Appendix 13

Coastal Avifauna Assessment

Boffa Miskell

Northport Eastern Expansion

Coastal Avifauna Assessment
Prepared for Northport Ltd
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Executive Summary

- Northport Limited is seeking a package of consents to authorise a proposed expansion of its facilities in Whangarei Harbour, comprising an approximately 13.7 ha footprint (comprising 11.7 ha of reclamation within the CMA and 2 ha of earthworks outside the CMA) at the eastern end of the existing port, together with a new wharf and dredging (capital and maintenance).
- This report presents an ecological assessment of the potential effects on the coastal avifauna as a result of the proposed eastern reclamation . The methods used to undertake this assessment are consistent with the EIANZ (2018) guidelines for undertaking ecological impact assessments, whereby ecological values are assigned to species, and the magnitude of effects identified in order to determine the overall level of effect of the proposal.
- The potential construction and operational effects that were assessed included permanent habitat loss, mortalities, disturbance and displacement (forms of habitat loss), impacts on food supply and foraging ability, artificial lighting, pollution and cumulative effects.
- Information regarding coastal avifauna species and habitat use at and adjacent to the project site were gathered from both desktop research and targeted field investigations.
- Coastal avifauna surveys conducted from One Tree Point to the CINZ jetty recorded a total of 19 species utilising the area, including four species classified as *Threatened* and 11 classified as *At Risk*.
- The potential overall effects of the construction and operation of the proposed eastern reclamation will be Low to Very Low, taking account of the management and mitigation measures proposed:
    - The provision and ongoing maintenance of additional high tide roosting habitat for the term of the consent, such as the re-creation of a historic sandbank to function as a high tide roost on the western side of Northport prior to construction commencing (Sections 6.1.1, 6.3.2 and 6.7);
    - Preparation and implementation of an Avifauna Management Plan that outlines measures to avoid direct impacts (mortalities) of construction on variable oystercatcher and little penguin / kororā (Section 6.2.1.1);
    - Should the underwater noise modelling identify the need, the implementation of some form of underwater noise mitigation for all piling activities using hydraulic impact hammer such that a safe underwater passage is maintained for kororā traversing in and out of the harbour (refer to Section 6.3.1.1); and

- Operational lighting to be hooded and orientated downwards to avoid attraction and potential mortalities of seabirds on the Project site (Section 6.5.1).

CONTENTS

Executive Summary i

1.0 Introduction 1

1.1 Existing Environment 1

2.0 Methods 3

2.1 Desktop investigation 3

2.2 Field investigations 3

2.3 Data constraints 7

2.4 Supporting information 7

2.5 Assessment methodology 8

2.6 Effects management hierarchy 11

3.0 Whangarei Harbour Coastal Avifauna 13

3.1 Species Ecology 15

3.2 Feeding Resources 25

3.3 Habitat Use 27

4.0 Summary of Ecological Values & Significance 42

5.0 Project Description 44

5.1 Construction method 44

6.0 Assessment of Potential Effects 47

6.1 Direct / permanent loss of habitat 47

6.2 Injuries and / or mortalities 51

6.3 Disturbance and displacement 53

6.4 Food supply and foraging ability 59

6.5 Artificial lighting 61

6.6 Pollution 63

6.7 Re-creation of high tide roost habitat 65

6.8 Summary of potential effects 71

7.0 Cumulative Effects 73

8.0 Application of the Effects Management Hierarchy 76

9.0 Proposed Consent Conditions 77

10.0 References 78

Appendices

Appendix 1: 4Sight NPL Coastal Bird Reports

Appendix 2: Representative site photos

Appendix 3: Wading bird survey dates

Appendix 4: Historic aerial images of Marsden Bay

Appendix 5: Avifauna species & habitat list

1.0 Introduction

Northport Ltd (NPL) is seeking a package of resource consents to authorise a proposed expansion of its facilities in Whangarei Harbour (see Map 1) to increase its freight storage and handling capacity to support the future freight needs of the upper North Island. The proposed development comprises:

- Expanding Northport's footprint to the immediate east of its existing facility by approximately 13.7 ha (comprising 11.7 ha of reclamation within the CMA and 2ha of earthworks outside the CMA).
- Capital and associated maintenance dredging to enlarge and deepen the existing swing basin and to enable construction of the new wharf.
- A 520 m long wharf (including the consented but not yet constructed 270 m long Berth 4) constructed on the northern (seaward) face of the proposed reclamation.
- Construction of a new tug jetty.

The anticipated port-related activities include a container terminal, Coastguard, biosecurity, border control/customs and quarantine facilities, harbour control facilities plus supporting offices and workshops. In the future, as the number of containers handled by Northport increases, ship-to-shore gantry cranes will be added.

Boffa Miskell Ltd (BML) has been engaged to undertake an assessment of the potential effects on the coastal avifauna associated with the proposal. This report begins (Section 2.0) by outlining the methods that were used to collect information on which to base the assessment. A description of the existing Whangarei Harbour coastal avifauna is then provided (Section 3.0), followed by a summary of the ecological values and significance (Section 4.0). Key project features relevant to the coastal avifauna assessment are described (Section 5.0), followed by the assessment of potential effects of proposal (Section 6.0) and cumulative effects (Section 7.0). The application of the effects management hierarchy to the Project is then outlined (Section 8.0), followed by the proposed consent conditions in relation to coastal avifauna (Section 9.0).

1.1 Existing Environment

We note that this assessment of effects has been undertaken in the context of the existing environment, which comprises two components:

1) Existing natural environment and built development features; overlaid by
2) Permitted (non-fanciful) activities and extant resource consents which are likely to be implemented.

As such, Table 1 identifies the coastal developments which have been considered as part of the existing environment for the purposes of this assessment.

Table 1: Coastal developments within Whangarei Harbour considered as part of the existing environment for the purposes of this assessment.

EXISTING BUILT DEVELOPMENT	EXTANT RESOURCE CONSENTS
• NorthPort site • CINZ site and wharves • Marsden Cove residential / marina development • Portland Cement • Port Nikau and Whangarei town basin • Parua Bay boat ramp and mooring • Parua Bay oyster farm	• NorthPort's Berth 4 expansion • CINZ channel optimisation project • Port Nikau marina expansion • Whangarei Marina Management Trust's new marina

2.0 Methods

2.1 Desktop investigation

A desktop investigation was undertaken to obtain information regarding historical and current avifauna assemblages (including seasonal distribution, abundance and diversity) associated with the Northport area and surrounding environments. The following sources were searched:

- Published literature;
- Unpublished reports;
- Relevant statutory documents;
- Data from the Ornithological Society of New Zealand's (OSNZ) 2004 atlas (C. J. R. Robertson et al., 2007) were collated from the 10 km x 10 km grid square (264, 659) that encompasses Northport and surrounding terrestrial and marine environments (refer to Map 1);
- Data were obtained from the NZ Birds Online website[1] Location feature, whereby "Whangarei Harbour" was entered as the search location to obtain a list of species recorded at the location (including identification of breeding species);
- Information regarding primary and secondary habitat associations[2] was obtained for each species from Heather & Robertson (2005), along with each species' New Zealand threat status according to Robertson *et al*. (2021).

2.2 Field investigations

2.2.1 Coastal avifauna

Since 2017, a series of coastal avifauna field surveys have been undertaken by 4Sight for NPL. These surveys were designed to collect data for three important activities in the lifecycle of a shorebird:

- Breeding – Nesting surveys;
- Roosting – High tide counts;
- Foraging – Mid and low tide counts.

The following sections provide a summary of the methods used to conduct these surveys, however a full description of the methods used can be found in the 4Sight reports which are included in Appendix 1 of this assessment.

[1] http://nzbirdsonline.org.nz/

[2] For the purpose of this report, primary habitat refers to the habitat in which the species spends most of its time. Secondary habitats are other habitat types which the species may also utilise.

2.2.1.1 Nesting surveys

Shorebirds

Shorebird nesting surveys were undertaken by 4Sight during the 2018/19 and 2019/20 breeding seasons (4Sight Consulting, 2019, 2020a). The surveys were undertaken in the following areas, as shown on Map 2:

1) Eastern – included the area from the eastern edge of the Northport facility (including the tug bay revetments) to the CINZ emergency response boat ramp (refer to Appendix 2 Photo 4, Photo 5 and Photo 6). This site was further split into two zones, 1) the tug bay, and 2) the eastern beach and revetment.
2) Western – encompassed the section of Marsden Bay from the western edge of the Northport boundary (including the western revetment; refer to Appendix 2 Photo 8) to the western edge of the Blacksmiths Creek high tide mangrove roost.
3) Northport onsite – survey comprised four observation points within the port.

During each survey the observer spent 15-30[3] minutes at each pre-defined observation point scanning the area. Following the observation period, pre-defined routes were walked to provide high resolution coverage of the survey sites (Map 2). Where the survey routes passed through densely vegetated areas approximately 2-5 minutes was spent observing the area for breeding associated bird activity, followed by a visual inspection and search of the vegetation. Co-ordinates of bird nesting and breeding-associated activity were mapped following each survey.

On the eastern and western survey sites, a total of four and seven shorebird nesting surveys were conducted during the 2018/19 and 2019/20 breeding seasons respectively (Table 2). While on the Northport site, a total of one and seven surveys were conducted during the 2018/19 and 2019/20 breeding seasons respectively (Table 2).

Table 2: Frequency of shorebird nesting surveys undertaken by 4Sight during the 2018/19 and 2019/20 breeding seasons.

SURVEY SITE	2018/19 SURVEYS	2019/20 SURVEYS
Eastern	Three surveys between 12 November and 10 December 2018, and one survey on 24 January 2019.	Seven surveys were undertaken between 30 October 2019 and 24 January 2020
Western	Three surveys between 12 November and 10 December 2018, and one survey on 24 January 2019.	Seven surveys were undertaken between 30 October 2019 and 24 January 2020
Northport	24 January 2019	Seven surveys were undertaken between 30 October 2019 and 24 January 2020

Penguins

A little penguin / kororā (*Eudyptula minor*) survey was conducted on 12 December 2019 along the western and eastern riprap edges of the Northport site (refer to Map 2 and Appendix 2 Photo 7 and Photo 8). Two ecologists (the report author and a 4Sight Ecologist) scaled the riprap inspecting the interstitial spaces for the presence of kororā, or any signs of nesting or moulting birds.

[3] ~5 minutes was spent at each observation point on the Northport site.

An additional kororā survey was undertaken on 17 June 2021 along the western and eastern riprap edges of the Northport site using a DOC-certified conservation dog specifically trained in detecting kororā.

2.2.1.2 Wading bird surveys

All wading bird surveys were undertaken by 4Sight during the spring / summer of 2017/18 and 2019/20 (4Sight Consulting, 2018, 2020c, 2020b) and winter[4] 2021.

Because of constraints due to Covid-19 restrictions, and in order to supplement the current survey findings, a subsequent round of winter surveys was undertaken in June - August 2022. Due to time requirements necessary to analyse and assess this data, it was not possible to include the results in this current assessment. Rather, a separate update will be provided at a later date that will report on the result of the 2022 winter survey. This timing does not detract from the usefulness of the current reporting.

Survey sites

The surveys were conducted over the following three sites, as shown on Map 2:

4) Eastern zone – comprised the beach from the eastern boundary of the Northport facility to the CINZ jetty (bound by the landward extent of the sand dunes and the MLWS mark) (refer to Appendix 2 Photo 4).
5) Western zone – included the section of Marsden Bay from the western boundary of the Northport facility to the Marsden Cove Marina channel (refer to Appendix 2 Photo 9, Photo 12, Photo 13 and Photo 15).
6) Expanded zone – an additional survey area added in December 2020 which included the coastline from the Marsden Cove Marina channel on the west side of the marina channel to the Marsden Yacht Club at One Tree Point (refer to Appendix 2 Photo 16 to Photo 19).

In the case of the Eastern and Western sites, each survey site was further broken into three compartments (East 1–3 and West 1–3), each of which was further divided into 'high water' and 'mid/low water' sub-compartments (refer to Map 2). The following discrete high-tide compartments were also identified, as shown on Map 2:

- Wildlife Refuge (see Photo 14, Appendix 2);
- Blacksmith's Creek - an area of mangrove edge and high shore zone at the outlet from the Blacksmiths Creek to Marsden Bay (see Photo 12, Appendix 2);
- Port – Areas within the Northport facility itself was also surveyed.

Survey Effort

Wading bird surveys were conducted over the following seasons and dates (refer to Appendix 3 for a list of survey dates):

- Spring / summer - between 23 August 2017 to 12 March 2018 and between 25 September 2019 to 17 February 2020.
- Winter – between 4 June and 26 July 2021.

[4] Report author advised on timing and frequency of the winter 2021 survey.

A summary of the of wading bird survey effort is provided in Table 3.Surveys were conducted according to the 'five minute bird count' specification of Hartley & Greene (2012). At each observation point the observer recorded weather conditions and human activity. The observer then counted all birds in the sub compartment being surveyed, keeping each count to approximately five minutes.

Table 3: Frequency of wading bird surveys undertaken by 4Sight during the spring / summer and winter surveys.

SURVEY SITE	SPRING / SUMMER		WINTER
	2017/18	2019/20	2021
Eastern	18 high tide 12 mid tide 21 low tide	16 high tide 16 mid tide 16 low tide	6 high tide 6 mid tide 6 low tide
Western	18 high tide 12 mid tide 21 low tide	16 high tide 16 mid tide 16 low tide	6 high tide 6 mid tide 6 low tide
Expanded	-	8 high tide 8 mid tide 8 low tide	6 high tide 6 mid tide 6 low tide

2.2.2 Intertidal ecology

A qualitative intertidal survey was conducted on the 8 November 2021 by Coast & Catchment (2022a), during which the length of Marsden Bay was walked over at low tide and notes were made on the presence of seagrass, macroalgae and other notable features. Fifty-four stations on the mid and lower intertidal zone were examined for cockles and pipis. In addition, a rapid quantitative survey for pipis and cockles was conducted between Northport and the Marsden Cove channel, whereby 18 stations between the mid and low tide level 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.

To further assist with the coastal avifauna assessment, on 13 and 14 June 2022 Coast & Catchment (2022a) collected 83 benthic ecological samples from the area between One Tree Point and the Channel Infrastructure (Marsden Refinery) wharf using a stratified random design, with sampling effort based on the size of the following intertidal zones:

- One Tree Point to the Marsden Cove Channel;
- Marsden Cove Channel to Northport;
- the proposed eastern reclamation area; and
- the area between the proposed eastern reclamation area and the Marsden Refinery wharf.

At each of the 83 sampling stations, a single 13 cm diameter × 15 cm deep core was obtained and sieved to 0.5 mm, preserved in isopropyl alcohol (IPA), and sent to an experienced taxonomist for sorting, identification and enumeration. General results were analysed using number of taxa and total counts of individuals.

2.2.3 High tide roost habitat

On 10 August 2022, the report author undertook a site visit with the Project's marine ecology and coastal processes experts to investigate a site for the potential re-creation of high tide roost habitat to the west of Northport. The site visit was undertaken at low tide.

2.3 Data constraints

The following data constraints have been identified and taken into consideration for this assessment, however we note that these do not affect the report validity or conclusions reached:

- FIELD DATA: As noted above, the period over which the winter coastal bird surveys were conducted were reduced due to constraints associated with Covid-19 restrictions. This is addressed by the additional surveys undertaken in June-August 2022.
- POPULATION ESTIMATES: There is no single source for obtaining coastal and seabird population estimates, both local and national. Furthermore, population estimates are not available for some species, or in other cases only historic estimates are available. The population estimates reported here have been obtained from a number of sources which will have used a variety of survey techniques (including effort, time of year, count method etc). As such, these estimates should be viewed in the context of relative scales, not exact numbers.
- OSNZ ATLAS (1999-2004): The data were collected over a five-year period (1999-2004) by a number of people with varying levels of species identification skills. While the atlas grid square locations are fixed, there is no standardised method in terms of survey effort or coverage within each 10 km x 10 km grid square.
- PENGUIN SURVEY: While the timing of the December 2019 penguin survey coincided with the breeding season, the method relied solely on human observers. Conversely, the June 2021 survey used a penguin detector dog but did not coincide with the breeding season. Nevertheless, recent surveys[5] that the report author has conducted at other kororā colonies around the North Island using a penguin detector dog have shown that birds return to land throughout much of the year, not just during the breeding season.

2.4 Supporting information

In addition to the information collected through the desktop (relevant literature and databases) and field investigations, this assessment has been based on the information provided in the following supporting documents and plans:

- MetOcean Solutions Ltd (2022a). *Dredging plume modelling: Dredging sediment plume dispersion over existing and proposed port configurations*. Report No. P051912 prepared by MetOcean Solutions Ltd for Northport Ltd.
- MetOcean Solutions Ltd (2022b) *Hydrodynamic modelling update: Effects of proposed reclamation and dredging layout on hydrodynamics.* Report No. P0519-10 prepared by MetOcean Solutions Ltd for Northport Ltd.

[5] Te Ara Tupua shared path (Wellington), Seaview wharf replacement (Wellington), Kennedy Point marina (Waiheke Island), Kaiwharawhara Ferry Terminal (Wellington), Shelly Bay (Wellington).

- MetOcean Solutions Ltd (2022c). *Morphodynamic modelling for Northport environment, modelling update: Predicted morphological response to proposed eastern land reclamation.* Report No. P0519-11 prepared by MetOcean Solutions Ltd for Northport Ltd.
- PDP (2020). *Air Quality Assessment – Northport proposed Eastern Expansion*. Report prepared by Pattle Delamore Partners Limited for Northport Ltd.
- Coast & Catchment (2022a). *Northport expansion project: Assessment of marine ecological effects.* Report No. 2021-24 prepared by Coast & Catchment for Northport Ltd.
- WSP (2022). *Northport eastern extension (Berth 5) concept design report.* Prepared by WSP for Northport Ltd.
- Tonkin & Taylor (2022). *Vision for Growth port development: Coastal process assessment.* Report prepared by Tonkin & Taylor Ltd for Northport Ltd.
- WSP drawing (1-19278.01(03) Sheet C01 Revision C) titled '*Eastern reclamation and berth 4 (FB) areas*', dated 2021-11-15.
- WSP drawing (1-19278.01(03) Sheet C02 Revision C) titled '*Eastern reclamation (FC) areas*', dated 2021-11-15.
- WSP drawing (1-19278.01(03) Sheet C03 Revision C) titled '*Setout plan - Eastern reclamation and wharf extents*', dated 2021-11-15.
- WSP drawing (1-19278.01(03) Sheet C04 Revision C) titled '*Dredging plan - Eastern reclamation and berth 4 and existing consented dredging*', dated 2021-11-15.
- Tonkin & Taylor drawing No. 1017349-02 (Rev 0) titled '*Bird roost concept layout plan',* dated August 2022.
- Tonkin & Taylor drawing No. 1017349-03 (Rev 0) titled '*Bird roost concept layout details',* dated August 2022.
- Tonkin & Taylor drawing No. 1017349-04 (Rev 0) titled '*Bird roost concept typical sections',* dated August 2022.

2.5 Assessment methodology

The following potential construction and operational phase effects (both direct and indirect) on coastal avifauna were considered for this assessment:

- Direct / permanent loss of habitat;
- Injuries and / or mortalities;
- Disturbance and displacement (effective habitat loss);
- Food supply and foraging ability;
- Artificial lighting;
- Pollution; and
- Cumulative effects.

Direct effects are those that have the potential to permanently remove habitat or result in injury or mortalities of birds, and where they occur are generally considered to have the greatest potential impact on the local or national population of the affected species. Indirect effects are those that may reduce available habitat, contaminate that habitat, or affect the ability of a species to forage, roost or nest effectively. These effects are harder to quantify, but we draw on information relating to matters such as existing disturbance, the extent of available habitat, and the known behaviours

of the birds of concern to determine the likely magnitude of these effects on the species of concern.

The methodology used to undertake this assessment is consistent with the EIANZ guidelines for undertaking ecological impact assessments (Roper-Lindsay et al., 2018), whereby ecological values are assigned (Table 4) and the magnitude of effects identified (Table 5) in order to determine the overall level of effect of the proposal (Table 6).

The EIANZ guidelines (Roper-Lindsay et al., 2018) use the New Zealand threat classification system as the criteria for assigning ecological value to species as outlined in Table 4. Robertson et al. (2021) provides the most recent threat classifications for avifauna and as such has been used to assign values to individual species. We note that threat classifications that are captured under the EIANZ Very High, High or Moderate ecological value criteria, are the same as those identified in the New Zealand Coastal Policy Statement (Department of Conservation, 2010) Policy 11a(i), that is, *Threatened* or *At Risk* species in the New Zealand Threat Classifications System lists.

Table 4: Criteria for assigning ecological value to species (Roper-Lindsay et al., 2018).

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Very High	*Nationally Threatened* (Nationally Critical, Nationally Endangered, Nationally Vulnerable, Nationally Increasing[6]) species found in the ZOI[7] either permanently or seasonally.
High	Species listed as *At Risk – Declining* found in the ZOI either permanently or seasonally.
Moderate	Species listed as any other category of *At Risk* (Recovering, Relict, Naturally Uncommon) found in the ZOI either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
Low	Nationally and locally common indigenous species.
Negligible	Exotic species, including pests, species having recreational value.

Table 5 lists the criteria and descriptions for determining the magnitude of effect as described in the EIANZ guidelines (Roper-Lindsay et al., 2018). For the purpose of this assessment, we have determined the magnitude of effect at the local scale; that being the wider Whangarei Harbour. This area includes the coastline and harbour waters to the west of a line drawn from Busby Head in the north to Ruakaka Estuary in the south (refer to Map 1). This scale is deemed appropriate based on the habitat types within that area and the manner in which the species being assessed use those habitats and is consistent with the "system-wide approach" under Policy D.2.18(5) of the proposed Northland Regional Plan. We have also taken a species rather than habitat focus, and as such the

[6] Nationally Increasing is category that was devised by DOC (Michel, 2021) in 2021 to resolve a problem that would arise if the population of a taxon assessed as At Risk Recovering A should stabilise. Threatened – Nationally Increasing is assigned to "Small population that have experienced a previous decline (or for which it is uncertain whether it has experienced a previous decline) and that is forecast to increase >10% over the next 10 years or 3 generations, whichever is longer" (Rolfe et al. 2021). Thus, while such a threat category is not identified in Roper-Lindsay et al. (2018), we have included it along with all other *Threatened* classifications in to the Very High ecological value category.

[7] Roper-Lindsay et al. (2018) define the Zone of Influence (ZOI) as "*the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities."*

population criteria (text italicised and bolded in Table 5) has been applied for the assessment of effects. The population proportion thresholds that have been applied to each magnitude level are as follows:

- Very High: >50% of the population affected;
- High: 20-50% of the population affected;
- Moderate: 10-20% of the population affected;
- Low: 1-10% of the population affected;
- Negligible: <1% of the population affected.

According to Roper-Lindsay et al. (2018), the overall level of effect (Table 6) can then be used to guide the extent and nature of the ecological management response required (including the need for biodiversity offsetting):

- Very High adverse effects require a net biodiversity gain.[8]
- High and Moderate adverse effects require no net loss of biodiversity values.
- Low and Very Low effects should not normally be a concern. If effects are assessed taking impact management developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure Low or Very Low effects.

Thus, for the purpose of this assessment, we have assessed and presented the overall level of effects taking into account impact management developed during project shaping. Following this, it is only those effects with Moderate, High or Very High levels that have residual effects requiring further management.

Table 5: Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018)

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR ***Loss***[9] ***of a very high 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***[9] ***of a high proportion of 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 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.
Low	Minor shift away from 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/patterns; AND/OR ***Having a minor effect on the known population*** or range of the element / feature.

[8] Though when ecological compensation is required because biodiversity offsetting is not possible, the principles of no-net-loss or net-gain do not apply (Maseyk et al., 2018).

[9] In the context of mobile fauna, the term "loss" can include displacement from an area.

MAGNITUDE	DESCRIPTION
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the "no change" situation; AND/OR ***Having a negligible effect on the known population*** or range of the element / feature.

Table 6: Criteria for describing the level of effect (Roper-Lindsay et al., 2018)

LEVEL OF EFFECT		ECOLOGICAL AND / OR CONSERVATION VALUE				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
MAGNITUDE	**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

2.6 Effects management hierarchy

The order of priority for ecological impact management we have applied to this assessment is outlined in Table 7 and Figure 1. This process has followed the effects management hierarchy as described in Roper-Lindsay et al. (2018) and Maseyk et al. (2018).

Table 7: Effects management hierarchy and terminology (Maseyk et al., 2018)

EFFECTS MANAGEMENT HIERARCHY	DEFINITION
1) Avoidance	To modify a project proposal to prevent any environmental damage or loss of an ecological or environmental feature or function.
2) Remediation	To reverse or stop any environmental damage.
3) Mitigation	To alleviate, or to abate, or to moderate the severity of something (environmental damage), and typically occurs at the point of impact.
4) Biodiversity offset	A measurable conservation outcome resulting from actions designed to compensate for residual, adverse biodiversity effects arising from activities after appropriate avoidance, remediation, and mitigation measures have been applied. The goal of a biodiversity offset is to achieve no-net-loss, and preferably a net-gain, of indigenous biodiversity values.
5) Environmental compensation	Non-quantified biodiversity benefits are offered to compensate for biodiversity losses. The compensation actions may benefit different biodiversity to that lost (out-of-kind compensation), including biodiversity of lesser conservation concern than that lost. Compensation is not quantified or balanced with losses and may involve subjective decision-making subject to socio-political influences.

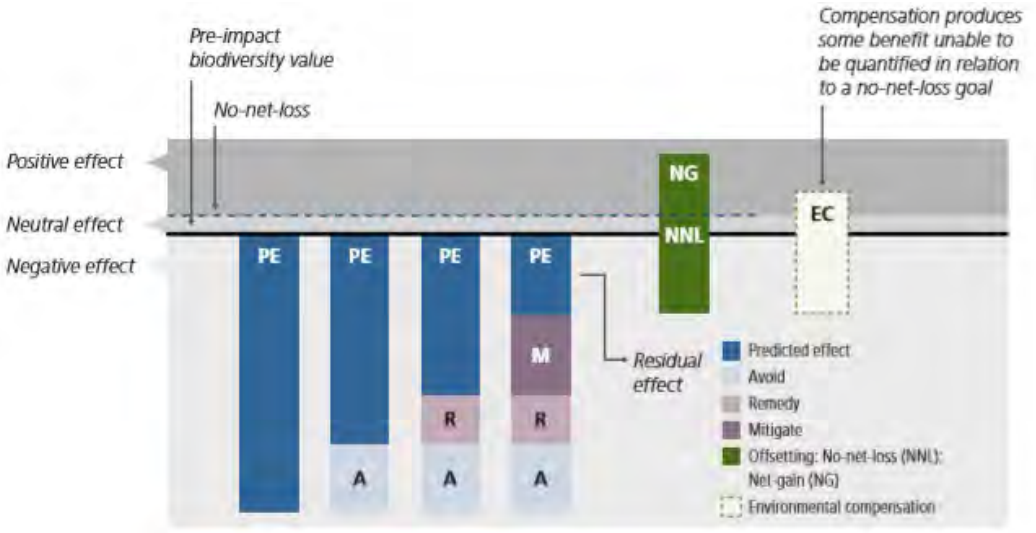

Figure 1: Conceptual illustration of effects management hierarchy progressing from avoidance to environmental compensation (Figure 2 from Maseyk et al. (2018))

3.0 Whangarei Harbour Coastal Avifauna

Northport is located at the entrance of Whangarei Harbour, Northland, adjacent to CINZ. The site is situated within the Waipu Ecological District and Eastern Northland Ecological Region (Lux et al., 2007). The Whangarei Harbour is approximately 100 km^2 in area and extends from the city of Whangarei to the Whangarei Heads.

The Whangarei Harbour coast and small areas within the river estuaries along Bream Bay have saltmarsh and mangrove communities that provide important breeding and feeding habitat for banded rail, fernbird, herons, and shag species (Lux et al., 2007).

There are several islands within the Whangarei Harbour which also provide habitat to a number of marine avifauna species. This includes Matakohe / Limestone Island, located in the inner Harbour, which contains a small population of breeding grey-faced petrel (*Pterdroma macroptera gouldi*; classified as *Not Threatened* (H. A. Robertson et al., 2021)); this species also breeds within the Bream Bay Reserve. Kororā, classified as *At Risk – Declining* (H. A. Robertson et al., 2021), have been recorded breeding on several islands located within close proximity to Northport, including High and Calliope Islands (refer to Map 1). White-fronted tern and red-billed gull have both been recorded breeding on Frenchman Island (Bioresearches, 2015).

In regard to pelagic seabirds such as other petrels and shearwaters, the majority of species recorded have been using the open water habitat of Bream Bay rather than the Whangarei Harbour waters.

In addition, there are a number of wading bird roost sites within the harbour, including Port Whangarei, Portland, Skull Creek, Takahiwai, Marsden Bay, Northern Harbour and Airport, and Ruakaka (Beauchamp & Parrish, 2007). However, Beauchamp & Parrish (2007) report that since the 1920s, major areas of wader habitat have been developed along the shores of Whangarei Harbour. These coastal developments have occurred in the upper, mid and lower Whangarei Harbour, and have included impacts on both the coastal edges, intertidal and subtidal habitats. Below is an excerpt taken from Beauchamp & Parrish (2007), summarising the location and changes in status of wading bird roosts sites around Whangarei Harbour. As identified in that table, there has been an incremental loss of roost sites in the area. This potential effect is particularly apparent when one considers the level of development that has occurred within Marsden Bay (refer to Appendix 4 for a series of historical (1942 – 2021) aerial images). The development of the Marsden Point oil refinery in 1964, and extensions in 1987, also destroyed a roost site, but some roosts remained nearby. Despite ongoing erosion, they were partly restored in the later 1990s. The development of Northport near Marsden Point removed c.5 ha of feeding habitat (Beauchamp & Parrish, 2007).

Table 1 Location and changes in status of wading bird roost sites in and around Whangarei Harbour, Northland, New Zealand, 1973-2000.

			Period		
Roost site	Area	NZMS 260 Q07	1973-1980	1981-1990	1991-2000
Port Whangarei	50 ha (ponds)	325040	Wall with spill areas onto mud flats of the harbour. Rough reclaimed land with weeds and ponds	Settlement ponds and reclaimed land with 5 ha of mud and shell used as a roost site	Reclaimed land with logs and port buildings. Settlement ponds with 1 ha of mud in original roost being filled by mangroves. Filled and mud ponds provide dry and shallow water roost areas during spring tides.
Portland	20 ha (mudflat)	308978	Limestone slack muddy spring tide roost. Muddy area forms a neap roost	One spring tide roost area progressively grown over by mangroves.	One spring tide roost overgrown, leaving muddy neap tide roost as only roost site. Site covered by largest spring tides.
Skull Creek	20 ha	346979	*Sarcicornia* and mud roost site	Unchanged	Unchanged
Takahiwai	20 ha	373960	*Sarcicornia*, mangrove and mud roost sites	Unchanged	Unchanged
Marsden Bay	2 ha	440951 463945	Long narrow tidal spit gradually eroding.	Eroding and shortening spit.	Tidal spit shortened before being eliminated in southeasterly gale in 1998. Replaced man-made island. Spring tide roost unchanged
Northern Harbour and Airport	30 ha	338023; 355037; 383014; 448020; 464985 493943.	Large grassed areas near runway.	Playing fields added in 2 areas providng more short grass, and closer access to roosting birds near the runway.	Area surrounding the airport occasionally used for hay production obscuring roosting birds. Full area available all tides.
Ruakaka	5 ha	425875	Estuary margin and sand bars	Unchanged	Unchanged and available in spring tides

To the immediate west of Northport, a Significant Ecological Area (SEA; "Area C") has been identified in the Northland Regional Plan. The area is described as follows: "*This area comprises shallow intertidal and subtidal sandy soft bottom habitats stretching from One Tree Point to Marsden Bay. These habitats 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 following a trend in the last four years in much of the harbour habitats suitable for seagrass. 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*." Unfortunately, no specific details are provided in the Northland Regional Plan regarding the shorebird species utilising the area.

Given the diversity and extent of available habitats, it is not surprising that a total of 73 bird species, comprising 21 introduced and 53 native species, have been recorded in the wider Whangarei Harbour area (refer to Appendix 5 for complete species list). Of the 53 native species, 37 are primarily associated with freshwater, coastal or oceanic habitats (refer to Appendix 5). Of those, a total of 19 species were recorded during the 4Sight surveys, including four species classified as *Threatened* and 11 classified as *At Risk* (Table 8).

In the following sections of this report, we provide a brief summary of individual species' ecology (Section 3.1), followed by a detailed analyses of how these species have been recorded utilising the coastal margin from One Tree Point to CINZ, as well as the Northport site (Sections 3.2 and 3.3).

Table 8: Native species recorded during 4Sight wading birds (2017/18, 2019/20 and 2021)

SPECIES		SPECIES CODE	THREAT CLASSIFICATION[10]
Reef heron	*Egretta sacra sacra*	RF	*Threatened - Nationally Endangered*
Caspian tern	*Hydroprogne caspia*	CTe	*Threatened - Nationally Vulnerable*
Northern NZ dotterel	*Charadrius obscurus aquilonius*	NZD	*Threatened - Nationally Increasing*
Wrybill	*Anarhynchus frontalis*	Wry	*Threatened - Nationally Increasing*
Banded dotterel	*Charadrius bicinctus bicinctus*	BDo	*At Risk - Declining*
Bar-tailed godwit	*Limosa lapponica baueri*	BtG	*At Risk - Declining*
Lesser knot	*Calidris canutus rogersi*	Lkn	*At Risk - Declining*
Red-billed gull	*Larus novaehollandiae scopulinus*	RbG	*At Risk - Declining*
South Island pied oystercatcher	*Haematopus finschi*	SIPO	*At Risk - Declining*
White-fronted tern	*Sterna s. striata*	WfT	*At Risk - Declining*
Pied shag	*Phalacrocorax v. varius*	Psh	*At Risk - Recovering*
Variable oystercatcher	*Haematopus unicolor*	VOC	*At Risk - Recovering*
Black shag	*Phalacrocorax carbo novaehollandiae*	BSh	*At Risk - Relict*
Little shag	*Phalacrocorax melanoleucos brevirostris*	LSh	*At Risk - Relict*
Royal spoonbill	*Platalea regia*	RSp	*At Risk - Naturally Uncommon*
Pied stilt	*Himantopus h. leucocephalus*	PSt	*Not Threatened*
Southern black-backed gull	*Larus d. dominicanus*	SBBG	*Not Threatened*
White-faced heron	*Egretta novaehollandiae*	WfH	*Not Threatened*
Eastern curlew	*Numenius madagascariensis*		*Vagrant*

3.1 Species Ecology

3.1.1 Charadriiformes

This group of birds includes:

- Waders: typical shorebirds, most of which feed by probing in the mud or picking items off the surface in both coastal and freshwater environments; and
- Gulls and terns: these are generally larger species which take fish from the sea.

[10] Robertson et al. (2017)

3.1.1.1 Northern NZ dotterel

Northern New Zealand dotterel (*Charadrius obscurus*), classified as *Threatened – Naturally Increasing* (H. A. Robertson et al., 2021), are found on or near the coast around much of the North Island and have an estimated population of 2,000 birds.[11]

Favoured breeding habitat includes sandy beaches (particularly at stream or river mouths), sand spits at the mouths of estuaries, and shell banks and sandbars in harbours, with approximately 48% of the breeding population is concentrated in Northland (Dowding & Moore, 2006). The Whangarei Harbour was not listed amongst the sites identified by Dowding & Moore (2006) as being important breeding sites (i.e. regularly holding 1% of either the effective or total population); however, the harbour was identified as the eighth-most important wintering site for this species. Riegen & Sagar (2020) reported an mean winter count of 21 birds in the Whangarei Harbour and 27 birds in the Ruakaka and Waipu Estuaries.

New Zealand dotterels consume a wide range of suitably-sized marine, littoral, and terrestrial invertebrates, and occasionally small fish. Sandhoppers (amphipods) are a common prey item on beaches, and small mussels are taken from rocks. Small crabs and annelid worms are among prey on estuaries; on grass, crickets, flies, beetles, and earthworms have been recorded.[11]

3.1.1.2 Banded dotterel

Banded dotterel (*Charadrius bicinctus*), classified as *At Risk - Declining* (H. A. Robertson et al., 2021), is found in the North, South and Stewart islands (Dowding & Moore, 2006). The national population is estimated to be approximately 50,000 birds.[12]

This species breeds throughout much of mainland New Zealand and on offshore and outlying islands; however, the main breeding concentrations are found in the shingle riverbeds of Hawke's Bay, Manawatu and the Wairarapa, and in the braided riverbeds of Marlborough, Canterbury, Otago and Southland (Dowding & Moore, 2006). Birds generally migrate to the northern North Island Harbours or Australia during the non-breeding season. Dowding & Moore (2006) identify the Whangarei Harbour as the 7th most important wintering site in New Zealand, with counts ranging from 5-689 birds.

The coastal foraging zone includes the intertidal zone, with the diet comprising crustaceans, worms and flies.

3.1.1.3 Wrybill

Wrybill (*Anarhynchus frontalis*) is classified as *Threatened – Nationally Increasing* (H. A. Robertson et al., 2021), with an estimated total population of 5000-5500 birds.[13] Wrybill breed only in braided riverbeds east of the main divide in Canterbury and Otago; after breeding birds migrate north and most individuals winter in the large harbours around Auckland (Dowding & Moore, 2006). Dowding & Moore (2006) identify the Whangarei Harbour as the 6th most important wintering site, with counts ranging from 52-156 birds.

[11] Dowding, J.E. 2013 [updated 2017]. New Zealand dotterel. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[12] Pierce, R.J. 2013. Banded dotterel. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[13] Dowding, J.E. 2013 [updated 2017]. Wrybill. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

On wintering grounds, a range of small marine and littoral invertebrates are taken (including annelid and polychaete worms, small molluscs, and insects), and the occasional small fish.[13]

3.1.1.4 Pied stilt

Pied stilt (*Himantopus himantopus leucocephalus*) is classified as *Not Threatened* (H. A. Robertson et al., 2021), with an estimated total New Zealand population of approximately 30,000 birds (Heather & Robertson, 2005). Pied stilts typically breed near shallow water in a wide variety of habitats throughout New Zealand; the main breeding locations in Northland include Awanui, Kawakawa, Dargaville and Naumai (Dowding & Moore, 2006).

In winter, pied stilts are widespread throughout both the North and South Islands. The highest numbers are consistently counted in the Firth of Thames, and Manukau and Kaipara Harbours (Riegen & Sagar, 2020). Dowding & Moore (2006) ranked the Whangarei Harbour as the tenth-most important wintering site, with counts ranging from 47-816 birds.

