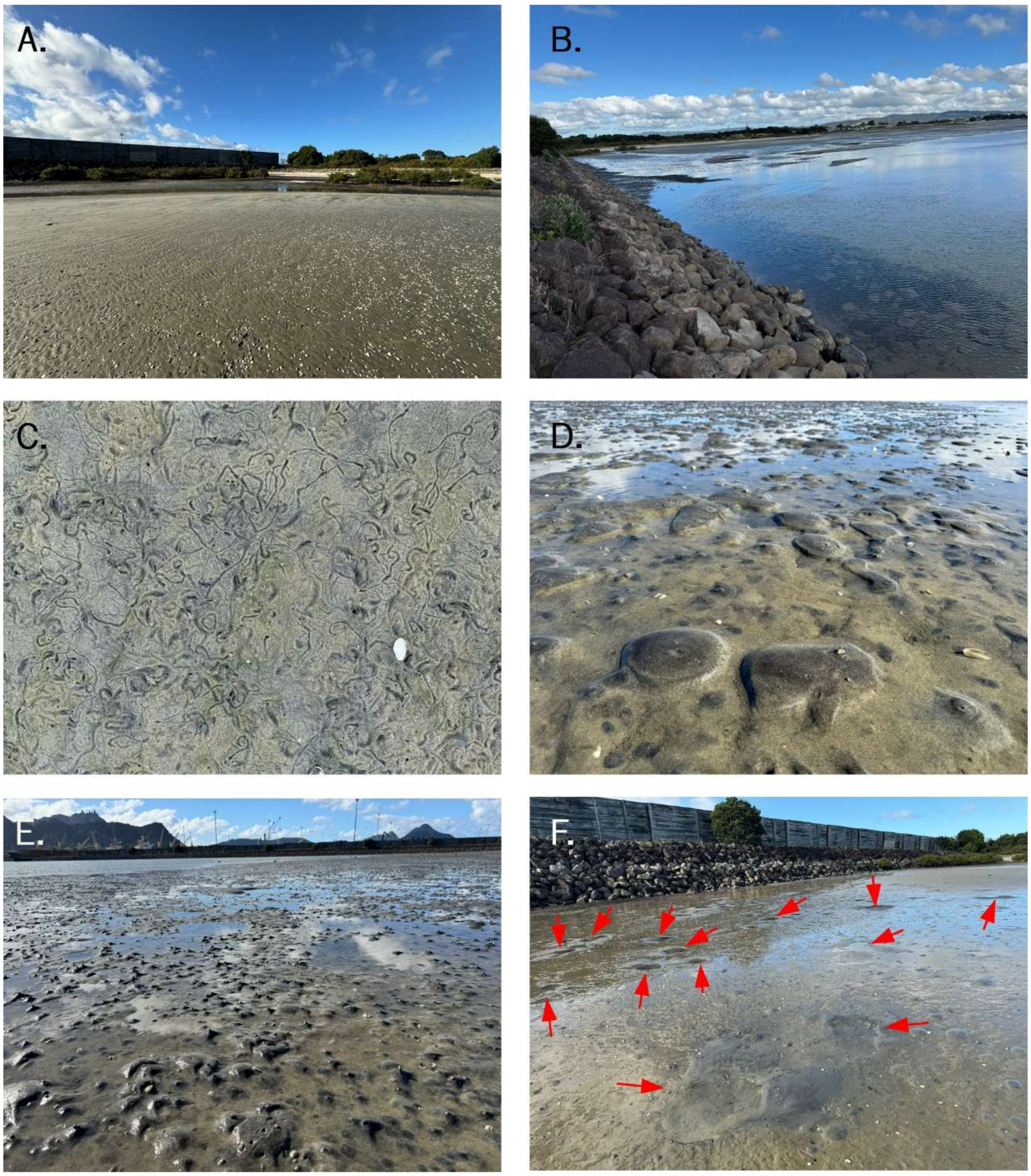
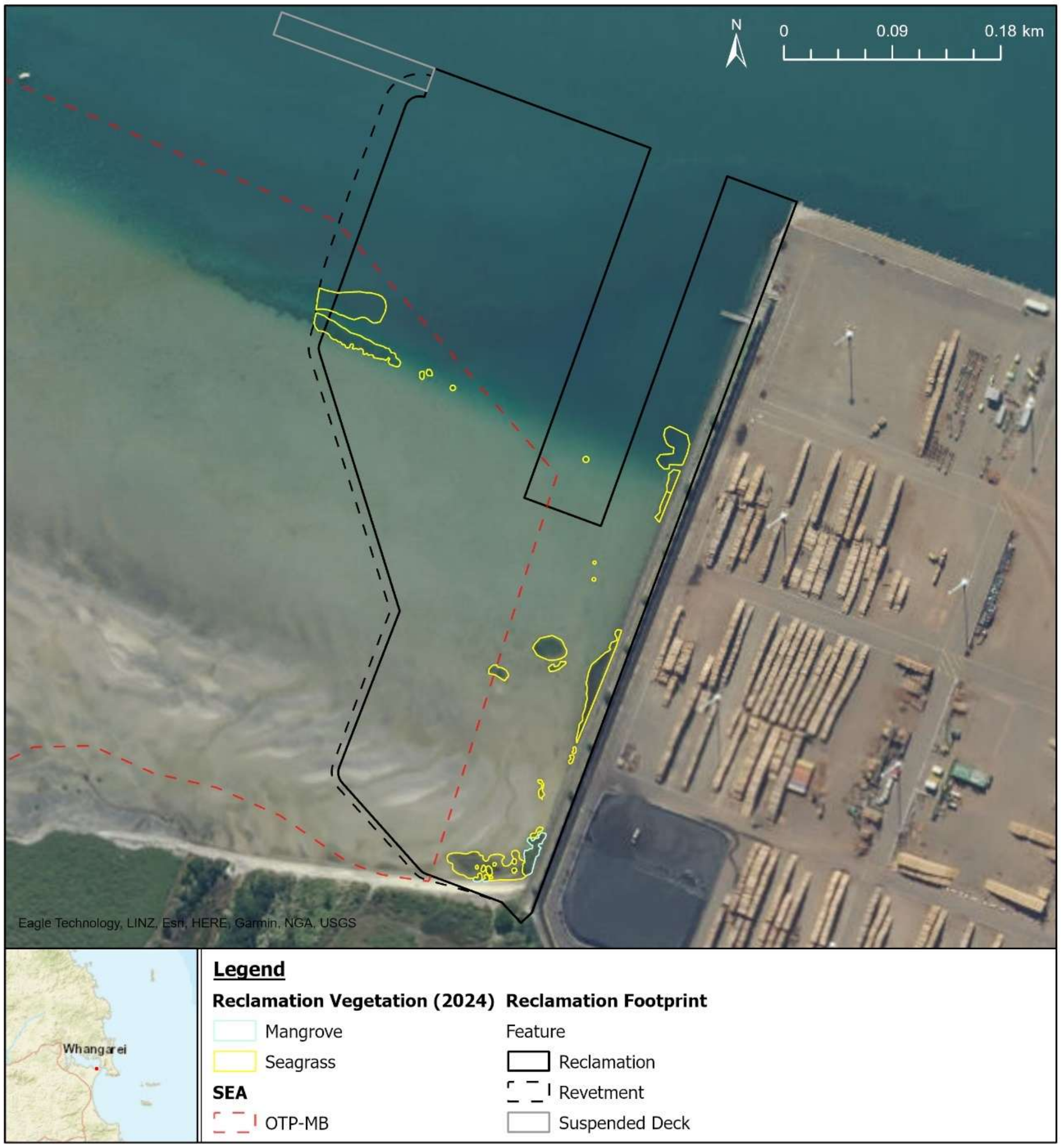


Figure 71: Patches of seagrass, and mangroves within the proposed reclamation area mapped from high-resolution aerial photos taken in 2024.[13]



7.3.1.2 MAGNITUDE OF EFFECT

The proposed reclamation and bird roost will permanently eliminate 5.36 ha (4.61%) of intertidal habitat that supports a diverse intertidal community and high levels of biological activity within Marsden Bay (of which, 3.36 ha is within the SEA). Dredging will convert 0.2 ha of intertidal area (0.04 ha in the SEA) to subtidal area. Consequently, 3.11 % of intertidal habitat within the SEA will be affected by the proposed development. Model predictions suggest there will be little, if any, overlap between dredging-related sediment plumes or sediment deposition and intertidal habitats. Therefore, effects related to dredging plumes on intertidal ecology are expected to be negligible. Hydrodynamic modelling also indicates that the proposed dredging and reclamation will only have a minor influence on the nearshore current field surrounding Blacksmith Creek (Berthot et al. 2026c), so the magnitude of any related ecological effects is expected to be low.

Key effects within Marsden Bay and [30] the SEA include:

- Permanent loss of a large fraction of a juvenile pipi bed, where moderate densities of pipi have consistently been recorded, with additional losses between the SEA and existing Northport revetment (the area also has some of the highest pipi densities in Whangārei Harbour – see Section 6.4.1).
- Permanent loss of high diversity intertidal sandflats within, and immediately adjoining, the SEA. Those losses include mid to low tide sandflats displaying high levels of biological activity, with numerous burrows, excavation mounds, ray feeding pits, bird foraging, and tracks of mobile macrofauna.
- Permanent loss of a small area of seagrass (and seagrass habitat) within the SEA (estimated to cover around 24 m^2 in 2024), and around 0.16 ha between the SEA and existing Northport revetment.

The overall abundance of infauna will only be slightly reduced within the harbour and OHEZ scales, and changes to the overall diversity of macrofauna at those scales are also not expected. However, the losses of pipi, benthic macrofauna, intertidal habitat and associated ecological services (e.g., intrinsic biodiversity values, sediment bioturbation, provision of prey and foraging habitat for fish and birds, kai moana values) at the SEA scale are much more significant.

In relation to pipi, the reason(s) for the moderate densities at the eastern end of Marsden Bay are unclear. Moderate numbers of juvenile pipi occur in areas where hydrodynamic modelling (Berthot & Watson 2022) indicated eddies form on either side of Northport, leading Kelly and Sim-Smith (2022) to propose that there may be a causal relationship between the presence of those eddies and the moderate pipi counts. Further modelling was carried out as part of this application to evaluate pipi larval dispersal from Mair Bank, Snake Bank and Marsden Bay, and settlement patterns at suitable pipi sites in Whangārei Harbour (Berthot et al. 2026b). Outputs from the modelled scenarios predict that the drydock reclamation and the combined drydock and eastern Northport reclamations will not have substantial impact on the overall amount of larval pipi settlement. However, some changes in the spatial pattern of settlement may occur (Figure 72). For instance, predicted settlement patterns show:

- Stage I leading to:
    - slight increases in settlement on Snake and Mair Banks of pipi larvae released from those banks, but less settlement of larvae coming from Marsden Bay;
    - slightly lower retention of larvae within Marsden Bay (from already low levels).
- Stage II leading to:
    - further increases in settlement on Snake and Mair Banks of pipi larvae released from those banks, along with an increase from existing levels in the settlement of larvae coming from Marsden Bay;
    - an increase in the retention of larvae within Marsden Bay.

Many other environmental factors determine the post-settlement survival of pipi and the establishment of beds in certain areas e.g., substrate type, food availability, predation, and post-settlement movement. As the eastern pipi bed is one of the two significant pipi populations in Marsden Bay, it is reasonable to

[30] Note that the ecological values of intertidal habitat between the SEA and Northport are similar to those within the SEA.

conclude that it is also one of the few areas in the bay with the right combination of factors needed to produce high larval settlement, survival and retention of juveniles (at least to ~30 mm length).[31] Accordingly, it appears unlikely that the loss that bed (or a significant proportion of it) will be offset by pipi settlement and survival elsewhere within Marsden Bay. Overall, at the SEA scale, effects on benthic communities and intertidal habitats are therefore considered to be consistent with a moderate magnitude of effect under the EIANZ criteria, while effects on pipi are consistent with a high magnitude of effect.