Diet is mainly aquatic and terrestrial invertebrates. In tidal areas the birds feed at low tide regardless of what time that occurs. Pied stilts primarily catch their food by sight, but when wading they may also probe and feel for food, especially when light is poor.[14]

3.1.1.5 Bar-tailed godwit

Bar-tailed godwit (*Limosa lapponica*), classified as *At Risk – Declining* (H. A. Robertson et al., 2021), breed in the Arctic and spend the non-breeding season (austral summer) around New Zealand estuaries and harbours. This species is the most common Arctic migrant in New Zealand, with Riegen & Sagar (2020) reporting an average of 82,611 birds in New Zealand harbours between 2005-2019. At Whangarei Harbour, an average of 254 birds were recorded in the winter counts and 2,738 birds in the summer counts (Riegen & Sagar, 2020).

On non-breeding grounds in New Zealand, bar-tailed godwit mainly eat polychaetes (probably over 70% of diet) but also small bivalves and crustaceans.[15]

3.1.1.6 Lesser knot

Lesser knot (*Calidris canutus*), classified as *At Risk – Declining* (H. A. Robertson et al., 2021), breed in the Arctic and spend the non-breeding season (austral summer) around New Zealand estuaries and harbours; though a small proportion of the population does overwinter in New Zealand. This species is the second most common Arctic migrant in New Zealand, with Riegen & Sagar (2020) reporting an average of 29,449 birds in New Zealand harbours between 2005-2019; at Whangarei Harbour, an average of 828 birds were recorded in the summer counts (Riegen & Sagar, 2020).

Lesser knot mainly eat small molluscs, especially bivalve shellfish. Important prey in New Zealand include pipi (*Paphies australis*), cockles/tuangi (*Austrovenus stutchburyi*), and nutshells (*Nucula hartvigiana*). They feed on open flats as well as seagrass beds, feeding principally by tactile means

[14] Adams, R. 2013 [updated 2017]. Pied stilt. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[15] Woodley, K. 2013 [updated 2017]. Bar-tailed godwit in Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

(probing, probably involving a remote pressure sense) but they also peck visually for surface prey such as gastropods. They can feed on small amphipods where prey densities are high enough.[16]

3.1.1.7 South Island pied oystercatcher

NZ pied oystercatcher (*Haematopus finschi*), classified as *At Risk – Declining* (H. A. Robertson et al., 2021), has an estimated national population of approximately 112,000 birds. Birds breed inland in the South Island on riverbeds and farmland; also known to breed on high country grasslands, and in coastal areas adjacent to estuaries and lagoons.[17]

Birds migrate to coastal areas of both the North and South Islands after breeding, including to Whangarei Harbour. Dowding & Moore (2006) identified the Manukau Harbour, Firth of Thames and Kaipara Harbour as the most important wintering sites for this species, with some 63,500 pied oystercatchers being recorded at these three sites in June 2003. Whangarei Harbour was ranked ninth out of 10 winter sites, with an estimated 619–2548 birds recorded during counts (Dowding & Moore, 2006).

In coastal areas, birds feed mainly on molluscs and worms, and have a strongly developed behaviour for preying on bivalves; other prey in coastal areas include crustaceans, cnidarians and fish. They feed by surface picking and deep probing in estuaries, on sandy shores, in pasture and on riverbeds (Heather & Robertson, 2005).

3.1.1.8 Variable oystercatcher

Variable oystercatcher (*Haematopus unicolor*), classified as *At Risk – Recovering* (H. A. Robertson et al., 2021), are almost exclusively a coastal wader, favouring sandy and rocky shorelines around the North, South and Stewart Islands and their offshore islands (Crossland, 2001; Dowding & Moore, 2006). The national population is estimated to be approximately 5,000-6,000 birds,[18] with about two-thirds of that population occurring in the North Island, particularly in Northland, Coromandel Peninsula and Bay of Plenty (Dowding & Moore, 2006). Breeding and wintering distributions are similar.

Riegen & Sagar (2020) reported a mean of 205 birds in the Whangarei Harbour during the 2005-2019 winter counts, and mean of 147 birds in the Ruakaka and Waipu Estuaries. In terms of the harbour's importance as a wintering site for variable oystercatcher, the area is ranked as the third highest in New Zealand (Dowding & Moore, 2006; Riegen & Sagar, 2020).

Their diet includes a wide range of littoral[19] invertebrates, including molluscs, crustaceans, and annelids; foraging patterns are influenced by tidal cycles (Heather & Robertson, 2005).

[16] Battley. P.F. 2013 [updated 2017]. Lesser knot. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[17] Sagar, P.M. 2013. South Island pied oystercatcher in Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[18] Dowding, J.E. 2013 [updated 2017]. Variable oystercatcher. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[19] Pertaining to the shore (Lincoln et al., 1998).

3.1.1.9 Southern black-backed gull

The black-backed gull (*Larus dominicanus*) is classified as *Not Threatened* (H. A. Robertson et al., 2021) and is common throughout New Zealand in most habitats; they are particularly abundant anywhere food scraps, offal and other organic waste that can be obtained.[20]

3.1.1.10 Red-billed gull

The red-billed gull is a very abundant species, but has been afforded a classification of *At Risk – Declining* due to the recent large declines at its three main breeding colonies (Three Kings Islands, Mokohinau Islands and Kaikoura Peninsula) (H. A. Robertson et al., 2021). This species nests in dense colonies, including at the Marsden Point refinery where the breeding colony is estimated to be 1,190 pairs (Frost & Taylor, 2018).

During the breeding season, red-billed gull feed mainly in inshore waters on the planktonic euphausiid *Nyctiphanes australis,* although some other marine invertebrates and small fish are taken (Heather & Robertson, 2005). Birds disperse during the non-breeding season (Higgins & Davies, 1996).

3.1.1.11 Caspian tern

Caspian tern (*Hydroprogne caspia*), classified as *Threatened – Nationally Vulnerable* (H. A. Robertson et al., 2021), remains uncommon in New Zealand with an estimated 1300-1400 breeding pairs (Bell & Bell, 2008). Bell & Bell (2008) estimated the Whangarei breeding population to be approximately 50-100 pairs.

This species associates mainly with coastal but also freshwater environments (Heather & Robertson, 2005). During the breeding season, birds from coastal colonies primarily forage inshore in harbours and estuaries. Caspian tern feed mostly on small surface-swimming fish such as yellow-eyed mullet, piper, and smelt; fish are caught by plunge-diving (Heather & Robertson, 2005)

3.1.1.12 White-fronted tern

The white-fronted tern, while common all around New Zealand coasts, is classified as *At Risk – Declining* (H. A. Robertson et al., 2021). The national population is estimated to be 15,000-20,000 pairs (Heather & Robertson, 2005; Higgins & Davies, 1996). Breeding colonies are widely distributed around the coast of the North Island, with some concentration in natural harbours and large estuaries, including Whangarei Harbour (Beauchamp & Parrish, 1999; Frost, 2017; Pierce, et al., 2002). Beauchamp & Parrish (1999) reported frequent low numbers (~60 birds) of white-fronted tern at the Port Whangarei sedimentation pond and roost area.

White-fronted tern feed on shoaling fish such as smelt and pilchard in coastal waters (Heather & Robertson, 2005). They catch small fish and crustaceans by plunging into the water from 5-10 m above the surface.

[20] Miskelly, C.M. 2013. Southern black-backed gull. In Miskelly, C.M. (ed.) *New Zealand Birds Online*. www.nzbirdsonline.org.nz

3.1.2 Pelecaniformes (herons, shags & spoonbill)

3.1.2.1 Reef heron

In New Zealand, reef heron (*Ardea sacra*) are widespread in the North, South and Stewart islands (Edgar, 1978; Heather & Robertson, 2005; C. J. R. Robertson et al., 2007). This species is classified as *Threatened – Nationally Endangered* (H. A. Robertson et al., 2021), with an estimated national population of 300-500 birds (Bell, 2010). With respect to Whangarei Heads, Pierce et al. (2002) describes the reef heron as a rare resident that breeds in the caves of coastline and islands.

The reef heron is a bird of the rocky shore, where it stalks around rock pools and small rivulets of water that may carry fish. It can also be seen on estuary mudflats feeding at low tide and may occasionally be seen wading in the shallow waves on sandy beaches. Reef herons catch and eat small fish, crustaceans and worms.[21]

3.1.2.2 White-faced heron

This widespread and common species is classified as *Not Threatened* (H. A. Robertson et al., 2021). Beauchamp & Parrish (1999) reported frequent low numbers (~60 birds) of white-faced heron at the Port Whangarei sedimentation pond and roost area.

Both saline and freshwater habitats are used for foraging, as indicated by the wide range of prey they consume: small fish, crabs, worms, insects, spiders, mice, lizards, tadpoles and frogs (Marchant et al., 1990). The white-faced heron is a predator that depends on vision and captures prey with a variety of methods; when foraging, they are essentially searchers, usually wading and walking, but occasionally standing and waiting for prey (Moore, 1984). Thus, they are coastal edge shallow-water foragers.

3.1.2.3 Royal spoonbill

Royal spoonbill (*Platalea regia*), classified as *At Risk – Naturally Uncommon* (H. A. Robertson et al., 2021), has an estimated New Zealand population of 2360 birds.[22] In New Zealand, birds breed in coastal colonies around North and South Islands, and disperses widely around the country after breeding. Beauchamp & Parrish (1999) reported low numbers (~40 birds) of royal spoonbill as seasonal (autumn, winter, spring) visitors at the Port Whangarei sedimentation pond and roost area.

Birds feed while wading in water during the day or night, whenever tide is suitable. They mainly eat fish in freshwater, and shrimps in tidal flats; also eats other crustaceans, aquatic insects and frogs. Bill structure limits it to feeding in water less than 40 cm deep over sand, mud or clay. Vibration detectors inside the bill can detect prey in murky water or darkness.[22]

3.1.2.4 Black shag

Black shag (*Phalocrocorax carbo novaehollandiae*), classified as *At Risk – Relict* (H. A. Robertson et al., 2021), is sparsely widespread from Northland to Stewart Island and is found in a variety of habitats including coastal and freshwater systems (Heather & Robertson, 2005).

[21] Adams, R. 2013. Reef heron. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

[22] Szabo, M.J. 2013 [updated 2017]. Royal spoonbill. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

Heather & Robertson (2005) estimate the national population to be 5,000-10,000 pairs, with most nesting in small colonies of 5-20 pairs. Beauchamp & Parrish (1999) reported low numbers (2 birds) of black shag occasionally at the Port Whangarei sedimentation pond and roost area.

Birds generally forage alone and the diet is mainly small and medium sized fish (<35 cm long), and may include (depending on habitat) mullet, wrasse, red cod, spotties, smelt, eels, bullies, galaxiids, trout and perch (Heather & Robertson, 2005; McKinnon et al., 2004).

Heather & Robertson (2005) report that black shags stay close inshore, mainly in water <3 m deep, but have been caught in crayfish pots set at 12 m deep.

3.1.2.5 Little shag

Little shag (*Phalacrocorax melanoleucos*) are considered to be widespread and common, with a national population of 5,000-10,000 breeding pairs and are classified as *At Risk - Relict* (Heather & Robertson, 2005; H. A. Robertson et al., 2021). Beauchamp & Parrish (1999) reported low numbers (8 birds) of little shag occasionally at the Port Whangarei sedimentation pond and roost area.

Little shag forage in sheltered coastal waters, estuaries and harbours, rivers and lakes. Diet varies greatly with habitat but is mainly small fish (<13 cm long). Little shag generally feed close to shore in waters less than 3 m deep (Heather & Robertson, 2005; Lalas, 1983).

3.1.2.6 Pied shag

The pied shag (*Phalacrocorax varius*), classified as *At Risk - Relict* (H. A. Robertson et al., 2021), has a widespread breeding distribution roughly comprising three distinct areas: northern North Island (Wairoa up to the far North), central New Zealand and southern South Island (WMIL, 2013). With an estimated national population of approximately 6,400 breeding pairs, some 1,500 of those breeding pairs are located within the northern North Island area (WMIL, 2013). Beauchamp & Parrish (1999) reported low numbers (57 birds) of pied shag as resident at the Port Whangarei sedimentation pond and roost area.

Birds generally forage close to shore in shallow water less than 10 m deep and their diet is mainly 6-15 cm long fish (Heather & Robertson, 2005; Lalas, 1983).

3.1.3 Sphenisciformes

In terms of foraging distribution and technique, Shealer (2002) classifies the Spheniscidae family, which penguins belong to, as coastal-inshore pursuit divers.

3.1.3.1 Northern little penguin

Kororā have not been recorded during the Northport surveys. Potential habitat is present on the existing revetments, and birds are known to be present in the wider Whangarei Harbour, including breeding along the northern shoreline, and on High and Calliope Islands (refer to Map 1) (Bioresearches, 2015).

Kororā are native to New Zealand and Australia; in New Zealand they are widely distributed along the coastlines of the North, South, Rakiura and Chatham islands and their offshore islands (Heather & Robertson, 2005; Marchant et al., 1990). The New Zealand population of kororā is estimated to be c. 50,000-100,000, with approximately 5,000 –10,000 breeding pairs of the northern form (C. J. R. Robertson & Bell, 1984). Robertson et al. (2021) have assigned an *At Risk – Declining*

classification to the northern little penguin (*Eudyptula minor iredalei).* Birds have been reported breeding along the north-eastern shoreline of the Whangarei Harbour entrance, including around Reotahi Bay to High Island area, Calliope Island, Home Point to Busby Head and Smugglers Bay (Munro, 1971; Parrish, 1985; Pierce, 2005).

Nests are situated relatively close to the sea in burrows excavated by the birds or other species, or in caves, rock crevices, under logs or in or under a variety of man-made structures including nest boxes, pipes, stacks of wood or timber, and buildings.[23] Adults are present at colonies throughout the year, though numbers are lowest between completion of moult (April) and start of breeding (August) (Marchant et al., 1990). For most colonies in New Zealand the breeding season begins around August and continues until January when chicks fledge (Davis & Renner, 2010).

During the breeding season, kororā are near shore foragers, restricted to foraging areas close to their nest (Gaskin & Rayner, 2017). Numerous studies have found that kororā generally travel no further than 20 km from the colony while feeding chicks (Cannell, 2016; Chiaradia & Kerry, 1999; Collins et al., 1999; Hoskins et al., 2008; Klomp & Wooller, 1988; Preston et al., 2008; Weavers, 1992).

Kororā are visual feeders foraging by pursuit diving; consequently diving is exclusively diurnal, with a midday peak (Cannell & Cullen, 1998; Preston et al., 2008; Ropert-Coudert et al., 2003, 2006).

3.1.4 Procellariidae (petrels)

3.1.4.1 Grey-faced petrel

Grey-faced petrel (*Pterodroma macroptera gouldi*), classified as *Not Threatened* (H. A. Robertson et al., 2021), is a widespread endemic subspecies that breeds on numerous islands and some mainland locations. Hongiora (Ruamaahua Aldermen Islands) has the largest local population with an estimated 20,000-50,000 pairs (Gaskin & Rayner, 2017). A number of smaller populations are found on Hen and Chickens, Mercury and Alderman islands (Taylor, 2000).

Gaskin & Rayner (2017) report that this species forages offshore in deep sub-tropical and temperate waters of the Tasman Sea and Pacific Ocean, and that recent dietary and tracking studies indicate the species to be an obligate deep-water specialist with > 80% of food, predominantly diurnally migrating species, predated or scavenged at night.

Grey-faced petrel are away from their colonies during the non-breeding season and disperse widely within the subtropical and temperate waters (Gaskin & Rayner, 2017).

3.1.5 Species summary

Table 9 provides a summary of species threat classification, population sizes and feeding ecology for those coastal birds that were recorded during the 4Sight wading bird surveys (from Marsden Bay to One Tree Point), as well as kororā and grey-faced petrel (also known to breed in the wider harbour).

[23] Flemming, S.A. 2013. Little penguin. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. www.nzbirdsonline.org.nz

Table 9: Summary of population, foraging and dietary information for coastal birds recorded during the 4Sight wading bird surveys (plus penguin and petrel species known to breed in the harbour).

SPECIES	NZ CLASSIFICATION	IUCN CLASSIFICATION	EST. WHANGAREI HBR POP	EST. NATIONAL POPULATION	FORAGING BEHAVIOUR	MARINE DIET
CHARADRIIFOMRES						
Waders / Shorebirds						
Northern NZ dotterel	Threatened – Nationally Increasing	Near Threatened	~80 birds	~2,000 birds	Coastal wader	Wide range of marine invertebrates, particularly sandhopper (amphipods). Also crabs and annelid worms.
Banded dotterel	At Risk – Declining	Least Concern	~700 birds	~50,000 birds	Coastal wader	Crustaceans, worms and flies.
Wrybill	Threatened – Nationally Increasing	Vulnerable	~150 birds	5000-5500 birds	Coastal wader	Annelid and polychaete worms, small molluscs, and insects
Pied stilt	Not Threatened	Least Concern	~800 birds	~30,000 birds	Coastal wader	Aquatic and terrestrial invertebrates
Bar-tailed godwit	At Risk – Declining	Near Threatened	~2,800 birds	~85,000 birds	Coastal wader	Mainly eat polychaetes (probably over 70% of diet) but also small bivalves and crustaceans
Lesser knot	At Risk – Declining	Near Threatened	~800 birds	~30,000 birds	Coastal wader	Mainly eat small molluscs, especially bivalve shellfish. Important prey in New Zealand include pipi, cockles/tuangi and nutshells.
South Island pied oystercatcher	At Risk – Declining	Least Concern	~2,500 birds	~100,000 birds	Coastal wader	Mainly on molluscs and worms, but also crustaceans, cnidarians and fish.
Variable oystercatcher	At Risk - Recovering	Least Concern	~350 birds	~5,000 birds	Coastal wader	Invertebrates, including molluscs, crustaceans, and annelids
Gulls & terns						
Black-backed gull	Not Threatened	Least Concern	Abundant	>1,000,000 birds	Surface seizer	Fish, as well as food scraps, offal and other organic waste that can be obtained.
Red-billed gull	At Risk - Declining	Least Concern	>1,190 pairs	~28,000 pairs	Surface seizer	Mostly planktonic euphausiid, but also other marine invertebrates and small fish.
Caspian tern	Threatened – Nationally Vulnerable	Least Concern	50-100 pairs	~1,300 pairs	Plunge-diving	Small surface-swimming fish
White-fronted tern	At Risk – Declining	Least Concern	>100 birds	~20,000 pairs	Plunge-diving	Small shoaling fish

SPECIES	NZ CLASSIFICATION	IUCN CLASSIFICATION	EST. WHANGAREI HBR POP	EST. NATIONAL POPULATION	FORAGING BEHAVIOUR	MARINE DIET
PELECANIFORMES						
Herons, shags & spoonbill						
Reef heron	Threatened – Nationally Endangered	Least Concern	>10 pairs?	~300-500 birds	Stalks	Small fish, crustaceans and worms
White-faced heron	Not Threatened	Least Concern	~100 birds	Abundant	Coastal wader	Small fish, crabs, worms, insects
Royal spoonbill	At Risk – Naturally Uncommon	Least Concern	~40 birds	~2,360 birds	Coastal wader	Mainly shrimp and crustaceans
Black shag	At Risk – Relict	Least Concern	>10 birds	5,000-10,000 pairs	Pursuit diver in water ≤3 m	Small and medium sized fish (<35 cm long)
Little shag	At Risk – Relict	Least Concern	>10 birds	5,000-10,000 pairs	Pursuit diver in water ≤3 m	Mainly small fish (<13 cm long)
Pied shag	At Risk - Recovering	Least Concern	>50 birds	~6,400 pairs	Pursuit diver in water ≤10 m	Mainly small fish (6-15 cm long)
SHENISCIFORMES						
Penguins						
Northern little penguin	At Risk - Declining	Least Concern	>100 birds	~10,000 pairs	Pursuit diver with most foraging within 15 m of the surface.	Small inshore fish species
PROCELLARIIDAE						
Petrels						
Grey-faced petrel	Not Threatened	Least Concern	<100 pairs	>100,000 pairs	Pelagic (off-shore)	Diver - depths up to 23 m

3.2 Feeding Resources

3.2.1 Intertidal

Within the Whangarei Harbour, intertidal communities generally fall into one of three broad types: those of sheltered tidal creeks (upper harbour), semi-exposed sandflats (mid-harbour), and exposed sandflats (lower harbour). These community types are largely driven by substrate type and a change in community composition exists from muddy upper harbour to sandier lower harbour sites (Griffiths, 2012).

The area of intertidal foraging habitat within the Whangarei Harbour is vast, with approximately 4,600 ha of intertidal flats. Within the lower harbour, approximately 58% of the marine area habitat is intertidal flats (Coast & Catchment, 2022a). The lower harbour supports extensive cockle (*Austrovenus stuchburyii*) and pipi (*Paphies australis*) beds (Pawley & Smith, 2014).

Coast & Catchment (2022a) characterise the intertidal sediments around Northport as predominantly sand, except for the area immediately west of the port, which is muddy sand. In terms of local feeding resources available to wading birds in the intertidal areas to the west and east of Northport, Coast & Catchment (2022a) reported the following characteristics:

- The diversity and abundance of macroinvertebrates varied across the survey area with marked differences apparent between intertidal sites on the western and eastern side of Northport.
- Numbers of individuals were higher on the western side (refer to Figure 2) but counts varied along the shore.
- Numbers of taxa in core samples was uniformly high on the western side of the port compared to the eastern side (refer to Figure 3).
- Total counts of specimens from major taxa groups displayed substantial variation across the survey area, with stations on the eastern half, and east of the proposed reclamation areas tending to have relatively low counts.
- The following four broad groupings were determined (refer to Figure 4), and for which a statistically significant difference was detected in community compositions:
  - Communities in upper to mid-shore stations on both sides of Northport (Cluster A).
  - Communities in stations associated with raised sand/shell ridges on both sides of Northport (Cluster B).
  - Communities in easternmost stations (Cluster C).
  - Communities in low-shore stations on the western side of Northport Cluster D).

Figure 2: Benthic macroinvertebrate abundance results (Source: Coast & Catchment (2022a))

Figure 3: Benthic macroinvertebrate taxa diversity results (Source: Coast & Catchment ((2022a))

Figure 4: Broad groupings ("clusters") of benthic invertebrates based on intertidal sampling (Source: Coast & Catchment (2022a))

3.2.2 Pelagic

Coast & Catchment (2022a) report that the fish communities around Northport appear to be similar to those that inhabit nearby reef areas, with leatherjackets, red moki, spotty, sweep, triplefins, kingfish, jack mackerel, two-spot demoiselle, and goatfish commonly observed around the rock revetments of Northport.

For visual pelagic foraging species, turbidity[24] in the water column can impact the ability to detect prey. Results from the State of the environment report (released in 2015) from Northland Regional Council on the water quality of Whangarei Harbour found that all five sample sites (Mair Bank, Marsden Point, Blacksmith Creek, Snake Bank and One Tree Point) in the immediate vicinity of Northport had turbidity medians between 0.6-0.9 NTU, well below the 10 NTU threshold recommended in the ANZ guideline (2018).

3.3 Habitat Use

Maps 3 to 8 provide a graphical presentation of the distribution and abundance of the major shorebird groups recorded during the 4Sight wading bird surveys. In summary:

- Dotterels were recorded along much of the coastal margin from One Tree Point to CINZ, as well as the Northport site (Map 3).

[24] A measure of the degree to which light is scattered in water by particles

- International migrant waders (bar-tailed godwit and lesser knot) were recorded primarily around the Blacksmith's Creek area, though a few godwit were also recorded further west up to One Tree Point and to the east of Northport. A single eastern curlew was recorded at the northern most-end of One Tree Point (Map 4).
- Oystercatchers and stilt were primarily recorded to the east of Northport and adjacent to the Marsden Cove Marina channel but extended all the way to One Tree Point (Map 5).
- Gulls and terns were recorded dispersed along the coast, with large concentrations of red-billed gull to the east of Northport (Map 6).
- Heron and spoonbill were recorded in relatively low numbers along the coast, primarily to the west of Northport (Map 7).
- Shags were recorded in low numbers and primarily associated with the port, though a few birds were recorded in the Blacksmith's Creek / Wildlife Refuge area and along to One Tree Point (Map 8).

To further investigate the distribution of intertidal foraging species relative to available food supply, species count data was overlaid on to the macroinvertebrate abundance heat maps (refer to Maps 9 to 22).

The following sections of this report investigate in greater detail the spatial patterns of use recorded during the 4Sight wading bird surveys to the east (Section 3.3.1) and west (Section 3.3.3), as well on the Northport site itself (Section 3.3.2).

3.3.1 East of Northport

To the immediate east of Northport, an approximately 750 m beach is bound to the east by the CINZ jetty. The landward extent of the coastal dune that runs behind this beach is approximately 20-30 m wide, with the vegetation cover including spinifex, lupin and pohutukawa.

Bioresearches (2015, 2020) reported the CINZ jetty as a key roosting area for white-fronted tern, with an average of 93 birds (maximum = 163) roosting during their counts.

Mair and Marsden banks, situated to the east of the jetty, have been identified as regionally significant shellfish beds. Bioresearches (2017) reported birds foraging in this area, with black-backed gull, red-billed gull and variable oystercatcher being the most abundant species recorded in the intertidal zone. This area however was not identified as a significant high tide roost.

3.3.1.1 High tide activity

High numbers of shorebirds were recorded within compartments East 1 and East 2 during the 2017/18, 2019/20 and 2021 high tide wading bird surveys (refer to Map 23 and Table 10), though the diversity of species recorded on the Eastern sites was lower than that recorded at the Western sites (refer to Table 14). Similar levels of densities of birds were recorded in East 1 and East 2 (refer Table 10 and Figure 5).

Table 10: Number of coastal bird species recorded during the high tide eastern wading bird surveys

SURVEY LOCATION		No. SPECIES	TOTAL ABUNDANCE	MEAN BIRD DENSITY (PER Ha)	SURVEY PERIOD
Northport ↓ CINZ jetty	HW East 1	11	5492	58.5	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	HW East 2	9	4166	58.1	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	HW East 3	5	493	8.2	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021

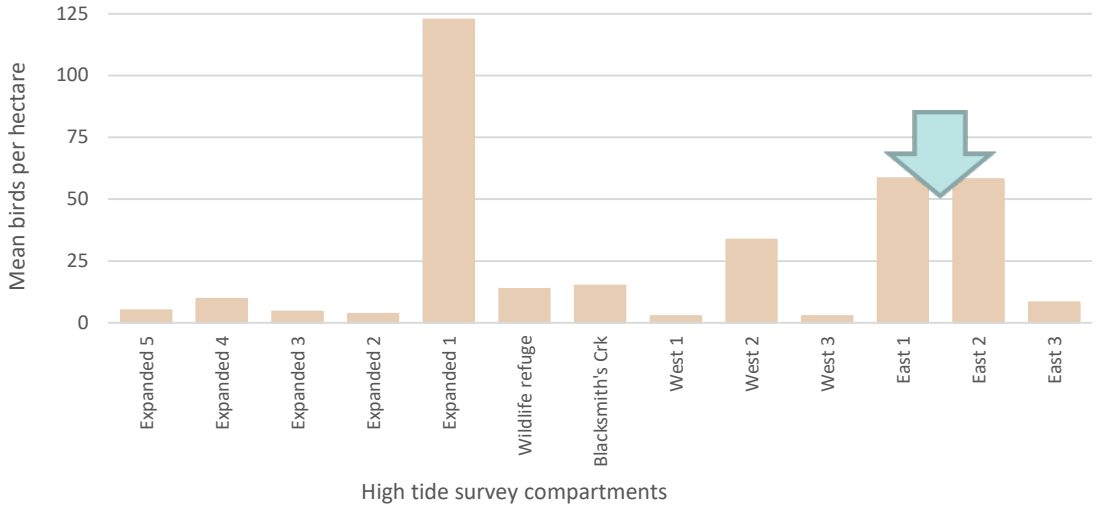

Figure 5: Mean density of birds recorded during high tide surveys over the 2017/18, 2019/20 and 2021 survey periods. (Green arrow denotes the survey compartments in which the proposed reclamation is located)

The species for which the highest mean abundance and densities were recorded in East 1 were SIPO (mean = 81 birds per count, Table 11; 34 birds per hectare; Figure 6) and variable oystercatcher (mean = 40 birds per count, Table 11; 17 birds per hectare, Figure 6). Red-billed gull recorded the highest mean abundance and densities in East 2 (mean = 81 birds per count, Table 11; 45.2 birds per hectare, Figure 6).

Table 11: Mean number of birds recorded per survey session during the high tide wading bird surveys. (Shaded column indicates the location of the proposed eastern reclamation)

SPECIES	MEAN No. BIRDS RECORDED PER SURVEY SESSION												
	Exp 5	Exp 4	Exp 3	Exp 2	Exp 1	W/life refuge	B/smith Creek	West 1	West 2	West 3	East 1	East 2	East 3
Banded dotterel	0	0	0	0	0	0	0	0	0	0	0	0	0
Bar-tailed godwit	0	0	0	0	8.54	0.00	19.23	1.80	56.43	0.80	0	1.75	0
Black shag	0	0	0	0	0	0.03	0	0	0	0	0	0	0
Caspian tern	0	0	0	0	0	0	0.18	0	0.10	0.05	0.48	0.05	0

SPECIES	MEAN No. BIRDS RECORDED PER SURVEY SESSION												
	Exp 5	Exp 4	Exp 3	Exp 2	Exp 1	W/life refuge	B/smith Creek	West 1	West 2	West 3	East 1	East 2	East 3
Lesser knot	0	0	0	0	0	0	9.25	0	15.00	0.50	0	0	0
Little shag	0	0	0	0.15	0.00	0.20	0.03	0	0	0.03	0.03	0	0
NZ dotterel	0.00	0.69	1.23	0.15	0.23	0	0.08	0	0	0.03	0.78	0.38	0.03
Pied shag	0.15	0.15	0.15	0.08	0	0.03	0.05	0	0.03	0	0.03	0	0
Pied stilt	0	0	0	0	0	0	0.68	0	1.68	1.10	0.03	0	0
Red-billed gull	8.54	7.77	6.69	0.69	10.77	0.55	1.38	4.65	1.10	0.50	15.85	81.13	12.03
Reef heron	0	0	0	0	0	0.25	0.03	0	0.03	0	0.03	0	0
Royal spoonbill	0.38	0.08	0.08	0	0	0	0	0	0	0	0	0	0
SBBG	0.38	0.08	0.08	0	0.85	0.95	2.15	0.03	0.28	0.18	0.30	0.28	0.13
SIPO	0	0	0.15	0	74.62	0	0.05	0.50	0	0.03	80.68	9.25	0
VOC	0	0	0.38	0.08	7.92	1.05	0.83	0.58	0.10	0.60	39.10	11.18	0.13
White-faced heron	0.08	0.08	0.23	0	0.08	2.08	0.95	0	0.03	0.23	0	0	0
White-fronted tern	0	0	0	0	0	0	0	0	0	0	0	0.13	0
Wrybill	0	0	0	0	0	0	0	0	0	0	0.03	0.03	0.03

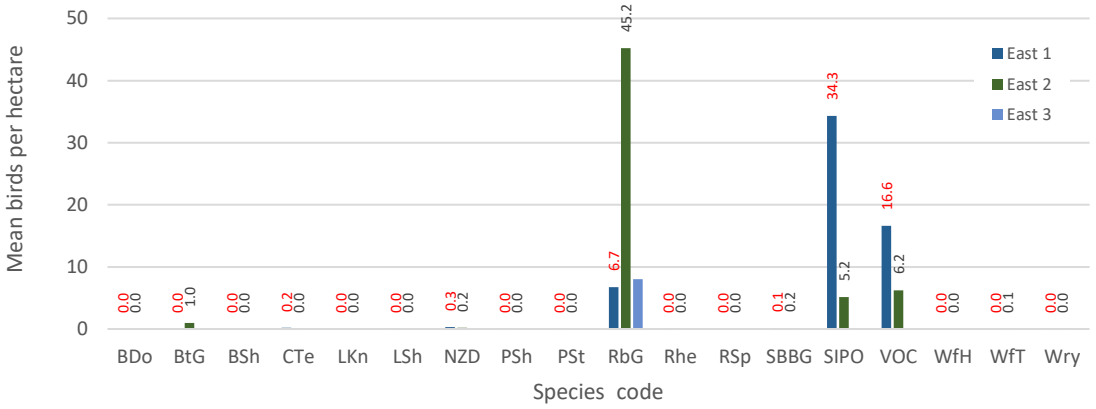

Figure 6: Mean birds recorded per hectare during high tide surveys at the eastern sites over the 2017/18, 2019/20 and 2021 survey periods, with data labels provided for compartments East 1 (red) and East 2 (black). (Refer to Table 8 for species codes)

3.3.1.2 Low – mid tide activity

Of the three compartments, the highest number (n=8497) and mean density (35.2 birds per hectare) of birds was recorded in East 2 during the summer 2017/18 and 2019/20, and winter 2021 low-mid tide surveys (refer to Map 24, Table 12 and Figure 7). The lowest species richness (n=7) was recorded in East 3 (refer to Map 24 and Table 12).

Table 12: Number of coastal bird species recorded during the low and mid tide eastern wading bird surveys

SURVEY LOCATION		No. SPECIES	TOTAL ABUNDANCE	MEAN BIRD DENSITY (PER Ha)	SURVEY PERIOD
Northport ↓ CINZ jetty	LW East 1	13	6865	16.3	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	LW East 2	12	8497	35.2	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	LW East 3	7	1055	14.9	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021

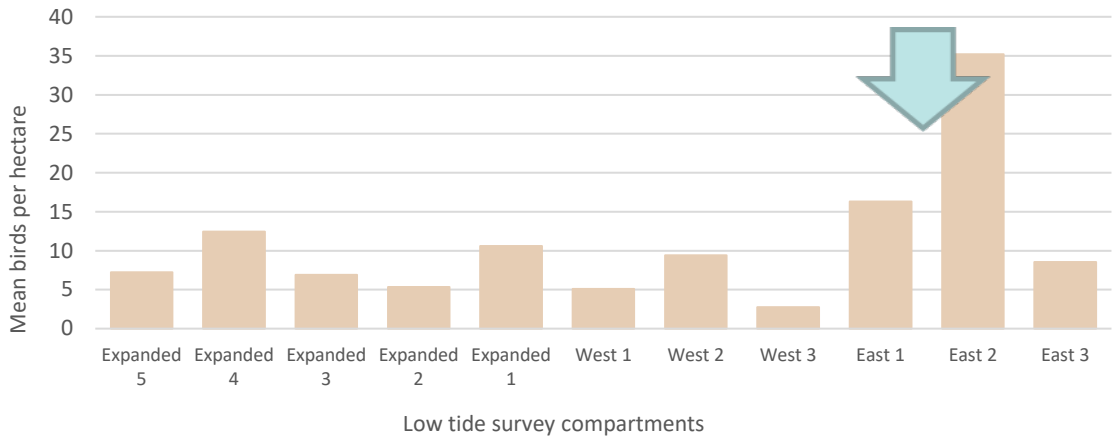

Figure 7: Mean density of birds recorded during low/mid tide surveys over the 2017/18, 2019/20 and 2021 survey periods. (Green arrow denotes the survey compartments in which the proposed reclamation is located)

The most abundant species recorded in East 1 were SIPO (mean = 38 birds per count; Table 13), followed by red-billed gull (mean = 33 birds per count; Table 13) and variable oystercatcher (mean = 21 birds per count; Table 13). Red-billed gull was the most abundant species recorded in East 2 (mean = 107 birds per count) (refer to Map 24 and Table 13). The same patterns were observed in the density of these species recorded at those sites (refer to Figure 8).

Table 13: Mean number of birds recorded per survey session during the low-mid tide wading bird surveys. Shaded column indicates the location of the proposed eastern reclamation)

SPECIES	MEAN No. BIRDS RECORDED PER SURVEY SESSION										
	Exp 5	Exp 4	Exp 3	Exp 2	Exp 1	West 1	West 2	West 3	East 1	East 2	East 3
Banded dotterel	0	0.10	0	0	0.24	1.45	0.61	0	0.03	0.01	0
Bar-tailed godwit	10.14	2.81	10.43	0.57	9.67	21.44	34.42	3.32	0	0.03	0
Black shag	0	0	0	0	0	0.01	0	0	0	0	0
Caspian tern	1.00	0.10	0	0.05	0.05	0.14	0.41	0.15	0.24	0.14	0.01
Lesser knot	0	0	0.05	0	0.05	24.70	49.38	7.11	0	0	0

SPECIES	MEAN No. BIRDS RECORDED PER SURVEY SESSION										
	Exp 5	Exp 4	Exp 3	Exp 2	Exp 1	West 1	West 2	West 3	East 1	East 2	East 3
Little shag	0.76	0.10	0.19	0.05	0	0	0.20	0	0	0	0
NZ dotterel	1.00	1.19	2.48	0.95	2.11	4.66	6.63	2.28	2.11	0.61	0.04
Pied shag	0.71	0.05	0.29	0.14	0.14	0.10	0.17	0.03	0.01	0.04	0.03
Pied stilt	2.10	1.81	2.52	0.33	0.05	0.76	1.61	1.06	0.10	0	0
Red-billed gull	35.43	42.90	39.48	4.81	8.57	14.89	21.82	7.70	32.58	106.83	13.94
Reef heron	0.05	0.05	0.10	0.10	0	0.10	0.13	0.07	0.04	0	0
Royal spoonbill	0.10	0.76	0.38	0	0	0	0.27	0.10	0	0	0
SBBG	18.00	10.90	5.24	0.19	1.95	2.04	6.72	0.50	0.90	0.86	0.39
SIPO	10.48	12.81	9.81	1.00	46.44	8.80	4.27	0.14	38.15	4.61	0.04
VOC	2.00	6.05	2.48	0.19	3.33	1.82	2.70	1.42	21.03	6.48	0.39
White-faced heron	2.71	1.57	3.57	0.62	0.67	0.59	2.30	0.77	0.07	0.04	0
White-fronted tern	0.62	0	0	0	0	0.07	2.42	0.01	1.41	0.01	0
Wrybill	0.05	0	0	0	0	0	0	0	0.01	0.01	0

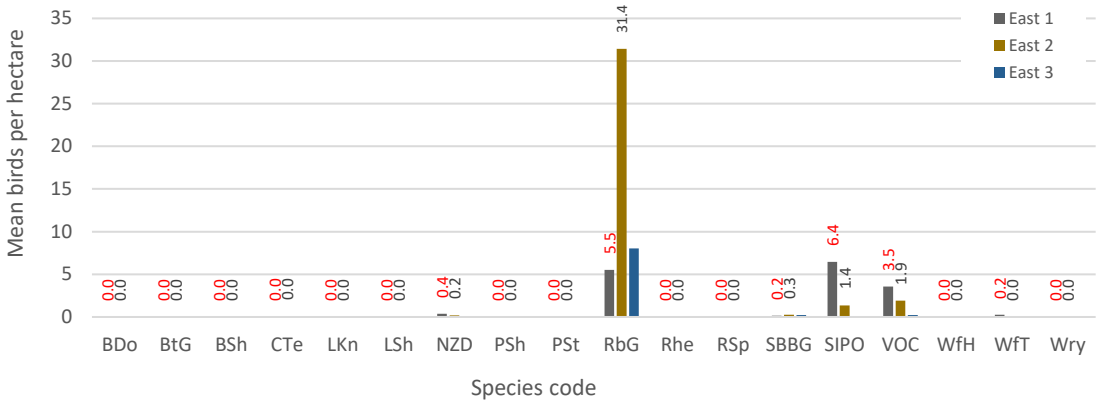

Figure 8: Mean birds recorded per hectare during low and mid tide surveys at the eastern sites over the 2017/18, 2019/20 and 2021 survey periods, with data labels provided for compartments East 1 (red) and East 2 (black). (Refer to Table 8 for species codes)

Coast & Catchment (2022a) reported marked differences between intertidal sites on the western and eastern side of Northport; both the number of individuals (abundance) and taxa (diversity) being higher on the western side (refer to Figure 2 and Figure 3 on page 26). Furthermore, on the eastern side, the intertidal benthic surveys showed a general decrease in macroinvertebrate diversity and abundance moving eastward (refer to Figure 2 and Figure 3 on page 26).

3.3.1.3 Nesting

No nesting wading or shorebird species were recorded during either the 2018/19 or 2019/20 season.

3.3.2 Northport

Despite Northport being an active port site, it contains areas of potential shorebird habitat, including large areas of open space, lawns and riprap edges. Surveys of both shorebird nesting and high tide roosts were conducted on the Northport site.

3.3.2.1 High tide activity

Ten species were recorded on the Northport site during high tide counts in 2019/20 and 2021 (refer to Map 23 and Figure 9), of which red-billed gull (mean = 16.8 birds per count) were the most abundant, followed by northern NZ dotterel (mean = 6.9 birds per count) and variable oystercatcher (mean = 4.4 birds per count).

3.3.2.2 Nesting

During the 2018/19 survey, variable oystercatcher were recorded breeding on top of the tug bay revetment at the Eastern Site (refer to Map 27). Later in the season (24/1/19), two pairs of variable oystercatcher (each with one chick) and one pair of New Zealand dotterel (with three chicks) were recorded on the Northport site.

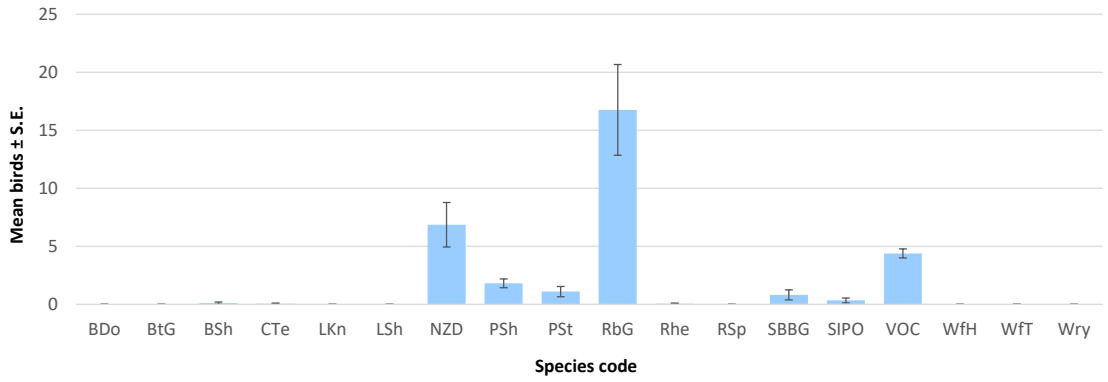

Figure 9: Mean (± S.E.) birds recorded during high tide surveys at Northport survey sites during 2019/20 and 2021 survey periods. (Refer to Table 8 for species codes)

During the 2019/20 survey, the Port site had the highest number of nesting birds recorded. This included a pair of northern NZ dotterel successfully raising chicks on top of the coal pile, a pair of variable oystercatcher was seen with chicks on the tug revetment, and a pied stilt was seen on a nest with four eggs next to the molasses pond (refer to Map 27).

The December 2019 kororā survey along the eastern and western riprap of the Northport site detected no sign of nesting birds. While outside of the breeding season, the June 2021 survey of the same area using a DOC-certified conservation dog gave three weak indications along the western riprap (refer to Map 27). Exploration of the crevices that the dog indicated on found no sign of birds or feathers. Nevertheless, given the riprap does provide potential kororā habitat, and a weak indication was given at three locations, we have taken a conservative approach and have assumed that these locations are used by nesting kororā.

3.3.3 West of Northport

To the west of Northport, an approximately 3.5 km long shoreline extends from One Tree Point to Marsden Bay (refer to Map 2). This area comprises 198 ha of shallow intertidal and subtidal sandy soft bottom habitats.[25] The shellfish, seagrass communities and associated benthic invertebrates have been reported to be a major food source for shorebirds.[25]

Snake Bank, situated to the north-west of Marsden Bay, is an extensive fine sand and shell shallow bank which contain a cockle population (Morrison & Parkinson, 2001). Bioresearches (2017) reported an average of 39 birds on the bank, with birds (predominantly SIPO, black-backed gull and variable oystercatcher) common during the low tide period. Snake Bank does not provide a high tide roost.

Urban residential development abuts much of this coastline (see Map 2), and the Marsden Cove Marina channel exits the coast along this stretch of shoreline, as does Black Smith's Creek. A Department of Conservation (DOC) wildlife refuge (approximately 0.05 ha) is located to the immediate west of the Blacksmith's Creek Estuary mouth. Black Smith's Creek Estuary has been classified as a Protected Natural Area; the 22 ha area contains a diverse mosaic of estuarine and terrestrial vegetation comprising mangrove shrubland, searush–oioi rushland, glasswort herbfield and marsh clubrush sedgeland (Lux et al., 2007). Both Australasian bittern (*Botaurus poiciloptilus*) and banded rail (*Gallirallus philippensis assimilis*) have been recorded there (Lux et al., 2007); these species are classified as *Threatened – Nationally Critical* and *At Risk – Declining* respectively (H. A. Robertson et al., 2021).

3.3.3.1 High tide activity

For the five high tide survey compartments (West 1-3, Blacksmith's Creek and Wildlife Refuge) for which wading bird data was collected over three seasons (summer 2017/18 and 2019/20, and winter 2021), Blacksmith's Creek high tide roost recorded the highest species richness (n=13) over the survey period (refer to Table 14 and Map 23). In terms of overall bird abundance, West 2 recorded the greatest number of birds (n=2990) and highest mean density (33.6 birds per ha; Figure 10) during high tide counts over the three seasons (Table 14).

However, when the data collected from the Expanded survey areas over two seasons are included, the highest mean density of birds (122.6 birds per ha) overall was recorded at Expanded 1 site (refer to Table 14 and Figure 10).

[25] Significant Ecological Marine Area Assessment Sheet, Whangarei Harbour Marine Values: Area C One Tree Point to Marsden Bay.

Table 14: Number of coastal bird species recorded during the high tide western (and expanded) wading bird surveys

SURVEY LOCATION		No. SPECIES	TOTAL ABUNDANCE	MEAN BIRD DENSITY (PER Ha)	SURVEY PERIOD
One tree Point	Expanded 5	5	124	5.0	• Summer 2019/20 • Winter 2021
	Expanded 4	6	115	9.6	• Summer 2019/20 • Winter 2021
	Expanded 3	8	117	4.5	• Summer 2019/20 • Winter 2021
	Expanded 2	5	15	3.6	• Summer 2019/20 • Winter 2021
	Expanded 1	7	1339	122.6	• Summer 2019/20 • Winter 2021
	Wildlife refuge	8	205	13.7	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	Blacksmith's Creek	13	1394	15.0	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	HW West 1	5	302	2.7	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	HW West 2	10	2990	33.6	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
Northport	HW West 3	11	161	2.6	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021

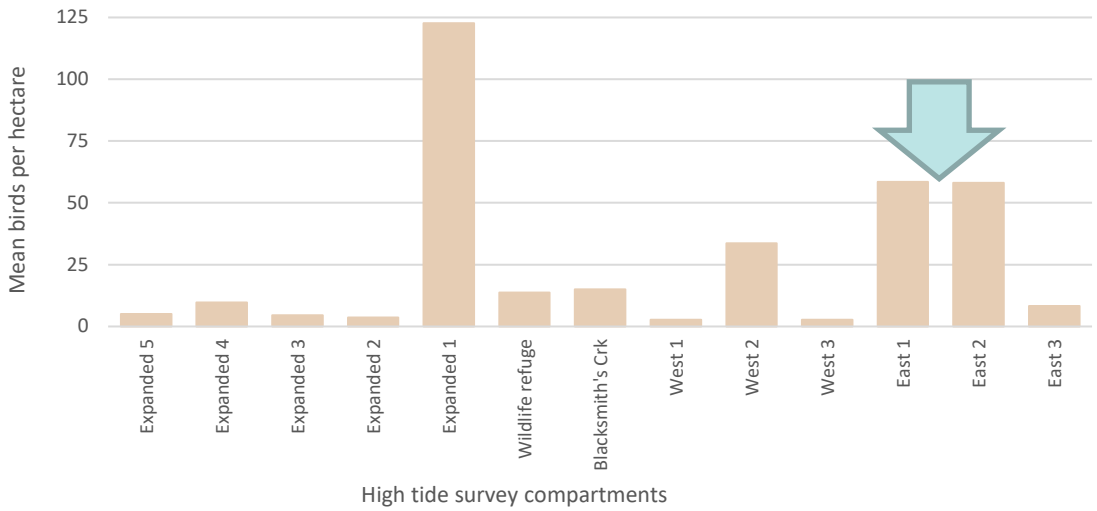

Figure 10: Mean density of birds recorded per hectare during high tide surveys (One Tree Point to Northport) over the 2017/18, 2019/20 and 2021 survey period. (Green arrow denotes the survey compartments in which the proposed reclamation is located)

Map 23 provides an overall (cumulative) picture of high tide activity based on all data collected over the 2017/18, 2019/20 and 2021 high tide counts, while the mean number of birds recorded during each high tide survey session is provided in Table 11. Notably, bar-tailed godwit and lesser knot were the most abundant species recorded in the high tide roosting flocks at compartment West 2 and Blacksmith's Creek (refer to Map 23, Table 11 and Figure 11).

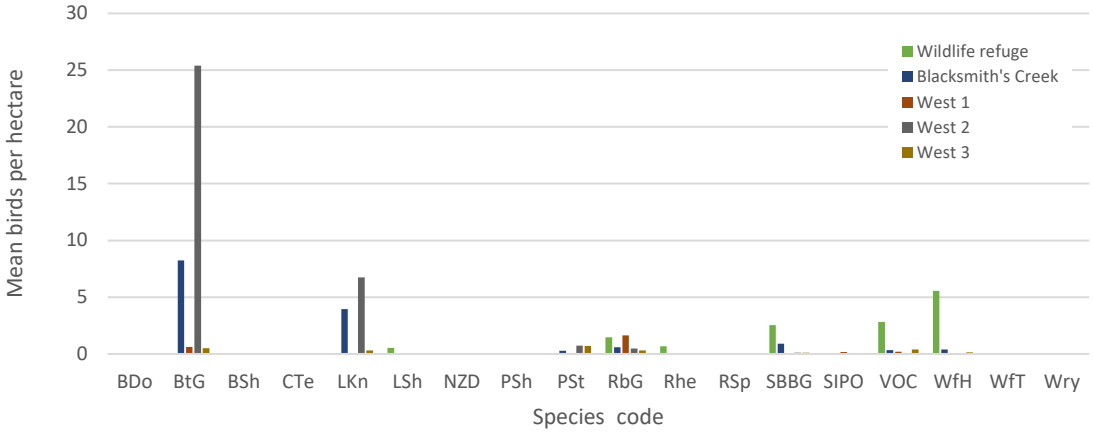

Figure 11: Mean birds per hectare recorded during high tide surveys at the western sites over the 2017/18, 2019/20 and 2021 survey periods. (Refer to Table 8 for species codes)

Map 25 presents the high tide data that were collected between 20/12/19 - 17/2/20 and winter 2021, as these were the time periods over which data were also collected for the Expanded area. SIPO were the most abundant species recorded during the high tide counts, with the majority recorded within compartment Expanded 1 (refer to Table 11 and Figure 12), adjacent to the Marsden Cove Marina Channel; notably, this high tide roost is in close proximity to Snake Bank which has been identified as an important foraging site for SIPO (Bioresearches, 2017).

Very few birds were recorded roosting in the remaining Expanded survey areas (refer to Map 25 and Figure 12).

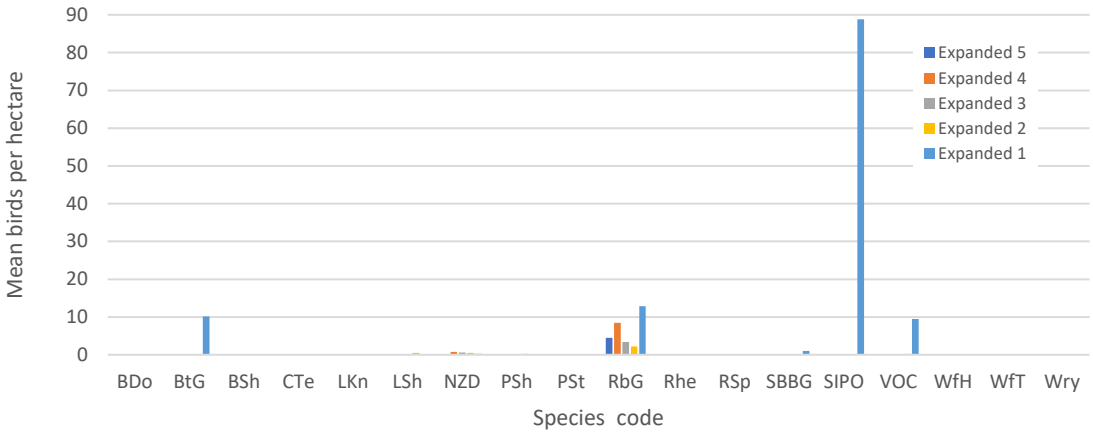

Figure 12: Mean birds per hectare recorded during high tide surveys at the expanded sites during 20/12/19-17/2/20 and winter 2021 survey periods. (Refer to Table 8 for species codes)

3.3.3.2 Low – mid tide activity

For the three compartments (West 1-3) for which wading bird data was collected during the low and mid-tide phases over three seasons (spring / summer 2017/18 and 2019/20, and winter 2021), highest species richness (n=16) and total bird abundance (n=9517) were recorded at West 2 (Table 15). Over the same period, the least number of birds (n=1750) were recorded in West 3, the survey compartment immediately adjacent to the port (Table 15).

Table 15: Number of coastal bird species recorded during the low and mid tide western (and expanded) wading bird surveys

SURVEY LOCATION		No. SPECIES	TOTAL ABUNDANCE	MEAN BIRD DENSITY (PER Ha)	SURVEY PERIOD
One Tree Point	Expanded 5	15	1788	7.2	• Summer 2019/20 • Winter 2021
	Expanded 4	14	1705	12.4	• Summer 2019/20 • Winter 2021
	Expanded 3	13	1617	6.9	• Summer 2019/20 • Winter 2021
	Expanded 2	12	189	5.3	• Summer 2019/20 • Winter 2021
	Expanded 1	13	1391	10.6	• Summer 2019/20 • Winter 2021
	LW West 1	15	5792	5.1	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
	LW West 2	16	9517	9.4	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021
Northport	LW West 3	14	1750	2.7	• Spring / summer 2017/18 • Spring / summer 2019/20 • Winter 2021

Figure 13 shows the mean number of birds recorded per hectare at each of the sites during low-mid tide surveys. Thus, even when accounting for differences in the size of the various compartments, the lowest density of birds was recorded within West 3, immediately adjacent to Northport; the intertidal benthic survey data also recorded generally lower macroinvertebrate abundance at that location (refer to Figure 2, page 26). Of the western sites, the greatest density of birds was recorded in compartments Expanded 1 and Expanded 4 (Table 15 and Figure 13).

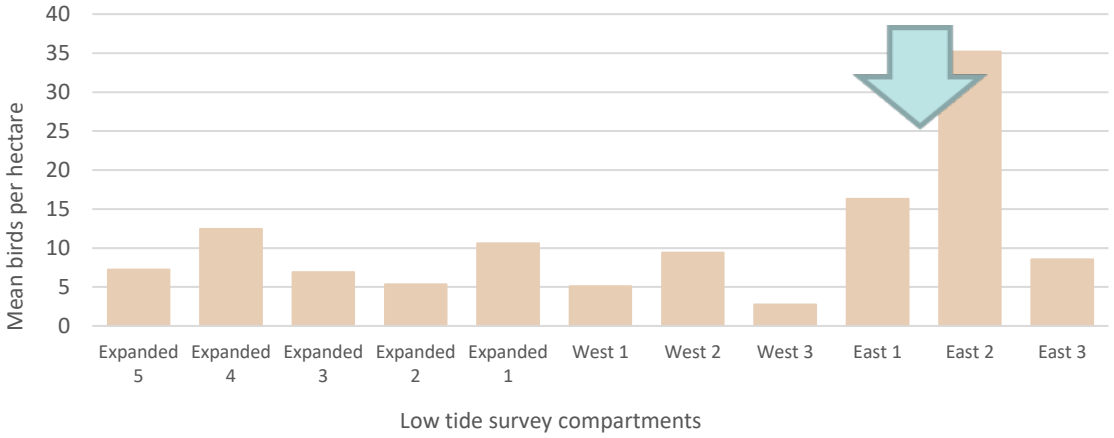

Figure 13: Mean density of birds recorded during low/mid tide surveys over the 2017/18, 2019/20 and 2021 survey period. (Green arrow denotes the survey compartments in which the proposed reclamation is located)

Map 24 provides an overall picture of activity based on all data collected over the 2017/18, 2019/20 and 2021 low and mid-tide counts. Lesser knot were the most abundant species recorded, and while observed utilising all three western compartments, their average numbers (mean = 49.4 birds; Table 13) and densities (3.5 birds per hectare; Figure 14) were highest in West 2. The diet of lesser knot comprises small molluscs, especially bivalve shellfish such as pipi, cockles / tuangi and nutshells.

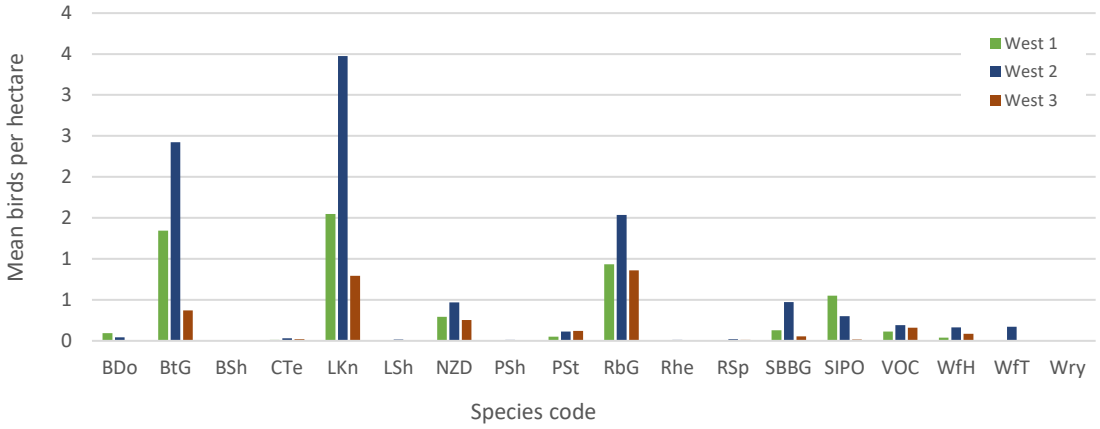

Figure 14: Mean birds recorded per hectare during low and mid tide surveys at the western sites over the 2017/18 and 2019/20 survey period. (Refer to Table 8 for species codes)

Bar-tailed godwit were also prevalent in compartments West 1 and West 2 (refer to Table 13 and Figure 14). The diet for this species contains mostly polychaete worms, but also includes small bivalves and crustaceans.

Northern NZ dotterel were recorded in all western compartments, but in relatively low numbers (refer to Table 13 and Figure 14). The diet for this species includes a wide range of marine invertebrates, particularly sandhoppers (amphipods), but also crabs and annelid worms.

Map 26 presents the low and mid-tide data that was collected between 20/12/19 - 17/2/20 and winter 2021, as these were the time periods over which data were also collected for the Expanded

area. All Expanded areas were utilised during these tidal phases, however the mean bird density differed between the compartments; the highest mean bird density was recorded in Expanded 4 (12.4 birds per hectare) and the lowest in Expanded 2 (5.3 birds per hectare; Table 15). Red-billed gull were the predominant species recorded at Expanded Areas 2-5, while SIPO was the predominant species recorded at Expanded Area 1 (refer to Figure 15 and Map 26).

The intertidal benthic survey data showed similar levels of macroinvertebrate abundance and diversity in the avifauna Expanded and western survey areas (refer to Figure 2 and Figure 3, page 26). The mean density of birds recorded foraging within Expanded Area 5 (7.2 birds per hectare) was mid-range of all the compartments to the west of Northport (refer to Table 15).

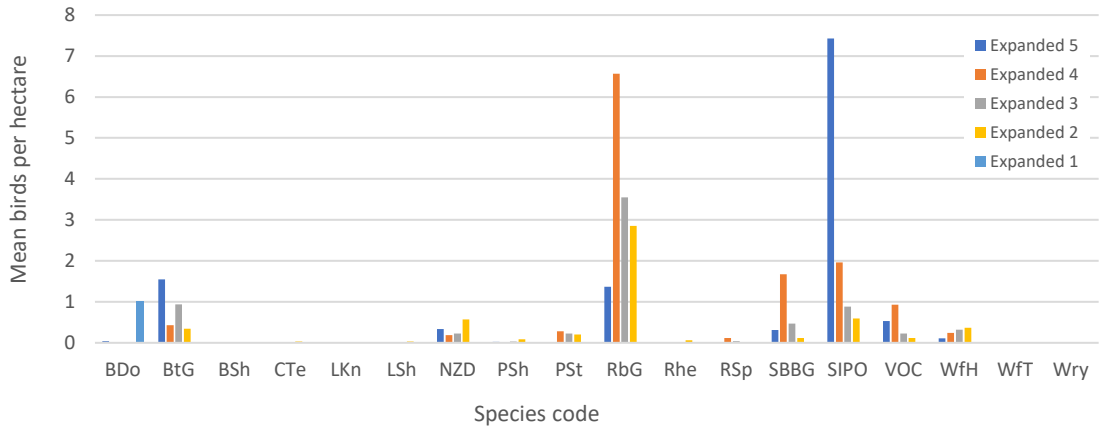

Figure 15: Mean birds recorded per hectare during low and mid tide surveys at the expanded sites during December 2019 to February 2020, and winter 2021 survey periods. (Refer to Table 8 for species codes)

3.3.3.3 Nesting

Variable oystercatcher were confirmed breeding within the Blacksmiths Creek mangrove survey area during both the 2018/19 and 2019/20 seasons, as well as on the Northport west revetment in 2019/20.

3.3.4 Wider lower harbour

Beauchamp & Parrish (2007) identified Marsden Bay and Ruakaka Estuary as the wading bird roosting sites within the lower (outer) Whangarei Harbour. Marsden Bay was reported to be an important (having >75% of a species total count at one location during any high tide) roosting site for SIPO, while Ruakaka Estuary was identified as an important roosting site for SIPO, variable oystercatcher, northern NZ dotterel, banded dotterel and ruddy turnstone. Beauchamp & Parrish (2007) reported that based on the wading bird counts since 1970's, the loss of a roost site was not critical to SIPO, variable oystercatcher, pied stilt, less knot or bar-tailed godwits because they were all well distributed amongst the roosts sites around the Whangarei Harbour at high tide. However, for some species, such as royal spoonbill, wrybill, banded dotterel, and Pacific golden plover, that use only a few sites, the loss of a single site may be more problematic. In terms of feeding resources, Beauchamp & Parrish (2007) report that the wading bird count data from the Whangarei Harbour and Ruakaka Estuary suggests that food resources are not limiting birds there.

Bioresearches' (2017) coastal bird surveys at eight locations around the wider lower harbour identified the relative importance of each of these locations as feeding and roosting habitat for gulls and wading birds (refer to Table 16). The key findings at each of those sites are as follows:

- Bream Bay beach:
  - Low species diversity (n=6) – Red-billed gull (53.3%), black-backed gull (20.7%), variable oyster catcher (13.3%), white-fronted tern, Caspian tern and Australasian gannet.
  - Primarily used by gulls as a resting / roosting habitat (Table 16).
- Mair Bank:
  - Moderate species diversity (n=10) – Black-backed gull (max = 196), red-billed gull (max = 70), variable oystercatcher (max = 66), Caspian tern, little shag, northern NZ dotterel, pied shag, pied stilt, SIPO and white-faced heron.
  - Predominant habitat use was resting (Table 16), primarily black-backed gull and but occasional Caspian tern, red-billed gull and variable oystercatcher.
  - Of the few feeding records, 5.7% were on the beach, 19.9% on the inner bank and 74.4% on the outer bank.
- CINZ jetty to Northport:
  - Moderate species diversity (n=10) – SIPO (max = 437), red-billed gull (max = 154), variable oystercatcher (max = 60), black-backed gull, Caspian tern, northern NZ dotterel, pied shag, pied stilt, spur-wing plover, white-fronted tern.
  - Dominant habitat use was resting rather than feeding (Table 16).
- One Tree Point:
  - High species diversity (n = 15) – Black-backed gull (max = 114), white-fronted tern (max = 71), bar-tailed godwit (max = 60), red-billed gull (max = 58), variable oystercatcher (max = 54), lesser knot (max = 37), Caspian tern, curlew, little shag, mallard, northern NZ dotterel, paradise shelduck, pied stilt, SIPO and white-faced heron.
  - Approximately equal use for feeding and resting (Table 16), but no high tide wading roost habitat.
- Snake Bank:
  - Moderate species diversity (n = 8) – SIPO (max = 63), black-backed gull, bar-tailed godwit, little shag, red-billed gull, variable oystercatcher, white-faced heron and white-fronted tern.
  - Feeding the predominant activity (Table 16), and primarily by SIPO.
  - Differs from Mair Bank in that black-backed and red-billed gulls were not as prominent, and SIPO rather than variable oystercatcher was the most common oystercatcher species.
  - This site is a shore commute from birds roosting at Marsden Bay.
- Reotahi Bay:
  - Low species diversity (n = 6) – red-billed gull (77.6%), white-fronted tern (10%), black-backed gull, Caspian tern, white-faced heron and variable oystercatcher.
  - Almost exclusively (98.2%; Table 16) for resting (in the intertidal area) or roosting on poles, boulders and trees.

- Taurikura Bay:
  - Moderate species diversity (n = 11) – red-billed gull (~75%), Australasian gannet, black-backed gull, Caspian tern, kingfisher, little shag, pied shag, red-billed gull, reef heron, spur-wing plover, variable oystercatcher and white-faced heron.
  - Primarily resting habitat (Table 16).

- Urquharts Bay:
  - Moderate – high species diversity (n = 12) - Australasian gannet, black-backed gull, Caspian tern, little shag, pied shag, red-billed gull, reef heron, SIPO, spur-winged plover, variable oystercatcher, white-faced heron and white-fronted tern.
  - Main activity recorded was resting and roosting, primarily by gulls.

Table 16: Comparative population composition and habitat use (source: Table 1 in Bioresearches (2017))

	Bream Bay Beach	Mair Bank	CINZ jetty to Northport	One Tree Point	Snake Bank	Reotahi Bay	Taurikura Bay	Uquharts Bay
% feeding	11.8	17.5	1.5	47.6	63.5	1.8	20.9	23.3
% resting / roosting	88.2	83.5	98.5	52.4	36.5	98.2	79.1	76.7
% wading birds	13.3	16.1	65.1	34.4	84.2	4.2	12.1	23.9
% gulls	74.0	82.9	31.0	42.3	12.9	84.4	81.1	68.2

4.0 Summary of Ecological Values & Significance

An assessment of effects is informed by the relevant statutory planning framework. Relevantly here, Appendix 5 of the Northland Regional Policy Statement (NRPS; NRC (2016)) outlines the criteria (representativeness, rarity / distinctiveness, diversity and pattern, ecological context) on which sites in Northland are assessed for ecological significance. On the basis of those criteria, the 198 ha area ("Area C"[26]) of shallow intertidal and subtidal sandy soft bottom habitats stretching from One Tree Point to Marsden Bay has been identified as a Significant Ecological Area (SEA). This area has been identified as Significant Bird Area in the proposed Northland Regional Plan as shown in Map 1, which shows that this habitat does not extend into the area of NorthPort's proposed eastern reclamation.

With regard to ecological value, all New Zealand biota have been assessed by DOC against a standard set of criteria (described in Townsend et al. (2008)) and lists published for each taxonomic group. This provides a consistent basis on which to assign ecological value for individual species. In Table 17 below, ecological values have been assigned using the EIANZ criteria (refer to Table 5 on page 10) to each of the coastal and estuarine avifauna species which have been recorded present in the wider Marsden Bay and Blacksmith's Creek areas. The 15 species recorded utilising the East 1 or East 2 compartments comprises four species that are considered to have Very High value, four species of High value, three species of Moderate value and four species of Low value (refer to Table 17).

Table 17: Coastal and estuarine avifauna species values

SPECIES	THREAT CLASSIFICATION[27]	ECOLOGICAL VALUE[28]	EAST 1 & 2	
			High	Low-mid
Australasian bittern	*Threatened – Nationally Critical*	Very High		
Reef heron	*Threatened - Nationally Endangered*	Very High	✓	✓
Caspian tern	*Threatened - Nationally Vulnerable*	Very High	✓	✓
Northern NZ dotterel	*Threatened - Nationally Increasing*	Very High	✓	✓
Wrybill	*Threatened - Nationally Increasing*	Very High	✓	✓
Banded dotterel	*At Risk – Declining*	High	✓	✓
Banded rail	*At Risk - Declining*	High		
Bar-tailed godwit	*At Risk - Declining*	High	✓	✓
Lesser knot	*At Risk – Declining*	High		
Red-billed gull	*At Risk - Declining*	High	✓	✓
South Island pied oystercatcher	*At Risk - Declining*	High	✓	✓

[26] Significant Ecological Marine Area Assessment Sheet

[27] Robertson et al. (2021)

[28] As per the EIANZ criteria defined in Table 4

SPECIES	THREAT CLASSIFICATION[27]	ECOLOGICAL VALUE[28]	EAST 1 & 2	
			High	Low-mid
White-fronted tern	*At Risk - Declining*	High	✓	✓
Pied shag	*At Risk - Recovering*	Moderate	✓	✓
Variable oystercatcher	*At Risk - Recovering*	Moderate	✓	✓
Black shag	*At Risk - Relict*	Moderate		
Little shag	*At Risk - Relict*	Moderate	✓	
Royal spoonbill	*At Risk - Naturally Uncommon*	Moderate		
Pied stilt	*Not Threatened*	Low	✓	✓
Southern black-backed gull	*Not Threatened*	Low	✓	✓
White-faced heron	*Not Threatened*	Low		✓

5.0 Project Description

Overall, the proposal includes:

- Reclamation within the CMA and earthworks to the immediate east of the existing reclamation to expand Northport's footprint by approximately 13.7 ha.
- Capital and associated maintenance dredging to enlarge and deepen the existing swing basin and to enable construction of the new wharf.
- A 520m long wharf (including the consented but not yet constructed 270 m long Berth 4) constructed on the northern (seaward) face of the proposed reclamation.
- Sheet piling and rock revetment structures on the eastern edge of the proposed reclamation.
- Treatment of operational stormwater via the existing pond-based stormwater system.
- Port-related activities on the proposed expansion and wharves.
- Construction of a new tug jetty.
- Replacement of the existing floating pontoon, public access and public facilities.

Based on a container terminal scenario, the expected equipment and facilities on land could include:

- STS (ship-to-shore) crane;
- Gantry cranes;
- Access and circulation roads;
- An area of empty container stacking, likely up to nine containers high (approximately 25 m high);
- An area of for reefer (refrigerated container) stacking. This may include steel latticework reefer towers to facilitate electrical connection to the reefers;
- Container exchange facilities to load and unload trucks;
- A rail siding and associated unloading and loading facilities;
- Workshops and maintenance facilities; and
- Lighting, expected to comprise similar setup to currently installed (35 m poles, likely with LED lighting but could be high-pressure sodium initially).

5.1 Construction method

The construction period is approximately 3 ½ years including 9 months for dredging (for reclamation including filter layers), followed by 2 years of pile installation (WSP, 2022).

5.1.1 Dredging

NPL holds an existing consent to dredge the swing basin, which provides for extending the swing basin beyond what is currently dredged. As such, this effects assessment only considers the effects of dredging outside the already consented area.

The nature of the dredge equipment is yet to be determined but could include either a Trailer Suction Hopper Dredger (TSHD) or Cutter Suction Dredger (CSD) for the swing basin, or a Backhoe Dredge (BHD) for the other dredging (i.e. for material with a high silt content, close to wharves in the berth pockets, and construction-related dredging).

Dredging associated with the eastern reclamation and wharf will involve:

- Construction dredging to form the desired batter slope beneath the wharf and to allow for placement of rip rap; and
- A small area (approximately 28,000 m^2) of dredging at the eastern end of the proposed wharf to create the berth pocket. The volume of this dredging is in the order of 40,000 m^3.
- An anticipated volume of up to 1.4 million m^3 of dredge spoil.

5.1.2 Reclamation & wharf

The proposed construction methodology for the reclamation and wharf, as described in WSP (2022), is as follows:

1) Construct the reclamation assuming that fill will come from other dredging works.
2) Shape edge of reclamation and trim back to design slope
3) Line with rock filter layers.
4) Construct concrete retaining wall including any temporary works required to support the construction crane.
5) Backfill behind retaining wall with stockpiled dredgings.
6) Construct a crane working platform behind the retaining wall.
7) Fabricate a 14-pile gate (2 bays) and install on temporary piles.
8) Pre-weld diameter 914mm OD piles into 36m (16 tons) and 24m (11 tons) lengths in welding yard on site.
9) If the rip rap is already placed, weld a 1m long “stinger” with a backing plate onto the leading end of the piles leaving at least 50% of the casing mouth open. If there is no rip rap, it should be possible to drive the piles through the filter layers with no stinger.
10) Pitch 36m long piles with the 750-ton crawler crane (or 280-ton service crane – capacity 16 ton at 40m) into gate.
11) Commence pile driving with vibohammer until penetration is slowed, then change to hydraulic impact hammer.
12) Place S280 hydrohammer (30 ton) on piles with 750-ton crane.
13) Drive piles to top of gate.
14) Pitch 24m length and splice weld extension to create 60m pile length.
15) Drive piles to final depth and set.
16) Extract and advance piling gate to next bays.
17) Empty material from inside the pile shafts to design depth with fly-drill suspended from either of the cranes.
18) Place reinforcing and concrete pile shafts as required.

19) Repeat steps 10-18 until all piles are completed.
20) Place rip rap with long reach digger (or crane and grab) between piles.
21) Construct wharf deck in situ in 2 bay pours as piling progresses ahead.
22) Install wharf furnishings (fenders, bollards etc) and services.
23) Complete backland works.

6.0 Assessment of Potential Effects

In terms of land use of the proposed eastern reclamation, this assessment is based on the potential for a container terminal as this has the largest physical presence (due to the size of ship-to-shore cranes, stacking cranes and the container stacks) and is likely to be a 'worst case'. Other port activities would fall within a container terminals envelope of effects. The following potential construction and operational phase effects (both direct and indirect) on coastal avifauna were considered for this assessment:

- Direct / permanent loss of habitat (Section 6.1);
- Injuries and / or mortalities (Section 6.2);
- Disturbance and displacement (effective habitat loss) (Section 6.3);
- Food supply and foraging ability (Section 6.4);
- Artificial lighting (Section 6.5);
- Pollution (Section 6.6); and
- Re-creation of high tide roost habitat (Section 6.7)

After considering each of these matters individually, we then determine an overall level of effect for each of the potentially affected species (Section 6.8) taking into account impact management and mitigation measures developed during project shaping.

For the purpose of this assessment, we have determined the magnitude of effect at the local scale; that being the Whangarei Harbour. This includes the coastline and harbour waters to the west of a line drawn from Busby Head in the north to Ruakaka Estuary in the south (refer to Map 1).

6.1 Direct / permanent loss of habitat

6.1.1 Potential construction effects

Approximately 6.6 ha of habitat above chart datum (CD) and 5.1 ha of habitat below CD will be lost beneath the proposed reclamation (Coast & Catchment, 2022a). The 6.2 ha of intertidal habitat represents <1% of the soft shore sandy intertidal habitat in the outer harbour and entrance zone, and an even smaller proportion (0.11%) of the intertidal area available within the wider Whangarei Harbour (Coast & Catchment, 2022a).

The mean number of birds recorded during each low-mid tide survey session is provided in Table 12 (page 31); it is during this tidal phase that the intertidal foraging habitat is available to birds, however that is not to say that all birds recorded during this phase are in fact foraging but could also be resting. At high tide wading birds move to high-tide roosts, either congregating elsewhere in the harbour or moving up the beach ahead of the tide. Fourteen species (Table 18) were recorded utilising the low-mid tide habitat within compartments East 1 or East 2, and will therefore be impacted by the eastern reclamation (Maps 3 to 8). While on average approximately 16% of Caspian tern recorded during the surveys were observed in low-mid tide compartments East 1 and / or East 2, this only represents 0.38% of the local Whangarei Harbour population. In comparison, of the local Whangarei Harbour populations, 3.4% of NZ dotterel, 5.86% of red-billed gull and

7.86% of variable oystercatcher were recorded within the low-mid tide compartments East 1 and / or East 2 (Table 18).

Table 18: Mean number of birds recorded in compartment East 1 (E1) and / or East 2 (E2) during the low-mid tide wading bird surveys, and that as a proportion of the sum of the means of birds recorded across all survey sites and the Whangarei Harbour populations.

SPECIES	WHANGAREI HARBOUR POPULATION (birds)	LOW-MID TIDE			
		Mean No. birds in E1 & E2	Sum of means all survey sites	Proportion of birds within E1 & E2	Proportion of Whangarei Hbr pop. within E1 & E2
Banded dotterel	700	0.04	2.43	1.739%	0.01%
Bar-tailed godwit	2800	0.03	92.83	0.030%	0.00%
Black shag	10	0	0.01	0	0
Caspian tern	100	0.38	2.29	16.606%	0.38%
Lesser knot	800	0	81.29	0	0
Little shag	10	0	1.29	0	0
NZ dotterel	80	2.72	24.06	11.298%	3.40%
Pied shag	50	0.06	1.71	3.295%	0.11%
Pied stilt	800	0.10	10.33	0.954%	0.01%
Red-billed gull	2380	139.41	328.95	42.380%	5.86%
Reef heron	20	0.04	0.62	6.815%	0.21%
Royal spoonbill	40	0	1.6	0	0
SBBG	1000	1.76	47.7	3.691%	0.18%
SIPO	2500	42.76	136.55	31.315%	1.71%
VOC	350	27.51	47.89	57.438%	7.86%
White-faced heron	100	0.11	12.92	0.872%	0.11%
White-fronted tern	100	1.42	4.55	31.265%	1.42%
Wrybill	150	0.03	0.08	35.211%	0.02%

In regard to roosting birds, the mean species abundance recorded during high tide counts at each site are provided in Table 10 (page 29). A total of 13 species (Table 19 below) were recorded utilising the high tide area in compartment East 1 and / or East 2. While on average approximately 96% of white-fronted tern recorded during the surveys were observed in high tide compartments East 1 and / or East 2, this only represents 0.13% of the local Whangarei Harbour population. Bioresearches (2015) reported 520 white-fronted tern in the Marsden Point – Busby Head area, with the oil refinery jetty a key roosting area for this species. The jetty was immediately outside the area surveyed for Northport.