Seagrass meadows in Whangārei Harbour and many other parts of New Zealand underwent a major contraction in the mid-21st century (Inlis 2003), resulting in seagrass being classified as “At Risk” under the New Zealand Threat Classification System (NZTCS). However, the past two decades have seen a resurgence of seagrass in Whangārei Harbour and many other places, with its extent in the harbour increasing from a few small pockets in 1999 to around 6 km^2 in 2016 (see Section 6.1). Against that background, the effects of losing a small area of seagrass (around 0.16 ha) within the SEA and in the area between the SEA and existing Northport revetment are considered to be negligible at the harbour and OHEZ scales, and low at the OTP-MB SEA scale.

Other effects include a change in coastal processes that are expected to accelerate the progressive rollback of the sand spit west of the reclamation into Blacksmiths Creek. That process (which is already occurring, but at a slower rate) will slowly smother some mangroves growing behind the spit and broaden intertidal sandflats seaward of the spit (see the coastal processes assessment Reinen-Hamill 2026). Past changes from that process are apparent on the current shore. A small pocket of mangroves covering around 0.03 ha in 2024 will also be lost from the south-western corner of the Northport revetment. However, a similar pocket of mangroves is expected to colonise the south-western corner of the drydock reclamation. It is likely to take a decade or more for mangroves to establish and grow to sizes similar to the ones lost. The effects of losing a small area of mangroves from an area outside the SEA, and the progressive rollback of the Blacksmith Creek spit into mangrove forest are considered to be negligible at the harbour and OHEZ scales, and low at the OTP-MB SEA scale.

7.3.1.3 OVERALL LEVEL OF EFFECT

Overall, the most relevant systems for the assessment of effects on intertidal habitats and biota are considered to be both Marsden Bay and the OTP-MB SEA (which have similarly high values) for reclamation effects. The proposed drydock will lead to a high magnitude of effect on pipi, moderate effects on mid-low tide areas displaying high ecological activity, low effects on seagrass and other intertidal values, and negligible effects on mangroves. Effects on pipi and mid to low tide habitats are considered to be particularly important. In accordance with the EIANZ guidelines, the overall level of effect is therefore ranked as high (i.e., a significant level of effect under RMA planning/legal framework).

[31] No adult pipi were found in the reclamation area. It is unknown whether pipi move to other locations as they grow or do not survive to adulthood.

Figure 72: Comparison of the modelled settlement patterns of pipi larvae originating from Snake Bank (top), Marsden Bay (middle), and Mair Bank (bottom) during existing (left) and Stage I (right) development periods. Modelling predictions adapted from Berthot et al. (2026b).

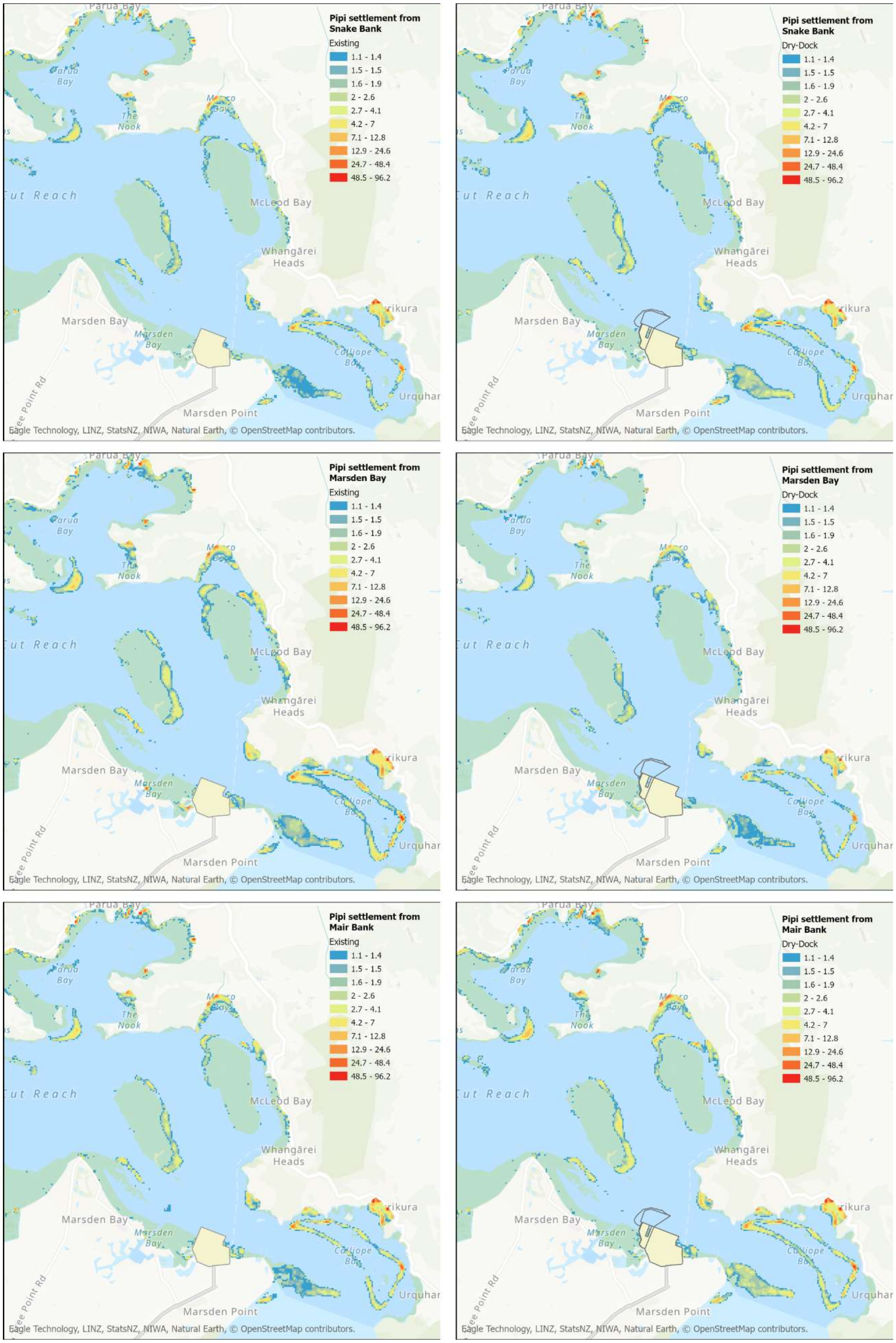
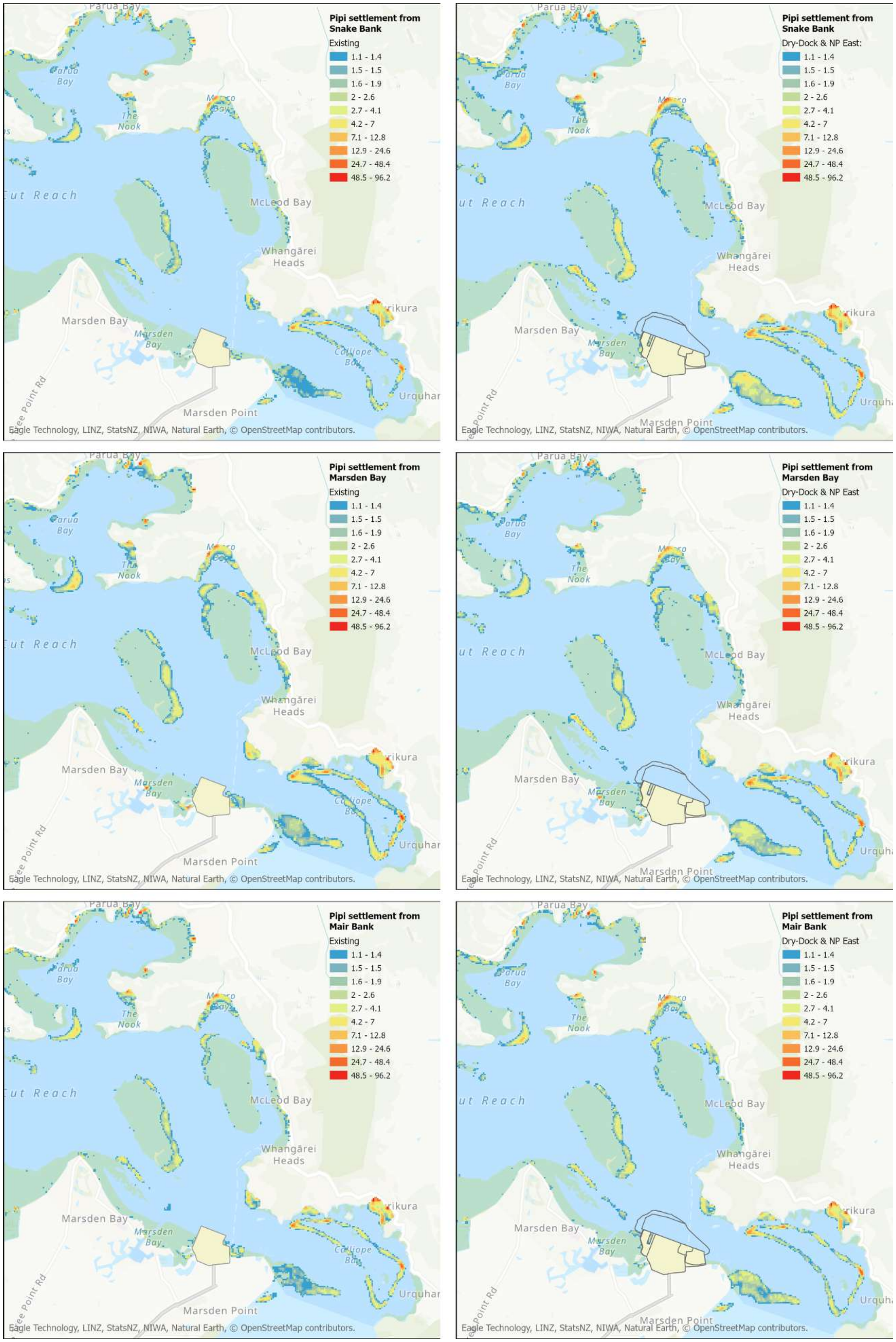


Figure 73: Comparison of the modelled settlement patterns of pipi larvae originating from Snake Bank (top), Marsden Bay (middle), and Mair Bank (bottom) during existing (left) and Stage II (right) development periods. Modelling predictions adapted from Berthot et al. (2026b).



7.3.2 EFFECTS ON SUBTIDAL SEDIMENT HABITAT AND BENTHIC COMMUNITIES

7.3.2.1 VALUES

Subtidal habitats in the mid to outer harbour contain:

- a variety of physical seabed habitats (Black *et al.*, 1989);
- macroalgae meadows, with a diverse, but low biomass, assemblage of species growing on subtidal shell and sediments (Neill & Nelson, 2016, Anderson *et al.*, 2019);
- a variety of biogenic habitats and habitat-forming species, including horse mussels, green-lipped mussels, scallops, dog cockles, seagrass, sponges, ascidians, rhodoliths, dead shell and worm beds (Morrison, 2003, Parsons *et al.*, 2016);
- very diverse assemblages of benthic macroinvertebrates, with nearly 200 taxa being identified in each of three subtidal surveys (see Section 6.3.2.1).

Ecological values of the area are high, due to several factors, including:

- Strong currents which convey a consistent flux of nutrients and planktonic organisms that sustain a diverse and productive assemblages of macroalgae and filter feeders.
- Relatively shallow depths and clear coastal waters that provide sufficient light to sustain macroalgae growth.
- Shell gravel that provides a stable substrate for sessile biota to attach to, and a complex, physical matrix that fulfils the niche requirements of numerous species.
- The presence of biogenic habitat forming species, which in turn, provide substrates, cover, food and/or other resources that attract and sustain broader species assemblages.
- The dynamic and spatially variable physical characteristics of the outer harbour, which include variation in exposure, depths, currents, natural features, and bottom types.