In comparison, of the local Whangarei Harbour populations, 3.6% of South Island pied oystercatcher, 4.1% of red-billed gull and 14.36% of variable oystercatcher were recorded within the high tide compartments East 1 and / or East 2 (Table 19).

Table 19: Mean number of birds recorded in compartment East 1 (E1) and / or East 2 (E2) during the high wading bird surveys, and that as a proportion of the sum of the means of birds recorded across all survey sites and the Whangarei Harbour populations.

SPECIES	WHANGAREI HARBOUR POPULATION (birds)	HIGH TIDE			
		Mean No. birds in E1 & E2	Sum of means all survey sites	Proportion of birds within E1 & E2	Proportion of Whangarei Hbr pop. within E1 & E2
Banded dotterel	700	0	0	0	0
Bar-tailed godwit	2800	1.75	88.54	1.98%	0.063%
Black shag	10	0	0.03	0	0
Caspian tern	100	0.53	0.85	61.76%	0.525%
Lesser knot	800	0	24.75	0	0
Little shag	10	0.03	0.43	5.81%	0.250%
NZ dotterel	80	1.15	3.58	32.12%	1.438%
Pied shag	50	0.03	0.66	3.79%	0.050%
Pied stilt	800	0.03	3.48	0.72%	0.003%
Red-billed gull	2380	96.98	151.64	63.95%	4.075%
Reef heron	20	0.03	0.33	7.58%	0.125%
Royal spoonbill	40	0	0.54	0	0
SBBG	1000	0.58	5.66	10.16%	0.058%
SIPO	2500	89.93	165.27	54.41%	3.597%
VOC	350	50.28	61.93	81.18%	14.364%
White-faced heron	100	0	3.74	0	0
White-fronted tern	100	0.13	0.13	96.15%	0.125%
Wrybill	150	0.05	0.08	62.50%	0.033%

6.1.1.1 Impact management & level of effects

The direct effect of permanent habitat loss associated with the eastern reclamation cannot be avoided, nor remedied or mitigated[29] due to the nature of the activity (reclamation) which will permanently remove all existing habitat beneath the proposed project footprint.

The eastern reclamation footprint provides foraging and/or roosting habitat for 11 *Threatened* or *At Risk* species. Given the area of permanent habitat loss that will occur relative to the wider available area, and the level of low-mid tide and high-tide activity by species in compartments East 1 and East 2, we have determined the potential effects of the permanent habitat loss on the local (Whangarei Harbour) coastal avifauna populations of species utilising that area as outlined in Table 20. We note that it is likely the same birds that are present on the intertidal flats during low-mid tide may roost in the high tide compartments. As such, rather than taking a cumulative approach to the proportion of the population effected, we have based our assessment on the higher of the two (low-mid or high tide) and identified these in red text in Table 19.

[29] Refer to definitions provided in Table 7, page 9

Despite a greater proportion of the New Zealand dotterel population being recorded within the proposed reclamation area during low-mid tide (3.4%) than high tide (1.4%), we consider the magnitude of effect in relation to the loss of foraging habitat will in fact be Negligible. This determination has been formed on the basis of the benthic macroinvertebrate data that was collected, and which identified a more diverse and abundance prey source on the western side of Northport (refer to Figure 2 and Figure 3 on page 26, and Map 9) than that on the eastern side. Consequently, we do not consider that the loss of the intertidal habitat on the eastern side will detrimentally impact the foraging ability and food supply of the New Zealand dotterel. Rather, the overall Moderate level of effect that has been identified for New Zealand dotterel is in relation to the loss of high tide / roosting habitat.

Table 20: Assessment of potential effects of permanent habitat loss on the local coastal avifauna populations without mitigation

SPECIES	EST. WHANGAREI HBR POP	PROPORTION WHANG. HBR POP WITHIN E1 &/or E2		VALUE[30]	MAGNITUDE OF EFFECT[31]	LEVEL OF EFFECT[32]
		Low-mid tide	High tide			
Banded dotterel	~700 birds	0.01%	0	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	0.00%	0.063%	High	Negligible	Very Low
Black shag	>10 birds	0	0	-	-	-
Caspian tern	50-100 pairs	0.38%	0.525%	Very High	Negligible	Low
Lesser knot	~800 birds	0	0	-	-	-
Little shag	>10 birds	0	0.250%	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	3.40%	1.438%	Very High	Low	Moderate
Pied shag	>50 birds	0.11%	0.050%	Moderate	Negligible	Very Low
Pied stilt	~800 birds	0.01%	0.003%	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	5.86%	4.075%	High	Low	Low
Reef heron	>10 pairs?	0.21%	0.125%	Very High	Negligible	Low
Royal spoonbill	~40 birds	0	0	-	-	-
SBBG	Abundant	0.18%	0.058%	Low	Negligible	Very Low
SIPO	~2,500 birds	1.71%	3.597%	High	Low	Low
VOC	~350 birds	7.86%	14.364%	Moderate	Moderate	Moderate
White-faced heron	~100 birds	0.11%	0	Low	Negligible	Very Low
White-fronted tern	>100 birds	1.42%	0.125%	High	Low	Low
Wrybill	~150 birds	0.02%	0.033%	Very High	Negligible	Low

The overall **Moderate** level of effect from permanent habitat loss on New Zealand dotterel and variable oystercatcher is associated with the permanent loss of high tide habitat (refer to Table 20),

[30] Refer to Table 4, page 7

[31] Refer to Table 5, page 9

[32] Refer to Table 6, page 10

the proportion of the local populations utilising the high tide roost area, and the relative scarcity of such habitat in the wider Whangarei Harbour.

As such, measures are required to address the potential **Moderate** level of effect on New Zealand dotterel and variable oystercatcher associated with the loss of high tide roosting habitat. This can be achieved through the re-creation of high tide roosting habitat on the western side of Northport; as described above (Section 3.0) and shown in the aerial images in Appendix 4, historically there was a sand / shell bank at this site, but which has been impacted over time due to the change in coastal processes associated with works in the CMA. As such, it is proposed that this sandbank be recreated at that location in order to provide a high tide roost for coastal avifauna, including variable oystercatcher and New Zealand dotterel. Furthermore, this habitat will be created prior to the construction of the eastern reclamation so that it available for use ahead of the loss of habitat.

Thus, based on the re-creation and ongoing maintenance (for the life of the consent) of the sandbank on the western side of Northport prior to construction commencing, the potential effect of the loss of roosting habitat associated with the eastern reclamation will be **Low** for New Zealand dotterel and variable oystercatcher.

6.2 Injuries and / or mortalities

6.2.1 Potential construction effects

The mobile nature of most avifauna species means that the potential for direct mortalities associated with construction activities are likely to be confined to birds that may be breeding or, in the case of kororā, moulting within the Project footprint.

While several species have been reported nesting on the Northport site itself (refer Section to 3.3.2.2 above), there is only one instance of birds nesting under the eastern reclamation footprint; 4Sight (2019) reported a pair of variable oystercatcher successfully nesting and raising two chicks along the existing Northport east revetment (refer to Map 27).

Both surveys for kororā found no sign of the presence of birds along the existing coastal rip-rap edge on the eastern side of Northport.

6.2.1.1 Impact management & level of effects

Potential injuries and / or mortalities of coastal avifauna during the construction phase will be avoided through the preparation of an Avifauna Management Plan which will outline measures to avoid direct impacts and manage kororā and nesting variable oystercatcher. This will include:

- For kororā:
  - Pre-construction (including rock removal) surveys by a suitably qualified and experienced coastal ornithologist to determine the presence of kororā within the western boundary riprap revetment;
  - Establishment of exclusion zones around nesting and / or moulting birds[33];

[33] Under no circumstances should nesting birds, nest contents or moulting penguins be moved. Furthermore, a DOC Wildlife Act permit is required to handle species listed in the Wildlife Act (1954).

- Rock removal works to occur in the presence of a suitably qualified and experienced coastal ornithologist;
- Measures to ensure that kororā are not trapped by construction works.

- For variable oystercatcher:
  - If construction works are to occur within 20 m of an area identified as potential variable oystercatcher nesting habitat during the breeding season, a suitably qualified and experienced coastal ornithologist should check for the presence of active nests.
  - If an active nest is detected, a 20 m exclusion zone should be established around the nest to ensure machinery and personnel do not come within 20 m of the nesting bird.

With the implementation of the above measures, we consider the magnitude of adverse effects as defined in Table 5) on nesting and moulting species to be Negligible (*Having a negligible effect on the known population*) and short term (i.e. limited to the period of construction).

Thus, we have determined the potential effects of mortalities on local coastal avifauna species as outlined below in Table 21.

Table 21: Assessment of potential effects of construction mortalities on the local coastal avifauna populations

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[34]	MAGNITUDE OF EFFECT[35]	LEVEL OF EFFECT[36]
Kororā	>100 birds	High	Negligible	Very Low
VOC	~350 birds	Moderate	Negligible	Very Low

6.2.2 Potential operational effect

Similar to potential construction effects, the mobile nature of most avifauna species means that the potential for direct mortalities associated with operational activities are likely to be confined to birds that may be nesting or with young chicks. To date, variable oystercatcher, pied stilt and northern NZ dotterel have all been recorded breeding on the existing and operational Northport site (refer Section 3.3.2.2 and Map 27).

6.2.2.1 Impact management & level of effects

Efforts should be made to avoid direct impacts on birds nesting on the eastern reclamation once it becomes operational. This could include measures such as identifying and demarcating an area around any nesting birds that are found. However, this may not always be possible and as such we have assumed that mortalities of nesting birds may happen on occasion during the operational phase of the project; and we have assumed that this potential mortalities could be of species previously recorded nesting on Northport.

However, given the unknown frequency that such events may occur, the relatively low numbers of birds nesting on the existing Northport site, and the ability of those birds to successfully raise chicks

[34] Refer to Table 4, page 7

[35] Refer to Table 5, page 9

[36] Refer to Table 6, page 10

(refer Section 3.3.2.2 above), we consider the magnitude of effects (as defined in Table 5) to be Negligible (*Having a negligible effect on the known population*).

Thus, we have determined the potential level of effects (combining ecological value and magnitude of effects) of mortalities during the operational phase on the local (wider Whangarei Harbour) coastal avifauna populations of species breeding on the existing Northport site as outlined in Table 22.

Table 22: Assessment of potential effects of operational mortalities of nesting birds on local coastal avifauna populations

SPECIES	EST. WHANGAREI HBR POP	BREEDING ON NORTHPORT	ECOLGOICAL VALUE[37]	MAGNITUDE OF EFFECT[38]	LEVEL OF EFFECT[39]
NZ dotterel	~80 birds	1 pair	Very High	Negligible	Low
Pied stilt	~800 birds	1 pair	Low	Negligible	Very Low
VOC	~350 birds	2 pairs	Moderate	Negligible	Very Low

6.3 Disturbance and displacement

Disturbance activities could occur during both the construction (e.g. noise, vibration and plant movement) and operational (presence of humans and dogs) phases of the Project. Disturbance to avifauna may result in short- or long-term displacement, decreased feeding rates, unattended nests (leading to incubation failure and increased opportunities for predators), and energy and time costs (Borgmann, 2010; Bowles, 1995; Kaldor, 2019; Lord et al., 2001; Price, 2008; Walls, 1999). Disturbance can result in an effective loss of habitat (Hockin et al., 1992).

Numerous studies have reported various distances at which various bird species are disturbed by human activities (Glover et al., 2011; Goss-Custard et al., 2006; Haase, 1995; Rodgers & Schwikert, 2002; Rodgers & Smith, 1995; Thomas et al., 2003; Weston et al., 2012). The distance at which a bird flees from perceived danger is referred to as the flight initiation distance (FID).

Weston et al.'s (2012) review of FIDs included 15 species recorded within or adjacent to the proposed eastern reclamation, thus providing the most relevant measures for this project on which to base potential disturbance distances (Table 23). Bar-tailed godwit was recorded as having the highest mean FID distance (45.1 m), followed closely by royal spoonbill (44.0 m), shags and herons. Of the coastal birds, red-billed gull were reported as having the lowest FID of 16.8 m; however, banded rail and Australasian bittern, which are confined to freshwater and estuarine marsh habitat, have even lower FIDS of 8.0 m and 10.0 m respectively. While no FID is available for variable oystercatcher, Walls (1999) noted that breeding success of variable oystercatcher is impaired by disturbance from people and dogs.

Based on the FIDs of species known to utilise the Project footprint, we have calculated the area of effective habitat loss based on a 45 m disturbance zone around that. The proposed eastern reclamation ZOI for coastal avifauna therefore includes the Project footprint and a 45 m disturbance zone.

[37] Refer to Table 4, page 7

[38] Refer to Table 5, page 9

[39] Refer to Table 6, page 10

Table 23: Mean flight initiation distances (FID; as reported in Weston et al. (2012)) for species within and adjacent to the Project site

SPECIES		MEAN FID (m)
Bar-tailed godwit	*Limosa lapponica*	45.1
Royal spoonbill	*Platalea regia*	44.0
Caspian tern	*Hydroprogne caspia*	35.0
Pied stilt	*Himantopus himantopus*	36.9
Black shag	*Phalacrocorax carbo*	32.3
Pied shag	*Phalacrocorax varius*	31.3
White-faced heron	*Egretta novaehollandiae*	31.2
Reef heron	*Egretta sacra*	31.1
SBBG	*Larus dominicanus*	24.4
Banded dotterel	*Charadrius bicinctus*	23.0
Lesser knot	*Calidris canutus*	21.3
Little shag	*Phalacrocorax melanoleucos*	19.8
Red-billed gull	*Larus novaehollandiae*	16.8
Australasian bittern	*Botaurus poiciloptilus*	10.0
Banded rail	*Gallirallus philippensis*	8.0

With respect to underwater noise impacts, a study of the foraging behaviour of African penguins (*Spheniscus demersus*) found that when birds were exposed to seismic surveys they foraged in less-preferred areas that were further away from the colony, thereby expending more energy (Pichegru et al., 2017). Furthermore, once the seismic survey had ceased, the penguins returned to their preferred feeding area.

6.3.1 Potential construction effects

Indirect disturbance to foraging, roosting or nesting avifauna is a potential adverse effect that may arise as a result of construction activities such as noise, vibration and plant movement.

Based on a 45 m disturbance zone around the Project footprint, disturbance from construction of the VFG eastern reclamation could result in an additional effective loss of 3.73 ha of intertidal foraging habitat (refer to Maps 5 and 6). Thus, the zone of influence associated with construction disturbance will potentially effect species utilising compartments East 1 and East 2; the species and proportion of their local Whangarei populations utilising these compartments during low-mid and high tide are provided in Table 18 (page 48) and Table 19 (page 49) respectively.

As noted above (Section 6.2), a pair of variable oystercatcher have been recorded breeding under the footprint of the proposed VFG eastern reclamation along the existing Northport east revetment (refer to Map 27). All other nesting activity recorded to date is a sufficient distance from the Project site that the construction and operation will not result in any greater disturbance than is currently experienced.

Unlike shorebirds that forage in the intertidal zone, all seabirds obtain their food from the marine environment; however, they differ in the methods used to obtain their prey (e.g. plunging, pursuit , seizing etc). These various methods differ in the amount of time individuals spend under water, with underwater pursuit species such as penguins, shearwaters, diving petrels and shags spending the greatest amount of time underwater relative to other seabird species.

6.3.1.1 Impact management & level of effects

The potential adverse effects of disturbance to foraging and roosting shorebirds during construction cannot be entirely avoided; however, there are other nearby areas of habitat to undertake these activities beyond the disturbance zone.

Those species nesting on the Northport site are already subject to high levels of disturbance due to it being a working port, and this is likely to increase with the construction of the proposed VFG.

Given the area of habitat that will be disturbed during construction relative to the wider available area, and the level of foraging and roosting activity by species in compartments East 1 and East 2, we have determined the potential effects of construction disturbance and displacement on the local (Whangarei Harbour) coastal avifauna populations of species utilising that area as outlined in Table 24. We note that it is likely the same birds that forage or rest in the low-mid tide compartments may roost in the high tide compartments. As such, we have based our assessment on the higher of the two potential effects (low-mid or high tide) and identified these in red text in Table 24. Further, it is important to note that these potential effects of disturbance and displacement will be temporary for the duration of the construction.

As was the case above (Section 6.1.1.1), we consider the magnitude of effect in relation to construction disturbance to foraging New Zealand dotterel to be Negligible. This is based on the availability of a more diverse and abundant food source nearby on the western side of Northport (refer to Figure 2 and Figure 3 on page 26), such that any birds that are disturbed by construction will not have to expend significant amounts of energy to locate food. Rather, the overall Moderate level of effect that has been identified for New Zealand dotterel is in relation construction phase disturbance to birds roosting on the eastern high tide habitat.

With respect to underwater noise disturbance associated with piling activities, foraging kororā will be exposed to the greatest disturbance due to the amount of time they spend underwater. We note that the proposed piling methodology (as outlined in Section 5.1.2) involves the use of vibrohammer in the first instance, then swapping to hydraulic impact hammer for the final phase. The underwater noise levels emitted by vibrohammer is significantly lower than that of hydraulic impact hammer; as such it is during the later stages of the piling when the hydraulic impact hammer is being used that kororā may experience underwater noise disturbance. As noted previously, kororā have been reported breeding along the north-eastern shoreline of the Whangarei Harbour entrance, including around Reotahi Bay to High Island area, Calliope Island, Home Point to Busby Head and Smugglers Bay (Munro, 1971; Parrish, 1985; Pierce, 2005). As such, it is likely that most birds forage outside of the harbour, and that >10% of the local population would forage within the Whangarei Harbour, and thereby only a small proportion of the local population would be exposed to the potential effects of underwater noise disturbance when the hydraulic impact hammer is being used.

Table 24: Assessment of potential effects of construction disturbance and displacement on the local coastal avifauna populations without mitigation

SPECIES	EST. WHANGAREI HBR POP	PROPORTION WHANG. HBR POP WITHIN E1 &/or E2		VALUE[40]	MAGNITUDE OF EFFECT[41]	LEVEL OF EFFECT[42]
		Low-mid tide	High tide			
Banded dotterel	~700 birds	0.01%	0	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	0.00%	0.063%	High	Negligible	Very Low
Black shag	>10 birds	0	0	-	-	-
Caspian tern	50-100 pairs	0.38%	0.525%	Very High	Negligible	Low
Lesser knot	~800 birds	0	0	-	-	-
Little shag	>10 birds	0	0.250%	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	3.40%	1.438%	Very High	Low	Moderate
Pied shag	>50 birds	0.11%	0.050%	Moderate	Negligible	Very Low
Pied stilt	~800 birds	0.01%	0.003%	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	5.86%	4.075%	High	Low	Low
Reef heron	>10 pairs?	0.21%	0.125%	Very High	Negligible	Low
Royal spoonbill	~40 birds	0	0	-	-	-
SBBG	Abundant	0.18%	0.058%	Low	Negligible	Very Low
SIPO	~2,500 birds	1.71%	3.597%	High	Low	Low
VOC	~350 birds	7.86%	14.364%	Moderate	Moderate	Moderate
White-faced heron	~100 birds	0.11%	0	Low	Negligible	Very Low
White-fronted tern	>100 birds	1.42%	0.125%	High	Low	Low
Wrybill	~150 birds	0.02%	0.033%	Very High	Negligible	Low
Kororā	>100 birds	-	-	High	Low	Low

The overall **Moderate** level of effect from construction on New Zealand dotterel and variable oystercatcher is being driven by the temporary disturbance to birds roosting during high tide (refer to Table 24). As such, measures are required to mitigate this potential Moderate level of effect. This can be achieved through the re-creation of high tide roosting habitat on the western side of Northport as described above (Section 6.1.1.1) prior to the construction of the eastern reclamation so that it available for use during construction.

Thus, based on the re-creation of the sandbank on the western side of Northport prior to construction commencing, the potential effect of the loss of roosting habitat associated with the eastern reclamation will be **Low** for New Zealand dotterel and variable oystercatcher.

While an overall **Low** level of effect from underwater noise disturbance associated with the use of hydraulic impact hammer is anticipated, it is recommended that some form of underwater noise mitigation be implemented during those piling activities to ensure a safe underwater passage route (i.e. beyond a likely underwater noise level effects threshold for kororā) for birds traveling past the

[40] Refer to Table 4, page 7

[41] Refer to Table 5, page 9

[42] Refer to Table 6, page 10

piling works. The form of noise mitigation to be used will be informed through the results of underwater noise modelling, and details provided in the project's Construction Environmental Management Plan and Avifauna Management Plan.

6.3.2 Potential operational effects

Operational disturbance to avifauna is a potential adverse effect that may arise by way of an effective loss of habitat (both terrestrial and intertidal) as a result of noise, or increased activities (e.g. recreational users, including the presence of dogs) (Hockin et al., 1992).

Based on a 45 m disturbance zone around the Project footprint, disturbance from the operation of the VFG eastern reclamation could result in an additional effective loss of 3.73 ha of intertidal foraging habitat. In addition, there may also be an effect on those currently roosting and / or foraging within compartment East 3 due to displacement by birds from compartments East 1 and East 2. There is also the potential for disturbance and displacement of species in compartment East 3 due to potential increased recreational pressure on that area following the construction of the eastern reclamation.

The wading bird surveys recorded five species utilising compartment East 3 during high tide, but only small proportions of their local Whangarei populations (Table 25). In terms of low-mid tide use, seven species were recorded within compartment East 3 (Table 26), but again only small proportions of their local Whangarei populations.

Table 25: Mean number of birds recorded in compartment East 3 (E3) during the high tide wading bird surveys, and that as a proportion of the sum of the means of birds recorded across all survey sites and the Whangarei Harbour populations.

SPECIES	WHANGAREI HARBOUR POPULATION (birds)	HIGH TIDE			
		Mean No. birds in E3	Sum of means all survey sites	Proportion of birds within E3	% of Whang. Hbr pop. within E3
Banded dotterel	700	0	0	0	0
Bar-tailed godwit	2800	0	88.54	0	0
Black shag	10	0	0.03	0	0
Caspian tern	100	0	0.85	0	0
Lesser knot	800	0	24.75	0	0
Little shag	10	0	0.43	0	0
NZ dotterel	80	0.02	3.58	0.47%	0.021%
Pied shag	50	0	0.66	0	0
Pied stilt	800	0	3.48	0	0
Red-billed gull	2380	8.05	151.64	5.31%	0.338%
Reef heron	20	0	0.33	0	0
Royal spoonbill	40	0	0.54	0	0
SBBG	1000	0.08	5.66	1.48%	0.008%
SIPO	2500	0	165.27	0	0
VOC	350	0.08	61.93	0.14%	0.024%

SPECIES	WHANGAREI HARBOUR POPULATION (birds)	HIGH TIDE			
		Mean No. birds in E3	Sum of means all survey sites	Proportion of birds within E3	% of Whang. Hbr pop. within E3
White-faced heron	100	0	3.74	0	0
White-fronted tern	100	0	0.13	0	0
Wrybill	150	0.02	0.08	20.91%	0.011%

Table 26: Mean number of birds recorded in compartment East 3 (E3) during the low-mid tide wading bird surveys, and that as a proportion of the sum of the means of birds recorded across all survey sites and the Whangarei Harbour populations.

SPECIES	WHANGAREI HARBOUR POPULATION (birds)	LOW-MID TIDE			
		Mean No. birds in E3	Sum of means all survey sites	Proportion of birds within E3	% of Whang. Hbr pop. within E3
Banded dotterel	700	0	2.43	0	0
Bar-tailed godwit	2800	0	92.83	0	0
Black shag	10	0	0.01	0	0
Caspian tern	100	0.01	2.29	0.35%	0.008%
Lesser knot	800	0	81.29	0	0
Little shag	10	0	1.29	0	0
NZ dotterel	80	0.02	24.06	0.10%	0.030%
Pied shag	50	0.02	1.71	0.95%	0.032%
Pied stilt	800	0	10.33	0	0
Red-billed gull	2380	8.04	328.95	2.44%	0.338%
Reef heron	20	0	0.62	0	0
Royal spoonbill	40	0	1.6	0	0
SBBG	1000	0.23	47.7	0.48%	0.023%
SIPO	2500	0.02	136.55	0.02%	0.001%
VOC	350	0.23	47.89	0.47%	0.065%
White-faced heron	100	0	12.92	0	0
White-fronted tern	100	0	4.55	0	0
Wrybill	150	0	0.08	0	0

6.3.2.1 Impact management & level of effect

The potential adverse effects of disturbance to foraging and roosting birds associated with the operation of the VFG cannot be entirely avoided. While educational signage can be erected in the area alluding the avifauna and ecological values that are present in the area, the likely success of this reducing disturbance effects to the birds that are present is very low. As such, this measure, while recommended, is not included in the consideration of impact management for this effect.

As such, we have determined the potential effects of operational disturbance and displacement on species recorded foraging or roosting within the 45 m operational disturbance zone or compartment East 3 as outlined below in Table 27. We note that it is likely the same birds that forage in the low-mid tide compartments may roost in the high tide compartments. As such, we have based our assessment on the higher of the two potential effects (low-mid or high tide) and identified these in red text in Table 27.

We also note that the proposed re-establishment of the historic sandbank to the west of Northport will provide an area of undisturbed roosting habitat.

Table 27: Assessment of potential effects of operational disturbance and displacement on the local coastal avifauna populations

SPECIES	EST. WHANGAREI HBR POP	PROPORTION WHANG. HBR POP WITHIN E3		ECOLOGICAL VALUE[43]	MAGNITUDE OF EFFECT[44]	LEVEL OF EFFECT[45]
		Low-mid tide	High tide			
Banded dotterel	~700 birds	0	0	-	-	-
Bar-tailed godwit	~2,800 birds	0	0	-	-	-
Black shag	>10 birds	0	0	-	-	-
Caspian tern	50-100 pairs	0.008%	0	Very High	Negligible	Low
Lesser knot	~800 birds	0	0	-	-	-
Little shag	>10 birds	0	0	-	-	-
NZ dotterel	~80 birds	0.030%	0.021%	Very High	Negligible	Low
Pied shag	>50 birds	0.032%	0	Moderate	Negligible	Very Low
Pied stilt	~800 birds	0	0	-	-	-
Red-billed gull	>1,190 pairs	0.338%	0.338%	High	Negligible	Very Low
Reef heron	>10 pairs?	0	0	-	-	-
Royal spoonbill	~40 birds	0	0	-	-	-
SBBG	Abundant	0.023%	0.008%	Low	Negligible	Very Low
SIPO	~2,500 birds	0.001%	0	-	-	-
VOC	~350 birds	0.065%	0.024%	Moderate	Negligible	Very Low
White-faced heron	~100 birds	0	0	-	-	-
White-fronted tern	>100 birds	0	0	-	-	-
Wrybill	~150 birds	0	0.011%	Very High	Negligible	Low

6.4 Food supply and foraging ability

Impacts on food supply or the ability of visual foragers to locate prey items can have flow-on effects to avifauna through reduced foraging resources.

[43] Refer to Table 4, page 7

[44] Refer to Table 5, page 9

[45] Refer to Table 6, page 10

6.4.1 Potential construction effects

Sediment mobilisation and increased turbidity generated by the dredging process has the potential to adversely affect marine biota in surrounding areas (Coast & Catchment, 2022a). There is the potential for adverse effects on marine water quality through increased suspended sediment and on marine invertebrates from the clogging of fine structures (such as gills) and smothering of benthic organisms (prey species) from deposited sediment. Impacts on benthic and fish communities can affect food supply for coastal and oceanic avifauna. In addition, increased water turbidity can impact on the foraging ability of visual foragers (e.g. penguin, shags, terns and herons) to locate prey items.

As such, the potential indirect effects on coastal avifauna associated with the Project are:

- Food supply – Changes in ability of wading shorebirds to access food or a decrease in food supply due to the deposition of sediment in the intertidal foraging areas; and / or
- Foraging ability – Changes in the ability of visual predators (divers) to detect prey in the water due to increased suspended sediment (TSS) in the water column.

Modelling undertaken by MetOcean predicts that sediment plumes generated during dredging will also affect the surrounding habitat; subtidal areas predominantly to the west of the port are predicted to be periodically subjected to elevated suspended sediment concentrations. Coast & Catchment (2022a) report that those effects would be compounded by the impacts of sediment deposition which smothers seabed communities and habitats (particularly shell gravel). The methods used for dredging are predicted to have major influence on sediment mobilisation, dispersal, and deposition. Effects are likely to be greatest if a trailing suction hopper dredger (TSHD) is used, and less so for cutter suction dredger (CSD) and backhoe dredger (BHD) operations.

6.4.1.1 Impact management & level of effects

It is expected that the effects can be minimised through good plume management/monitoring (in real time) and use of silt curtains in the shallower high-risk areas.

Based on the depth and duration of the suspended and deposited sediment to the east of Northport associated with the dredging activity for the VFG eastern reclamation, and the effects of this on the marine fauna that form the diet of the coastal birds, we consider the magnitude of effects (as defined in Table 5) to be Negligible (*Having a negligible effect on the known population*) for all species.

As such, we have determined the potential effects on food supply and foraging activity on local (Whangarei Harbour) coastal avifauna species as outlined below in Table 28.

Table 28: Assessment of potential effects of construction sediment suspension and deposition on food supply and foraging activity of local coastal avifauna populations

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[46]	MAGNITUDE OF EFFECT[47]	LEVEL OF EFFECT[48]
Banded dotterel	~700 birds	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	High	Negligible	Very Low
Black shag	>10 birds	Moderate	Negligible	Very Low
Caspian tern	50-100 pairs	Very High	Negligible	Low
Lesser knot	~800 birds	High	Negligible	Very Low
Little shag	>10 birds	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	Very High	Negligible	Low
Pied shag	>50 birds	Moderate	Negligible	Very Low
Pied stilt	~800 birds	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	High	Negligible	Very Low
Reef heron	>10 pairs?	Very High	Negligible	Low
Royal spoonbill	~40 birds	Moderate	Negligible	Very Low
SBBG	Abundant	Low	Negligible	Very Low
SIPO	~2,500 birds	High	Negligible	Very Low
VOC	~350 birds	Moderate	Negligible	Very Low
White-faced heron	~100 birds	Low	Negligible	Very Low
White-fronted tern	>100 birds	High	Negligible	Very Low
Wrybill	~150 birds	Very High	Negligible	Low
Kororā	>100 birds	High	Negligible	Very Low

6.5 Artificial lighting

An increase in artificial lighting associated with the VFG eastern reclamation is unlikely to impact on the nocturnal foraging of waders. In fact, Santos et al. (2010) found that artificial illumination from urban areas and roads had a positive effect on nocturnal foraging of waders whereby visual foragers increased their foraging effort in illuminated areas, and mixed foragers changed to more efficient visual foraging strategies. These behavioural shifts improved prey intake rate by an average of 83% in visual and mixed foragers (Santos et al., 2010).

Light-induced mortalities have been recorded for a number of seabirds, particularly petrels, whereby they are attracted to artificial light sources and either collide with structures or are vulnerable to predation when on land (Black, 2005; Deppe et al., 2017; Le Corre et al., 2002, 2003; Montevecchi, 2006; Reed et al., 1985; Rodríguez et al., 2012; Rodríguez & Rodríguez, 2009). Another potential effect of attraction to artificial lights is that birds are temporarily diverted

[46] Refer to Table 4, page 7

[47] Refer to Table 5, page 9

[48] Refer to Table 6, page 10

towards the light(s) and away from other areas (e.g. breeding colonies). The potential for either of these effects has been considered for this assessment.

Incidences of attraction to artificial lights and strike have been attributed to low levels of moonlight and inclement weather resulting in poor visibility (Deppe et al., 2017; Poot et al., 2008; Reed et al., 1985; Rodríguez & Rodríguez, 2009).

While shags have been recorded foraging at night, we found no records of species being attracted to artificial lights.

6.5.1 Impact management & level of effects

There is already a level of artificial lighting present in the existing environment (e.g. Northport, CINZ and residential development) and the proposed lighting for the VFG project will not significantly increase the existing ambient levels or increase the range of species that might be affected.

However, there will be a small cumulative increase in lighting on the coastal margin and as a matter of good practice we recommend efforts to minimise construction and operational lighting where it can reasonably be carried out. This would include:

- Lighting should be kept to the minimum required for safe operation; and
- Wherever practicable lighting should be directed downwards and shielded to reduce light projecting horizontally towards coastal waters and avoid light projecting vertically to passing birds.

Based on the above measures, we consider the magnitude of potential adverse effect (as defined in Table 5) to be Negligible (*Having a negligible effect on the known population*) for all species.

As such, we have determined the potential effects of attraction to artificial lighting causing fatalities or impacting foraging of local populations of coastal avifauna species as outlined in Table 29.

Table 29: Assessment of potential effects of attraction to operational artificial lighting causing fatalities on local populations of coastal avifauna

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[49]	MAGNITUDE OF EFFECT[50]	LEVEL OF EFFECT[51]
Banded dotterel	~700 birds	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	High	Negligible	Very Low
Black shag	>10 birds	Moderate	Negligible	Very Low
Caspian tern	50-100 pairs	Very High	Negligible	Low
Lesser knot	~800 birds	High	Negligible	Very Low
Little shag	>10 birds	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	Very High	Negligible	Low

[49] Refer to Table 4, page 7

[50] Refer to Table 5, page 9

[51] Refer to Table 6, page 10

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[49]	MAGNITUDE OF EFFECT[50]	LEVEL OF EFFECT[51]
Pied shag	>50 birds	Moderate	Negligible	Very Low
Pied stilt	~800 birds	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	High	Negligible	Very Low
Reef heron	>10 pairs?	Very High	Negligible	Low
Royal spoonbill	~40 birds	Moderate	Negligible	Very Low
SBBG	Abundant	Low	Negligible	Very Low
SIPO	~2,500 birds	High	Negligible	Very Low
VOC	~350 birds	Moderate	Negligible	Very Low
White-faced heron	~100 birds	Low	Negligible	Very Low
White-fronted tern	>100 birds	High	Negligible	Very Low
Wrybill	~150 birds	Very High	Negligible	Low
Grey-faced petrel	<100 pairs	Low	Negligible	Very Low

6.6 Pollution

Marine pollutants include hydrocarbons, heavy metals, hydrophobic persistent organic pollutants and small plastic debris. The location of seabirds at or near the top of the marine food web makes them particularly sensitive to these pollutants (Burger & Gochfeld, 2002; Furness & Camphuysen, 1997). Some toxins can have a range of effects on seabirds, including affecting development, physiology and behaviour, reproductive performance and survival rates (Burger et al., 1992; Burger & Gochfeld, 1993; Finkelstein et al., 2006; Fry, 1995; Howarth et al., 1982).

6.6.1 Potential construction effects

Dredging operations can potentially release toxins into the marine environment through the remobilisation of contaminated sediments (Nayar et al., 2004; Su et al., 2002; Sundberg et al., 2007).

6.6.1.1 Impact management & level of effects

4Sight's (2021) analysis of intertidal sediment quality at sites to the west and east of Northport concluded that presently heavy metals and PAHs are not elevated and do not occur at concentrations that would adversely impact the habitat or the biota. Furthermore as noted above (Section 6.4), 4Sight's (2021) review of water quality measures associated with historic capital dredging and decant and maintenance dredging by Northport reported that metals and PAHs in the decant discharge were at levels below analytical detection. Overall, the Marine Ecology assessment for the eastern reclamation proposal determined that the magnitude of adverse effect of remobilised contaminants on the marine habitat and biota would be negligible for all potentially affected species.

Based on the above measures, we consider the magnitude of the potential adverse effect (as defined in Table 5) to be Negligible (*Having a negligible effect on the known population*) for all species.

As such, we have determined the potential effects of pollution associated with the construction and operation of the VFG eastern reclamation on local coastal avifauna species as outlined below in Table 30.

Table 30: Assessment of potential effects of construction-related pollution on local populations of coastal avifauna

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[52]	MAGNITUDE OF EFFECT[53]	LEVEL OF EFFECT[54]
Banded dotterel	~700 birds	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	High	Negligible	Very Low
Black shag	>10 birds	Moderate	Negligible	Very Low
Caspian tern	50-100 pairs	Very High	Negligible	Low
Lesser knot	~800 birds	High	Negligible	Very Low
Little shag	>10 birds	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	Very High	Negligible	Low
Pied shag	>50 birds	Moderate	Negligible	Very Low
Pied stilt	~800 birds	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	High	Negligible	Very Low
Reef heron	>10 pairs?	Very High	Negligible	Low
Royal spoonbill	~40 birds	Moderate	Negligible	Very Low
SBBG	Abundant	Low	Negligible	Very Low
SIPO	~2,500 birds	High	Negligible	Very Low
VOC	~350 birds	Moderate	Negligible	Very Low
White-faced heron	~100 birds	Low	Negligible	Very Low
White-fronted tern	>100 birds	High	Negligible	Very Low
Wrybill	~150 birds	Very High	Negligible	Low
Kororā	>100 birds	High	Negligible	Very Low
Grey-faced petrel	<100 pairs	Low	Negligible	Very Low

6.6.2 Potential operational effects

Stormwater run-off from the operating port has the potential to collect and transport pollutants in the receiving marine environment.

6.6.2.1 Impact management & level of effects

There is already a level of pollution generated within the existing environment (e.g. Northport, CINZ and residential development) which the proposal will not significantly increase based on features of the current design that will capture and treat runoff (refer to Section 5.0).

[52] Refer to Table 4, page 7

[53] Refer to Table 5, page 9

[54] Refer to Table 6, page 10

Based on the above measures, we consider the magnitude of the potential adverse effect (as defined in Table 5) to be Negligible (*Having a negligible effect on the known population*) for all species. As such, we have determined the potential effects of pollution associated with the operation of the eastern reclamation on local (wider Whangarei Harbour) coastal avifauna species as outlined above in Table 30.

Table 31: Assessment of potential effects of pollution on local populations of coastal avifauna

SPECIES	EST. WHANGAREI HBR POP	ECOLOGICAL VALUE[55]	MAGNITUDE OF EFFECT[56]	LEVEL OF EFFECT[57]
Banded dotterel	~700 birds	High	Negligible	Very Low
Bar-tailed godwit	~2,800 birds	High	Negligible	Very Low
Black shag	>10 birds	Moderate	Negligible	Very Low
Caspian tern	50-100 pairs	Very High	Negligible	Low
Lesser knot	~800 birds	High	Negligible	Very Low
Little shag	>10 birds	Moderate	Negligible	Very Low
NZ dotterel	~80 birds	Very High	Negligible	Low
Pied shag	>50 birds	Moderate	Negligible	Very Low
Pied stilt	~800 birds	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	High	Negligible	Very Low
Reef heron	>10 pairs?	Very High	Negligible	Low
Royal spoonbill	~40 birds	Moderate	Negligible	Very Low
SBBG	Abundant	Low	Negligible	Very Low
SIPO	~2,500 birds	High	Negligible	Very Low
VOC	~350 birds	Moderate	Negligible	Very Low
White-faced heron	~100 birds	Low	Negligible	Very Low
White-fronted tern	>100 birds	High	Negligible	Very Low
Wrybill	~150 birds	Very High	Negligible	Low
Kororā	>100 birds	High	Negligible	Very Low
Grey-faced petrel	<100 pairs	Low	Negligible	Very Low

6.7 Re-creation of high tide roost habitat

As identified above (Sections 6.1.1.1 and 6.3.1.1), the re-creation and ongoing maintenance of the sandbank on the western side of Northport (prior to construction) is proposed to address the potential effects of permanent loss of high tide habitat and distance to roosting birds associated with the construction of the eastern reclamation. While this measure will address those effects identified, it is also necessary to assess the potential effects that may result from the implementation of this measure.

[55] Refer to Table 4, page 7

[56] Refer to Table 5, page 9

[57] Refer to Table 6, page 10

6.7.1 Location

At high tide, most waders and shorebirds are forced from their low-water feeding grounds to sites which are traditionally called roosts. The choice of a roost site is important and there are a number of factors that influence roost choice including predation risk and disturbance rates, as well as energetic costs of remaining thermoneutral at the roost, and flying to the roost from feeding grounds (Jackson, 2017; Jaques & Strong, 2003; Piersma et al., 1993; Rogers, 2003). In practice it may be difficult for some birds to find suitable roost points, with instances of birds forced to spend the entire high tide on the wing (flying) (Buehler, 2002; Hötker, 2000). Negative impacts on birds using high tide roosts have been reported in associated with disturbance from human (and associated canine) recreational use (Stigner et al., 2016). As such, minimising the ability for recreational users to access roosts during high tide is beneficial to roosting birds.

The incremental loss of high tide roost sites that has occurred historically around the Whangarei Harbour was outlined in Section 3.0 above (page 13), including within Marsden Bay (refer to Appendix 4).

While the area above MHWS to the west of Northport was considered as a location for creating high tide roost habitat, this was discounted due to the access that recreational users (and dogs) would have to this area, thereby not solving the issue of disturbance to roosting birds.

As such, based on the historic presence and its separation from the coast at high tide, the proposed location for the rec-creation of a sand high tide roosting has been proposed to the immediate west of Northport (refer to T&T drawing No. 1017349-02, Photo 1 and Photo 2). The site visit on 10 August 2022 conducted by the report author, and the Project's marine ecology and coastal processes experts identified several constraints that the location of the sandbank would seek to accommodate, including:

- Being reasonably close to the area lost;
- Be independent from the existing shoreline during high tide to provide separation from human and dog disturbance;
- The avoidance of a cockle bed (refer to Photo 3); and
- An appropriate offset from the hightide shoreline and coastal wetland.

Photo 1: View from the shoreline looking towards proposed location for the high tide roost

Photo 2: View looking east towards Northport, with proposed location for high tide roost in the foreground.

Photo 3: View of cockle bed to be avoided.

6.7.2 Design features

Based on the proposed location, the following design parameters were developed (refer to Tonkin & Taylor (2022) for further details):

- An initial footprint of approximately 4,573 m^2 and an area of approximately 2,703 m^2 above MHWS (refer to T&T drawing No. 1017349-03);
- Crest RL of 3.4 m above chart datum, providing approximately 0.6 m above MHWS (refer to T&T drawing No. 1017349-04).
- A final crest area of approximately 120 m x 10 m (refer to T&T drawing No. 1017349-03).
- Initial side slopes of approximately 4(H):1(V), with the expectation that the seaward and side slope will flatten (8:1) and adjust naturally over time, while the landward slope will largely remain steep (refer to T&T drawing No. 1017349-04).
- A sand volume of approximately 7,400m^3 (excluding bulking and losses during placement[58]).

[58] Losses from the occupation area of the bird roost can be expected during placement as there will be regular tide and wind wave shaping of the smaller volumes deposited to form this roost, even though it is relatively sheltered (R. Reinen-Hamill, *pers. comm*).

6.7.3 Construction

The preferred construction method for the formation of the roost utilises a marine-based approach. Sand would be brought to the area at high tides with shallow draft barges and unloaded and shaped with hydraulic excavators. These barges generally have reasonably limited carrying volume (in the order of several hundred cubic metres). The barge could be retained at this location during falling tides and unloaded to the proposed line and level and this process repeated until the roost was completed. This is likely to require at least 40 barge loads and take one to three months to complete (Tonkin & Taylor, 2022).

6.7.4 Level of effect

The location of the proposed high tide roost within the intertidal zone will result in the removal of an area of foraging habitat. In order to determine the level of this effect, the footprint of the proposed high tide roost has been overlaid on the coastal avifauna and benthic macro-invertebrate maps (Maps 9-22) for wading and shorebird species that primarily forage in the intertidal zone.

A total of 97 birds were recorded over the course of all the shorebird surveys under the footprint of the proposed high tide and comprised the following species (Table 32): northern NZ dotterel (Map 9), lesser knot (Map 13), pied stilt (Map 14), SBBG (Map 19), white-faced heron (Map 21) and Caspian tern. Given these species were recorded during the low-mid tide surveys, we have assumed that these birds were utilising this area to forage. As such, the proposed high tide roost will result in the loss of approximately 4,573 m^2 of foraging habitat for those species.

Table 32: Species and number of coastal birds recorded within the proposed sandbank footprint

SPECIES	No. BIRDS	DATE OBSERVED
Lesser knot	30	20/12/2017
Lesser knot	50	6/11/2019
Pied stilt	1	4/06/2021
White-faced heron	1	28/06/2021
NZ dotterel	2	5/07/2021
Southern black-backed gull	11	13/07/2021
Caspian tern	1	20/07/2021
Caspian tern	1	25/07/2021

Despite more than 1% of the estimated Whangarei Harbour populations of Caspian tern, NZ dotterel and lesser knot being recorded within the footprint of the proposed high tide roost (refer to Table 33 below), we consider the magnitude of effect in relation to the loss of foraging habitat on those species will in fact be **Negligible** (rather than Low). This determination has been formed on the basis of the benthic macroinvertebrate data that were collected, and which identified a more diverse and abundance prey source further to the west of the proposed high tide roost (e.g. refer to Maps 9 and 13). Also, with respect to Caspian tern, this species primarily feeds on small surface-swimming fish, and forages much less frequently in the soft mud and shallow water. Consequently, we do not consider that the loss of the intertidal habitat associated with the re-

creation of a high tide roost at the proposed location will detrimentally impact the foraging ability and food supply of the New Zealand dotterel, lesser knot or Caspian tern.

As noted above (Section 6.7.3), it is possible that construction could take up to three months, with works occurring during low tides. Thus, the potential effects associated with the construction of the proposed sand bank will be of a temporary nature.

As such, we have determined the potential effects of the re-creation of the high tide roost to the west of Northport on local (wider Whangarei Harbour) coastal avifauna species as outlined below in Table 33.

Table 33: Assessment of potential effects of construction and loss of foraging habitat associated with the re-creation of a sandbank on local populations of coastal avifauna

SPECIES	EST. WHANGAREI HBR POP	MAX No. BIRDS WITHIN FOOTPRINT	PROPORTION OF POPULATION	ECOLOGICAL VALUE[59]	MAGNITUDE OF EFFECT[60]	LEVEL OF EFFECT[61]
Banded dotterel	~700 birds	-	-	High	-	-
Bar-tailed godwit	~2,800 birds	-	-	High	-	-
Black shag	>10 birds	-	-	Moderate	-	-
Caspian tern	50-100 pairs	1	1%[62]	Very High	Negligible	Low
Lesser knot	~800 birds	50	6%	High	Negligible	Low
Little shag	>10 birds	-	-	Moderate	-	-
NZ dotterel	~80 birds	2	2.5%	Very High	Negligible	Low
Pied shag	>50 birds	-	-	Moderate	-	-
Pied stilt	~800 birds	1	0.1%	Low	Negligible	Very Low
Red-billed gull	>1,190 pairs	-	-	High	-	-
Reef heron	>10 pairs?	-	-	Very High	-	-
Royal spoonbill	~40 birds	-	-	Moderate	-	-
SBBG	Abundant	11	>1%	Low	Negligible	Very Low
SIPO	~2,500 birds	-	-	High	-	-
VOC	~350 birds	-	-	Moderate	-	-
White-faced heron	~100 birds	1	1%	Low	Negligible	Very Low
White-fronted tern	>100 birds	-	-	High	-	-
Wrybill	~150 birds	-	-	Very High	-	-
Kororā	>100 birds	-	-	High	-	-
Grey-faced petrel	<100 pairs	-	-	Low	-	-

[59] Refer to Table 4, page 7

[60] Refer to Table 5, page 9

[61] Refer to Table 6, page 10

[62] Based on a conservative approach of assuming 50 pairs (i.e. the lower range of the estimated Whangarei Harbour population)

6.8 Summary of potential effects

A summary of the potential effects identified in Sections 6.1-6.7, based on the implementation of the management and mitigation measures identified, is provided in Table 34.

Table 34: Summary of potential effects associated with the construction (Con.) and operation (Op.) of the proposed eastern reclamation with the implementation of management and mitigation measures

SPECIES	PERMANENT HABITAT LOSS		MORTALITIES		DISTURBANCE & DISPLACEMENT		FOOD SUPPLY & FORAGING ABILITY		ARTIFICIAL LIGHTING		POLLUTION		ROOST RE-CREATION	OVERALL PROJECT EFFECT
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.		
Banded dotterel	Very Low	-	-	-	Very Low	-	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
Bar-tailed godwit	Very Low	-	-	-	Very Low	-	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
Black shag	-	-	-	-	-	-	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
Caspian tern	Low	-	-	-	Low	Low	Low	-	-	Low	Low	Low	Low	LOW
Lesser knot	-	-	-	-	-	-	Very Low	-	-	Very Low	Very Low	Very Low	Low	LOW
Little shag	Very Low	-	-	-	Very Low	-	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
NZ dotterel	Low	-	-	Low	Low	Low	Low	-	-	Low	Low	Low	Low	LOW
Pied shag	Very Low	-	-	-	Very Low	Very Low	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
Pied stilt	Very Low	-	-	Very Low	Very Low	-	Very Low	-	-	Very Low	Very Low	Very Low	Very Low	VERY LOW
Red-billed gull	Low	-	-	-	Low	Very Low	Very Low	-	-	Very Low	Very Low	Very Low	-	LOW
Reef heron	Low	-	-	-	Low	-	Low	-	-	Low	Low	Low	-	LOW
Royal spoonbill	-	-	-	-	-	-	Very Low	-	-	Very Low	Very Low	Very Low	-	VERY LOW
SBBG	Very Low	-	-	-	Very Low	Very Low	Very Low	-	-	Very Low	Very Low	Very Low	Very Low	VERY LOW
SIPO	Low	-	-	-	Low	-	Very Low	-	-	Very Low	Very Low	Very Low	-	LOW
VOC	Low	-	Very Low	Very Low	Low	Very Low	Very Low	-	-	Very Low	Very Low	Very Low	-	LOW
White-faced heron	Very Low	-	-	-	Very Low	-	Very Low	-	-	Very Low	Very Low	Very Low	Very Low	VERY LOW
White-fronted tern	Low	-	-	-	Low	-	Very Low	-	-	Very Low	Very Low	Very Low	-	LOW
Wrybill	Low	-	-	-	Low	Low	Low	-	-	Low	Low	Low	-	LOW
Kororā	-	-	Very Low	-	Low	-	-	-	-	-	Very Low	Very Low	-	LOW
Grey-faced petrel	-	-	-	-	-	-	-	-	-	Very Low	Very Low	Very Low	-	VERY LOW

7.0 Cumulative Effects

As explained in Section 1.1 above (page 1), for the context of this assessment the "existing" environment comprise both the built developments and extant resource consents that are listed in Table 1.

Cumulative effects are concerned with things that will occur, and include two components:

1) Effects arising / building up over time; and
2) Effects arising in combination with other effects.

Therefore, cumulative effects are not limited to those arising from the proposed activity but include the effects of the proposed activity in combination with "existing" effects, whether arising from existing uses, permitted activities, and consented and probable uses.

We have determined that the appropriate spatial scale for consideration of cumulative effects is the Whangarei Harbour and considered the potential cumulative effect of those coastal developments listed in Table 35 in conjunction with the current proposal for Northport's eastern expansion.

Table 35: Coastal developments within Whangarei Harbour for which cumulative effects have been considered.

EXTANT RESOURCE CONSENTS
• NorthPort's Berth 4 expansion • CINZ channel optimisation project • Port Nikau marina expansion • Whangarei Marina Management Trust's new marina

The following effects on coastal avifauna arising in combination with those developments listed in Table 35 have been considered (and summarised in Table 36):

- Berth 4 Expansion:
  - Effects on coastal avifauna related to discharges to the marine environment and increased lighting.
- Channel optimisation (Bioresearches, 2017):
  - Project-generated effects on shorebird habitats were considered high at Mair Bank and low-moderate at Reotahi Bay as a result of their proximity to the works.
  - The species most susceptible to a turbidity increase in the dredging area was considered to be korora; the concern was disruption of its passage between shoreline nesting areas, specifically those within the Harbour and the nearby open water.
  - Vessel lighting would likely attract seabird and result in collisions with dredging vessels.
- Port Nikau marina:

  - Creation of a mixed use development in an area that was historically used for port related activities, but which has largely become redundant due to the relocation of the majority of the port related activities to Marsden Point.
  - Adjacent to wading bird foraging habitat (mudflats).

- Whangarei marina (4Sight Consulting, 2017):
  - A less than minor effect on banded rail due to small amount of habitat (mangrove) loss and the fact that this habitat lies at the margin of what is likely to constitute the preferred habitat, based on known habitat preferences.

Table 36: Coastal avifauna effects from each of the coastal developments within Whangarei Harbour for which cumulative effects have been considered

PROJECT	SPECIES AFFECTED	EFFECT	LEVEL OF EFFECT
Northport Berth 4 expansion	Not identified	Effects on coastal avifauna related to discharges to the marine environment and increased lighting	Not identified
CINZ channel optimisation	Shorebirds	Project-generated effects on shorebird habitats	High at Mair Bank and low-moderate at Reotahi Bay
	Kororā	Disruption to passage between shoreline nesting areas due to increased water turbidity	Less than minor
Port Nikau marina	Not identified	Disturbance to foraging wading birds	Not identified
Whangarei marina	Banded rail	Permanent habitat loss	Less than minor
Eastern expansion	Variable oystercatcher	Permanent habitat loss as well as construction related disturbance / displacement	Low
	Northern NZ dotterel	Permanent habitat loss as well as construction related disturbance / displacement	Low

Based on the above affects identified by the various projects, there will be no cumulative effects on coastal avifauna in relation to discharges into the marine environment or increase in lighting on the coastal margin. As such, these effects would remain the same as identified in Table 34 (page 72), that being Low to Very Low for all coastal avifauna.

None of the above listed projects identified the permanent loss of habitat for variable oystercatcher or Northern NZ dotterel. As such, there will be no cumulative effects on coastal avifauna in relation to permanent habitat loss, and the effects would remain the same as identified in Table 34 (page 72).

While the Port Nikau marina assessment noted the potential for disturbance to foraging wading birds, the species and level of effect was not identified. Thus, based on the information provided in the Port Nikau marina assessment, we have determined the will be no cumulative effects on coastal avifauna in relation to construction related disturbance associated with the eastern

reclamation. As such, these effects would remain the same as identified in Table 34 (page 72) for all coastal avifauna.

In summary, the cumulative (overall) effects of the projects listed in Table 36 will be:

- Low to Very Low for all coastal avifauna species in relation to discharges into the marine environment;
- Low to Very Low for all coastal avifauna species in relation to lighting on the coastal margin;
- Low for northern NZ dotterel and variable oystercatcher in relation to permanent habitat loss.
- Low for northern NZ dotterel and variable oystercatcher in relation to construction disturbance / displacement.

8.0 Application of the Effects Management Hierarchy

As outlined through the above assessment, the application of the effects management hierarchy to this Project in relation to coastal avifauna has resulted in an overall Low to Very Low effect on coastal avifauna. The key mitigation measures responsible for achieving this level of effect are:

- The provision and ongoing maintenance of additional high tide roosting habitat for the term of the consent, such as the re-creation of a historic sandbank to function as a high tide roost on the western side of Northport prior to construction commencing (refer to Sections 6.1.1, 6.3.2 and 6.7). The
- The preparation and implementation of an Avifauna Management Plan which to avoid direct impacts and manage kororā and nesting variable oystercatcher (refer to Section 6.2.1); and
- Should the underwater noise modelling identify the need, the implementation of some form of underwater noise mitigation for all piling activities using hydraulic impact hammer such that a safe underwater passage is maintained for kororā traversing in and out of the harbour (refer to Section 6.3.1.1); and

We note that should any of the proposed measures outlined not be adopted or implemented, than additional measures would be required to appropriately address the potential effects on coastal avifauna identified in the above assessment (Section 6.0).

9.0 Proposed Consent Conditions

As noted previously, it is imperative that the impact management and mitigation measures developed during the project shaping, and on which the above assessment are based, are implemented. As such, consent conditions are required which address:

- The provision and ongoing maintenance of additional high tide roosting habitat for the term of the consent, such as the re-creation of a historic sandbank to function as a high tide roost on the western side of Northport prior to construction commencing (Sections 6.1.1, 6.3.2 and 6.7).
- Preparation of an Avifauna Management Plan which will include:
  - Pre-construction survey of kororā and variable oystercatcher to avoid direct effects of mortalities during construction (Section 6.2.1.1);
  - Should the underwater noise modelling identify the need, underwater noise mitigation measures for all piling activities using hydraulic impact hammer such that a safe underwater passage is maintained for kororā traversing in and out of the harbour (Section 6.3.1.1).
- Operational lighting to be hooded and orientated downwards to avoid attraction and potential mortalities of seabirds on the Project site (Section 6.5.1).

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Appendix 1: 4Sight NPL Coastal Bird Reports

4SIGHT CONSULTING

LAND. PEOPLE. WATER.

Northport

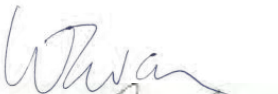
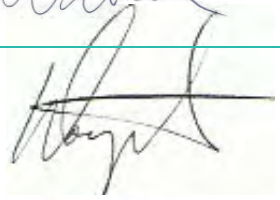
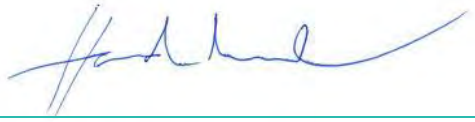
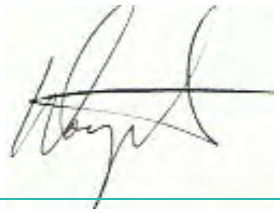
Baseline Nesting Bird Survey
October 2019 – January 2020

For Northport Limited

May 2020

REPORT INFORMATION AND QUALITY CONTROL

Prepared for:	Greg Blomfield Terminal Facilities Manager Northport Limited

Author:	Wiea van der Zwan Ecology Consultant	
Reviewers:	Mark Poynter Principal Ecology Consultant	
	Dr. Hannah Mueller Senior Ecology Consultant	
Approved for Release:	Mark Poynter Principal Ecology Consultant	

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CONTENTS Page

1 INTRODUCTION 1
1.1 Background 1
1.2 Report Purpose 1
2 APPROACH & METHODS 1
3 RESULTS 4
4 SUMMARY 8
5 REFERENCES 9

List of Tables

Table 1. Summary of nesting activity recorded over the survey period conducted between 30th October 2019 and 24th January 2020. 7

List of Figures

Figure 1: Eastern Site including the tug bay revetments and the eastern beach and revetment. 2
Figure 2: Western Site including the western revetment) to the western edge of the Blacksmiths Creek high tide mangrove roost. 3
Figure 3: Northport survey site 'Port Site'. 3
Figure 4. Recorded bird species identified within the survey area (coloured dots). The crosses at each record identify is a nest was confirmed (green cross) or where birds were not confirmed on a nest (red cross). Note: most recent available aerial imagery dates to 2014/16; the coal pile currently extends further south capturing the two records for nesting NZ dotterel and unconfirmed nesting variable oystercatcher, respectively. 5
Figure 5. Pied stilt on its nest next to the molasses pond at the Port Site (left) and its nest with four eggs (right). 6
Figure 6. Song thrush nest with four eggs in a Pohutukawa tree within the eastern beach dune area. 6
Figure 7. Variable oystercatcher nest with two eggs at the tug revetment (left). Pair of variable oystercatcher and NZ dotterel nesting on top of the coal pile (right). 7

List of Appendices

Appendix A: Indicative Vision for Growth footprint
Appendix B: Species known to be present within Whangarei Harbour

1 INTRODUCTION

1.1 Background

Northport Limited (Northport) has engaged 4Sight Consulting Limited (4Sight) to undertake surveys to identify wading and shorebirds nesting within and near the port including the area between the Northport facility and Marsden Point oil refinery terminal. This work was completed to provide additional background information relevant to Northport's current 'Vision for Growth' (VFG) strategy.

The Northport 'Vision for Growth' proposes reclaiming up to approximately 9.6 ha to the west and up to approximately 17.1 ha to the east of the current Northport facility (Blomfield 2017). The indicative VFG footprint is shown in Appendix A:.

This 2019-2020 survey is a follow-up survey from the nesting bird survey undertaken during the summer of 2018-2019 (Bone 2019) and can be read in conjunction with wading bird surveys undertaken in the summers of 2017-2018 (Bone 2018) and 2019-2020 (van der Zwan 2020a; van der Zwan 2020b) that focused mainly on feeding, roosting and resting activity of wading and shorebirds.

1.2 Report Purpose

The intertidal area to the east and west of Northport is utilised by a range of coastal bird species, including wading birds such as variable oystercatcher, NZ dotterel, lesser knot, and others (Pierce 2005). The 2017-2018 and 2019-2020 surveys conducted by 4Sight identified a total of 19 wading and shorebird species utilising the area for feeding, resting, and roosting. At least 12 of the bird species recorded may potentially nest within the proposed VFG footprint.

Northport requires understanding of the utilisation of intertidal areas and the adjacent port environs by wading birds in relation to its VFG strategy. This information will be used in an assessment of ecological environmental effects (AeEE) of the VFG footprint once that is finalised. The AeEE is yet to be completed.

Wading and shorebird use of the shoreline has a strong seasonal component, with activity generally greater from September through to the end of February. This survey was designed to capture bird activity during this period.

Four surveys were undertaken between 30 October 2019 and 24 January 2020 within the study areas shown in Figure 1, Figure 2, and Figure 3 below. This report presents the results of nesting birds within the survey VFG footprint and associated areas. During the survey, notes were taken not only of nesting and breeding wading and shorebirds, but of all bird species, including open country and coastal forest birds.

2 APPROACH & METHODS

As noted above, prior surveys have identified 19 wading and shorebird species utilising the area for resting, roosting, and feeding (van der Zwan 2020a). As some of these species are expected to breed in the area, a literature study was undertaken to understand which of the bird species might be potentially nesting in the area. A full list of species potentially present in the area was derived from the New Zealand Birds Online database (New Zealand Birds Online 2013) based on the search criteria 'Location - Whangarei Harbour' (Appendix B:).

Due to the small geographical area and the relatively open habitat of the upper shore and foredune zones, 'complete' nest counts as described by Dunn et al. (2006) were completed for these areas. Due to the dense nature of the back-dune vegetation and the restricted access to the eastern tug revetment, the counts in these zones are not assumed to be complete, but rather give an indication of nesting activity.

The survey area comprised three sites, one to the east and one to the west of the Northport facility, and a third within the Northport facility itself. The eastern and western sites encompassed a strip running from the facility boundaries to the east (Eastern Site) and to the west (Western Site). The width of the strip was bound by mean high water springs (MHWS) on the seaward side and extending approximately 20m inland. Four sites were selected within the Northport area (Port Site) (Figure 1, Figure 2, Figure 3).

As shorebird nesting activity is generally greatest between early spring to early summer, the survey was designed to capture a representative 'snapshot' of this period, including capturing the fledging success late summer. Seven surveys were undertaken between 30 October 2019 and 24 January 2020.

Besides monitoring wading and shorebird nesting and breeding behaviour, notes were taken of all birds nesting in the area, including open country and coastal forest birds.

The survey protocol was adapted from methods described by the Florida Fish and Wildlife Conservation Commission (2016), while nest locating techniques were based on Martin and Geupel (1993). During each survey the observer spent 15-30 minutes at each pre-defined observation point scanning the area with a Konus Konuspot – 80 spotting scope with 80 x magnification (Figure 1, Figure 2, and Figure 3). Due to the nature of the site, only five minutes were spent at each observation point within the Port Site and no spotting scope was required as the location of breeding birds had already been determined by Northport staff and during previous surveys.

Following the observations from each observation point, pre-defined routes were walked to provide high resolution coverage of the survey sites (Figure 1, Figure 2, and Figure 3). Where the survey routes passed through densely vegetated areas approximately 2-5 minutes were spent observing the area for breeding associated bird activity, followed by a visual inspection and search of the vegetation. To confirm or rule out potential nesting, during the route survey, the observer approached birds (i.e. walking past at no closer than 2 m) and documented their behaviour as either being indicative of nesting, or not.

Coordinates of bird nesting and breeding associated activity were mapped using GIS mapping software for visual representation.

Weather conditions and human activity were recorded for each survey.

The Eastern Site included the area from the eastern edge of the Northport facility (including the tug bay revetments) to the New Zealand Refining Company emergency response boat ramp. This site was further split into two zones, the tug bay, and the eastern beach and revetment (Figure 1).

Figure 1: Eastern Site including the tug bay revetments and the eastern beach and revetment.

The Western Site encompassed the section of Marsden Bay from the western edge of the Northport boundary (including the western revetment) to the western edge of the Blacksmiths Creek high tide mangrove roost (Figure 2).

Figure 2: Western Site including the western revetment) to the western edge of the Blacksmiths Creek high tide mangrove roost.

Figure 3: Northport survey site 'Port Site'.

The Northport onsite survey comprised four observation points within the port at the approximate locations where breeding activity had been previously reported by Northport staff (Figure 3).

3 RESULTS

A total of 56 bird species have previously been identified within Whangarei Harbour (Appendix B:). 29 of these species are known to breed within this area.

During the survey period, four of these species (three native species) were recorded either actively nesting or displaying breeding associated behaviour within the survey area (Figure 4 and Table 1). Of these, two species are classified as 'At Risk – Recovering' (variable oystercatcher and New Zealand dotterel), one species classified as 'Not Threatened' (pied stilt), and one is an 'Introduced and Naturalised' species (song thrush) (Robertson et al. 2016).

Within the Eastern Site, several empty nests were found within trees present in the dune area. A song thrush was seen sitting on a nest with four eggs (Figure 6) in a pohutukawa tree, while a further five nests were found within this area (Figure 4). One of these nests appeared to be abandoned and had two dead chicks in it, likely house sparrow (Table 1). The remaining four nests were empty, but likely were from exotic open country bird species such as song thrush, blackbirds, house sparrows, or finches.

Within the Western Site, four empty nests, unidentified as to species, were found within the Blacksmiths Creek mangrove area. Two pairs of variable oystercatchers were seen on nests (Figure 4 and Table 1). One pair was seen raising two chicks on the west revetment while the other pair was seen resting at a nest in the Blacksmiths Creek mangrove area.

Nesting activity was also observed at the Port Site (Figure 4 and Table 1). A pied stilt was seen on a nest with four eggs next to the molasses pond (Figure 5) but the fledging success of this nest is unknown. At the tug revetment, a pair of variable oystercatchers was followed throughout the survey period and seen raising chicks at the end of the survey season (Figure 7). A pair of NZ dotterel was seen raising chicks on top of the coal pile, and a pair of variable oystercatchers was seen mating and attempting to breed, but no nest was seen (Figure 7).

Figure 4. Recorded bird species identified within the survey area (coloured dots). The crosses at each record identify is a nest was confirmed (green cross) or where birds were not confirmed on a nest (red cross). Note: most recent available aerial imagery dates to 2014/16; the coal pile currently extends further south capturing the two records for nesting NZ dotterel and unconfirmed nesting variable oystercatcher, respectively.

Figure 5. Pied stilt on its nest next to the molasses pond at the Port Site (left) and its nest with four eggs (right).

Figure 6. Song thrush nest with four eggs in a Pohutukawa tree within the eastern beach dune area.

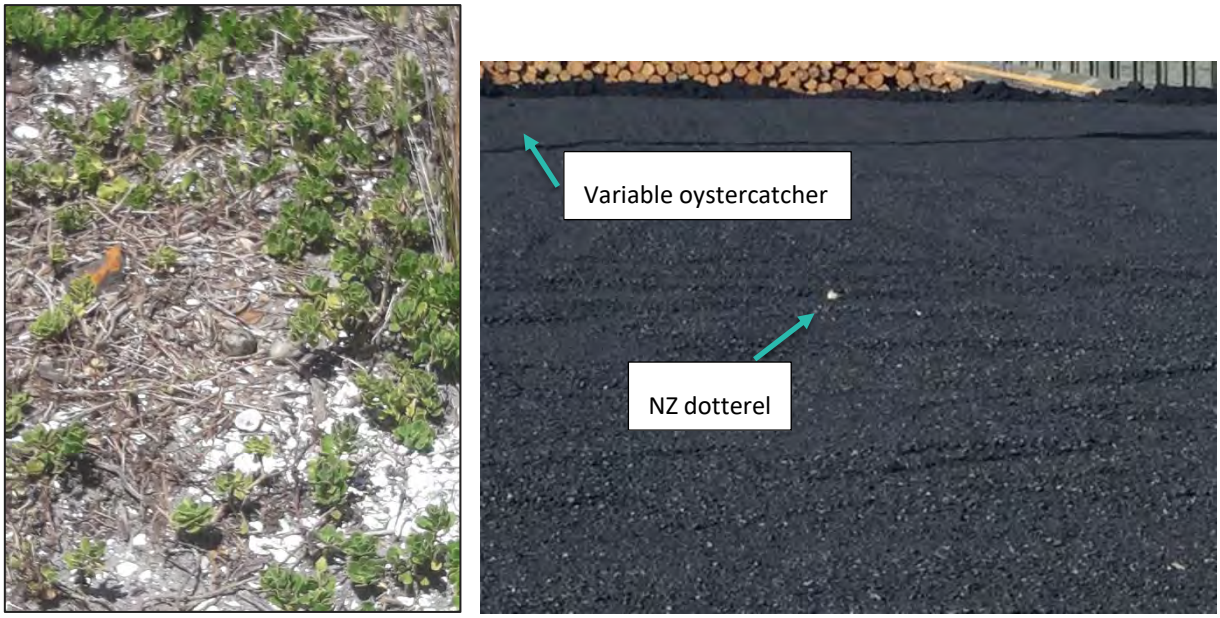

Figure 7. Variable oystercatcher nest with two eggs at the tug revetment (left). Pair of variable oystercatcher and NZ dotterel nesting on top of the coal pile (right).

Table 1. Summary of nesting activity recorded over the survey period conducted between 30th October 2019 and 24th January 2020.

	Species	# pairs	# nests	#chicks	individual birds (incl. chicks)	Notes
E	NZ Dotterel	5	1	1	11	
	Variable oystercatcher	3			6	
	Unidentified nest in tree		5			1 nest had 2 dead chicks (likely sparrow)
	Song thrush	1	1		2	4 eggs seen within nest
P	NZ Dotterel	1	1	2	4	
	Variable oystercatcher	4	1	2	10	
	Pied stilt	1	1		2	4 eggs seen within nest
W	Variable oystercatcher	2	2	2	6	
	Unidentified nest in tree		2			

4 SUMMARY

Findings of the 2019-2020 nesting bird survey are summarised below:

- Four of the 29 species identified as having the potential to nest within or adjacent to the port were recorded nesting within the survey area. One of the nesting species was an exotic open country species, while the other three species were native coastal bird species;
- Two native species have a threat classification of 'At Risk – Recovering' (variable oystercatcher and New Zealand dotterel) and one species is classified as 'Not Threatened' (pied stilt).
- At the Eastern Site, no nesting wading or shorebird species were recorded, with six nests of (assumed) exotic species found within the trees at the eastern dune area;
- At the Western Site, two nesting pairs of variable oystercatchers were recorded alongside four unidentified nests within the part of the Blacksmiths Creek mangrove area that falls within the survey area;
- The Port Site had the highest number of nesting birds recorded:
    - A pair of NZ dotterel was observed successfully raising chicks on top of the coal pile, while a pair of variable oystercatcher was seen mating, but no nest was seen;
    - A pair of variable oystercatcher was seen with chicks on the tug revetment; and
    - A pied stilt was seen on a nest with four eggs nesting next to the molasses pond.

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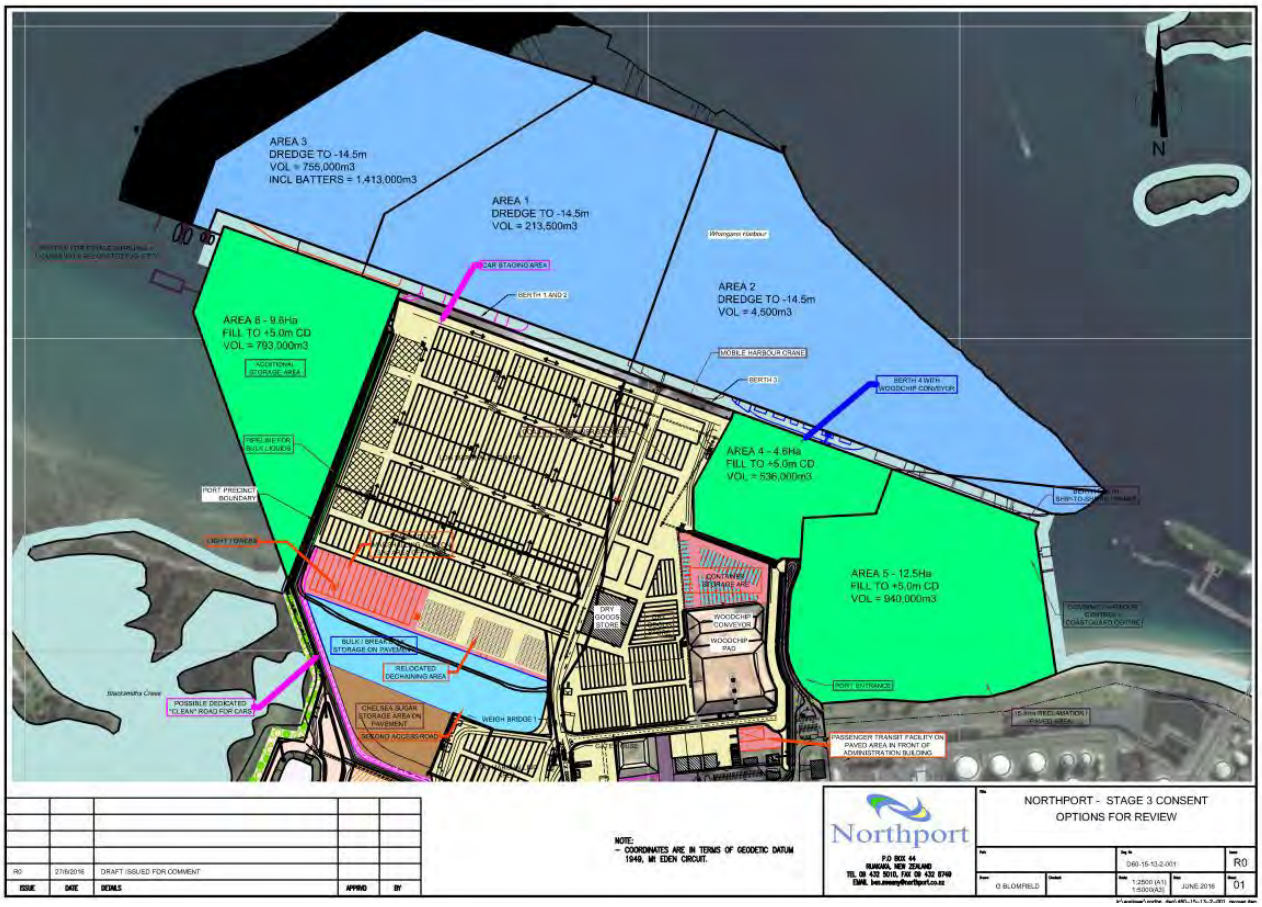
Appendix A:

Indicative Vision for Growth footprint

Draft plan of the 'Vision for Growth' project showing the proposed areas of reclamation (green) and dredging (blue) as issued in the Northport consultant RFP. Provided by Northport Ltd.



Appendix B:

Species known to be present within Whangarei Harbour

Bird species recorded within Whangarei Harbour (New Zealand Birds Online 2013), potentially present within the survey area. Conservation status derived from Robertson et al. (2016). Ecological value derived from Table 5 in Roper-Lindsay et al. (2018).

* denote species known to be **breeding within Whangarei Harbour**.