There is considerable variation in the subtidal habitats and communities in the outer harbour. Habitats within the proposed drydock reclamation and dredging areas include bare sand and shell gravel (some with numerous small holes of unknown origin – possibly worm tubes, shellfish siphons, and/or crustacean burrows), dense patches of red algae (some with dense aggregations of turret or horn shells), scattered sponges, and scattered to moderate densities of starfish (see Section 6.3.2.2). Video transects near the proposed entrance to the pocket berth also recorded footage of seafloor areas completely covered with a variety of biogenic species, including sponges, bryozoans, hydroids and macroalgae. Isolated kelp and sparse patches of subtidal seagrass have also been recorded in that area (subtidal seagrass beds are known to be very important fish nurseries in northern New Zealand estuaries, especially for snapper and trevally (Morrison et al. 2014a)).

Macroalgae meadows in Whangarei Harbour contain diverse but low biomass species assemblages growing on subtidal shell and sediments (Neill & Nelson, 2016, Anderson *et al.*, 2019). Surveys carried out over the past 30+ years, indicate that subtidal macroalgae meadows are a widespread and persistent feature (Black et al. 1989, Neill & Nelson 2016, Section 6.2.1), and that macroalgae have recolonised areas that have been dredged.

Three subtidal macroalgae species classified as “At Risk” have been recorded in Whangārei Harbour, but it is not known if they are present in the proposed reclamation or dredging areas. The classifications for all of those species are tagged with the qualifier “Data poor”, which is used to indicate the uncertainty about the listing due to the lack of data (Townsend et al. 2008). Only one of those species, *Aeodes nitidissima,* is likely to be endemic (Russell et al. 2009).

The other two "At Risk" macroalgae (*Feldmannia mitchelliae* and *Hincksia granulosa*) found in the harbour are not endemic, internationally widespread, and known to disperse long distances attached to flotsam, other floating seaweeds, and potentially through hull fouling (see Section 6.2.1). Note that the "At Risk" classifications of these species have the qualifier 'Data Poor', which indicates that there is uncertainty about the listing due to a lack of data (Townsend et al. 2008). The information identified during this assessment indicates that there is sufficient information to warrant a review of their classification and suggests that their listing should be revised. It is unlikely that the proposed activities will compromise the sustainability of New Zealand populations.

Subtidal seafloor communities around the port also contain very diverse assemblages of infaunal benthic macroinvertebrates. Forty-seven grab samples obtained from either side of Northport (in dredged and undredged areas) contained 198 taxa. Remarkably similar numbers of taxa were obtained in two previous subtidal surveys of the outer harbour/harbour entrance (see Section 6.3.2).

Overall, the ecological values of the subtidal seafloor within the drydock reclamation footprint are assessed as being high, while the ecological values of communities on the existing port revetment are assessed as moderate. Note that part of the proposed reclamation footprint (around 0.57 ha) is within the OTP-MB SEA. Available data suggests that subtidal ecological values within the proposed reclamation and dredging areas are likely to be similar to, or higher than, those in the SEA. Ecological values in the proposed dredging area are therefore assessed as being high to very high, with the highest values observed within a previously dredged area.

7.3.2.2 MAGNITUDE OF EFFECT

The proposed reclamation will permanently eliminate around 4.6 ha of subtidal habitat that supports a high-value seabed community. Around 0.57 ha of that area is within the OTP-MB SEA. Consequently, 0.88% of subtidal habitat and associated ecological values within the SEA will be permanently lost.

When the area covered by Northport's existing dredging consent is excluded, the first stage of the proposed dredging will directly affect around 1.31 ha of existing subtidal habitat (that includes deepening 0.36 ha by 1.5 m below Northport's consented dredging depth)convert around 0.2 ha of intertidal habitat to subtidal habitat. The second stage involves deepening of around 34 ha of subtidal channel covered by existing and proposed Northport dredging consents down to a basin depth of 18 m (i.e. increasing depths by around 2 m to 3.5 m) and slightly increasing the extent of batter slopes by around 0.33 ha. Dredging will, or could, affect marine biota, communities and habitat by:

- direct physical removal of biota;
- physically removing substrates that biota attach to (particularly shell gravel), and/or live on or in.
- deepening, which permanently reduces the amount of light reaching the seabed;
- smothering biota beneath mobilised sediment;
- smothering substrates that biota attach to and/or live on or in seabed substrates;
- increasing suspended sediment, which affects vision, feeding, behaviour, physiological condition, and other ecological functions and values;
- temporarily reducing the amount of light reaching the seabed through the suspension and dispersal of sediments during dredging operations; and,

- reducing current speeds, and the associated flux of food and nutrients.

Reclamation structures will also affect water currents and the underwater light regime, particularly within the pocket berth.

All macroalgae within the dredging footprint will likely be removed, and changes in substrate characteristics (particularly shell gravel) could alter the mix of species that recolonise the outer 0.1 ha area. More significant changes are expected in the benthic community that recolonises the pocket berth, which is likely to become a quiescent, shady water body (see Berthot et al. 2026c, and Figure 67 and Figure 68). Consequently, it is likely to accumulate fine sediments and contaminants, while macroalgae growth on the seafloor is likely to be limited by shade and a reduced flux of nutrients compared to surrounding areas. The lack of current and increased deposition are also likely to produce low-diversity seafloor communities mainly comprised of tolerant infaunal species, and lacking the large, habitat-forming epibiota that are common in the surrounding channel areas. However, tolerant, fouling species are likely to colonise drydock structures, and macroalgae may also grow near the surface.

The amount of sediment dispersed and redeposited during Stage 1 is likely to be limited to small quantities of little concern, because the areas being dredged beyond those already consented, are relatively small, and the pocket berth will be sheltered from wind and tidal currents.

The second stage of dredging involves a much greater area. Effects of the proposed dredging include deepening the existing dredged basin by around 2 m to 3.5 m, substantially reducing current flows within the dredged basin and slightly increasing current flows during peak flood and ebb tides on the western and eastern sides of the dredge footprint (Berthot et al. 2026c). While ecological recovery will occur within the dredge basin, the combined effects of removing existing habitat and biota, reduced current speeds, reduced light, and potentially, the loss of shell gravel, are expected to produce a community that has lower abundance and diversity values, and that is less productive than the one existing prior to dredging.

Modelling of sediment dispersal plumes for three potential dredging methods: trailing suction hopper dredger (TSHD), cutter suction dredger (CSD), and backhoe dredger (BHD) also predicts that sediment plumes will disperse beyond the areas directly affected by dredging (Berthot et al. 2026a). For the BHD and CSD options, the dredging vessels were assumed to operate continuously 24 hours a day, 7 days a week over a 1-month period. However, for the TSHD three different dredge operation cycles of varying duration[32] were used depending on the area of operation. In that case, repeated cycles were modelled, involving periods of dredging and hopper filling, followed by standby periods when dredging stopped. The duration of each period was varied by site, with dredging occurring for 29% (sites 1 & 2), 33% (sites 5 to 7) or 56% (sites 3 & 4) of the time. Accordingly, the median (50th percentile) predictions of TSS concentrations from the modelled TSHD sites 1, 2, 5, 6 & 7 show little, if any, sediment dispersal from those sites. Those predictions are therefore of limited relevance to the assessment of the ecological effects of dredging plumes, because they provided little detail on the extent and intensity of plumes generated during active dredging phases. The 90th percentile predictions were therefore used for assessing the ecological effects of sediment plumes.

Key findings of ecological relevance from the dispersal plume modelling are presented in Figure 74 & Figure 75. Briefly, they indicate that:

[32] 1) Infilling with no overflow; 2) Infilling with overflow; and, 3) Standby between infilling.

- BHD and CSD dredges are predicted to produce total suspended solids concentrations greater than 5 mg/L within small, localised areas for 50% of the time.
- BHD plumes from 90th percentile predictions tended to be of relatively low intensity, and were generally restricted to the dredging area, and narrow band in the channel towards the west of the port.
- For CSD, sediment was also predicted to disperse in a narrow band beyond the dredging area, with the most intense plumes originating from modelled Sites 1 to 4 using the existing bathymetry, and Site 4 using the Northport shipyard and drydock facility (NSDF) bathymetry. The worst case for CSD is the 90th percentile prediction for Site 3 and the existing bathymetry, which shows a plume with near-bed sandy silt concentrations of around 150 mg/L or greater, extending around 1.8 km westward.
- The 90th percentile predictions for TSHD produced the largest and most intense sediment plumes of the three methods. Modelling results based on the existing bathymetry, predict that dispersal from modelled Site 1 and to a lesser extent Site 2 will on occasion produce large, intense, near-bed plumes of sandy-silt that extend in a band along the subtidal portion of the main channel (Figure 75). Silty-sand plumes were predicted to have similar forms but be more limited in extent. However, results from sites 3 to 7 predict that intense plumes dispersing from those sites will largely be contained within the proposed dredged area, as were plumes from all sites when the NSDF bathymetry was modelled.

Modelling of sediment deposition was done for the same three dredging methods described above, with the models also run continuously over a 1-month period (Berthot et al. 2026a). Sediment depositional depths are predicted to be greatest within the dredging footprint and immediately west of the footprint (see Figure 76 for TSHD predictions). Predicted deposits of ≥ 1 mm were confined to the subtidal channel, with localised depositional depths of up to 1.5–2 m predicted near each dredging site. Note that the deposition modelling results are considered to be conservative and regarded as indicative of the upper bound of potential effects with deposits west of the dredge basin expected to be returned to the dredged area over time (Berthot et al. 2026a, Reinen-Hamill 2026).

Modelling therefore predicts that if a TSHD is used, a relatively large area of the channel between Marsden Bay and Snake Bank may experience suspended sediment concentrations at levels where adverse effects on subtidal habitats and communities occur. However, potential effects are likely to be tempered by TSHD dredging activity stopping at regular intervals. Suspended sediment effects would be compounded by the impacts of sediment deposition which smothers seabed communities and habitats (particularly shell gravel). Modelling predicts that the effects of suspended and deposited sediment are likely to be much more localised for CSD and BHD operations. In all cases, the effects of suspended sediment would cease at the conclusion of dredging and, over time, sediment deposited west of the dredged area is expected to return to the dredge basin (Reinen-Hamill 2026).

Also note that given the spatial overlap, it is difficult to disentangle potential effects associated with the second stage of dredging in this application from those of Northport's consented activities. The level, and duration of effects will, among other things, depend on the timing and duration of dredging activities carried out each consent, the amount of environmental change (e.g. in currents and seabed substrates), and ecological recovery rates. For instance, the direct effects of dredging related to this application on the "existing environment" (which include the effects of the yet to be implemented Northport dredging) would be minimal if it occurred immediately after Northport's dredging. That is because ecological features would already be removed through Northport dredging.

However, extending the duration of dredging by running Northport and MBIE campaigns back to back could increase the magnitude of indirect, offsite effects. Turbidity effects would be prolonged and it increases the potential for greater accumulation of deposited sediments. Conversely, ecological recovery from direct effects would be interrupted if the two dredging campaigns were separated by an extended period, but a break between campaigns could reduce indirect offsite effects of sediment dispersal and deposition.

Overall, reclamation and the creation of the pocket berth will lead to the permanent loss or significant degradation of around 5.5 ha (6%) of subtidal habitat within Marsden Bay will be (including 0.57 ha within the OTP-MB SEA). High value benthic communities and habitats will also be removed during dredging of the navigation channel, and sediment plumes and deposition are expected to affect communities and habitats beyond dredging sites. While ecological recovery will occur within the dredge basin, the combined effects of removing existing habitat and biota, reduced current speeds, reduced light, and potentially, the loss of shell gravel, are expected to produce a community that has lower abundance and diversity values, and that is less productive than the one existing prior to dredging. The magnitude of those effects is assessed as high.

The limited plume footprints of BHD and CSD dredging, intermittent nature of TSHD dredging, along with proposed plume monitoring, turbidity triggers, and management actions (MBIE 2026) will limit the magnitude of offsite ecological effects of dredging plumes. Ecological values affected by dredging plumes are expected to return to pre-existing levels relatively quickly (probably in the order of months). The magnitude of those effects are assessed as low.

Figure 74: Comparison of 90th percentile predictions of total suspended sediment concentrations from BHD, CSD and TSHD dredging at modelled site 1, with the existing bathymetry. Results are shown for the silty sand and sandy silt, at three water depths. Concentrations below 5 mg/l were masked (adapted from plots in Berthot et al. 2026a).

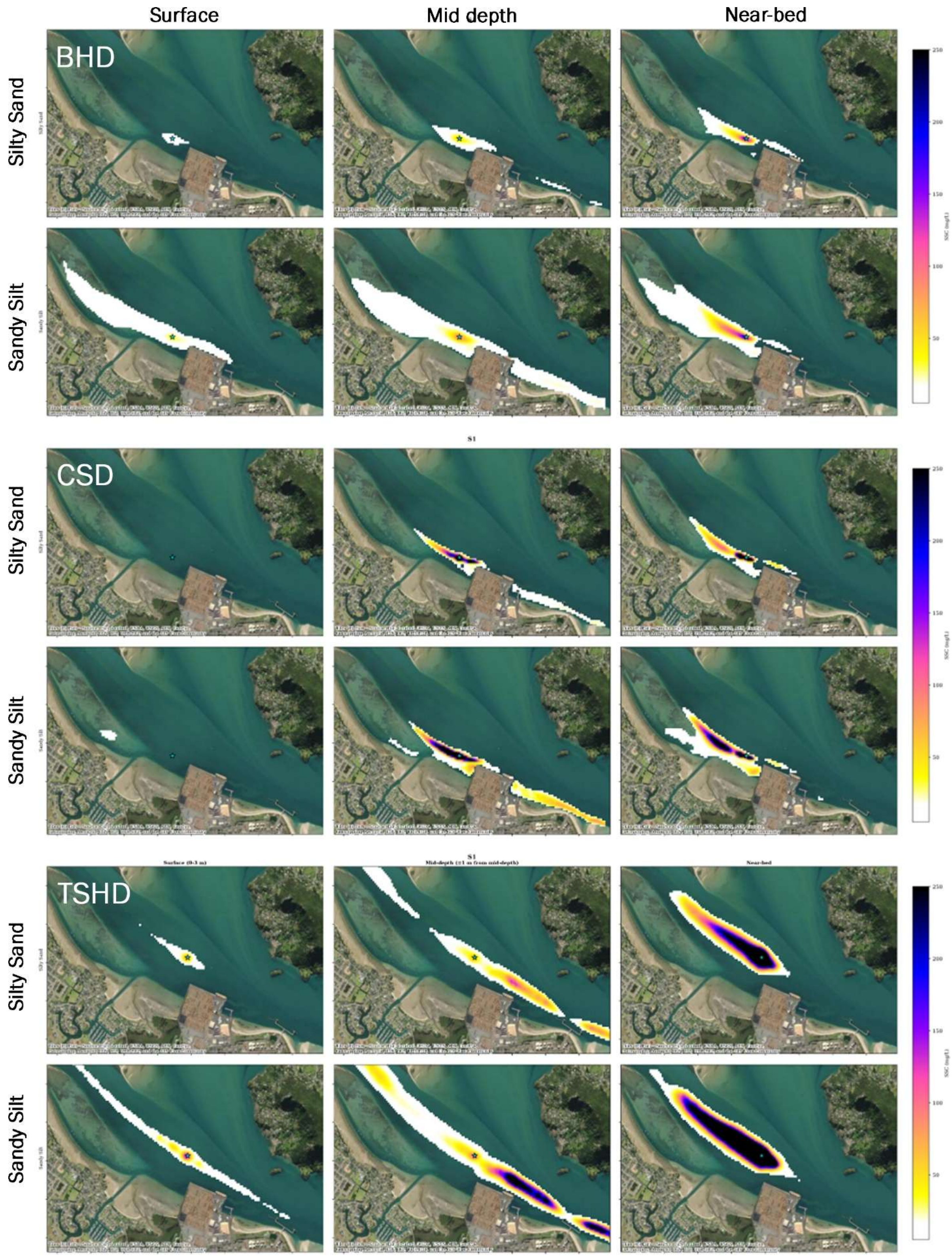


Figure 75: Comparison of 90th percentile predictions of near-bed total suspended sediment concentrations for TSHD dredging at modelled sites 1 to 7 using the existing bathymetry. Results are shown for the sandy silt. Concentrations below 5 mg/l were masked (adapted from plots in Appendix A in Berthot et al. 2026a).

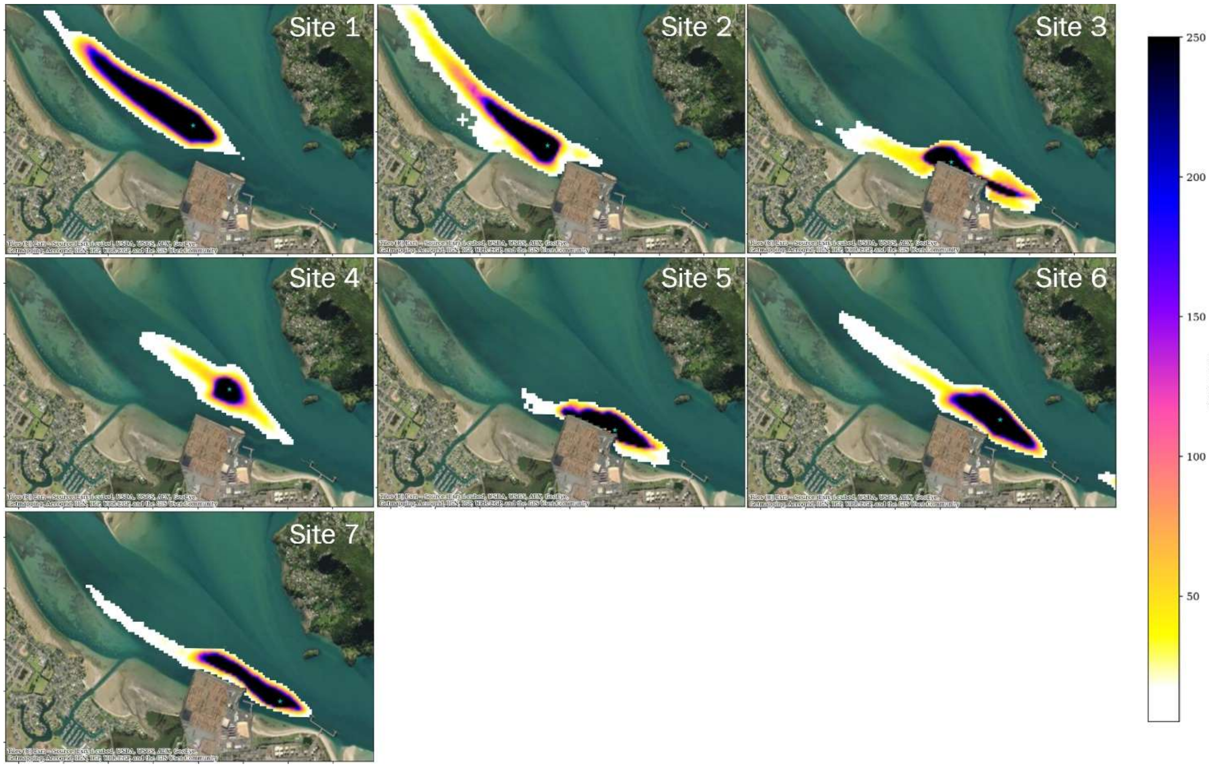
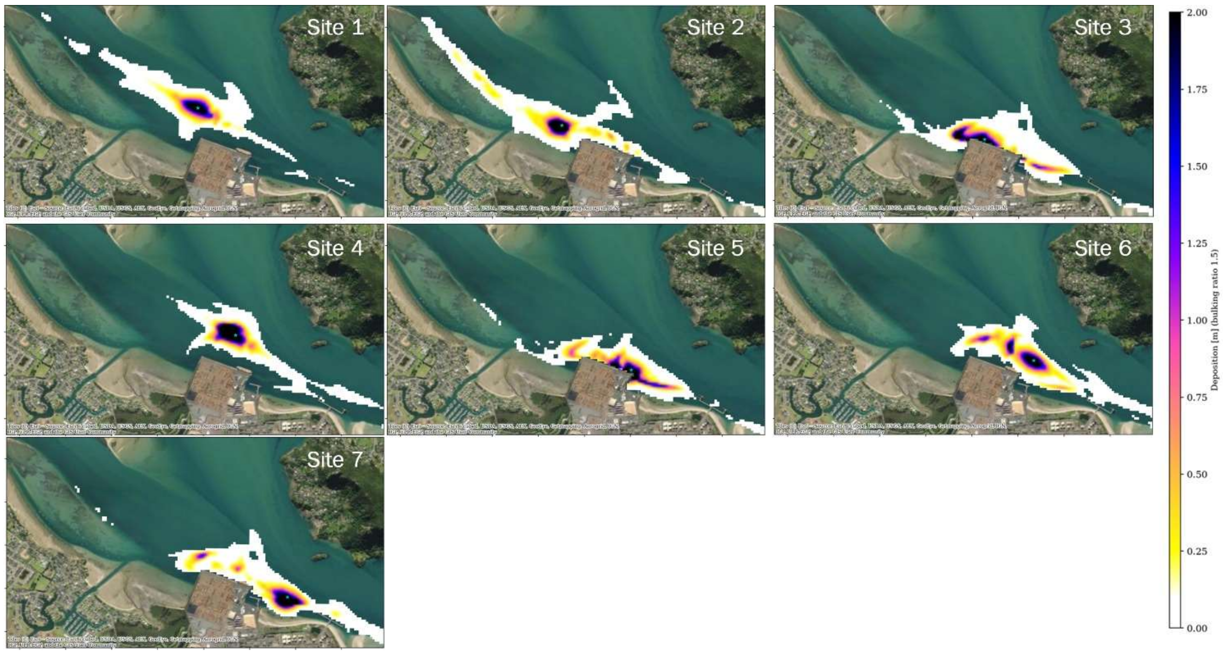


Figure 76: Comparison of final cumulative deposition thickness for sandy silt from TSHD dredging of the existing bathymetry at modelled sites 1 to 7. Deposition thicknesses below 1 mm were masked (from Cussioli et al. 2022).