Common name	Scientific name	Conservation status	Ecological value
Common myna*	*Acridotheres tristis*	Introduced and Naturalised	Negligible
Eurasian skylark*	*Alauda arvensis*	Introduced and Naturalised	Negligible
Wrybill	*Anarhynchus frontalis*	Threatened - Nationally Vulnerable	Very High
Mallard*	*Anas platyrhynchos*	Introduced and Naturalised	Negligible
Grey duck*	*Anas superciliosa*	Threatened - Nationally Critical	Very High
Bellbird*	*Anthornis melanura*	Not Threatened	Low
New Zealand pipit*	*Anthus novaeseelandia*	At Risk - Declining	High
Ruddy turnstone	*Arenaria interpres*	Migrant	Moderate
Fernbird*	*Bowdleria punctata*	At Risk - Declining	High
Lesser knot	*Calidris canutus*	Threatened - Nationally Vulnerable	Very High
European goldfinch	*Carduelis carduelis*	Introduced and Naturalised	Negligible
European greenfinch*	*Carduelis chloris*	Introduced and Naturalised	Negligible
Common redpoll*	*Carduelis flammea*	Introduced and Naturalised	Negligible
Banded dotterel	*Charadrius bicinctus*	Threatened - Nationally Vulnerable	Very High
New Zealand dotterel	*Charadrius obscurus*	At Risk - Recovering	High
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	Low
Swamp Harrier	*Circus approximans*	Not Threatened	Low
Black swan	*Cygnus atratus*	Not Threatened	Low
White-faced heron*	*Egretta novaehollandiae*	Not Threatened	Low
Reef heron	*Egretta sacra*	Threatened - Nationally Endangered	Very High
Black fronted dotterel	*Elseyornis melanops*	At Risk - Naturally Uncommon	High
Yellowhammer*	*Emberiza citrinella*	Introduced and Naturalised	Negligible
Blue penguin	*Eudyptula minor*	At Risk - Declining	High
Chaffinch*	*Fringilla coelebs*	Introduced and Naturalised	Negligible
Banded rail*	*Gallirallus philippensis*	At Risk - Declining	High
Grey Warbler*	*Greygone igata*	Not Threatened	Low
Australian magpie*	*Gymnorhina tibicen*	Introduced and Naturalised	Negligible
South Island pied oystercatcher	*Haematopus finschi*	At Risk - Declining	High
Variable oystercatcher	*Haematopus uniclor*	At Risk - Recovering	High

Pied stilt	*Himantopus himantopus*	Not Threatened	Low
Welcome swallow*	*Hirundo neoxena*	Not Threatened	Low
Caspian tern	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	Very High
Southern black-backed gull*	*Larus dominicanus*	Not Threatened	Low
Red-billed gull	*Larus novaehollandiae*	At Risk - Declining	High
Bar-tailed godwit	*Limosa lapponica*	At Risk - Declining	High
Australasian Gannet	*Morus serrator*	Not Threatened	Low
House sparrow*	*Passer domesticus*	Introduced and Naturalised	Negligible
Tomtit*	*Petroica macrocephala*	Not Threatened	Low
Black shag	*Phalacrocorax carbo*	At Risk - Naturally Uncommon	High
Little shag	*Phalacrocorax melanoleucos*	Not Threatened	Low
Little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	High
Pied shag	*Phalacrocorax varius*	At Risk - Recovering	High
Eastern rosella*	*Platycercus eximius*	Introduced and Naturalised	Negligible
Pacific golden plover	*Pluvialis fulva*	Migrant	Moderate
Pukeko*	*Porphyrio melanotus*	Not Threatened	Low
Tui*	*Prosthemadera novaeseelandiae*	Not Threatened	Low
Dunnock*	*Prunella modularis*	Introduced and Naturalised	Negligible
New Zealand fantail*	*Ripidura fuliginosa*	Not Threatened	Low
White-fronted tern	*Sterna striata*	At Risk - Declining	High
Common starling*	*Sturnus vulgaris*	Introduced and Naturalised	Negligible
Paradise shelduck	*Tadorna variegata*	Not Threatened	Low
New Zealand Kingfisher*	*Todriamphus sanctus*	Not Threatened	Low
Eurasian blackbird*	*Turdus merula*	Introduced and Naturalised	Negligible
Song thrush*	*Turdus philomelos*	Introduced and Naturalised	Negligible
Spur-winged plover	*Vanellus miles*	Not Threatened	Low
Silvereye*	*Zosterops lateralis*	Not Threatened	Low

4SIGHT CONSULTING

LAND. PEOPLE. WATER.

Northport

Wading Bird Survey
October 2019 – February 2020

For Northport Limited

May 2020

REPORT INFORMATION AND QUALITY CONTROL

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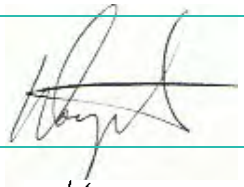
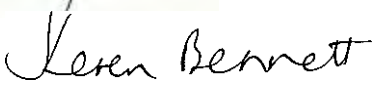
Reviewer:	Mark Poynter Principal Ecology Consultant	
Approved for Release:	Keren Bennett Ecology Manager	

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CONTENTS Page

1 INTRODUCTION 1
1.1 Project Background 1
1.2 Report Purpose 1
2 APPROACH & METHODS 2
3 RESULTS 4
3.1 Notable Areas of Bird Activity 4
3.1.1 Overview 4
3.1.2 Low water 6
3.1.3 Mid water 6
3.1.4 High water 7
3.2 Bird Diversity and Abundance 7
3.2.1 Low water 7
3.2.2 Mid water 9
3.2.3 High water 11
3.3 Threatened and At-Risk Wading and Shorebirds 14
4 SUMMARY 16
4.1 Notable Areas of Bird Activity 16
4.2 Bird diversity and abundance 16
4.3 Discussion 17
5 REFERENCES 18

List of Tables

Table 1. Summary of total number of individuals and species recorded at low water across eastern and western sites. 8
Table 2. Summary of total number of individuals and species recorded at mid water across eastern and western sites. 10
Table 3. Summary of total number of individuals and species recorded at high water across eastern and western sites. 11
Table 4: Summary of all bird species recorded during the survey period, including their conservation status, derived from Robertson et al. 2016. 14
Table 5: Summary of total number of 'Threatened' and 'At-Risk' species recorded in each compartment over the duration of the survey. Underlined species indicate these were most commonly observed within this compartment throughout the survey. 15

List of Figures

Figure 1: Bird survey compartments for each tidal level on the sandflats surrounding Northport. Greyed blue compartments indicate surveys undertaken in additional areas, reported on in van der Zwan (2020). 3
Figure 2: Overview of general locations of shore bird activity on the sandflats surrounding Northport at low, mid and high water. Greyed blue compartments indicate surveys undertaken in additional areas, reported on in van der Zwan (2020). 5
Figure 3. Average birds present during the entire survey period at low water within the eastern and western sites. *Note: Recordings for West 3 stopped unexpectedly on the last survey date, which means some data may be missing from this last survey. 9
Figure 4. Average birds present during the entire survey period at mid water within the eastern and western sites. 10
Figure 5. Average birds present during the entire survey period at high water within the eastern and western sites. Note: two additional compartments are included during high water surveys (West 4 – Wildlife refuge, and West 5 – Blacksmiths Creek). These sites were part of West 2 during low and mid water surveys. 13

List of Appendices

Appendix A: Indicative Vision for Growth footprint
Appendix B: Species name abbreviations

1 INTRODUCTION

1.1 Project Background

Northport Ltd has engaged 4Sight Consulting (4Sight) to undertake wading and shorebird bird surveys in Marsden Bay and between the Northport facility and Marsden Point oil refinery terminal. This work was completed to provide additional background information relevant to Northport's current 'Vision for Growth' (VFG) strategy.

The Northport 'Vision for Growth' proposes reclaiming up to approximately 9.6 Ha to the west and up to approximately 17.1 Ha to the east of the current Northport facility (Blomfield 2017). The indicative VFG footprint is shown in Appendix A:.

The first wading and shorebird survey was carried out covering the period August 2017 – March 2018 (Bone, 2018). The 2020 report presents the results of a follow-up survey using the same methodology. The 2019 - 2020 survey included additional surveying to the west towards One Tree Point as well as the Northport facility itself. Findings of the surveys undertaken at these expanded sites will be reported as a separate stand-alone report (van der Zwan 2020).

1.2 Report Purpose

The intertidal area to the east and west of Northport is utilised by a range of coastal bird species, including wading birds such as variable oystercatcher, NZ dotterel, lesser knot, and others (Pierce 2005). Northport requires to understand the utilisation of intertidal areas and the adjacent port environs by wading birds in relation to its VFG strategy. This information will be used to inform an assessment of ecological environmental effects (AeEE) of the VFG footprint once that is finalised. The AeEE, is yet to be undertaken.

Wading and shorebird use of the shoreline has a strong seasonal component, with activity generally being greater from September through to end of February. This survey was designed to capture bird activity during this period.

This report follows on from the findings of the 2017 - 2018 wading and shorebird surveys carried out and reported to Northport (Bone 2018) and presents data on the presence, distribution and activity of birds (resting/roosting/feeding) surveyed between September 2019 – February 2020 (Figure 1).

2 APPROACH & METHODS

This survey follows the methodology used during the 2017-2018 wading bird survey (Bone 2018). The methodology was adapted from the Whangarei District Council's Plan Change 113 which required baseline surveys and monitoring of the wading birds around the Ruakaka estuary and adjacent beaches. That approach was negotiated through an Environment Court mediation process in cooperation with the Department of Conservation.

The survey area in the Northport study, included the intertidal areas directly to the east and west of the Northport facility (Figure 1). These sites are referred to as the Eastern and Western Sites.

The Eastern Sites comprise the beach from the eastern boundary of the Northport facility to the New Zealand Refining Company jetty (bound by the landward extent of the sand dunes and the MLWS mark). The Western Sites comprise the section of Marsden Bay from the western boundary of the Northport facility to the Marsden Cove Marina channel. Both the Western and Eastern Sites were also surveyed in 2017 - 2018.

In the 2019 - 2020 season, surveys were extended to the west to include the expanded areas shown in Figure 1. These included the balance of Marsden Bay to the west of the marina channel, as well as further west toward One Tree Point. The Northport facility itself was also surveyed, as a potential site used by birds, particularly over high tide periods. These additional survey areas are also shown in Figure 1.

Surveying the expanded area was intended to provide additional information on the wider distribution of wading birds and the relative ecological importance of different parts of the shore along this section of the harbour. Results from these additional surveys, covering the area toward One Tree Point and the port itself, are detailed in a separate report (van der Zwan 2020).

The Eastern and Western Sites were further broken into three compartments. Compartment boundaries in the east/west orientation were arbitrary and intended primarily to facilitate a systematic and consistent approach to data collection by observation. These were identified as East 1, East 2, East 3 and West 1, West 2 and West 3 respectively. All compartments were governed by the appropriateness of viewing distances from pre-selected observation points which are identified in Figure 1.

Each compartment was further divided into high water (HW), mid water (MW) and low water (LW) sub-compartments, also shown in Figure 1. The elevated bird roost (Wildlife Refuge) within West 2 was dealt with as a separate HW sub compartment. Additionally, within West 2, an area of mangrove edge and high shore zone at the outlet from the Blacksmiths Creek to Marsden Bay was dealt with separately during HW observations and is denoted 'Blacksmiths Creek'.

Between September 2019 until February 2020 approximately three surveys per month were completed to provide a representative picture of bird distribution and density at low, mid and high water. A total of 16 surveys were completed on the Western and Eastern sites for all water levels.

Surveys were conducted according to the 'five minute bird count' specification of Hartley and Greene (2012). The observer then counted all birds in the sub compartment being surveyed, keeping each count to approximately five minutes. This approach is a reliable measure of 'relative abundance' which minimises the chance that some birds are counted twice. At each observation point the observer notes were taken on weather conditions and human activity.

A Konus Konuspot – 80 spotting scope with 80 x magnification was used to spot birds and assist identification. Voice recordings were taken of all observations, which were later transcribed to the raw data spreadsheet. Photographs were taken of key roosts and bird activity following each count. Locations of key birds and use were recorded in real time onto a tablet using Avenza Maps software.

In this case, **notable areas of bird activity** was defined as areas where there was an obvious and elevated density of birds roosting, resting, or feeding or where there were indications of nesting activity (i.e. pairs of birds or chicks, but did not include a formal nest survey).

Mean bird abundance was calculated as the total number of birds of each species divided by the total number of surveys. Areas of notable bird activity and graphs of average bird density for each species in each compartment (expressed as mean number per survey ± standard error (SE)) were mapped using ArcGIS Pro 2.5.0 mapping software for graphical representation.

Figure 1: Bird survey compartments for each tidal level on the sandflats surrounding Northport. Greyed blue compartments indicate surveys undertaken in additional areas, reported on in van der Zwan (2020).

3 RESULTS

Due to the large volume of field data, raw data is not presented here. However, all raw field data is stored on the 4Sight database and is available upon request. Results of analysis of the raw field data are presented below.

3.1 Notable Areas of Bird Activity

The patterns of notable areas of bird activity areas within each site is discussed below and depicted in Figure 2. Notable bird activities. These were defined as areas where there was an obvious and elevated density of birds roosting, resting, or feeding or where there were indications of nesting activity (i.e. pairs of birds or chicks, but does not include a formal nest survey). A total of 429 notable observations of notable areas of bird activity were recorded, of which 228 were in the HW zone and 96 and 105 in the MW and LW zones, respectively.

3.1.1 Overview

Use of the surveyed areas by wading and shorebirds were identified as resting, roosting, feeding and nesting. A distinction was drawn between resting and roosting birds. Birds which were more widely distributed but not obviously feeding, were identified as 'resting'. Aggregations of birds on high tide roosts or on elevated shell-banks, and which were not feeding, were identified as 'roosting'. 'Nesting' was identified by birds actively sitting on a nest or expressing nesting/courting behaviour.

In general, observations showed that wading birds and shorebirds used the greater part of the high shore and intertidal zone to the east and west of Northport over the entire study period (Figure 2). On any survey day, birds could be present in high numbers while roosting or more widely dispersed while resting and feeding. Bird feeding was strongly influenced by tidal height as many birds followed the water's edge over ebb and flood tidal phases. Birds utilised the slightly elevated mid and low shore areas during low and mid tide, but as these became progressively more inundated with increasing tide, vacated these areas and moved to roosting sites higher on the shore.

Due to the large areas of sandflat exposed at low tide, areas of bird use were extensive during the LW phase. In comparison, bird distribution was compressed to the high shore roosting areas at HW. The data suggests that most of the birds present in any one compartment at LW remained within that compartment during MW and HW. Even during LW periods, some bird use occurred on the high tide roosting areas, particularly within West 2 at the Wildlife Refuge, the mangrove edge on the eastern side of Blacksmiths Creek, and at the upper shore area of East 1.

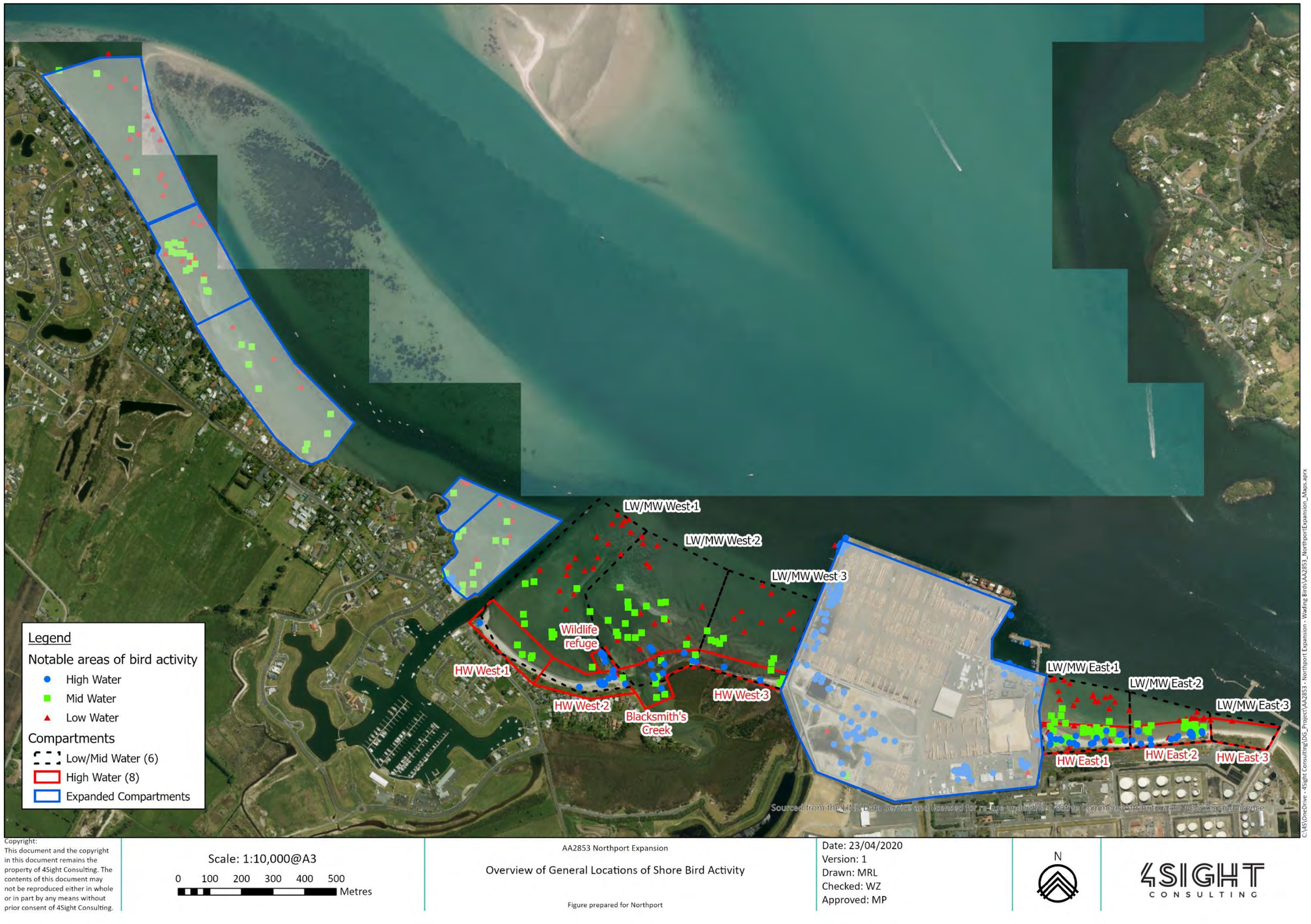

Figure 2: Overview of general locations of shore bird activity on the sandflats surrounding Northport at low, mid and high water. Greyed blue compartments indicate surveys undertaken in additional areas, reported on in van der Zwan (2020).

3.1.2 Low water

During the low water survey period, bird use was mostly concentrated in the mid to low shore zones including along the margins of the Blacksmiths Creek outlet flow. Little bird activity was noted on the upper shores during LW periods, although some birds were present on the upper shores of West 3 (Figure 2).

Eastern Sites

The intertidal shoreline tapers strongly toward the east and potential habitat declines in that direction.

Notable bird use occurred throughout East 1 and commonly included feeding NZ dotterel and resting red-billed gulls on the lower shores.

Notable bird use was also observed throughout the East 2 compartment although more so to the east, closer to the refinery. Large flocks of red-billed gull (up to 600 individuals) were noted resting on the eastern end of East 2. Occasional NZ dotterel were observed on the upper shores of East 2.

Little notable activity was observed within East 3 except some larger groups of red-billed gulls at the lower shores of East 3.

Western Sites

Notable bird use was mostly recorded within sites West 1 and West 2 near the Blacksmiths Creek outflow path which is rather broad as it crosses the mid and lower intertidal zones. Notable activity within West 1 was observed as large flocks of bar-tailed godwits (up to 300 individuals) and lesser knot (up to 200 individuals) feeding on the sandbanks between the Marsden Cove Marina channel and Blacksmiths Creek. Groups of NZ dotterel and banded dotterels were also observed within West 1.

Sporadic notable activity was noted within the upper shores along the mangrove forest edge within West 2. A group of 17 royal spoonbill were observed feeding within West 2 on one occasion. Furthermore, NZ dotterel, large flocks of lesser knot, spur-winged plover, and occasional banded dotterel were observed feeding within West 2.

Notable bird activity occurred throughout the lower shores of West 3. Feeding NZ dotterel were observed within West 3, as well as large flocks of red-billed gulls and lesser knot feeding.

3.1.3 Mid water

Over the mid water survey period, bird activity was dispersed widely over the exposed shore and elevated intertidal banks in all compartments both to the west and east of Northport. Small clusters of notable bird activity were present within West 3 and East 2, while no notable activity was observed within East 3 (Figure 2).

Eastern Sites

East 1 indicated evenly spread use of notable bird activity throughout the site where shore and intertidal banks were exposed. Large flocks of South Island pied oystercatchers (SIPO) (up to 250 individuals) were observed resting on the mid shore in the centre of East 1, often with a lower number of variable oystercatchers among them. NZ dotterel were also often seen feeding and/or resting on the western end of East 1.

Two clusters of notable activity were recorded within East 2, one towards the west and one towards the east, close to the refinery. The western cluster comprised predominantly of flocks of SIPO and variable oystercatchers resting, while the eastern cluster were all large groups of red-billed gulls (up to 500 individuals) resting.

No notable bird activity was recorded within East 3.

Western sites

Notable bird activity was evenly scattered throughout West 1 and West 2, where two clusters were noted in West 3.

Large flocks of lesser knot and bar-tailed godwits (over 200 and 250 individuals, respectively) were observed feeding on the intertidal area within West 1 as well as occasional larger group of SIPO feeding on the western end of West 1. A group of ten white-faced heron was observed on one occasion resting on the rock wall along Blacksmiths Creek.

Within West 2 birds were present further inland along the mangrove forest edge along Blacksmiths Creek. Along the mangrove edge and inland along Blacksmiths Creek, NZ dotterel were observed resting, while large flocks of bar-tailed godwits and lesser knot (up to 150 and 100 respectively) were more commonly seen feeding on the intertidal area in the centre of West 2. Occasional banded dotterel were also observed in this area.

West 3 presented two clusters of notable activity, one at the eastern end of this site, directly adjacent to Northport and a second cluster at the western end of this site. The eastern cluster comprised mostly of small groups NZ dotterel (up to three birds) feeding and occasionally white-faced-heron and variable oystercatcher were observed feeding. The western cluster comprised of large flocks of lesser knot feeding (up to 50 individual birds) as well as small numbers of NZ dotterel (two birds) feeding in this area.

3.1.4 High water

At the high water survey period, bird distribution was condensed to the high shore areas within each site. Activity was mostly well distributed across most compartments to the east and west of Northport, with the absence of any notable bird activity within East 3 (Figure 2).

Eastern Sites

Notable bird activity recorded on the high shore areas within sites East 1 and East 2 included large flocks of SIPO (up to 320 individual birds). Variable oystercatchers were often present among the flocks of SIPO. Occasional NZ dotterel were also observed in East 1.

Large flocks of red-billed gull (up to 350 individuals) were seen resting on the upper shores of East 2, as well as occasional flocks of SIPO and variable oystercatchers at its western end. Occasional NZ dotterel were seen and a flock of 70 bar-tailed godwits was observed on one occasion.

No notable activity was recorded within East 3.

Western Sites

Little notable bird activity was observed within West 1, with one record of a resting pair of variable oystercatchers on the grass verge at the far western corner within West 1 near the Marsden Cove Marina channel.

Highest levels of notable activity were recorded within West 2 with large flocks of bar-tailed godwits (up to 900 individuals) roosting on the upper shore. Large flocks of lesser knot (up to 200 individuals) were also noted in this area. Groups of pied stilts (up to 16 individuals) were recorded on two occasions, as well as a little shag on the rock wall along Blacksmiths Creek.

Scattered notable activity was observed within West 3 along the upper shores towards Northport. A breeding pair of variable oystercatchers was seen with a chick on a number of occasions on the rock wall near Northport.

Most notable species present on the Wildlife Refuge (West 4) were white-faced heron (observed in groups of up to 21 individuals) and a reef heron. On the upper shores near the Blacksmiths Creek (West 5) and along the mangrove forest edge, large flocks of bar-tailed godwits and lesser knot (up to 260 and 100 individuals, respectively) were recorded. A pair of Caspian tern was also noted roosting in this area.

3.2 Bird Diversity and Abundance

Analysis of all recorded data in the field was undertaken to depict the diversity and abundance of individual species within each site at the different tidal levels. The graphs below present the average abundance of species within each compartment (Figure 3Figure 4Figure 5). A full list of abbreviations used in the graphs is provided in Appendix B:. Details on the presence of threatened bird species within each compartment are outlined in Section 3.3 below.

3.2.1 Low water

A total of 7,048 individual birds, across 18 species were recorded at low water throughout the survey site during the survey period. A total of 3,419 birds (48.5%) within the eastern sites and 3,629 (51.5%) within the western sites (Table 1). The majority of individual birds were red-billed gulls (61%), followed by lesser knot (10.2%), and bar-tailed godwits (9.5%). Species composition within the eastern and western sites was different and is discussed further below. Average

species abundance was more evenly spread at the western sites, while at the eastern sites fewer species were present and average abundance was dominated by red-billed gull.

Table 1. Summary of total number of individuals and species recorded at low water across eastern and western sites.

Low water	East 1	East 2	East 3	West 1	West 2	West 3	Total East	Total West	Total Survey
Total # individuals	597	2558	264	732	2293	604	3419	3629	7048
Total # of species	9	11	3	15	16	12	11	17	18
Dominant species	RBG	RBG	RBG	RBG	LK	SWP	RBG	RBG	RBG
Dominant species %	82.1%	96.1%	98.5%	48.5%	27.3%	36.4%	94.1%	29.8%	61.0%

Eastern sites

At the eastern sites at low water nine bird species were recorded in East 1, 11 species in East 2, and three species in East 3 throughout the survey period (Figure 3). Among all three compartments, red-billed gull was the most abundant species (82.1% East 1; 96.1% East 2; 98.5% East 3).

Abundance in East 1 at low water was dominated by red-billed gull with an average of 31.2 individuals. This was followed by NZ Dotterel and variable oystercatcher with an average abundance of 2.4 and 2.3, respectively. The remaining six species recorded in compartment one each had an average abundance of less than 1.

Abundance in East 2 at low water was also dominated by red-billed gull with an average of 153.6 individuals. The remaining eight species recorded from East 2 each had an average abundance of less than 3.0.

Abundance in East 3 at low water was again dominated by red-billed gull with an average of 16.3 individuals. The remaining two species recorded in East 3 each had an average abundance of less than 1.0.

Western sites

At the western sites at low water 17 bird species were recorded during the survey period, 15 species were recorded in compartment West 1, 16 species were recorded in West 2, and 12 species were recorded in West 3 (Figure 3). Red-billed gulls were most encountered in West 1 (48.5%). West 2 presented a more equal representation of species: bar-tailed godwits (27.2%), lesser knot (24.8%), and red-billed gull (24.0%). West 3 was dominated by spur-winged plover (36.4%) and red-billed gull (29.3%).

Abundance in West 1 at low water was dominated by red-billed gull with an average of 22.2 individuals taken over the total survey period. The second most common species within this site was New Zealand dotterel with an average abundance of 6.5 individuals followed by bar-tailed godwit and banded dotterel with an average abundance of 4.9 and 3.6, respectively. The remaining 11 species recorded in West 1 each had average abundances of less than 3.0 individuals per survey.

The most common species within West 2 at low water were lesser knot with an average abundance of 39.0 individuals per survey, bar-tailed godwit with an average abundance of 35.6, and red-billed gull with an average abundance of 34.4 individuals per survey. The three next most common species had average abundances between 5 and 11 individuals per survey, with the remaining 10 species having average abundances of less than 3.5 individuals per survey.

Average abundance in West 3 at low water was dominated by spur-winged plover with an average of 13.8 individuals throughout the survey period, followed by red-billed gull with an average of 11.1 individuals during the survey period. The next most common species was lesser knot with an average of 6.5 individuals. The remaining nine species recorded in West 3 each had an average abundance of less than 2.2.

It is noted that due to mechanical failure, part of the last day of recordings was lost for West 3 - LW. This may have impacted the final results of species recorded within this compartment (West 3 - LW), although the impact is thought to be very small.

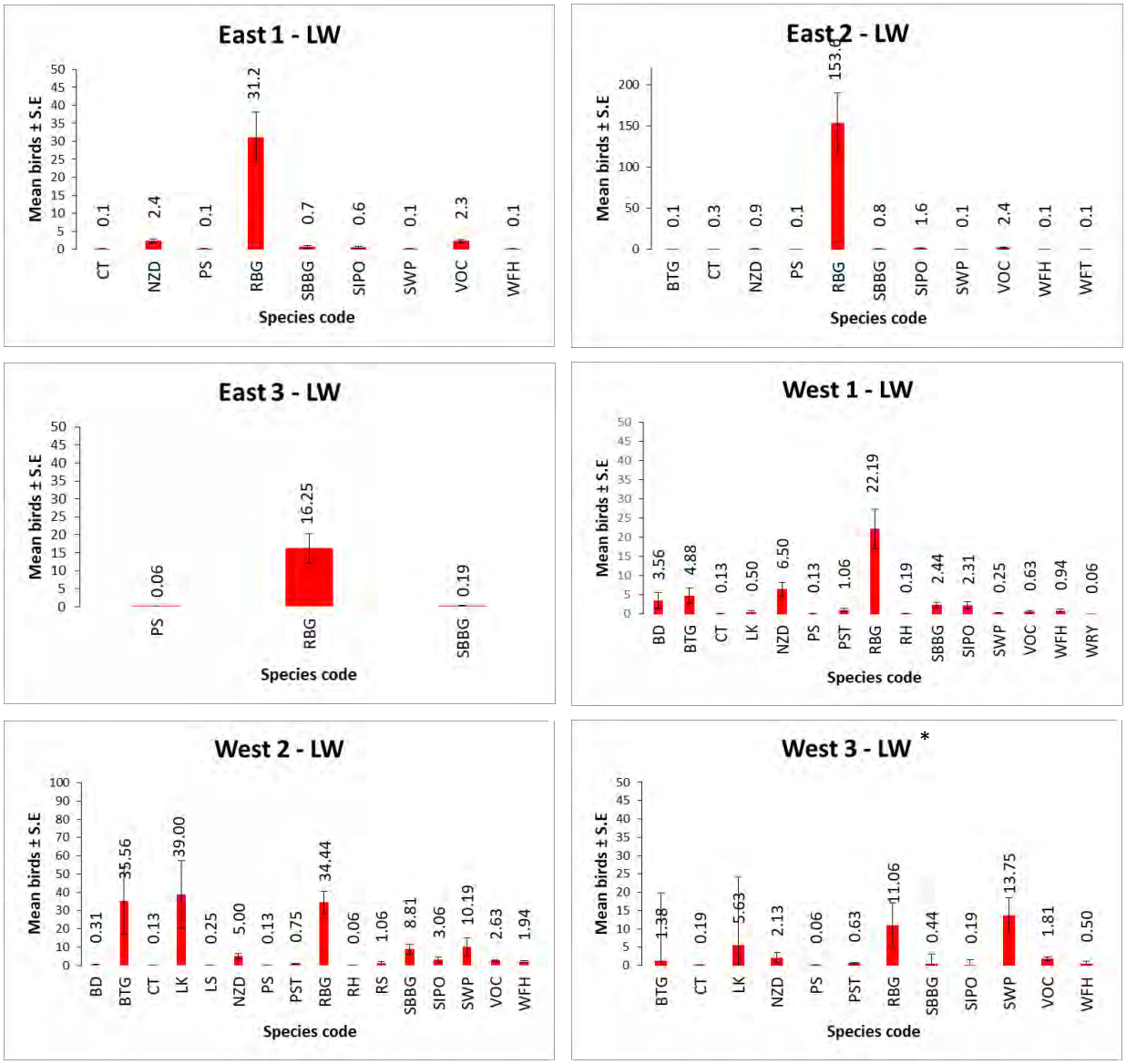

Figure 3. Average birds present during the entire survey period at low water within the eastern and western sites. *Note: Recordings for West 3 stopped unexpectedly on the last survey date, which means some data may be missing from this last survey.

3.2.2 Mid water

A total of 10,277 individual birds, across 17 species were recorded at mid water throughout the survey site during the survey period. A total of 5,041 birds (49.1%) within the eastern sites and 5,236 (50.9%) within the western sites (Table 2). Red-billed gulls were dominant (33.3%), followed by lesser knot (19.5%), and bar-tailed godwits (16.7%), and SIPOs (13.4%). Average abundance of species was more evenly spread at the western sites, while at the eastern sites fewer species were present and average abundance was dominated by red-billed gulls.

Eastern sites

At the eastern sites a total of ten species were recorded at mid water, seven bird species were recorded in East 1, eight species in East 2 and four species in East 3 (Figure 4). Most birds within East 1 were SIPO, while red-billed gulls were most common in East 2 and East 3.

Table 2. Summary of total number of individuals and species recorded at mid water across eastern and western sites.

Mid water	East 1	East 2	East 3	West 1	West 2	West 3	Total East	Total West	Total Survey
Total # individuals	1822	2880	339	1981	2727	528	5041	5236	10277
Total # of species	7	8	4	12	16	14	10	16	17
Dominant species	SIPO	RBG	RBG	BTG	LK	LK	RBG	LK	RBG
Dominant species %	48.6%	83.4%	97.3%	42.1%	42.4%	32.2%	62.3%	38.3%	33.3%

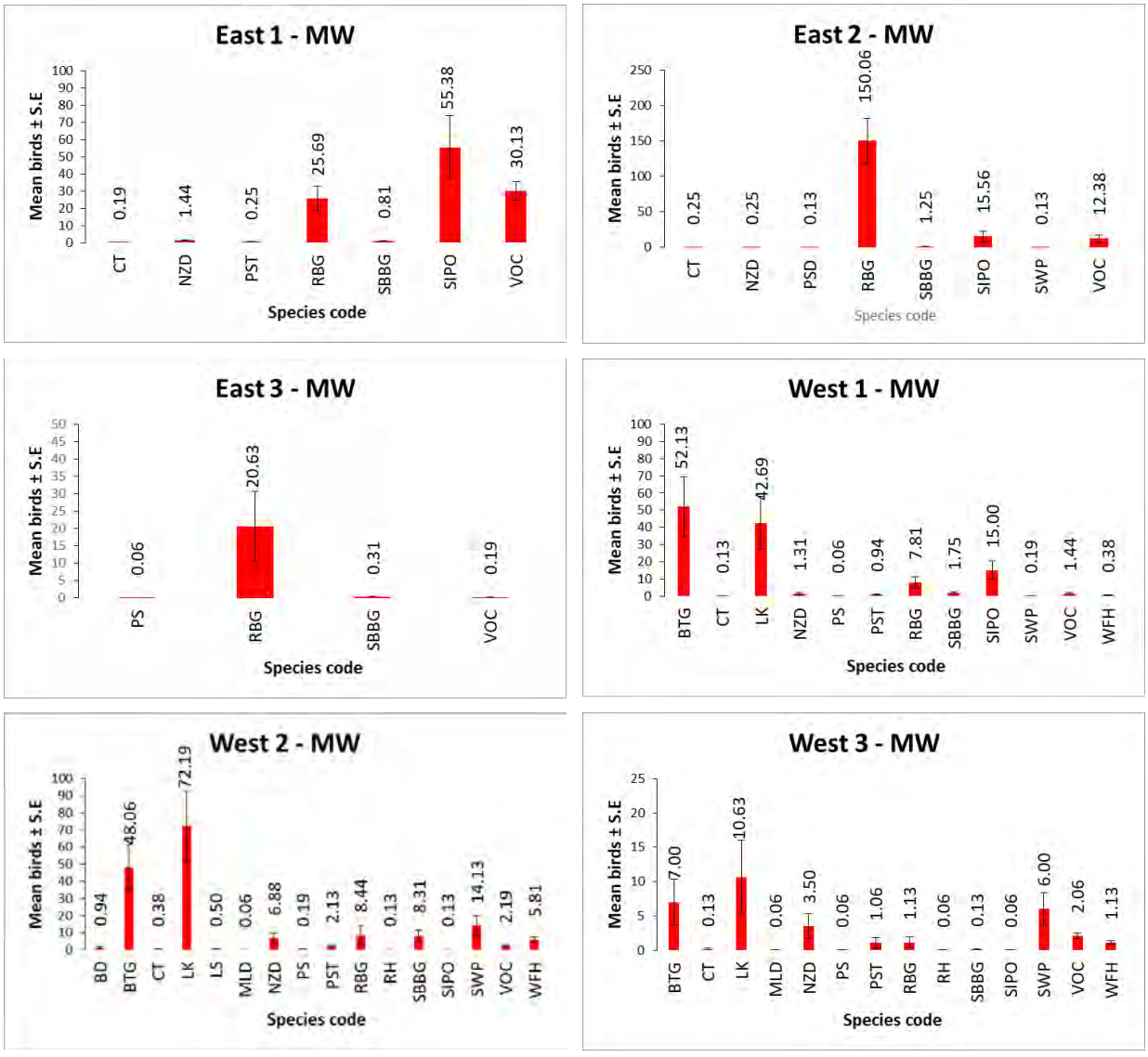

Figure 4. Average birds present during the entire survey period at mid water within the eastern and western sites.

East 1 at mid water was dominated by SIPO with an average abundance of 55.4, variable oystercatcher with an average abundance of 30.1 and red-billed gull with an average abundance of 25.7. The remaining four species had average abundances of less than 2.0.

East 2 was dominated by red-billed gull at mid water with an average abundance of 150.1 followed by SIPO with an average abundance of 15.6 and variable oystercatcher with an average abundance of 12.4. The five remaining species had average abundances of less than 2.0.

East 3 at mid water was dominated by red-billed gull with an average of 20.6 individuals. The remaining three species recorded in East 3 each had an average abundance of less than 1.

Western sites

At the western sites at mid water, 12 bird species were recorded in West 1, 16 species were recorded in West 2 and 14 species were recorded in West 3 (Figure 4). Lesser knot and bar-tailed godwit were the most common bird species present among the three western sites at mid water.

West 1 at mid water was dominated by bar-tailed godwits with an average of 52.1 individuals recorded per survey throughout the survey period, lesser knot was the second most common species with an average abundance of 42.7 followed by SIPO with an average abundance of 15.0. Red-billed gull was also relatively common with an average abundance of 7.8. The remaining eight species recorded in West 1 each had average abundances of less than 2.0.

West 2 at mid water was dominated by lesser knot with an average abundance of 72.2 individuals followed by bar-tailed godwit with an average abundance of 48.1. Spur-winged plover was the third most common species at West 2 at mid water with an average abundance of 14.1. The remaining 13 species had average abundances of less than 8.5.

The most common species in West 3 at mid water were lesser knot, bar tailed godwits and spur-winged plover, with average abundances of 10.6, 7.0, and 6.0 respectively. The remaining 11 species recorded in West 3 each had an average abundance of less than 4.0.

3.2.3 High water

A total of 8,286 individual birds, across 16 species were recorded at high water throughout the survey site during the survey period. A total of 4,870 birds (58.8%) within the eastern sites and 3,416 (41.2%) within the western sites (Table 3). Overall, across all sites red-billed gulls (31.9%) were most common, followed by bar-tailed godwits (27.3%), SIPO (17.3%), and variable oystercatchers (10.9%). Most compartments showed a lower number of species during high water surveys, with average abundance more evenly spread at each site compared to results from mid and low water surveys. One thing to note is that at high water two additional compartments are included (West 4 – Wildlife refuge and West 5 – Blacksmiths Creek). During low and mid water surveys, these sites were part of West 2.

Table 3. Summary of total number of individuals and species recorded at high water across eastern and western sites.

High water	East 1	East 2	East 3	West 1	West 2	West 3	West 4	West 5	Total East	Total West	Total Survey
Total # individuals	1688	2813	369	238	1996	110	78	994	4870	3416	8286
Total # of species	11	8	3	4	8	9	6	13	14	14	16
Dominant species	SIPO	RBG	RBG	RBG	BTG	BTG	WFH	BTG	RBG	BTG	RBG
Dominant species %	62.0%	69.9%	98.9%	52.5%	73.6%	27.3%	60.3%	62.6%	51.0%	64.2%	31.9%

Eastern sites

At the eastern sites at high water, 11 bird species were recorded in East 1, eight species were recorded in East 2 and three species were recorded in East 3 (Figure 5). Red-billed gull, SIPO, and variable oystercatchers were the most abundant species within the eastern sites.

Abundance in East 1 at high water was dominated by SIPO with an average abundance of 65.4, variable oystercatcher with an average abundance of 28.1 and red-billed gull with an average abundance of 9.6. The remaining eight species had average abundances of equal to or less than 1.0.