7.3.2.3 OVERALL LEVEL OF EFFECT

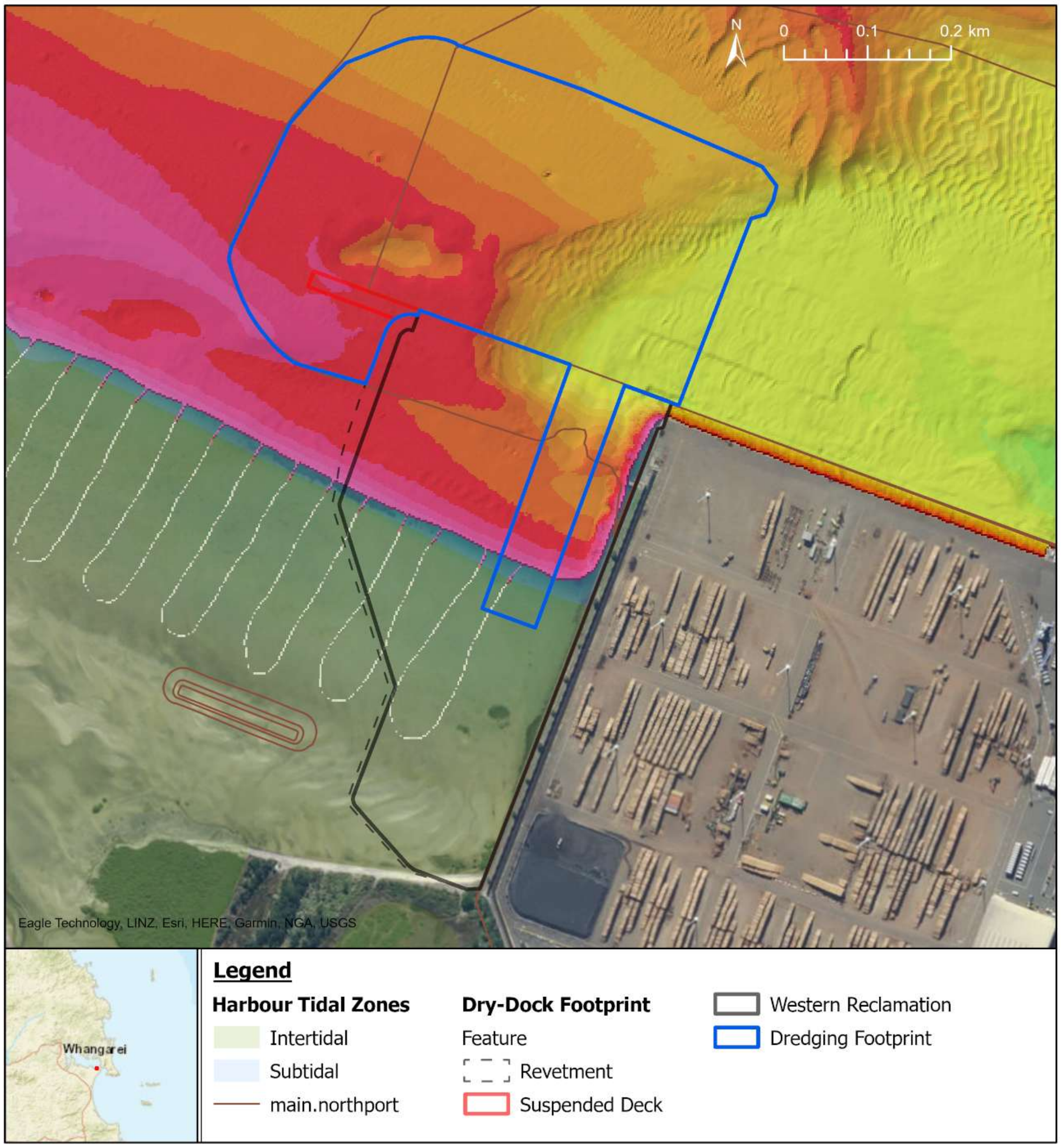
Overall, the most relevant systems for the assessment of effects on subtidal sediment habitats and biota are considered to be both Marsden Bay and the OTP-MB SEA (which have similarly high values) for reclamation effects and dredging effects. Ecological values of the subtidal seafloor within the drydock reclamation footprint are assessed as being high. Around 5.5 ha (6%) of subtidal habitat within Marsden Bay will be permanently lost or significantly degraded (including 0.57 ha (0.88%) of the OTP-MB SEA).

High value benthic communities and habitats will also be removed during dredging of the navigation channel, and sediment plumes and deposition are expected to affect communities and habitats beyond dredging sites. While ecological recovery will occur within the dredge basin, the combined effects of removing existing habitat and biota, reduced current speeds, reduced light, and potentially, the loss of shell gravel, are expected to produce a community that has lower abundance and diversity values, and that is less productive than the one existing prior to dredging. The magnitude of reclamation and dredging effects is assessed as high.

Overall effects on subtidal habitats and communities are therefore assessed as high at the Marsden Bay and moderate at the SEA scale, leading to an overall high to very high level of effect (a significant level of effect on Marsden Bay and the OTP-MB SEA under RMA planning/legal framework).

Figure 77: High-resolution aerial photos taken in 2024[13] showing patches of seagrass and mangroves within the proposed reclamation area, and in the broader OTP-MB SEA. The subtidal margin is overlaid.

Figure 78: Image of current channel bathymetry around the proposed drydock (data provided by Northport).



7.3.3 EFFECTS ON ROCKY (REVETMENT) HABITAT

7.3.3.1 VALUES

Reef habitat is a relatively moderate component of the Whangārei Harbour ecosystem, but it makes an important contribution to the biodiversity values of the harbour. Revetments along the western and eastern margins of Northport are narrow artificial reefs, with the lower intertidal and subtidal sections providing similar habitat and community values to naturally occurring reefs in the harbour. They contain a variety of macroalgae, sponges, gastropods, echinoderms, crustaceans, and other marine invertebrates typical of north-eastern New Zealand reefs, and support a relatively diverse assemblage of fish, including obligate reef dwellers. Kai moana species associated with the port revetments include (but may not be limited to) oysters and crayfish.

Given that the existing area of revetment is an artificial construction, the ecological values of the existing structures as rocky reef habitat are assessed as moderate.

7.3.3.2 MAGNITUDE AND OVERALL LEVEL OF EFFECT

Reclamation will eliminate around 306 m of intertidal and 203 m of subtidal existing rock revetment, and create around 261 m of intertidal and 356 m of subtidal rock revetment around the edge of the reclamation. All biota that cannot, or does not, move from existing revetment structures will be smothered. However, in the medium term (around 5 years) those losses will be offset by the colonisation and growth of similar reef species on the new revetment. The piles underneath the suspended deck and around the drydock berth pocket will also provide hard structures for reef species to colonise. Based on communities found on similar under-wharf structures to the ones proposed (Figure 79), shading is expected to create cool, dark conditions that are expected to allow a variety of (typically) subtidal species, such as subtidal sponges, ascidians, and hydroids to colonise and survive.

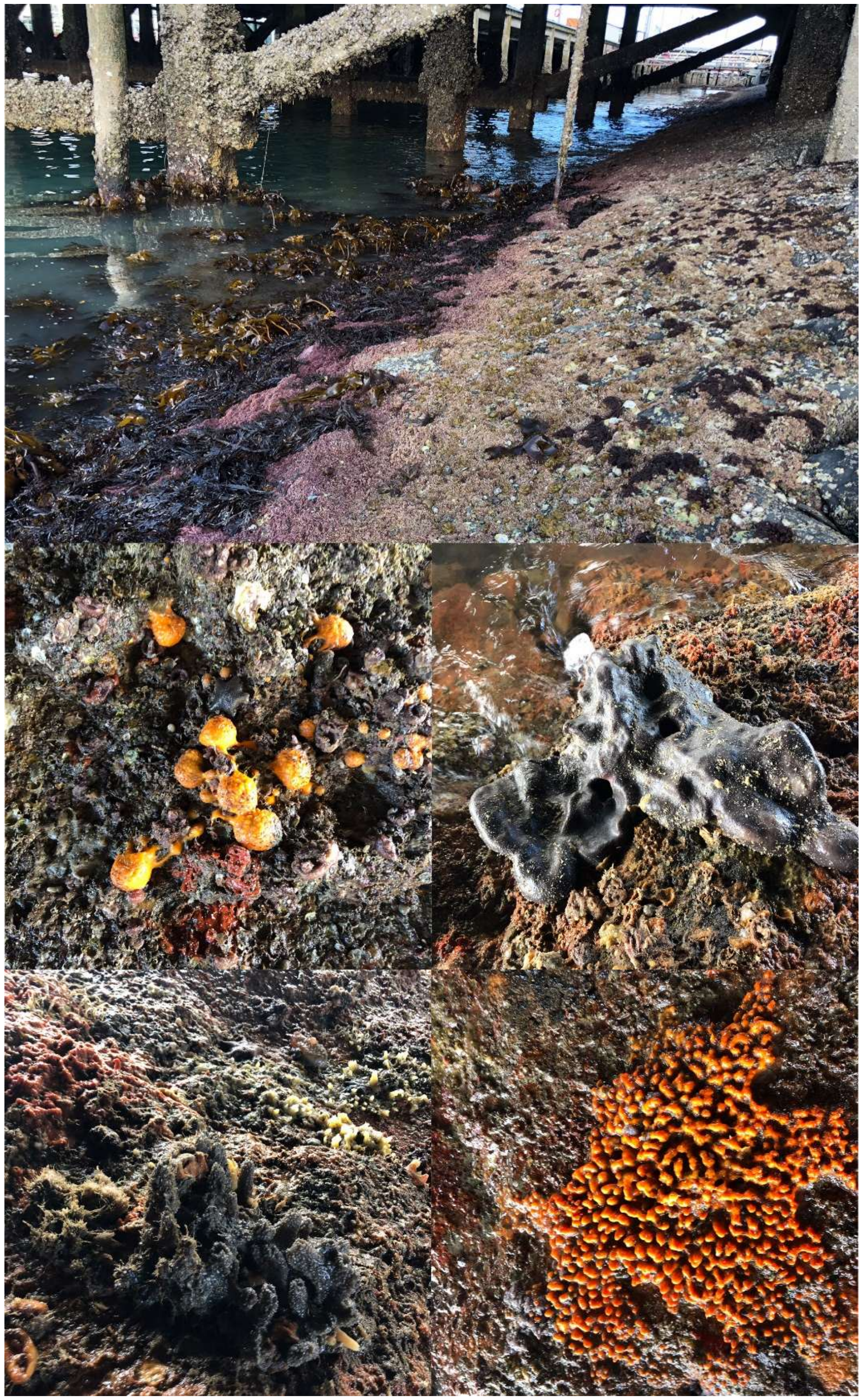
Rocky reef is not present in the proposed dredging area, and modelling of the sediment dispersal plumes predicts that there will be little, if any, overlap between dredging sediment plumes or sediment deposition, and reef habitat within the harbour.

Given that:

- the existing area of revetment is an artificial construction;
- more revetment will be created than is lost;
- other natural reefs occur in the harbour;
- any adverse effects on reef species that are threatened or at risk will be low at worst (equating to a less than minor effect);
- dredging is unlikely to affect existing reefs; and,
- recovery will occur over a period of around 5 years;

the overall effect of reclamation on reef habitat and biota at all scales is considered to be low immediately, and positive in the medium to long term; and the overall effect of dredging on reef habitat and biota at all scales is considered to be negligible.

Figure 79: Photos showing examples of biota in an under-wharf community (Brighams Wharf, Auckland), which includes a variety of (typically) subtidal species growing in the intertidal zone.



7.3.4 EFFECTS ON FISH

7.3.4.1 VALUES

Whangārei Harbour contains a moderately diverse assemblage of fish and biogenic habitats that may be important to some species. Existing port structures and the abundant biogenic habitats in the turning basin and reclamation area are likely to provide abundant food, shelter and habitat for fish species. Fish species that are likely to utilise the subtidal area around Northport include snapper, spotty, trevally, goat fish, leatherjackets, parore, rays, red moki, sweep, triplefins, kingfish jack mackerel and two-spot demoiselles. All of these species are widespread around northern New Zealand.

The OTP-MB SEA contains large areas of intertidal/shallow subtidal seagrass, particularly in the western half of Marsden Bay. Seagrass in the area immediately west of Northport is less abundant, comprising small, primarily intertidal patches. While subtidal seagrass beds have been shown to provide important nursery habitats for juvenile fish, particularly snapper and trevally, intertidal seagrass beds provide much lower habitat values (Morrison et al. 2014b).

Intertidal areas in the OTP-MB SEA provide important feeding areas for fishes and shorebirds, and the presence of numerous ray feeding pits in the intertidal area west of Northport shows that the area is a common feeding ground for rays.

Overall, the information summarised above indicates that the proposed reclamation footprint and area to be dredged have high ecological values for fishes. This ranking is consistent with, and reflects the RPN identification of OTP-MB as a significant ecological area.

7.3.4.2 MAGNITUDE OF EFFECTS

The proposed reclamation and bird roost will permanently eliminate around 5.36 ha (4.6%) of intertidal and 4.6 ha (5.2%) of subtidal benthic habitat in Marsden Bay. At the SEA scale, reclamation will lead to the direct and permanent loss of 2.85% (3.36 ha) of intertidal habitat, and 0.88% (0.57 ha) of subtidal habitat.

The proposed dredging is also expected to create a quiescent, shady pocket berth that is likely to accumulate fine sediments and contaminants. Macroalgae growth on the seafloor is likely to be limited by shade and a reduced flux of nutrients compared to surrounding areas. The lack of current and increased deposition is also likely to produce low diversity seafloor communities mainly comprised of tolerant infaunal species, and without the large, habitat-forming epibiota, that are common in the surrounding channel areas.