Abundance in East 2 at high water was dominated by red-billed gull with an average abundance of 122.9. Variable oystercatcher and SIPO follow with an average abundance of 24.6 and 22.9, respectively. The five remaining recorded species had average abundances of less than 4.5.

Abundance in East 3 at high water was dominated by red-billed gull with an average of 22.8 individuals. The remaining two species recorded in East 3 each had an average abundance of less than 0.2 individual birds per survey.

Western sites

At the Western Site at high water, four species were recorded in West 1, eight species were recorded in West 2 and nine species were recorded in West 3, six species from West 4 (Wildlife Refuge) and 13 in West 5 (Blacksmiths Creek) (Figure 5). Bar-tailed godwits were common in most of the western sites at high water.

West 1 at high water was dominated by red-billed gull with an average abundance of 7.8 followed by bar-tailed godwits with an average abundance of 4.5. The remaining two species had an average abundance of less than 2.0.

West 2 at high water was dominated by bar-tailed godwit with an average abundance of 91.9 individuals. Lesser knot was also common with an average abundance of 28.1. The remaining six species had average abundances of less than 4.0.

Abundance at West 3 was evenly spread across the nine recorded species. Bar-tailed godwits were most common with an average abundance of 1.9 followed by spur-winged plover with an average abundance of 1.8 individuals recorded per survey. The remaining seven species each had an average abundance of less than 1.0.

Abundance was low for all six species recorded at the West 4 (Wildlife Refuge) at high water. White-faced heron was the most dominant species with an average abundance of 2.9. The remaining five species each had an average abundance of less than 1.0.

The most common species in the West 5 (Blacksmiths Creek) compartment was bar-tailed godwit with an average abundance of 38.9 followed by lesser knot with an average abundance of 11.9 and spur-winged plover with an average abundance of 5.3. The remaining 10 species had an average abundance of less than 2.1.

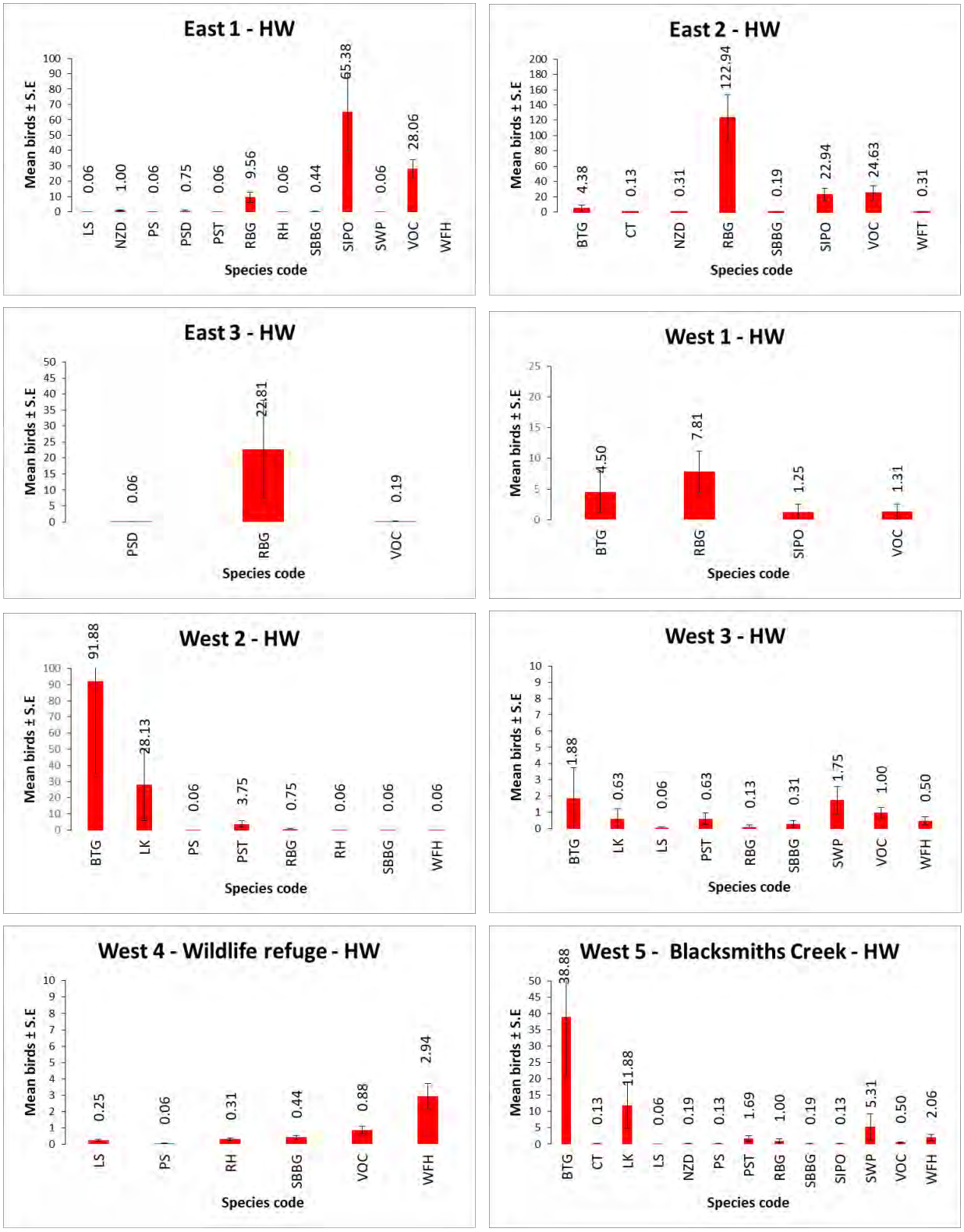

Figure 5. Average birds present during the entire survey period at high water within the eastern and western sites. Note: two additional compartments are included during high water surveys (West 4 – Wildlife refuge, and West 5 – Blacksmiths Creek). These sites were part of West 2 during low and mid water surveys.

3.3 Threatened and At-Risk Wading and Shorebirds

A total of 20 wading and shorebird species were recorded throughout the entire survey area over the duration of the survey (September 2019 – February 2020). Of these, two are offshore migrants (bar-tailed godwit and lesser knot) and three are internal migrants (SIPO, wrybill, and pied stilt). Of the species recorded, 13 have been recognised under the New Zealand Threat Classification System (Robertson et al. 2016), six being classified as 'Threatened' and eight being classified as 'At Risk', as summarised in Table 4.

Table 4: Summary of all bird species recorded during the survey period, including their conservation status, derived from Robertson et al. 2016.

Scientific name	Common name, Māori name	Conservation status
Anarhynchus frontalis	Wrybill, ngutu-pare	Threatened – Nationally Vulnerable
Anas platyrhynchos	Mallard duck	Introduced and naturalised
Calidris canutus rogersi	Lesser knot	Threatened – Nationally Vulnerable
Charadrius bicinctus bicinctus	Banded dotterel, tūturiwhatu	Threatened – Nationally Vulnerable
Charadrius obscurus aquilonius	New Zealand dotterel	At Risk - Recovering
Egretta novaehollandiae	White-faced heron, matuku moana	Not Threatened
Egretta sacra sacra	Reef heron, matuku moana	Threatened – Nationally Endangered
Haematopus finschi	South Island pied oystercatcher, tōrea	At Risk - Declining
Haematopus unicolor	Variable oystercatcher, tōrea pango	At Risk - Recovering
Himantopus himantopus	Pied stilt, poaka	Not Threatened
Hydroprogne caspia	Caspian tern, taranui	Threatened – Nationally Vulnerable
Larus dominicanus dominicanus	Southern black-backed gull, karoro	Not Threatened
Larus novaehollandiae scopulinus	Red-billed gull, tarāpunga	At Risk - Declining
Limosa lapponica	Bar-tailed godwit, kūaka	At Risk - Declining
Phalacrocorax melanoleucos brevirostris	Little shag, kawau paka	Not Threatened
Phalacrocorax varius varius	Pied shag, kāruhiruhi	At Risk - Recovering
Platalea regia	Royal spoonbill, kotuku ngutupapa	At Risk – Naturally uncommon
Sterna striata striata	White-fronted tern, tara	At Risk - Declining
Tadorna variegata	Paradise shelduck, pūtangitangi	Not Threatened
Vanellus miles novaehollandiae	Spur-winged plover	Not Threatened

The total number of birds with a national threat status classification, classified as either 'Threatened' or 'At Risk' varied at the different sites (Table 5). While 'Threatened' and/or 'At Risk' were present within all compartments, most 'Threatened' species were observed in West 1 and 2, while East 2 and West 2 comprised the highest number of 'At Risk' species.

Bird species classified as 'Threatened' or 'At Risk' are prominent in the area. The two compartments to the immediate east and west of Northport (East 1 and West 3 respectively), host a total of 7 and 9 respectively 'Threatened' and 'At Risk' species.

Table 5: Summary of total number of 'Threatened' and 'At-Risk' species recorded in each compartment over the duration of the survey. Underlined species indicate these were most commonly observed within this compartment throughout the survey.

Compartment	Threatened species	# Threatened	At Risk species	# At Risk	Total # Threatened and At-Risk species
East 1	Caspian tern, Reef heron	2	NZ dotterel, Red-billed gull, SIPO, Variable oystercatcher, Pied Shag,	5	**7**
East 2	Caspian tern	1	Bar-tailed godwit, NZ dotterel, Pied shag, Red-billed gull, SIPO, Variable oystercatcher, White fronted tern**	7	**9**
East 3	N/A	0	Red-billed gull, Pied shag, Variable oystercatcher	3	**3**
West 1	Caspian tern, Lesser knot, Reef Heron, Wrybill**, Banded Dotterel	5	Bar-tailed godwit, NZ dotterel, Pied shag, Red-billed gull, SIPO, Variable oystercatcher,	6	**11**
West 2	Caspian tern, Lesser knot, Reef Heron, Banded Dotterel, Black-billed gull	5	Bar-tailed godwit, NZ dotterel, Pied shag, Red-billed gull, SIPO, Variable oystercatcher, Royal spoonbill**	7	**12**
West 3	Caspian tern, Lesser knot, Reef Heron	3	Bar-tailed godwit, NZ dotterel, Red-billed gull, SIPO, Variable oystercatcher, Pied shag	6	**9**
West 4 - Wildlife Refuge*	Reef Heron	1	Pied shag, Variable oystercatcher	2	**3**
West 5 - Blacksmiths Creek*	Lesser knot, Caspian Tern	1	Bar-tailed godwit, NZ dotterel, Red-billed gull, SIPO, Variable oystercatcher, Pied shag	3	**4**

*Note: West 4 and West 5 were only surveyed as separate compartments during high water surveys. During low and mid water surveys, these compartments were included in West 2.

**These species were only recorded within this compartment.

4 SUMMARY

4.1 Notable Areas of Bird Activity

Notable areas of bird use and activity were identified. These included high water roosts, mid- and low water resting areas, nesting areas and feeding grounds.

At the eastern sites:

- During low water surveys, notable bird use activities were mostly evenly spread throughout East 1. Observations included large flocks of SIPO resting/roosting during mid and high-water surveys. Small numbers of feeding and resting NZ dotterel were observed across the different tides and resting red-billed gulls were seen on the lower and mid shores.
- Within East 2 large flocks of red-billed gull (up to 600 individuals) were noted resting at the eastern end of East 2 during low water surveys. During mid- and high-water surveys, two clusters of birds formed: the western cluster comprised predominantly of resting flocks of SIPO and variable oystercatchers, while the eastern cluster were large groups of resting red-billed gulls (up to 500 individuals). Occasional NZ dotterel were observed on the upper shores of East 2 during low- and high-water surveys.
- Little notable activity was recorded within East 3 except some larger groups of red-billed gulls at the lower shores of East 3 at low water surveys.

At the western sites:

- West 1: Notable bird activity was observed as large flocks of bar-tailed godwit and lesser knot feeding on the sandbanks between the Marsden Cove Marina channel and Blacksmiths Creek during low- and mid-water surveys. Groups of NZ dotterel and banded dotterel were also observed within West 1. There was an occasional larger group of SIPO feeding on the western end of West 1 during mid water surveys, while little notable bird activity was observed within West 1 at high water.
- West 2: NZ dotterel, large flocks of lesser knot, spur-winged plover, and occasional banded dotterel were observed feeding at low water. At mid water, NZ dotterel were seen resting, while large flocks of bar-tailed godwits and lesser knot were more commonly observed feeding on the intertidal area along the mangrove edge and further inland along Blacksmiths Creek. Occasional banded dotterel were also seen in this area. Large flocks of bar-tailed godwit and lesser knot were seen roosting on the upper shore at high water. Groups of pied stilt were seen roosting along the mangrove forest edge.
- West 3: Feeding NZ dotterel were most notable at low water, as well as large flocks of feeding red-billed gulls and lesser knot. During mid water surveys, two clusters of birds formed at West 3. An eastern cluster comprised mostly of feeding NZ dotterel, occasionally white-faced-heron, and variable oystercatcher. A western cluster comprised of large flocks of feeding lesser knot as well as small numbers of feeding NZ dotterel. A breeding pair of variable oystercatchers was observed with a chick on a number of occasions on the rock wall near Northport.
- West 4 and 5: The Wildlife Refuge (West 4) mostly showed white-faced heron and a reef heron, while on the upper shores near the Blacksmiths Creek (West 5) and along the mangrove forest edge, large flocks of bar-tailed godwits and lesser knot were seen.

4.2 Bird diversity and abundance

A total of 25,611 individual birds were recorded across 20 wading and shorebird species over the duration of the survey throughout the survey area.

In general:

- The number of birds counted was similar between the eastern and western sites.
- Species diversity was greater at the western sites than at the eastern sites.

- The bird community was dominated by a few abundant species at the eastern site. Average abundance was more evenly distributed between species at the western sites.
- Species diversity was highest at low water and lowest at high water surveys for both the eastern and western sites. This indicates that some species leave the area at HW.
- Abundance of birds was highest at mid water and lowest at low water. Although less space is available at HW, species abundance was higher at HW than at LW.
- Species distribution changed throughout the different compartments depending on the tidal state.
- 'Threatened' and 'At Risk' species were present throughout the survey area over the duration of the survey.
- At the eastern sites, species diversity was higher toward Northport (East 1) than the oil refinery jetty (East 3) (a total of 13 species versus five species, respectively).
- At the western sites, species diversity was similar across the entire site (15 species close to Northport (West 3) and 15 to 17 species in the West 1 and West 2, respectively).

4.3 Discussion

The study area hosts a wide range of coastal birds including international migratory waders, internal migrants, flocking and solitary species.

Collectively this assemblage of bird species utilises all the available habitat from the high shore to the low intertidal area on either side of Northport, between the refinery jetty in the east and the Marsden Cove Marina channel in the west.

The broader habitat in this area provides roosting, resting, and feeding habitat for wading and shorebirds. Thirteen of the 20 recorded species are listed within the New Zealand Threat Classification system as 'Threatened or 'At Risk'.

The presence of several 'Threatened' and 'At Risk' species in close vicinity to Northport and within the indicative 'Vision for Growth' footprint **Error! Reference source not found.**is an important matter for consideration in the VFG assessment of environmental effects.

This 2019 - 2020 report, largely supports and strengthens the findings of the previous survey completed in 2017 – 2018 (Bone 2018).

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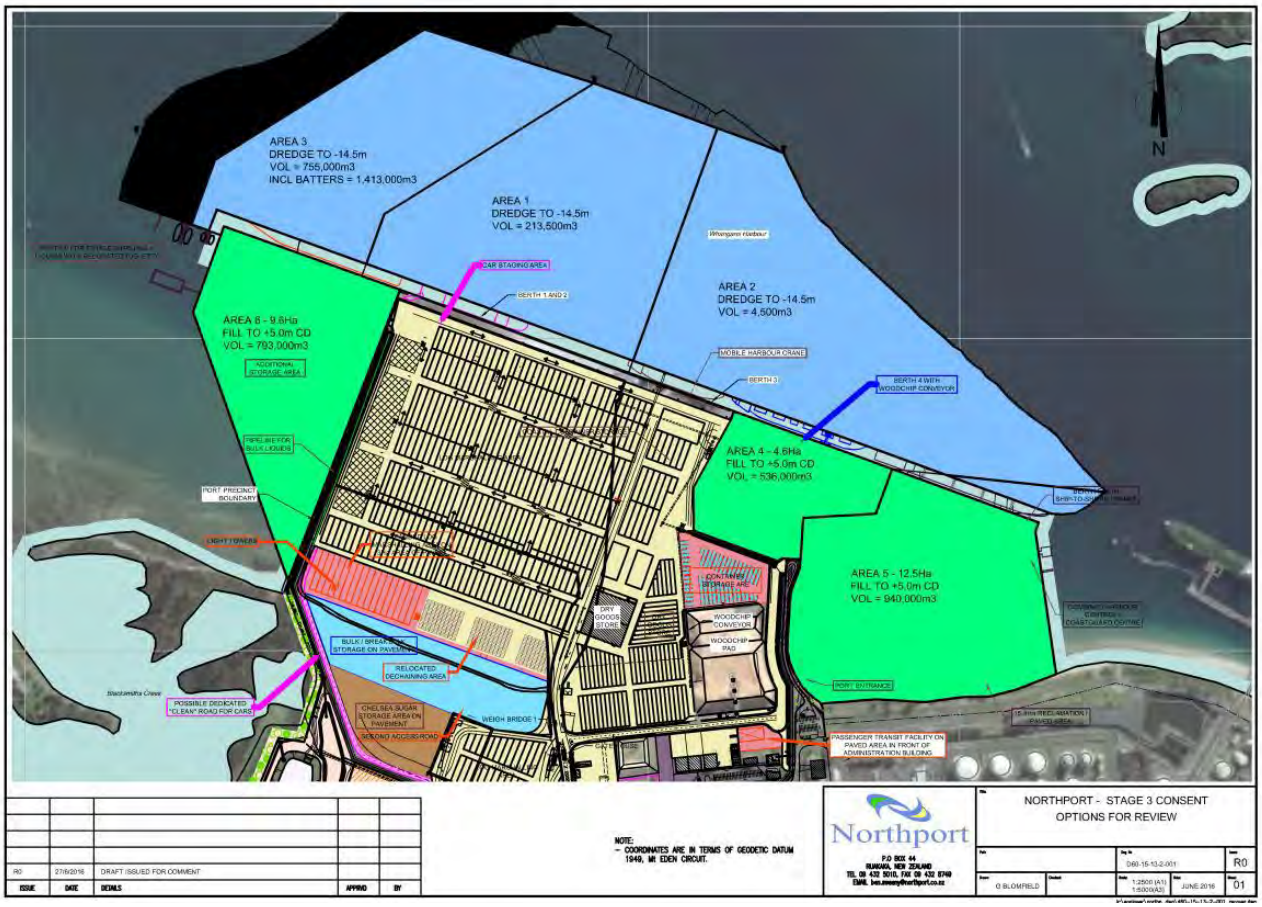
Appendix A:

Indicative Vision for Growth footprint

Draft plan of the 'Vision for Growth' project showing the proposed areas of reclamation (green) and dredging (blue) as issued in the Northport consultant RFP. Provided by Northport Ltd.



Appendix B:

Species name abbreviations

Species names and associated abbreviations used in Figures 4 – 6 of the report.

Abbreviation	Species name	Species group
BD	Banded dotterel	Plover
BTG	Bar-tailed godwit	Godwit/knot/whimbrel
CT	Caspian tern	Terns
LK	Lesser knot	Godwit/knot/whimbrel
LS	Little shag	Shag
MLD	Mallard	Duck
NZD	New Zealand dotterel	Plover
PS	Pied shag	Shag
PSD	Paradise shelduck	Duck
PST	Pied stilt	Oystercatcher/stilt
RBG	Red-billed gul	Gulls
RH	Reef heron	Heron/Spoonbill
RS	Royal spoonbill	Heron/Spoonbill
SBBG	Southern black-backed gull	Gulls
SIPO	South Island pied oystercatcher	Oystercatcher/stilt
SWP	Spur-winged plover	Plover
VOC	Variable oystercatcher	Oystercatcher/stilt
WFH	White-faced heron	Heron/Spoonbill
WFT	White-fronted tern	Terns
WRY	Wrybill	Plover

4SIGHT CONSULTING

LAND. PEOPLE. WATER.

Northport

Wading Bird Survey – Expanded Areas December 2019 – February 2020

For Northport Ltd

May 2020

REPORT INFORMATION AND QUALITY CONTROL

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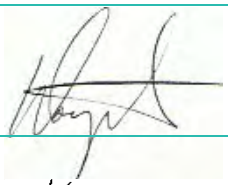
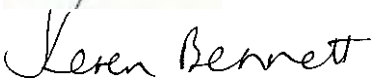
Reviewer:	Mark Poynter Principal Ecology Consultant	
Approved for Release:	Keren Bennett Principal Ecology Consultant	

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CONTENTS Page

1 INTRODUCTION 1
1.1 Project Background 1
1.2 Report Purpose 1
2 APPROACH & METHODS 2
3 RESULTS 5
3.1 Notable areas of bird activity 5
3.1.1 Expanded Area - Overview 5
3.1.2 Expanded Area - Low water 7
3.1.3 Expanded Area - Mid water 7
3.1.4 Expanded Area - High water 7
3.1.5 Port Site - High Water 8
3.2 Bird Diversity and Abundance 8
3.2.1 Expanded Area Site 8
3.2.2 Port site 12
3.3 Bird Conservation Status Overview 13
4 SUMMARY 15
4.1 Notable areas of bird activity 15
4.2 Bird diversity and abundance 15
4.3 Discussion 16
5 REFERENCES 17

List of Tables

Table 1. Summary of total number of individuals and species recorded at low water at Expanded Area. 8
Table 2. Summary of total number of individuals and species recorded at mid water at Expanded Area. 10
Table 3. Summary of total number of individuals and species recorded at Expanded Area 11
Table 4. Summary of total number of individuals and species recorded at the Port Site at high water. 12
Table 5. Summary of all bird species recorded during the survey period, including their conservation status, derived from Robertson et al. 2016. 13
Table 7: Total number of Threatened and At-Risk species recorded in each compartment over the duration of the survey 14

List of Figures

Figure 1: Bird survey compartments for each tidal level surrounding Northport. Greyed out compartments indicate survey areas monitored as part of the complimentary study (van der Zwan 2020). 4
Figure 2: Overview of general locations of shore bird activity surrounding Northport at low, mid and high water. Greyed out compartments indicate survey areas monitored as part of the complimentary study (van der Zwan 2020). 6
Figure 3. Average number of birds present during the entire survey period at low water within the Expanded Area. 9
Figure 4. Average number of birds present during the entire survey period at mid water within the Expanded Area 11
Figure 5. Average number of birds present during the entire survey period at high water at the Expanded Site. Note: No birds were seen within Expanded Site 2 during high water surveys. 12
Figure 6. Average number of birds present during the entire survey period at high water at the Port Site. 13

List of Appendices

Appendix A: Indicative Vision for Growth footprint
Appendix B: Species name abbreviations

1 INTRODUCTION

1.1 Project Background

Northport Ltd has engaged 4Sight Consulting (4Sight) to undertake wading and shorebird bird surveys in Marsden Bay and between the Northport facility and Marsden Point oil refinery terminal. This work was completed to provide additional background information relevant to Northport's current 'Vision for Growth' (VFG) strategy.

The Northport 'Vision for Growth' proposes reclaiming up to approximately 9.6 hectares to the west and up to approximately 17.1 hectares to the east of the current Northport facility (Blomfield 2017). The indicative VFG footprint is shown in Appendix A:.

The first wading and shorebird survey was carried out covering the period August 2017 – March 2018 (Bone, 2018). The 2019 - 2020 survey was undertaken in two parts. The first presents the results of a follow-up survey of the same area using the same methodology (van der Zwan 2020). The second part of the 2019 - 2020 survey included an expanded area (hereafter 'Expanded Area') requiring additional surveying to the west towards One Tree Point as well as the Northport facility itself (hereafter 'Port Site'). This report presents the findings of this second part of the work.

1.2 Report Purpose

The intertidal area to the east and west of Northport is utilised by a range of coastal bird species, including wading birds such as variable oystercatcher, NZ dotterel, lesser knot, and others (Pierce 2005). Northport requires to understand the utilisation of intertidal areas and the adjacent port environs by wading birds in relation to its VFG strategy. This information will be used in an assessment of ecological environmental effects (AeEE) of the VFG footprint once that is finalised. The AeEE, is yet to be undertaken. Wading and shorebird use of the shoreline has a strong seasonal component, with activity generally being greater from September through to end of February. This survey was designed to capture bird activity during this period.

This report follows on from the findings of the 2017 - 2018 wading and shorebird surveys carried out and reported to Northport (Bone 2018) and presents data on the presence, distribution and activity of birds (resting/roosting/feeding) surveyed between September 2019 – February 2020 (Figure 1). Surveying the expanded area was intended to provide additional information on the wider distribution of wading birds and the relative ecological importance of different parts of the shore along this section of the harbour as well as the Northport facility itself.

2 APPROACH & METHODS

This survey follows the methodology used during the 2017-2018 wading bird survey (Bone 2018). The methodology was adapted from the Whangarei District Council's Plan Change 113 which required baseline surveys and monitoring of the wading birds around the Ruakaka estuary and adjacent beaches. That approach was negotiated through an Environment Court mediation process in cooperation with the Department of Conservation.

The Expanded Site comprises the coastline from the Marsden Cove Marina channel on the west side of the marina channel to the Marsden Yacht Club at One Tree Point. The Northport facility itself was also surveyed as part of this survey.

Expanded Area

The Expanded Area was surveyed from 12 December 2019 until 17 February 2020. Eight surveys were completed covering all tidal heights. The Expanded Area was broken into five compartments, numbered from 1 to 5. The division of compartments did not cover the whole coastline. As shown in Figure 1, a gap exists between compartments 1 and 2 that was not included in the survey. The decision for this was taken to maximise survey efficiency. The area excluded showed high levels of human disturbance and no birds were observed in the initial surveys. All compartments were governed by the suitability of viewing distances from pre-selected observation points. The observation points are also shown in Figure 1. Each site was further divided into high water (HW), mid water (MW) and low water (LW) sub-compartments, also shown in Figure 1.

Surveys were conducted according to the 'five-minute bird count' specification of Hartley and Greene (2012). The observer then counted all birds in the sub compartment being surveyed, keeping each count to approximately five minutes. This approach is a reliable measure of 'relative abundance' which minimises the chance that some birds are counted twice. At each observation point the observer notes were taken on weather conditions and human activity.

A Konus Konuspot – 80 spotting scope with 80 x magnification was used to spot birds and assist identification. Voice recordings were taken of all observations, which were later transcribed to the Raw data spreadsheet. Photographs were taken of key roosts and bird activity following each count. Locations of key birds and use were recorded in real time onto a tablet using Avenza Maps software.

In this case, key areas of notable bird activity was defined as areas where there was an obvious and elevated density of birds roosting, resting, or feeding or where there were indications of nesting activity (i.e. pairs of birds or chicks, but did not include a formal nest survey).

Mean bird abundance was calculated as the total number of birds of a species divided by the total number of surveys. Areas of notable bird activity and graphs of average bird density for each species in each compartment (expressed as mean number per survey ± standard error (SE)) were mapped using ArcGIS Pro 2.5.0 mapping software for graphical representation.

Port Site

Fifteen surveys were completed at the Port Site from 10 October 2019 until 17 February 2020 with approximately three surveys per month. Surveys were undertaken only during high water because it was thought that particular species may have been using the Port as a 'high tide roosting area'. The Port site encompasses the Northport cargo area, particularly the area of stockpiled coal on the western end of the port, the rock walls surrounding the port, and the molasses pond in the east of the port, but all areas were visually assessed.

Due to the nature of the site and health and safety requirements associated with surveying within an operational port, the survey was undertaken from a car while being escorted around the site. All bird activity was recorded using Avenza Maps software. The entire Port area was not inspected. Observations were restricted to mainly the perimeter and areas where it was safe to stop.

Figure 1: Bird survey compartments for each tidal level surrounding Northport. Greyed out compartments indicate survey areas monitored as part of the complimentary study (van der Zwan 2020).

3 RESULTS

Due to the large volume of field data, raw data is not presented here. However, all raw field data is stored on the 4Sight database and is available upon request. Results of analysis of the raw field data are presented below.

3.1 Notable areas of bird activity

The patterns of notable bird activity areas within each site are discussed below and depicted in Figure 2. Notable bird activities were defined as areas where there was an obvious and elevated density of birds roosting, resting, or feeding or where there were indications of nesting activity (i.e. pairs of birds or chicks, but does not include a formal nest survey). A total of 239 notable observations were recorded, of which 161 were at HW (seven within Expanded Site and 154 at the Port Site) and 39 each in the MW and LW zones.

It is noted that all bird observations were recorded at the Port Site, while only notable bird activity was noted for the Expanded Area.

3.1.1 Expanded Area - Overview

Use of the surveyed areas by wading and shorebirds were identified as resting, roosting, and feeding. A distinction was drawn between resting and roosting birds to the extent that birds which were more widely distributed but not obviously feeding, were 'resting'. Aggregations of birds on high tide roosts or on elevated shell-banks, and which were not feeding, were identified as 'roosting'.

In general, observations showed that wading birds and shorebirds used the greater part of the high shore and intertidal zone of the expanded area over the entire study period. Surveys at the Port Site showed concentrations of bird activity in small areas (Figure 2).

On any survey day, birds in the Expanded Area could be present in high numbers while roosting or more widely dispersed while resting and feeding. Bird feeding was strongly influenced by tidal height as many birds followed the water's edge over ebb and flood tidal phases. Birds utilised the slightly elevated mid and low shore areas during low and mid tide, but as these became progressively more inundated with increasing tide, vacated these areas and moved to roosting sites higher on the shore.

Due to the large areas of sandflat exposed at low tide, areas of bird use were extensive during the LW phase. In comparison, bird distribution was compressed to the high shore roosting areas at HW. However, it was apparent that birds present in any one compartment at LW remained within that compartment during MW but appear to move elsewhere during HW. During LW periods, little bird use occurred on the high tide roosting areas, except occasionally within Expanded Site 4. The coast along One Tree Point offers very little beach during high tide, resulting in the absence of potential high water roost areas for wading birds.

Figure 2: Overview of general locations of shore bird activity surrounding Northport at low, mid and high water. Greyed out compartments indicate survey areas monitored as part of the complimentary study (van der Zwan 2020).

3.1.2 Expanded Area - Low water

During the low water survey period, notable bird activity was mostly concentrated in the mid to low shore zones including those along the margins of the Marsden Cove Marina channel and the sandspit at the far-western point of the Expanded Area. Little bird activity was noted on the upper shores during LW periods, although some birds were present on the upper shores of Expanded Site 3 (Figure 2).

Notable bird use activities were spread throughout Expanded Site 1, predominantly on the lower shores along the Marsden Cove Marina channel. Notable species within this site were mostly feeding NZ dotterel, but banded dotterel were also recorded on one occasion.

Little notable activity was observed within Expanded Site 2, with sporadic NZ dotterel on the lower shores feeding along the water edge.

Bar-tailed godwits (group size of 17) and NZ dotterel were observed feeding along the water edge within Expanded Site 3.

Groups of red-billed gull (up to 22 individuals), southern black-backed gulls (groups up to 17 birds) were commonly observed roosting on the upper shores of Expanded Site 4. NZ dotterel and a reef heron were recorded feeding along the water edge within this site.

Most notable activity was noted within Expanded Site 5, with a group (17 individuals) of Caspian tern resting on the far-western end of this site, as well as groups of southern black-backed gulls, red-billed gulls, and occasional variable oystercatcher resting and/or roosting on the lower shores. NZ dotterel were seen feeding, as well as little shag along the water edge.

3.1.3 Expanded Area - Mid water

Over the mid water survey period, bird activity was dispersed widely over the exposed shore and elevated intertidal banks in all compartments within the Expanded Site. Highest levels of notable bird activity were recorded within Expanded Site 4, while little notable activity was observed within Expanded Site 2 and 5 (Figure 2).

Notable activity was scattered through Expanded Site 1, dominated by South Island pied oystercatcher (SIPO) roosting on the higher shores (groups up to 270 individuals were seen) to the east of the site, while bar-tailed godwits (25 individuals) were observed roosting on the higher shores to the west of this site. Occasional NZ dotterel and reef heron were recorded feeding along the water edge.

One feeding reef heron was noted within Expanded Site 2, while groups of bar-tailed godwits (up to 30 individuals) were observed feeding throughout Expanded Site 3. Groups of red-billed gull were also seen roosting on the high shores of Expanded Site 3.

Highest levels of notable activity were observed within Expanded Site 4, dominated by groups of roosting red-billed gull (up to 50 individuals) and southern black-backed gulls (up to 25 individuals). Most of these groups were seen on the mid shores in the centre of this site. Groups of up to 75 SIPO were observed roosting and feeding within this site, as well as herons and occasional NZ dotterel.

Notable activity within Expanded Site 5 comprised of groups of feeding or roosting bar-tailed godwits (up to 30 individuals) and a group of 20 southern black-backed gull.

3.1.4 Expanded Area - High water

At the high water survey period, bird distribution was condensed to the high shore areas within each site. Activity was sparse within some sites, while absent in others. The Port Site was only surveyed at high water and all bird activity was recorded in Avenza maps software which gives a relatively high number of notable bird activity for this site (Figure 2).

Large numbers of SIPO (up to 270 individuals) and variable oystercatcher (up to 25 individuals) were observed roosting on the high shores of Expanded Site 1, where a small area of sandy beach was exposed during high tide.

The remaining four compartments of the Expanded Site showed no bird activity, except for a single southern black-backed gull feeding on the high shore of Expanded Site 4.

3.1.5 Port Site - High Water

Clusters of birds were recorded around the perimeter of the Port Site, with a pair of variable oystercatcher and red-billed gull in the north-western corner of the Port (Figure 2).

Pairs of NZ dotterel, variable oystercatcher, and spur-winged plover were observed nesting on top of the pile of coal on the western extent of the Port. Chicks of NZ dotterel were observed, while it was assumed that the pair of variable oystercatchers was sitting on a nest.

Scattered throughout the southern part of the Port a group of 110 individual SIPO were observed resting. Up to 48 spur-winged plover and up to 70 NZ dotterel were recorded on any one occasion. Caspian tern, southern black-backed gull, pied stilt, and red-billed gull were also observed in this area.

Along the rock wall facing north towards the tugboat jetty (in the north-eastern corner of the Port, Figure 2), groups of up to 50 red-billed gulls were observed, as well as pied shag, and spur-winged plover. Most notable at this location were a pair of variable oystercatchers with two chicks, as well as a pair of NZ dotterel on a nest with three eggs.

In the area behind the offices of the Port (in the south-western corner of the Port Site, Figure 2), variable oystercatcher, NZ dotterel, and spur-winged plover were seen on a grassed area, while groups of up to 60 red-billed gull, NZ dotterel, and pied stilt were commonly seen around the water basin. Throughout the survey it was noticed that the pair of pied stilts had built a nest and four eggs were laid.

3.2 Bird Diversity and Abundance

3.2.1 Expanded Area Site

Low water

Table 1. Summary of total number of individuals and species recorded at low water at Expanded Area.

Low water	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Total
Total # individuals	186	99	606	702	1070	**2663**
Total # of species	10	9	12	14	15	**18**
Dominant species	RBG	RBG	RBG	RBG	RBG	**RBG**
Dominant species %	41.4%	62.6%	55.0%	59.7%	40.6%	**49.8%**

Within the Expanded Area at low water, diversity and abundance increased closer to One Tree Point. Ten bird species were recorded in Expanded Site 1, nine species in Expanded Site 2, 12 species in Expanded Site 3, 14 species in Expanded Site 4 and 15 species in Expanded Site 5 (Table 1). Among all five compartments, red-billed gull was the most abundant species followed by either SIPO or bar-tailed godwits (Figure 3).

Abundance in Expanded Site 1 at low water was dominated by red-billed gull with an average of 9.7 individuals. This was followed by SIPO with an average abundance of 4.8 individuals, followed by NZ dotterel with an average abundance of 4.4. The remaining seven species recorded at this site each had an average abundance of less than 2.0.

Abundance in Expanded Site 2 at low water was dominated by red-billed gull with an average of 153.6 individuals. This was followed by SIPO with an average abundance of 1.4 individuals, followed by NZ dotterel with an average abundance of 1.0. The remaining six species recorded at this site each had an average abundance of less than 1.0.

Abundance in Expanded Site 3 at low water was dominated by red-billed gull with an average of 41.6 individuals. This was followed by bar-tailed godwits with an average abundance of 1.4 individuals, followed by white-faced heron with an average abundance of 6.0. The remaining nine species recorded in Expanded Site 3 each had an average abundance of less than 6.0.

Abundance in Expanded Site 4 at low water was dominated by red-billed gull with an average of 52.4 individuals. This was followed by SIPO with an average abundance of 10.8 individuals, followed by southern black-backed gulls with an average abundance of 7.1. The remaining 11 species recorded at this site each had an average abundance of less than 6.0.

Abundance in Expanded Site 5 was dominated by red-billed gull with an average of 54.3 individuals followed by southern black-backed gull and SIPO with an average abundance of 25.5 and 18.4 individuals, respectively. Expanded Site 5 has the highest diversity among all compartments at low water and is the only compartment where wrybill was recorded.