While the proposed activities will affect important habitat for fish, impacts on fish, per se, are expected to be low and temporary, because:

- The species potentially affected are able to move to other areas.
- Fish stock sizes are managed through fishing controls set under the Fisheries Management Act.
- Fish populations are unlikely to be limited by habitat or resource availability because fishing (carried out under the Fisheries Act) has reduced the populations of targeted species to levels well below those historically occurring.
- None of the fishes potentially affected are Threatened or At Risk species.

Overall, the effect of disturbing or losing important fish habitat within the dredging and reclamation footprints is assessed as low at all scales.

7.4 DISCHARGES OF CHEMICAL STRESSORS AND TOXICANTS.

Activities associated with the dry-dock facility will generate a variety of chemical stressors and toxicants (Blackburn 2026, Stewart 2026), including:

- general stormwater pollutants from diffuse sources such as metals and/or particulates from tyre wear, general (inert) sediment, brake lining dust, and roof runoff; and,
- inorganic, organic and organometallic chemicals associated with ship maintenance and repair activities.

Onsite activities will also involve the movement and storage of lubricants, fuels, solvents and paint products. However, the proposed activities are not expected to generate runoff with a high oxygen demand or significant nutrient loads.

The facility will be designed to separate process water and associated contaminants produced in high-risk ship maintenance areas, from the Northport stormwater system and to prevent them from being discharged directly to the coastal marine area. However, the deposition of some airborne emissions from high-risk areas into the CMA is likely.

Standard stormwater runoff from roofs, roads, accessways and low-risk hardstand areas will be collected and pre-treated before discharge to the extended Northport stormwater canal and pond system. High-risk areas will be hydraulically separated from standard stormwater areas. Operational wash-water and process runoff from high-risk areas will be captured, buffered and treated where required, before discharge to the Whangārei District Council wastewater network under trade waste approval, or removed to another authorised disposal pathway. The following assessment of ecological effects is therefore based on the assumptions that:

- High risk areas will be hydraulically separated from standard stormwater areas and all process water from them will be diverted to trade waste. Consequently, no further assessment is required.
- The quality of stormwater runoff from the remaining dry-dock areas will be similar to or better than runoff from Northport (because of the proposed pre-treatment and it won’t include runoff from log yards).
- Some airborne emissions from high-risk areas will deposit in the CMA.

7.4.1 STORMWATER DISCHARGES

The existing Northport stormwater treatment pond has sufficient capacity to treat contaminant loads from “standard” sources of runoff from the proposed facility and remain compliant with the discharge standards within Northport’s existing consent. Prior to obtaining a new consent in 2025, Northport’s discharge consent conditions were more stringent than the thresholds set out in the Regional Plan for Northland. The new (2025) Northport expansion consent tightened the criteria further — requiring the monitoring location for analytes to be within the discharge network (i.e. before reasonable mixing) (Blackburn 2026).

Detailed assessments of the pre-2025 Northport and broader stormwater systems were provided in Poynter and Kane (2015) and Poynter (2021). At that time, consent conditions required event related sampling of pond water quality (prior to discharge to the coastal environment) to be carried out on three occasions each year, with three samples to be collected over each of those days. Every sample had to be analysed for total suspended solids, volatile suspended solids, turbidity (NTU) and pH. In addition, the first sample of the first discharge event was analysed for aluminium, copper, lead, zinc, polycyclic aromatic hydrocarbons (PAH) and resin acids.

Conservative Action Levels were prescribed for particular contaminants to enable the early detection and investigation of issues before an environmentally harmful situation arises. Consent requirements for discharge water quality monitoring are complimented by conditions that required:

- Northport to carry out whole effluent toxicity testing (WETT) of stormwater on at least one occasion, with the need for further testing to be considered if new contaminants are introduced;
- pond influent monitoring once each year to enable treatment efficiency to be checked.

Results from the monitoring indicated that the quality of discharged stormwater is reasonably good. Little, if any, need for dilution in the mixing zone was required to achieve compliance, or reduce concentrations to levels below ANZG (2018) 95% protection guideline values (Poynter 2021). For instance:

- All of the prescribed metals presented in Poynter (2021) were well below consented concentration limits for the receiving environment (based on ANZG (2018) 95% guideline values), after providing for 200 times dilution within the mixing zone. In most cases, metal concentrations were below the receiving environment limit before they left the pond. The exception was copper, but that only had pond concentrations of around two times the receiving environment limit. Based on expected dilution rates (Poynter & Kane 2015), copper concentrations will be well below consent standards and guideline values after reasonable mixing.
- Poynter and Kane (2015) indicated that polycyclic aromatic hydrocarbons (PAH) concentrations in eleven samples collected between November 2013 and December 2014 had concentrations below levels of detection.
- Continuous pond monitoring between 2019 and 2020, and spot sampling between September 2018 and September 2019, showed pond water is reasonably aerated (average DO concentration at the discharge was 7.24 mg/L), turbidity and total suspended solids (TSS) concentrations were low (particularly given the nature of port runoff) with an average of 9.53 NTU and a TSS maximum of 15 mg/l), and that the average pH of 7.47 was within consent limits.

Overall, that information indicated that stormwater discharges from Northport posed little ecological risk, even prior to more stringent discharge limits being imposed in 2025. That conclusion was supported by toxicity testing (WETT) carried out by NIWA in 2003 and 2005, which showed no significant toxicity at 200 times dilution, and even under the highest concentrations tested (32% and 63.5% for a marine algae and the wedge shell *M. liliana*, respectively), there were no adverse effects on the test organisms relative to the control (see Poynter & Kane 2015).

No changes are proposed to stormwater discharge standards, apart from the addition of tin to the list of monitoring parameters. Consequently, stormwater discharge effects from the dry-dock facility are not expected to cause any additional adverse ecological effects.

7.4.2 AIRBORNE EMMISSIONS

The ecological risk posed by airborne emissions of antifouling chemicals during dry-dock operations was assessed by Stewart (2026). Sediment dwelling intertidal communities were identified as being at most risk, because airborne contaminants can land directly onto intertidal sediments. In contrast, airborne contaminants landing in subtidal areas would be dispersed and diluted by tidal currents before settling on the seabed.

In relation to the risk to intertidal communities, Stewart (2026) concluded that the time required for sediment concentrations to reach toxicity thresholds ranged from 139 to 382,705 years for the antifouling chemicals Tris-2,4,6-(dimethylaminomethyl)phenol (TMAP) and ZincB respectively. Other antifouling chemicals had no accumulation limit. Further, accumulation periods for other antifouling chemicals were, at worst, expected to be in a similar range to TMAP. Overall, the risk from the drift of unencapsulated painting was assessed as negligible for ecological effects on intertidal sediments near the Shipyard and Dry Dock.

7.4.3 OVERALL EFFECTS

Assuming that:

- High risk areas will be hydraulically separated from standard stormwater areas and all process water from them will be diverted to trade waste.
- The quality of stormwater runoff from the remaining dry-dock areas will be similar to or better than runoff from Northport (because of the proposed pre-treatment and it won't include runoff from log yards).
- Adequate measures can be put in place to monitor and ensure early responses to increasing trends in contaminants and/or exceedances of standards for contaminants in stormwater discharges and the CMA.

The effects of contaminant discharges from the proposed dry-dock facility are not expected to cause adverse ecological effects.

7.5 CUMULATIVE EFFECTS

7.5.1 BACKGROUND

When considering cumulative effects, context is important. Whangārei Harbour has been modified by decades of industrial, rural, urban, and coastal activities, which, among other things, include:

- the disposal of millions of cubic metres of sediment produced from cement production and channel dredging;
- dredging effects associated with maintaining navigable channel depths around the outer harbour and Marsden Cove, through to Whangārei;
- the construction of existing developments in the CMA, including Northport, Channel Infrastructure, Port Whangārei, and various marinas; and,
- fishing and shellfish harvesting.

Activities for which consents have been granted, but are yet to be actioned or completed, have also been considered where relevant. They include:

- consented reclamation and dredging by Northport; and,
- consented dredging to deepen and realign the commercial shipping channel by Channel Infrastructure.

Importantly, some effects associated with the proposed drydock are already provided for under Northport's dredging consents.[33]

[33] The only changes are related to the slight difference between the currently consented and proposed dredging footprints and the different dredge depths involved.

7.5.2 ACTIVITIES TO BE CONSIDERED

The potential effects of the proposed reclamation, dredging, and the discharge of chemical stressors and toxicants outlined above are:

- loss of marine habitat and biota living within the dredging and reclamation footprints;
- displacement of species that utilise the reclamation area, but do not permanently live within it;
- effects of sediment suspension, dispersal and deposition beyond the dredging zone;
- indirect effects arising from alteration to currents, wave and/or sedimentation patterns;
- effects on reef habitat;
- ecological effects associated with potential changes to water quality from discharges to the CMA.

Of these, the cumulative disturbance or loss of habitat and biota from the combined impacts of dredging and reclamation appears to be the main issue with the potential to act in a cumulative fashion and increase the magnitude of effects beyond those already described.

7.5.3 CUMULATIVE LOSS OF MARINE HABITAT

Subtidal video surveys show that the harbour entrance contains highly diverse biogenic habitats and species. The two dominant biogenic habitats present were dense shell and macroalgae meadows. These habitats are known to provide important ecosystem services and habitats for a wide variety of organisms, as summarised below.

1. Dense shell habitats:
    a. provide a hard substrate for a diverse range of epifauna to attach to, and may form the basis of the development of other biogenic habitats, e.g., sponge gardens, bryozoan thickets;
    b. stabilise the sediment;
    c. can alter the flow dynamics across the seabed;
    d. often support a significantly higher infaunal diversity than surrounding fine sediment habitats;
    e. may act as a nursery habitat for post-settlement snapper, which have been shown to aggregate around sediment structures such as mounds, pits and burrows (Compton et al. 2012; Morrison et al. 2014a; Anderson et al. 2019).
2. Macroalgae meadows:
    a. are important primary producers and act as a carbon sink;
    b. can modify water flows and sediment regimes;
    c. provide biogenic habitat, food and refuge to a wide range of fishes and invertebrates;
    d. may act as a nursery area for juvenile snapper (< 10 cm) and other fish species;
    e. comprising filamentous species provide a primary settlement substrate for mussel and scallop larvae;
    f. get washed ashore where they provide habitat and food for beach invertebrates and birds (Morrison *et al.*, 2014; Anderson *et al.*, 2019).

Other biogenic habitat-forming species, such as sponges, bryozoans, and horse mussels, were also observed in the subtidal video survey conducted for Northport, which collectively formed a mixed species biogenic habitat, but they did not reach sufficient densities to be defined as their own, separate biogenic habitats. It is also possible that other biogenic habitats were present in the area that could not be verified in the video survey. For example, large areas of dense holes could have been made by buried shellfish.

Northport have consent to carry out new dredging of around 61 ha of subtidal habitat, and reclamation of around 7.6 ha of intertidal and 9.4 ha of subtidal habitat on the eastern side of the port. Northport also have consent to construct a bird roost within the OTP-MB SEA covering around 0.54 ha of intertidal habitat. However, that bird roost will be replaced by the proposed drydock roost. The combined consented, but yet to be implemented, Northport activities therefore directly affect around 79 ha of coastal habitat (Figure 81).

Channel Infrastructure have also gained consent to dredge around 144 ha from the approach and entrance channel to Whangārei Harbour (Kemble et al. 2017; NRC 2018b; Figure 80), but are yet to exercise it. Georectified images indicate that around 40 ha will be dredged from the OHEZ (Figure 81). Drop camera, dredge and grab sampling in and around areas that Chanel Infrastructure have consent to dredge were carried out by West and Don (2016) (Figure 82). In summary, they found:

- the overall diversity of infaunal taxa was very high;
- seabed habitats in the dredging areas consisted of sand and shell gravel;
- the only kaimoana shellfish species present were green-lipped mussels, which were obtained from stations C23 MN, C26 N, and C27 MN (see Figure 82);
- macroalgae meadows, sponge gardens, scallops, horse mussels or other living biogenic features are not apparent in photographs obtained from any stations in the dredging areas.

Proposed reclamation and dredging for the MBIE drydock are the only activities that encroach on the OTP-MB SEA. Associated effects on the SEA have been assessed in Section 7.3. The following section provides breakdowns of the combined areas of intertidal and subtidal habitat affected by consented and proposed reclamation and dredging, and the combined significance of effects on larger system scales.

Figure 80: Map showing Channel Infrastructure consented dredging areas (from NRC 2018b).

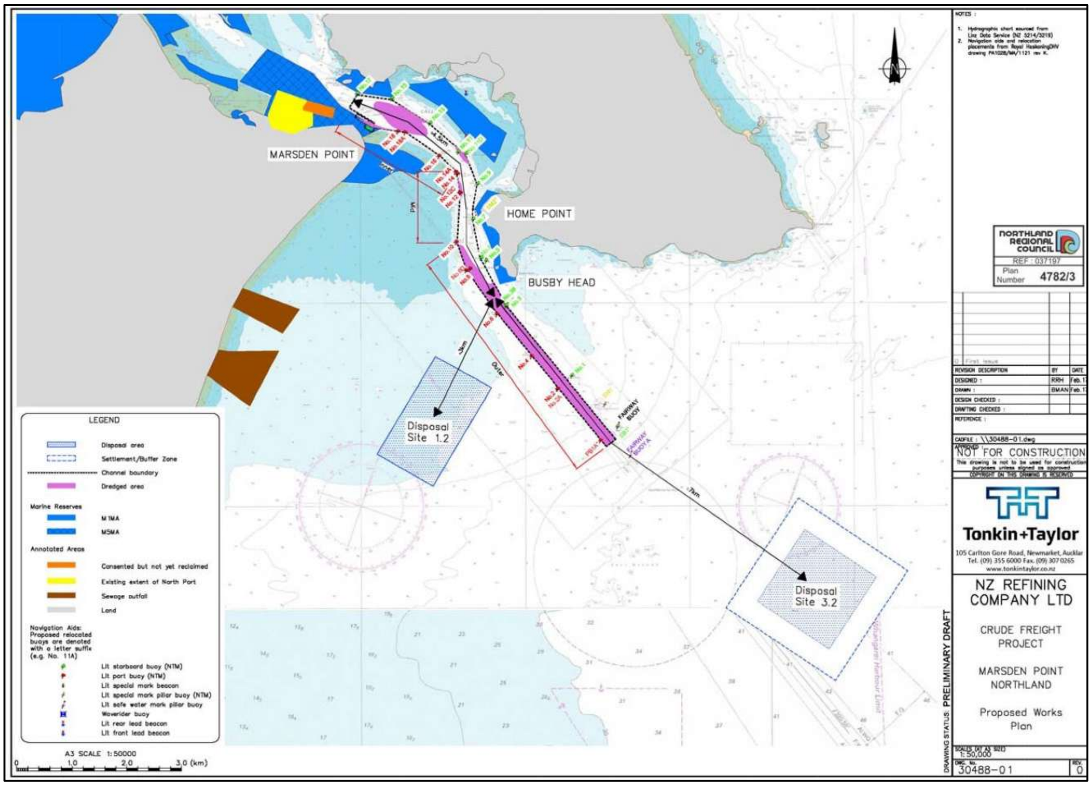


Figure 81: Activity areas included in the cumulative effects assessment.

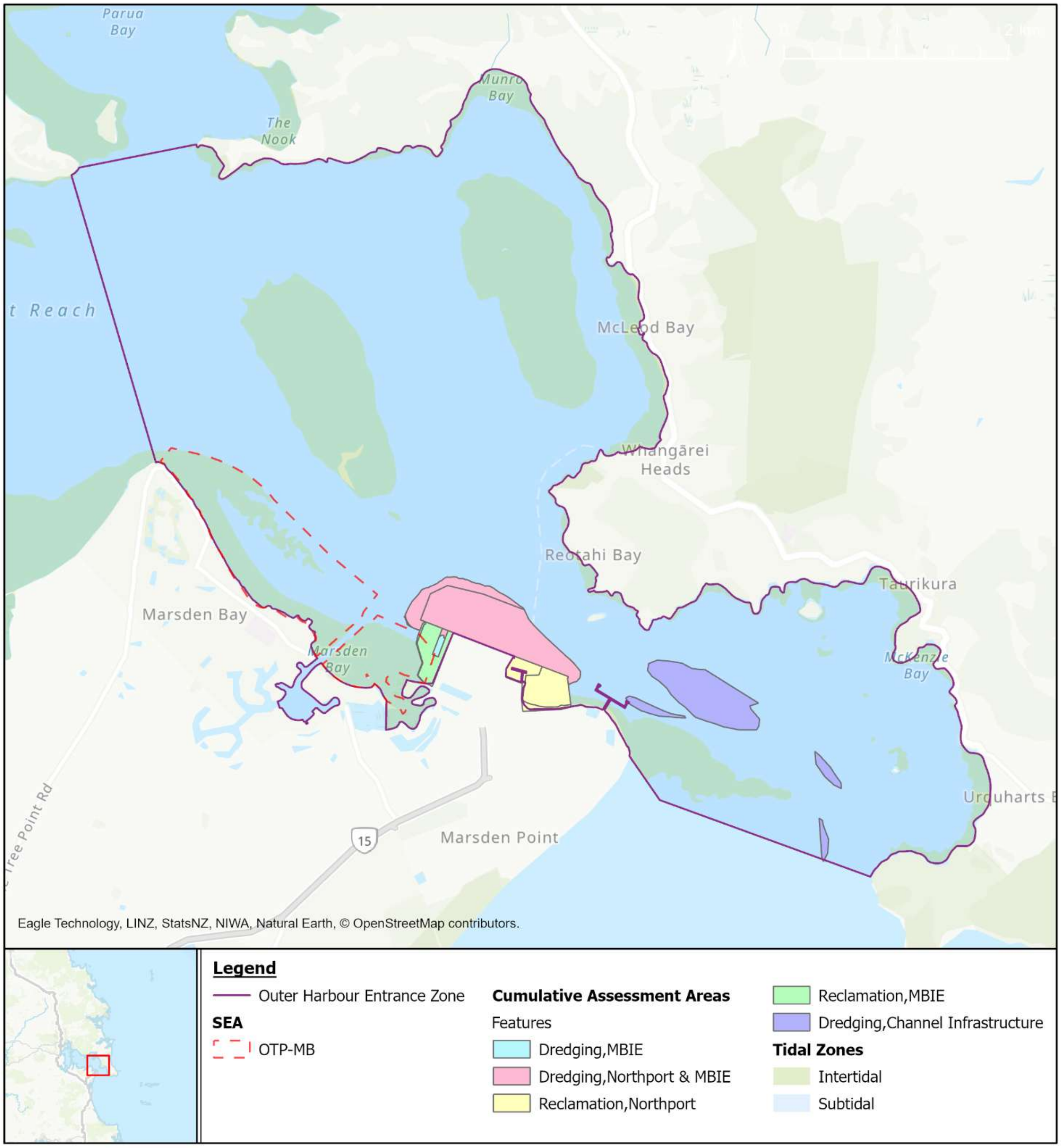


Figure 82: Stations sampled by West and Don (2016) showing station codes and substrate types.

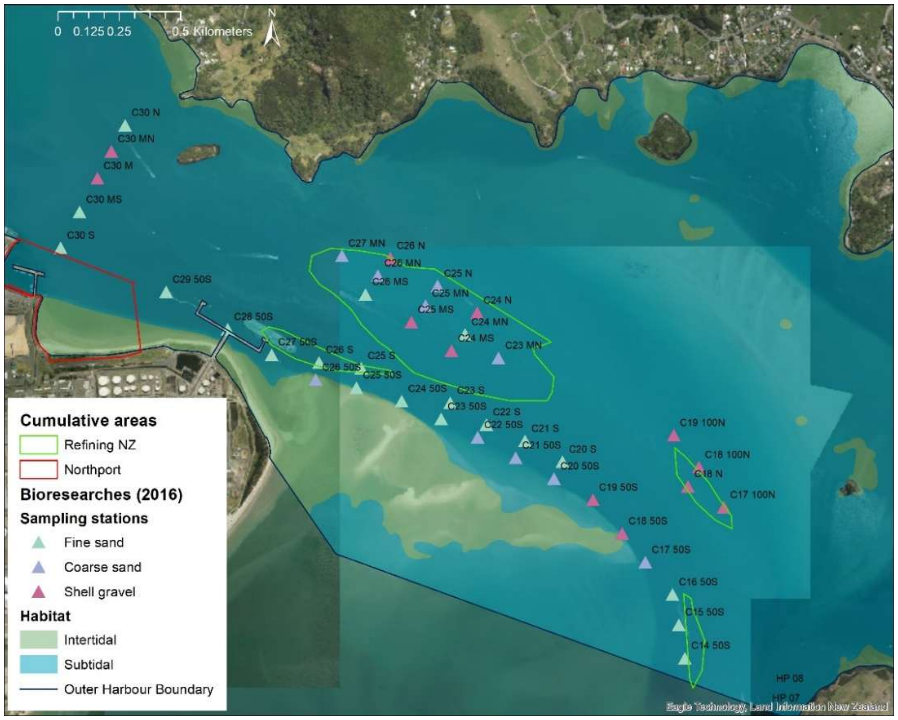


Table 7: Extents of proposed and consented reclamation and dredging areas expressed as percentages of the intertidal and subtidal area within the OHEZ ecological system. Note that areas affected by dredging sediment plumes have not been included.

Tidal Zone	Activity	Extents of the areas affected (ha)					Proportion of the OHEZ affected (%)	
		MBIE	Northport	Channel Infrastructure	Tidal Zone by Activity	Tidal Zone	By Tidal Zone & Activity	By Tidal Zone
Intertidal	Dredging	0.20	0		0.20		0.03	
	Reclamation	5.36	7.24		12.60	12.80	2.08	2.11
Subtidal	Dredging	1.64*	61	40	102.64		5.21	
	Reclamation	4.60	9.48		14.08	116.72	0.71	5.92

Total Area Affected	129.52 ha
Total Proportion of the OHEZ	5.03 %

* Includes Stages I & II, but excludes areas covered by Northport's existing dredging consent.

7.5.4 SIGNIFICANCE OF CUMULATIVE EFFECTS

Reclamation will result in a permanent reduction in the extent of physical and biological features that increase diversity values and support important ecosystem services. Dredging will physically alter (deepen) habitats and disturb such features.

The significance of ecological effects associated with reclamation and dredging were individually assessed for the proposed reclamation and dredging, and for combinations of those developments and other dredging and reclamation projects that have already been consented.

The OTP-MB SEA, Marsden Bay and OHEZ were all considered relevant systems for the assessment of cumulative effects. Key results from the assessment are:

- Cumulative effects on intertidal habitat are ranked as high to very high (i.e., a significant level of effect under RMA planning/legal framework), due to the permanent loss of around 12.81 ha of high and moderate value habitats, ecological communities and species. The extent of losses includes 3.11% of intertidal habitat in the OTP-MB SEA, 4.78% in Marsden Bay, and 2.11% in the OHEZ.
- Around 5.4 ha of subtidal habitat with high ecological values within Marsden Bay will be permanently lost or permanently degraded. A further 9.48 ha of moderate value subtidal habitat on the eastern side of Northport will also be permanently lost. In addition, around 103 ha in the OHEZ has been consented for dredging, which has been assessed as having a moderate to high effect (Kelly & Sim-Smith 2022). The proposed MBIE dredging will compound those effects. In combination, if all of those activities were implemented, around 5.9% of total subtidal area of the OHEZ would be directly affected, with additional offsite effects likely from dredging plumes. The overall cumulative effects on subtidal sediment habitats and biota are therefore ranked as high at the SEA level and high to very high at the Marsden Bay and OHEZ levels (i.e., a significant level of effect under RMA planning/legal framework).

  Risks can be reduced by:

  - minimising sediment suspension and dispersal through the selection of dredging methods;
  - using best practice methods such as real-time turbidity monitoring and triggers to maintain the effects of dredging plumes within acceptable limits (e.g., Napier Port 2019 and as required under the Vision for Growth consents).

  However, gaps between dredging campaigns, the loss of shell material, weaker current flows and reduced light levels would prolong recovery and ultimately produce a benthic system with lower diversity and productivity values than those currently present.

- The overall effect of reclamation on reef habitat and biota at all scales is considered to be low immediately, and positive in the medium to long term; and the overall effect of dredging on reef habitat and biota at all scales is considered to be negligible.

- The effects of disturbing or losing important fish habitat within the dredging and reclamation footprints are assessed as low at all scales (a "less than minor" effect under the applicable RMA planning/legal framework).
- The effects of chemical stressors and toxicants are assessed as very low.

Table 8: Assessment of cumulative effects on intertidal benthic habitats and macrofauna, relative to the SEA system.

Development	Effects on sandy intertidal habitat and ecology.	Rationale	Notes
This project	High to very high	Around 5.36 ha (4.61%) of high-value intertidal habitat within Marsden Bay, together with its diverse benthic community and high level of biological activity will be permanently lost, including around 3.36 ha (3.07%) of the OTP-MB SEA, and a large proportion of a juvenile pipi bed (the largest of two pipi beds in Marsden Bay). A further 0.2 ha of intertidal habitat will be affected by dredging.	
This project and Northport consented	High to very high	As above, plus the permanent loss of around 7.24 ha of intertidal habitat on the eastern side of Northport.	In addition to the effects listed above, around 2% of intertidal habitat in the OHEZ will be affected.
Channel Infrastructure, this project and Northport consented	High to very high	Same as above.	There is no sandy intertidal habitat in the currently consented Channel Infrastructure areas, so there are no additional effects.

Table 9: Assessment of cumulative effects on subtidal habitat and benthic macrofauna relative to the SEA and OHEZ system.

Development	Effects on subtidal benthic habitats and communities.	Rationale	Notes
This project	High to very high	Around 4.6 ha (5.19%) of high-value subtidal habitat within Marsden Bay, together with its diverse benthic community, will be permanently lost to reclamation (including around 0.57 ha (0.88%) of subtidal habitat in the OTP-MB SEA). Dredging and reclamation structures will change 1.11 ha of high to very high value habitat to degraded low value habitat. A further 34 ha of of high to very high value habitat will be directly disturbed and modified by dredging within subtidal channel covered by existing and proposed Northport dredging consents. That dredging will involve deepened down to a basin depth of 18 m (i.e. increasing depths by around 2 m to 3.5 m), increasing the risk of losing shell material from the seabed, altering current flows and reducing light levels on the seabed. Those changes would ultimately produce a benthic system with lower diversity and productivity values than those currently present. Surrounding offsite areas will be indirectly affected by sediment plumes.	The dredged pocket berth is expected to become a quiescent and shady water body that is likely to accumulate fine sediments and contaminants, and have low ecological values.
This project and Northport consented	High to very high	Above effects, plus around 9.48 ha subtidal habitat on the eastern side of Northport will be permanently lost to reclamation. A further 27 ha (approximately) of high to very high value habitat will be directly disturbed and modified by	A relatively large area with high ecological values will be directly affected by reclamation and dredging (3.87% of the OHEZ, 5.19% of Marsden Bay and 0.88% of the SEA subtidal).

Development	Effects on subtidal benthic habitats and communities.	Rationale	Notes
		dredging, and offsite areas will be indirectly affected by sediment plumes.	The scale and magnitude of indirect effects (particularly sediment plumes and deposition) depend on the method of dredging. Very high-level effects only apply if TSHD dredging is used. Recovery of ecological values on the seabed is expected but gaps between dredging campaigns, the loss of shell material, weaker current flows and reduced light levels would prolong recovery and ultimately produce a benthic system with lower diversity and productivity values than those currently present. Risks of indirect dredging effects can be reduced through monitoring and management regimes.
Channel Infrastructure, this project and Northport consented	Very high	Above effects, plus around 40 ha of high to very high value habitat directly disturbed and modified by dredging, with surrounding offsite areas indirectly affected by dredging sediment plumes.	Subtidal habitats of the Channel Infrastructure OHEZ dredging areas have very high infaunal diversity. Known habitats in the area include sand and shell hash, with scattered green-lipped mussels present in 2016. The areas do not appear to contain seaweed meadows or other living biogenic habitats. Effects could be diminished by using sequencing to allow recovery (or partial recovery) in one area before moving to the next.

Table 10: Assessment of cumulative effects on reef habitat and biota relative to the Harbour system.

Development	Effects on reef habitat and biota	Rationale	Notes
This project	Low, but temporary and positive in the medium to long-term.	Human-made features. Supports a high-value ecological community. Losses will be more than offset by newly created habitat. Recovery expected.	The extent of rocky reef is limited in the harbour. Community associated with existing rocky revetments will be lost, but they will reform on new revetments. The length of revetment created will be greater than the length lost.
This project and Northport	Same as above.	Same as above.	Same as above.
Channel Infrastructure, this project and Northport consented	Same as above.	Same as above.	No reef in Channel Infrastructure area. Same as above.

Table 11: Assessment of cumulative effects on fish relative to the Harbour system.

Development	Effects on fish habitat	Rationale	Notes
This project	Low	Permanent displacement from a very small portion of the available habitat. Temporary displacement from areas affected by dredging.	Affected species are mobile and able to utilise other locations
This project and Northport consented	Same as above	Same as above	Same as above
Channel Infrastructure, this project and Northport consented	Same as above	Same as above	Same as above

Table 12: Assessment of cumulative ecological effects of discharging chemical stressors and toxicants.

Development	Effects of stormwater discharges	Rationale	Notes
This project	Low	Past performance, set standards, high risk discharges going to tradewaste, monitoring linked to management responses.	Adverse ecological effects beyond the mixing zone managed through site controls, monitoring and discharge standards.
This project and Northport consented	Low	Same as above.	Same as above.
Channel Infrastructure, this project and Northport consented	Low	Same as above.	Same as above.

8 CONCLUSIONS AND RECOMMENDATIONS

The entrance to Whangārei Harbour supports a diverse marine ecological community, including seagrass, cockle and pipi beds, a high diversity of macrofaunal taxa, diverse subtidal habitats with large areas of biogenic habitat, and numerous fish species. An assessment of potential marine ecological effects (excluding biosecurity issues and effects on birds and mammals) of the proposed development was conducted on three different scales: the OHEZ, Marsden Bay and the OTP-MB SEA. The overall results of that assessment are summarised in Table 13 below.

The proposed reclamation and bird roost will lead to the loss of around 5.36 ha of intertidal and 4.6 ha of subtidal habitat within Marsden Bay. The proposed dredging will directly affect around 35 ha of existing subtidal habitat and convert around 0.2 ha of intertidal habitat to subtidal habitat. Other relevant activities with the potential to produce effects that act in a cumulative fashion include a consented dredging by Northport and Channel Infrastructure, and 16.72 ha of consented reclamation by Northport. In combination, if all of those activities were implemented, around 2.1% of the total intertidal area, and 5.9% of the total subtidal area in the OHEZ would be directly affected by dredging or reclamation.

Most effects within the reclamation and dredging footprints are unavoidable. However, actions can be taken (including through conditions of consent) to reduce the overall level of effects. Possibilities include:

- minimising sediment suspension and dispersal through the selection of dredging methods;
- using best practice methods such as real-time turbidity monitoring and triggers to maintain the effects of dredging plumes within acceptable limits (e.g., Napier Port 2019 and as required by the Vision for Growth consents);
- monitoring recovery after dredging is complete and reseeding dredged areas with shell, if shell/gravel is not present at the dredged depth, or if it does not re-establish naturally.

8.1 RECOMMENDATIONS

If consent is granted it is recommended that conditions are included that require real time monitoring of dredging plumes, and the responses of intertidal and subtidal ecological communities and habitats to dredging and unanticipated physical changes beyond the reclamation footprint. Monitoring has been proposed in the draft environmental monitoring and management plan for capital dredging, which addresses this recommendation (MBIE 2026).

Table 13. Summary of individual effects of the proposed development at the scale of: the outer harbour and entrance zone (OHEZ); Marsden Bay, and One Tree Point to Marsden Bay Significant Ecological Area (OTP-MB SEA).

Potential effects	System		
	OHEZ	Marsden Bay	OTP-MB SEA
Effects on intertidal sediment habitats and macrofauna	High to very high	High to very high	High to very high
Effects on subtidal habitat and benthic macrofauna	Very high	Very high	High
Effects on fish	Low	Low	Low
Effects on reef habitat	Low and positive in medium to long term	Low and positive in medium to long term	Low and positive in medium to long term
Effects of chemical stressors and toxicants	Very low	Very low	Very low

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10 QUALIFICATIONS AND EXPERIENCE OF THE AUTHORS

This report was prepared by Dr Shane Kelly and Dr Carina Sim-Smith.

10.1 DR SHANE KELLY

Dr Kelly has a BSc in Zoology and a PhD in Biological Sciences, both from the University of Auckland. He has a diverse range of experience, with a strong emphasis on applied science, environmental assessment, marine conservation and resource management. During his early career, he was Project Leader/Principal Advisor in Environmental Research and Monitoring at the Auckland Regional Council (ARC). In this capacity, he managed major research, monitoring, and strategic projects. These included State of the Environment monitoring programmes for water quality, sediment quality and ecosystem health. He was a key technical advisor on major urban infrastructure programmes and supported regulatory and planning teams by providing input to policy and plan development, major consents, and associated hearings and appeals.

Dr Kelly established Coast and Catchment Ltd in 2008, and he has since provided technical advice on the effects of numerous coastal and land-use activities. Among other things, he has assessed and advised local and regional councils or applicants on impacts related to port dredging, port development and port discharges at Marsden Point, Napier and Gisborne. His work has also included the assessment of environmental values and issues in multiple harbours and estuaries and providing effects assessments and technical advice on stormwater and wastewater discharges; water and sediment quality; aquaculture development and regulation; and pollution spills. Dr Kelly also led the production of five "State of the Hauraki Gulf" reports. As an independent hearing commissioner, Dr Kelly has heard applications that include: abandoning the Rena shipwreck; redeveloping the Wellington Interislander ferry terminal; and the dredging and redevelopment associated with the highly contaminated Calwell slipway in Port Nelson.

10.2 DR CARINA SIM-SMITH

Dr Sim-Smith has a BSc, MSc and PhD in Marine Sciences, all from the University of Auckland. She has a diverse research background that has covered a wide range of key New Zealand marine species including snapper, kingfish, groper, mussels, toheroa, rock lobsters and sponges. Dr Sim-Smith has spent around 10 years working with NIWA as an aquaculture scientist, both as an employee and a self-employed consultant, where she led projects on aquaculture development, aquaculture best management practices, environmental assessments, and marine biosecurity.

Dr Sim-Smith joined Coast and Catchment in 2013, and has subsequently led three nationally significant marine biosecurity projects for the Ministry for Primary Industries. She has co-authored four State of the Hauraki Gulf reports, and has surveyed, mapped and monitored numerous marine habitats and communities, in relation to environmental impact assessments and marine restoration efforts. A significant part of her work has involved assisting companies, councils, council-owned organisations, and non-governmental organisations (NGOs) with technical advice, the assessment of environmental effects, and consent monitoring. Dr Sim-Smith has evaluated the ecological and biosecurity effects of marine farms, stormwater and wastewater discharges, dredging and dredge spoil disposal, and a range of coastal developments including the Northport extension, Sugar Loaf Wharf extension, and Kopu Marine Precinct.

11 CODE OF CONDUCT

In preparing this report, we have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2023) and agree to comply with it. We confirm that this evidence is written within our expertise, except as stated and where we are relying on the information provided by another person. We have not omitted to consider material facts known to us that might alter or detract from the opinions expressed.

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