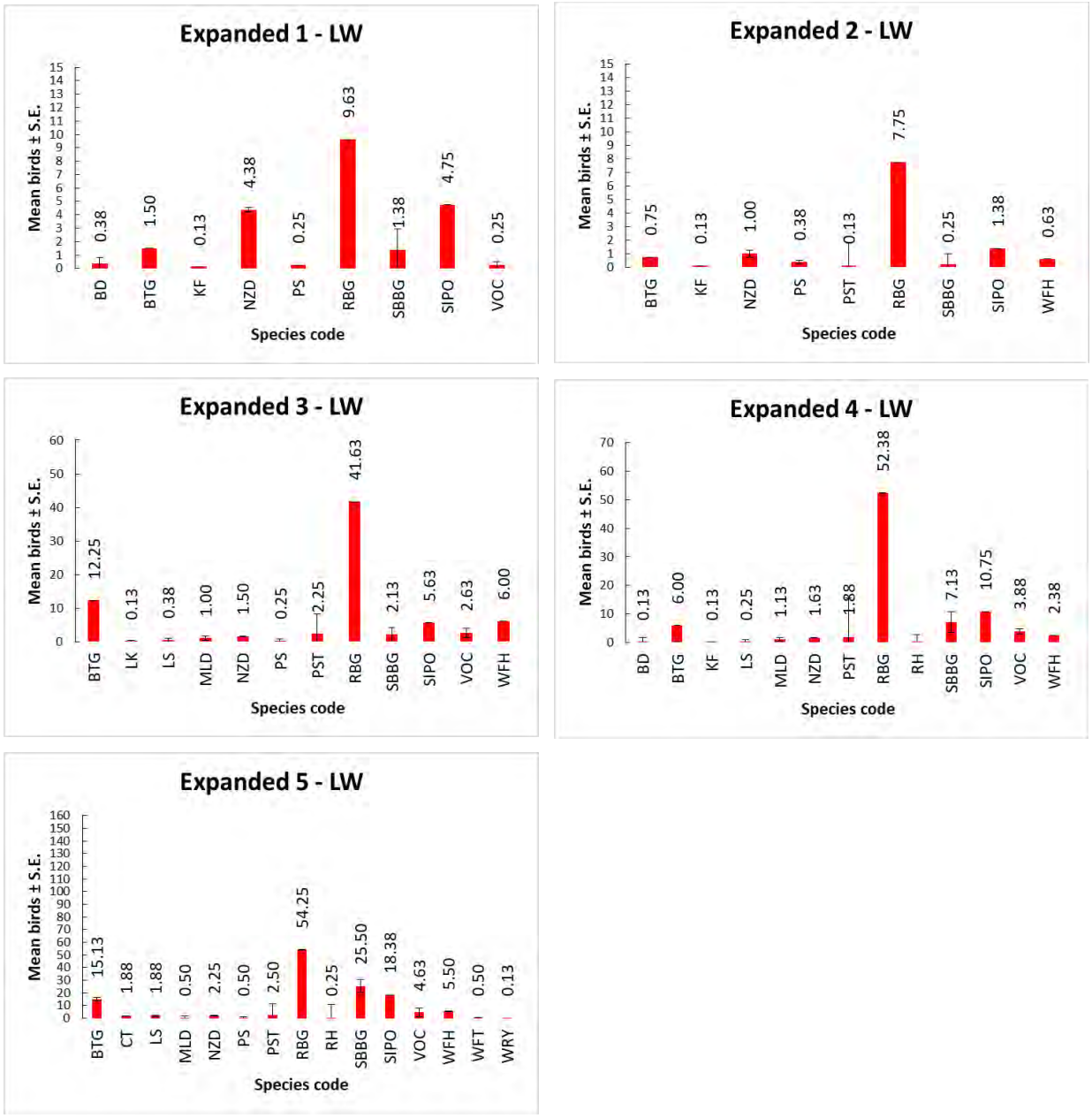

Figure 3. Average number of birds present during the entire survey period at low water within the Expanded Area.

Mid water

Table 2. Summary of total number of individuals and species recorded at mid water at Expanded Area.

Mid water	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Total
Total # individuals	1021	26	532	654	342	**2575**
Total # of species	11	6	11	10	11	**17**
Dominant species	SIPO	SIPO	RBG	RBG	BTG/RBG	**SIPO**
Dominant species %	71.%	38.5%	39.1%	46.3%	31.6%	**41.9%**

Within the Expanded Area at mid water, 11 bird species were recorded in Expanded Site 1, six species in Expanded Site 2, 11 species in Expanded Site 3, 10 species in Expanded Site 4 and 11 species in Expanded Site 5 (Table 2). Among four of the compartments either red-billed gulls, SIPO or bar-tailed godwits were the dominant three species (Figure 4).

Abundance in Expanded Site 1 at mid water was dominated by SIPO with an average of 90.8 individuals, bar-tailed godwit with an average abundance of 24.4 and red-billed gull with an average abundance of 7.0. The remaining eight species recorded in Expanded Site 1 each had an average abundance of less than 3.0.

Abundance in Expanded Site 2 at mid water was dominated by SIPO with an average of 1.3 individuals, followed by red-billed gull and bar-tailed godwits with and average abundance of 0.9 and 0.8 individuals, respectively. The remaining three species had an average abundance of 0.1.

Abundance in Expanded Site 3 at mid water was dominated by red-billed gull with an average of 26.0 individuals, SIPO with an average abundance of 17.0 and bar tailed godwits with an average abundance of 14.0. The remaining eight species had average abundances of less than 3.0.

Abundance in Expanded Site 4 at mid water was dominated by red-billed gull with an average abundance of 37.9 individuals and SIPO with an average abundance of 20.6 individuals, followed by southern black-backed gull and variable oystercatchers with an average abundance of 11.0 and 7.8, respectively. The remaining six species had average abundances of less than 2.0.

The most common species in Expanded Site 5 at mid water were bar-tailed godwits and red-billed gull, with an equal average abundance of 13.5 individuals. The remaining nine species recorded in Expanded Site 5 each had an average abundance of less than 6.0.

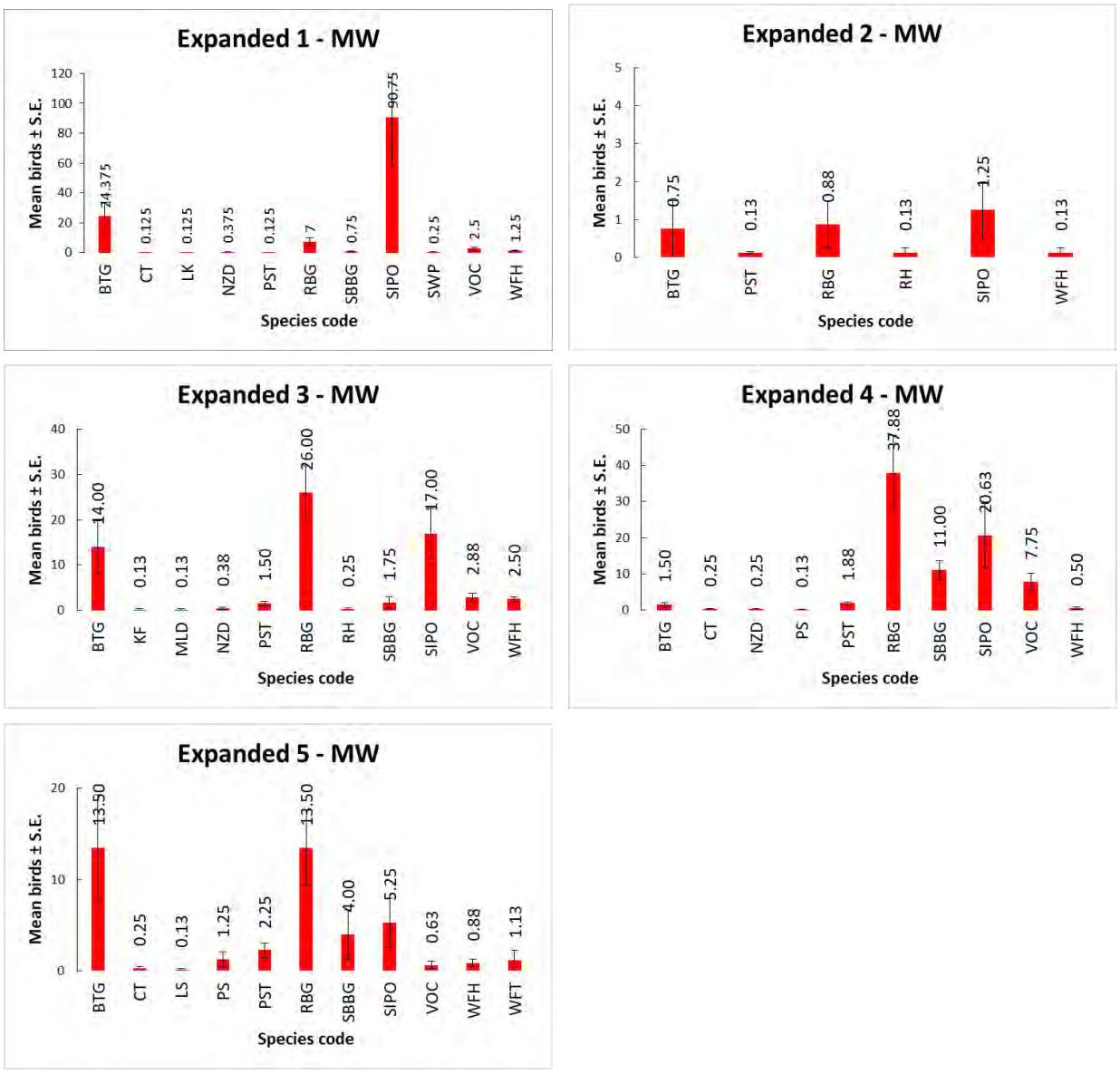

Figure 4. Average number of birds present during the entire survey period at mid water within the Expanded Area

High water

Table 3. Summary of total number of individuals and species recorded at Expanded Area

High water	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Total
Total # individuals	1224	-	64	49	8	**1345**
Total # of species	6	-	3	2	2	**8**
Dominant species	SIPO	N/A	RBG	RBG	RBG	**SIPO**
Dominant species %	75.5%	N/A	87.5%	98.0%	87.5%	**68.8%**

Within the Expanded Area at high water, six bird species were recorded in Expanded Site 1, none in Expanded Site 2, three species in Expanded Site 3, two species in Expanded Site 4, and two species in Expanded Site 5 (Table 3, Figure 5).

Abundance in Expanded Site 1 at high water was dominated by SIPO with an average of 115.5 individuals, bar-tailed godwit with an average abundance of 13.9 and red-billed gull with an average abundance of 13.0. The remaining three species recorded at this site each had an average abundance of less than 10.0.

No species were observed during high water in Expanded Site 2.

Abundance in Expanded Site 3 at high water was dominated by red-billed gull with an average abundance of 7.0 individuals. The remaining two species had an average abundance of less than 1.0.

Abundance in Expanded Site 4 at high water was dominated by red-billed gull with an average abundance of 6.0 individuals. NZ dotterel was the only other species present at this site at high water and had an average abundance of 0.1.

Few species were recorded at Expanded Site 5 at high water with the two species recorded (red billed gull and lesser knot) having an average abundance of less than 1.

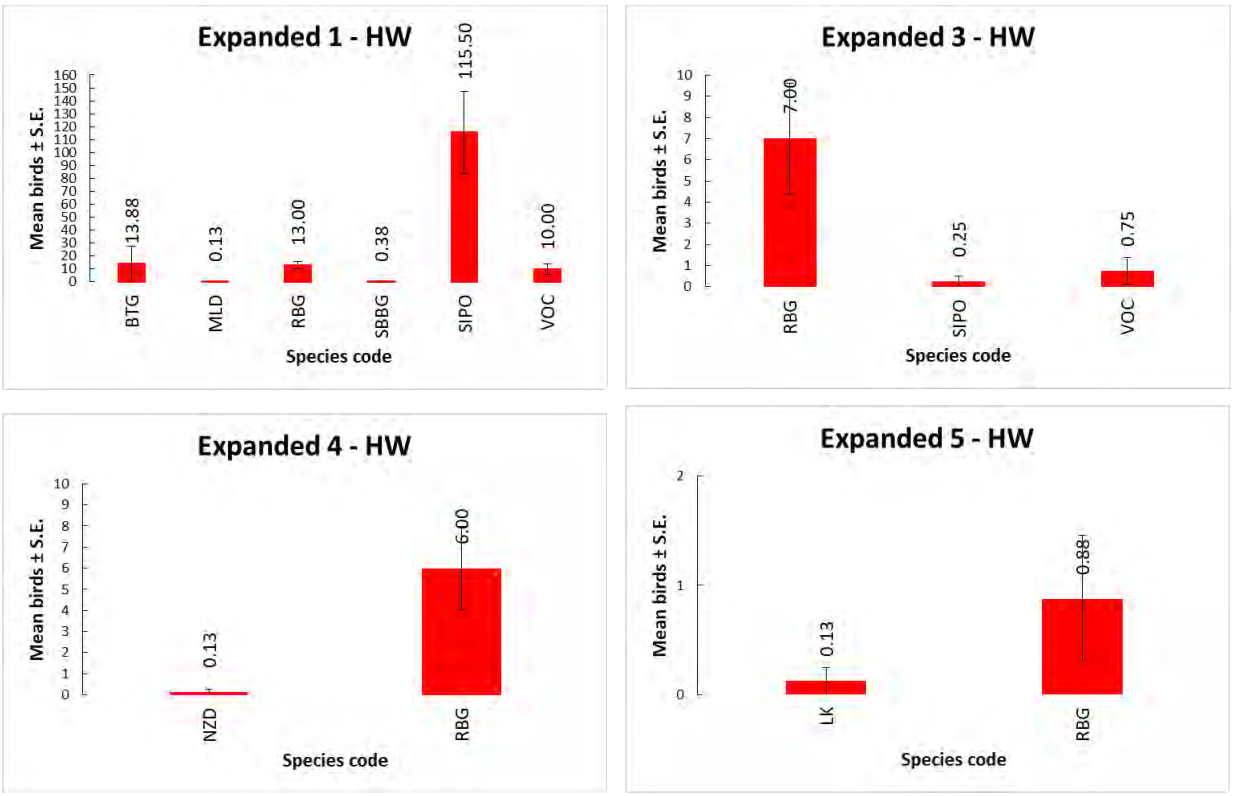

Figure 5. Average number of birds present during the entire survey period at high water at the Expanded Site. Note: No birds were seen within Expanded Site 2 during high water surveys.

3.2.2 Port site

High water

Table 4. Summary of total number of individuals and species recorded at the Port Site at high water.

High water	Port Site
Total # individuals	658
Total # of species	8
Dominant species	RBG
Dominant species %	44.5%

Highest species diversity at high water was recorded at the Port Site, with eight bird species recorded (Table 4). Red-billed gull was the most common species with an average abundance of 19.5, followed by NZ dotterel and spur-winged plover with an average abundance of 8.4 and 7.5, respectively. The remaining five species had and average abundance of less than 5.0 (Figure 6).

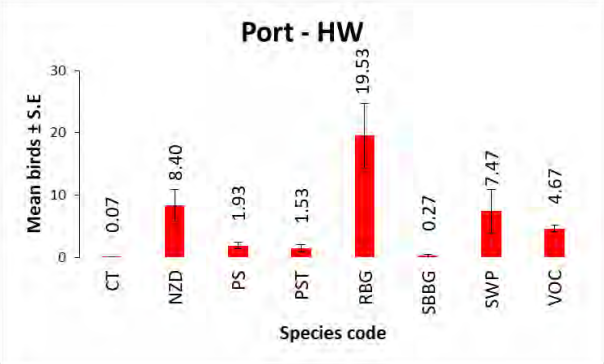

Figure 6. Average number of birds present during the entire survey period at high water at the Port Site.

3.3 Bird Conservation Status Overview

A total of 19 wading and shorebird species were recorded throughout the entire survey area over the duration of the survey (October 2019 – February 2020). Of these, two are offshore migrants (bar-tailed godwit and lesser knot) and three are internal migrants (SIPO, wrybill, and pied stilt). Of all the species recorded, 12 have been recognised under the New Zealand Threat Classification System (Robertson et al. 2016), five being classified as 'Threatened' and seven being classified as 'At Risk', as summarised in Table 5.

Table 5. Summary of all bird species recorded during the survey period, including their conservation status, derived from Robertson et al. 2016.

Scientific name	Common name, Māori name	Conservation status
Anarhynchus frontalis	Wrybill, ngutu-pare	Threatened – Nationally Vulnerable
Anas platyrhynchos	Mallard duck	Introduced and naturalised
Calidris canutus rogersi	Lesser knot	Threatened – Nationally Vulnerable
Charadrius bicinctus bicinctus	Banded dotterel, tūturiwhatu	Threatened – Nationally Vulnerable
Charadrius obscurus aquilonius	New Zealand dotterel	At Risk - Recovering
Egretta novaehollandiae	White-faced heron, matuku moana	Not Threatened
Egretta sacra sacra	Reef heron, matuku moana	Threatened – Nationally Endangered
Haematopus finschi	South Island pied oystercatcher (SIPO), tōrea	At Risk - Declining
Haematopus unicolor	Variable oystercatcher, tōrea pango	At Risk - Recovering
Himantopus himantopus	Pied stilt, poaka	Not Threatened
Hydroprogne caspia	Caspian tern, taranui	Threatened – Nationally Vulnerable
Larus dominicanus dominicanus	Southern black-backed gull, karoro	Not Threatened
Larus novaehollandiae scopulinus	Red-billed gull, tarāpunga	At Risk - Declining
Limosa lapponica	Bar-tailed godwit, kūaka	At Risk - Declining
Phalacrocorax melanoleucos brevirostris	Little shag, kawau paka	Not Threatened
Phalacrocorax varius varius	Pied shag, kāruhiruhi	At Risk - Recovering
Sterna striata striata	White-fronted tern, tara	At Risk - Declining
Todiramphus sanctus vagans	New Zealand Kingfisher	Not Threatened
Vanellus miles novaehollandiae	Spur-winged plover	Not Threatened

The total number of birds with a national threat status classification, classified as either 'Threatened' or 'At Risk' varied throughout the different sites (Table 6). While 'Threatened' and/or 'At Risk' birds were recorded within all compartments, most 'Threatened' and 'At Risk' species were observed in Expanded 1.

As expected, fewest 'Threatened' and 'At Risk' species were observed within the Port Site, which was only surveyed during high tide.

This analysis is important given that bird species classified as 'Threatened' or 'At Risk' are prominent in the area.

Table 6: Total number of Threatened and At-Risk species recorded in each compartment over the duration of the survey

Compartment	Threatened species	# Threatened	At Risk species	# At Risk	Total number of Threatened and At-Risk species
Expanded Site 1	Banded dotterel	1	bar-tailed godwit, NZ dotterel, pied shag, red-billed gull, South Island pied oystercatcher, variable oystercatcher	6	**7**
Expanded Site 2			bar-tailed godwit, NZ dotterel, pied shag, red-billed gull, South Island pied oystercatcher	5	**5**
Expanded Site 3	lesser knot	1	bar-tailed godwit, NZ dotterel, pied shag, red-billed gull, South Island pied oystercatcher, variable oystercatcher	6	**7**
Expanded Site 4	reef heron, banded Dotterel	2	bar-tailed godwit, NZ dotterel, red-billed gull, South Island pied oystercatcher, variable oystercatcher	5	**7**
Expanded Site 5	Caspian tern, lesser knot, reef heron, wrybill	4	bar-tailed godwit, NZ dotterel, pied shag, red-billed gull, South Island pied oystercatcher, variable oystercatcher, white fronted tern	7	**11**
Port Site	Caspian tern	1	red-billed gull, NZ dotterel, variable oystercatcher, pied shag	4	**5**

4 SUMMARY

4.1 Notable areas of bird activity

Notable areas of bird use and activity were identified. These included high water roosts where a small area of sandy beach was exposed during high tide, mid- and low water resting areas, and feeding grounds.

Expanded Area:

- ES1: During low water surveys, notable bird use activities were mostly evenly spread throughout Expanded Site 1. During high water surveys, notable observations included large flocks of roosting SIPO. Small numbers of feeding NZ dotterel were seen across the different tides and resting/roosting red-billed gulls were observed on the lower and mid shores.
- ES2: Within Expanded Site 2 little notable activity was observed. Occasional NZ dotterel were recorded feeding at low water, as well as a reef heron.
- ES3: Small groups of bar-tailed godwits were observed feeding within Expanded Site 3 during low and mid water, as well as occasional NZ dotterel. Groups of red-billed gull were commonly observed roosting on the mid shores, no notable activity occurred within this site during high water.
- ES4: Most notable activity was noted within Expanded Site 4, predominantly roosting red-billed gulls and Southern black-backed gulls were noted on the mid and low shores.
- ES5: During low water surveys, Caspian tern were observed resting within Expanded Site 5, as well as up to five NZ dotterel feeding across the lower shores. During mid water surveys, red-billed gulls and southern black-backed gulls were observed roosting on the mid shores. No activity was noted during high water surveys, likely due to the absence of beach at high tide.

Port Site:

- Clusters of birds were recorded around the perimeter of the Port Site, with a pair of variable oystercatcher and red-billed gull in the north-western corner of the Port.
- Pairs of NZ dotterel, variable oystercatcher, and spur-winged plover were observed nesting on top of the pile of coal at the west of the Port. Chicks of NZ dotterel were observed, while it was assumed that the pair of variable oystercatchers were sitting on a nest.
- Scattered throughout the southern part of the Port a group of 110 individual SIPO were observed resting. Up to 48 spur-winged plover and up to 70 NZ dotterel were recorded on any one occasion. Caspian tern, southern black-backed gull, pied stilt, and red-billed gull were also seen in this area.
- Along the rock wall facing north towards the tugboat jetty, a pair of variable oystercatchers was repeatedly observed throughout the survey period, raising two chicks. A pair of NZ dotterel was also observed on a nest with three eggs.
- In the area behind the Port offices, variable oystercatcher, NZ dotterel, and spur-winged plover were observed on a grassed area, while groups of up to 60 red-billed gull, NZ dotterel, and pied stilt were commonly seen around the molasses pond. Throughout the survey it was noticed that the pair of pied stilts had built a nest and four eggs were laid.

4.2 Bird diversity and abundance

A total of 7,241 individual birds were recorded across 19 wading and shorebird species over the duration of the survey throughout the survey area.

In general:

- Abundance of individuals of each species was greatest at Expanded Site 1, lowest at Expanded Site 2, and equally high at Expanded Sites 3, 4, and 5.

- The bird community was dominated by a few abundant species throughout the Expanded Area sites, while average abundance was more evenly distributed between species at the Port Site.
- Species diversity was highest at low and mid water and lowest at high water surveys for the Expanded Area.
- Species abundance was highest at low and mid water and lowest at high water with birds absent from some sites.
- Species distribution changed throughout the different compartments depending on the water level.
- 'Threatened' and 'At Risk' species were present throughout the survey area over the duration of the survey.

4.3 Discussion

The study area hosts a wide range of coastal birds including international migratory waders, internal migrants, flocking and solitary species. Adding to the information provided in the study of nearby sites (van der Zwan 2020) and the 2017 – 2018 survey (Bone 2018), information gathered during this survey indicates this broader habitat area also provides roosting, resting, nesting and feeding habitat for wading and shorebirds.

While a direct comparison between the 'original sites' immediately adjacent to the Port and discussed in van der Zwan (2020) is not possible as fewer days were surveyed, some obvious differences between the original sites and the expanded sites include:

- Kingfisher were only recorded within the Expanded Area while royal spoonbill and paradise shelduck were only recorded at the 'original sites' (van der Zwan 2020); and
- Far fewer banded dotterel, lesser knot, bar-tailed godwit, and red-billed gull, and more little shag, pied shag, and white-fronted tern, appear the be utilising the Expanded Area relative to the observations made in the 'original sites'.

Collectively this assemblage of bird species utilises all the available habitat from the high shore to the low intertidal area west of the Marsden Cove Marina channel as well as the Northport cargo area.

Observations within the Expanded Area recorded 12 species listed within the New Zealand Threat Classification system as 'Threatened or 'At Risk' compared to 13 similarly classified species reported for the 'original sites' (van der Zwan 2020).

Within the Expanded area and the Port site, there were no additional 'Threatened' or 'at Risk' species to those already recorded in the 'original sites' reported by van der Zwan (2020).

5 REFERENCES

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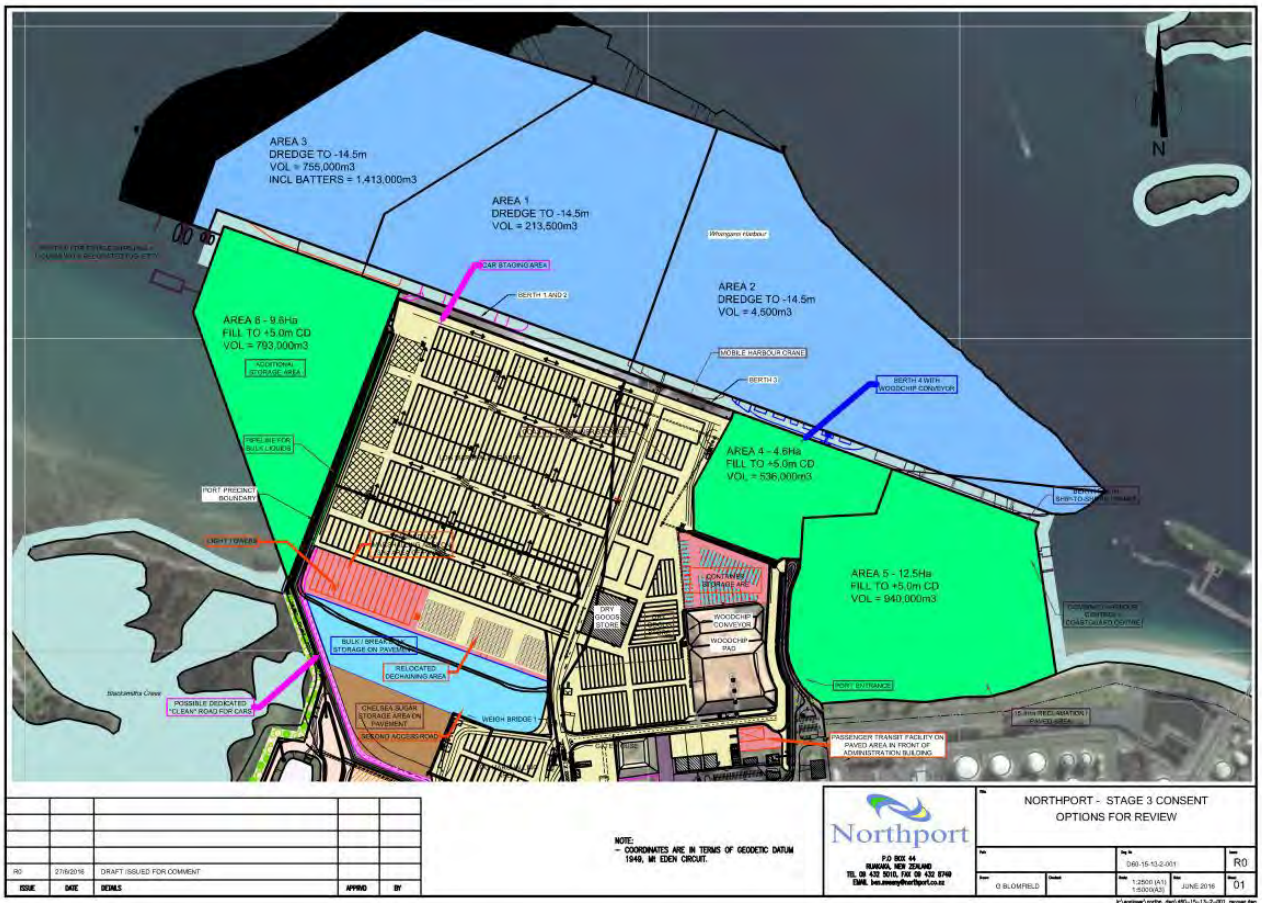
Appendix A:

Indicative Vision for Growth footprint

Draft plan of the 'Vision for Growth' project showing the proposed areas of reclamation (green) and dredging (blue) as issued in the Northport consultant RFP. Provided by Northport Ltd.



Appendix B:

Species name abbreviations

Species names and associated abbreviations used in Figures 3 – 5 of the report.

Abbreviation	Species name	Species group
BD	Banded dotterel	Plover
BTG	Bar-tailed godwit	Godwit/knot/whimbrel
CT	Caspian tern	Terns
LK	Lesser knot	Godwit/knot/whimbrel
LS	Little shag	Shag
KF	New Zealand Kingfisher	Kingfisher
MLD	Mallard	Duck
NZD	New Zealand dotterel	Plover
PS	Pied shag	Shag
PSD	Paradise shelduck	Duck
PST	Pied stilt	Oystercatcher/stilt
RBG	Red-billed gul	Gulls
RH	Reef heron	Heron/Spoonbill
RS	Royal spoonbill	Heron/Spoonbill
SBBG	Southern black-backed gull	Gulls
SIPO	South Island pied oystercatcher	Oystercatcher/stilt
SWP	Spur-winged plover	Plover
VOC	Variable oystercatcher	Oystercatcher/stilt
WFH	White-faced heron	Heron/Spoonbill
WFT	White-fronted tern	Terns
WRY	Wrybill	Plover

Appendix 2: Representative site photos

Photo 4: View west towards Northport of wading bird survey areas East 1, 2 and 3.

Photo 5: View towards CINZ overlooking the dune component of the eastern nesting survey site.

Photo 6: View of the riprap revetment along the eastern boundary of Northport boundary

Photo 7: Riprap along the edge of Berth 3

Photo 8: Riprap revetment along Northport western boundary

Photo 9: View west overlooking wading bird survey areas West 1 and 2.

Photo 10: Blacksmith's Creek wetland

Photo 11: Mangroves within Blacksmith's Creek wetland

Photo 12: View west overlooking wading bird survey area West 2

Photo 13: View east towards Northport overlooking wading bird survey area West 2

Photo 14: DOC Wildlife refuge

Photo 15: View west overlooking wading bird survey area West 1

Photo 16: Wading bird survey – Expanded area 1

Photo 17: Wading bird survey – Expanded area 2

Photo 18: Wading bird survey – Expanded area 3

Photo 19: Wading bird survey – Expanded area 4

Appendix 3: Wading bird survey dates

SURVEY DATE	TIDAL PHASE		
	High	Mid	Low
23/08/2017			✓
24/08/2017	✓		
29/08/2017	✓		
7/09/2017	✓		✓
8/09/2017	✓		✓
22/09/2017	✓		✓
12/10/2017	✓		✓
13/10/2017	✓		✓
19/10/2017	✓	✓	✓
13/11/2017	✓	✓	✓
14/11/2017	✓	✓	✓
20/11/2017	✓	✓	✓
12/12/2017	✓	✓	✓
19/12/2017	✓	✓	✓
20/12/2017	✓	✓	✓
11/01/2018	✓	✓	✓
17/01/2018	✓	✓	✓
26/01/2018	✓	✓	✓
2/02/2018	✓	✓	✓
19/02/2018		✓	✓
26/02/2018			✓
2/03/2018			✓
12/03/2018			✓
No. surveys	**18**	**12**	**21**

SURVEY DATE	TIDAL PHASE		
	High	Mid	Low
25/09/2019	✓	✓	✓
15/10/2019	✓	✓	✓
23/10/2019	✓	✓	✓
30/10/2019	✓	✓	✓
6/11/2019	✓	✓	✓
13/11/2019	✓	✓	✓
21/11/2019	✓	✓	✓
5/12/2019	✓	✓	✓
12/12/2020	✓	✓	✓
20/12/2020	✓	✓	✓
6/01/2020	✓	✓	✓
10/01/2020	✓	✓	✓
21/01/2020	✓	✓	✓
4/02/2020	✓	✓	✓
11/02/2020	✓	✓	✓
17/02/2020	✓	✓	✓
No. surveys	**16**	**16**	**16**

SURVEY DATE	TIDAL PHASE		
	High	Mid	Low
4/06/21	✓	✓	✓
28/06/21	✓	✓	✓
5/07/21	✓	✓	✓
13/07/21	✓	✓	✓
20/07/21	✓	✓	✓
26/07/21	✓	✓	✓
No. surveys	**6**	**6**	**6**

Appendix 4: Historic aerial images of Marsden Bay

1942 Marsden Bay (Source: retrolens.nz)	 ©Sourced from http://retrolens.nz and licensed by LINZ CC-BY 3.0
1971 Marsden Point and Bay, noting the Refinery NZ (Source: retrolens.nz)	 ©Sourced from http://retrolens.nz and licensed by LIN

1985 Marsden Bay (Source: Google Earth)	
2004 Marsden Bay (Source: Google Earth)	
2021 Marsden Bay (Source: Google Earth)	

Appendix 5: Avifauna species & habitat list

Avifauna species list compiled from OSNZ atlas square data, NZ Birds Online (Whangarei Harbour search location) and wading bird surveys conducted by 4Sight for Northport.

Information regarding primary (dark green) and secondary (light green) habitats presented in the following table was obtained for each species from Heather & Robertson (2005). For the purpose of this report, primary habitat refers to the habitat in which the species spends most of its time. Secondary habitats are other habitat types which the species may also utilise.

SPECIES		THREAT CLASSIFICATION [63]		HABITAT								SOURCE		
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	OSNZ (2640, 6590)	NZBIRDS ONLINE Whangarei Hrbr [64]	Northport surveys
Bellbird	*Anthornis m. melanura*	Not Threatened	Not Threatened	■	□	□					□		✓	
Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	Not Threatened$^{CD\ Inc}$	■		□						✓		
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	Not Threatened	■		□	□	■				✓	✓	
Morepork	*Ninox n. novaeseelandiae*	Not Threatened	Not Threatened	■	□	□	□					✓		
North Island brown kiwi	*Apteryx mantelli*	Not Threatened	Not Threatened$^{CD\ PD\ RF}$	■	□	□	□					✓		
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	Not Threatened^{EF}	■	□	□					□	✓	✓	
North Island kaka	*Nestor meridionalis septentrionalis*	At Risk	Recovering$^{CD\ Inc\ PD\ PF}$	■	□							✓		
Shining cuckoo	*Chrysococcyx l. lucidus*	Not Threatened	Not Threatened	■		□						✓	✓	
Tomtit	*Petroica macrocephala toitoi*	Not Threatened	Not Threatened	■	□	□							✓	
Tui	*Prosthemadera n. novaeseelandiae*	Not Threatened	Not Threatened^{Inc}	■		□						✓	✓	
Blackbird	*Turdus merula*	Introduced	Introduced & Naturalised^{SO}	□	□	■	□				□	✓	✓	
Brown quail	*Coturnix ypsilophora australis*	Introduced	Introduced & Naturalised^{SO}			■	□					✓		
California quail	*Callipepla californica*	Introduced	Introduced & Naturalised^{SO}			■	□					✓		
Eastern rosella	*Platycercus eximius*	Introduced	Introduced & Naturalised^{SO}	□	□	■						✓	✓	
Grey warbler	*Gerygone igata*	Not Threatened	Not Threatened	□	□	■					□	✓	✓	
Pheasant	*Phasianus colchicus*	Introduced	Introduced & Naturalised^{SO}			■						✓		
Silvereye	*Zosterops lateralis lateralis*	Not Threatened	Not Threatened^{SO}	□	□	■					□	✓	✓	
Chaffinch	*Fringilla coelebs*	Introduced	Introduced & Naturalised^{SO}	□	□	□	■				□	✓	✓	

[63] Robertson et al. (2021) with qualifiers (Rolfe et al., 2021): CD=Conservation Dependent (CDB indicates the need for only good biosecurity); CI=Climate Impact; CR=Conservation Research Needed; De=Designated; DPR=Data Poor Recognition; DPS=Data Poor Size; DPT=Data Poor Trend; EF=Extreme Fluctuations; IE=Island Endemic; Inc=Increasing; OL=One Location; PD=Partial Decline; PF=Population Fragmentation; RF=Recruitment Failure; RR=Range Restricted; SO=Secure Overseas; Sp=Sparse; TO=Threatened Overseas.

[64] Red tick indicates that species has been recorded breeding within the Whangarei Harbour.

SPECIES		THREAT CLASSIFICATION [63]		HABITAT								SOURCE		
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	OSNZ (2640, 6590)	NZBIRDS ONLINE Whangarei Hrbr [64]	Northport surveys
Dunnock	*Prunella modularis*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Goldfinch	*Carduelis carduelis*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Greenfinch	*Carduelis chloris*	Introduced	Introduced & Naturalised[SO]									✓	✓	
House sparrow	*Passer domesticus*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Magpie	*Gymnorhina tibicen*	Introduced	Introduced & Naturalised[SO]									✓	✓	
NZ pipit	*Anthus n. novaeseelandiae*	At Risk	Declining[CI CR]										✓	
Redpoll	*Carduelis flammea*	Introduced	Introduced & Naturalised[SO]										✓	
Skylark	*Alauda arvensis*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Song thrush	*Turdus philomelos*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Not Threatened[SO]									✓	✓	✓
Starling	*Sturnus vulgaris*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Swamp harrier	*Circus approximans*	Not Threatened	Not Threatened[SO]									✓	✓	
Welcome swallow	*Hirundo n. neoxena*	Not Threatened	Not Threatened[SO ST]									✓	✓	
Wild turkey	*Meleagris gallopavo*	Introduced	Introduced & Naturalised[SO]									✓		
Yellowhammer	*Emberiza citrinella*	Introduced	Introduced & Naturalised[SO]									✓	✓	
Australasian bittern	*Botaurus poiciloptilus*	Threatened	Nationally Critical[CR DPT RF Sp TO]									✓		
Black-billed gull	*Larus bulleri*	At Risk	Declining[CI CR RF]											
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk	Relict[CR DPS DPT SO Sp]									✓	✓	✓
Black swan	*Cygnus atratus*	Not Threatened	Not Threatened[SO]									✓	✓	
Black-fronted dotterel	*Charadrius melanops*	At Risk	Naturally Uncommon[SO Sp]										✓	
Grey duck x mallard hybrid	*Anas superciliosa x platyrhynchos*	Not Threatened	Not Threatened									✓	✓	

SPECIES		THREAT CLASSIFICATION [63]		HABITAT								SOURCE		
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	OSNZ (2640, 6590)	NZBIRDS ONLINE Whangarei Hrbr [64]	Northport surveys
Little black shag	*Phalacrocorax sulcirostris*	At Risk	Naturally Uncommon[RR SO]					■	■			✓	✓	
Little shag	*Phalacrocorax melanoleucos brevirostris*	At Risk	Relict[CR DPT]					■	■			✓	✓	✓
Mallard	*Anas platyrhynchos*	Introduced	Introduced & Naturalised[SO]				■	■				✓	✓	
North Island fernbird	*Bowdleria punctata vealeae*	At Risk	Declining[CI CR DPS DPT]					■	■				✓	
South Island pied oystercatcher	*Haematopus finschi*	At Risk	Declining[CI]				■	■	■			✓	✓	✓
Paradise shelduck	*Tadorna variegata*	Not Threatened	Not Threatened				■	■				✓	✓	
Pied shag	*Phalacrocorax varius varius*	At Risk	Recovering[CD]					■	■			✓		✓
Pied stilt	*Himantopus h. leucocephalus*	Not Threatened	Not Threatened[SO]				■	■	■			✓	✓	✓
Pukeko	*Porphyrio m. melanotus*	Not Threatened	Not Threatened[Inc SO]				■	■				✓	✓	
Banded dotterel	*Charadrius bicinctus bicinctus*	At Risk	Declining[CD CI CR DPS PD]					■	■			✓	✓	✓
Banded rail	*Gallirallus philippensis assimilis*	At Risk	Declining[CI CR DPS DPT RR]					■	■			✓	✓	
Black-backed gull	*Larus d. dominicanus*	Not Threatened	Not Threatened[SO]				■		■			✓	✓	✓
Caspian tern	*Hydroprogne caspia*	Threatened	Nationally Vulnerable[SO Sp]					■	■			✓	✓	✓
Bar-tailed godwit	*Limosa lapponica baueri*	At Risk	Declining[CI TO]						■			✓	✓	✓
Eastern curlew	*Numenius madagascariensis*	Vagrant	Vagrant[TO]						■					✓
Lesser knot	*Calidris canutus rogersi*	At Risk	Declining[CI TO]						■			✓	✓	✓
Northern NZ dotterel	*Charadrius obscurus aquilonius*	Threatened	Nationally Increasing[CD CI Inc RR]					■	■				✓	✓
Pacific golden plover	*Pluvialis fulva*	Migrant	Migrant[SO]				■	■	■				✓	
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk	Declining[CI]				■	■	■			✓	✓	✓
Red-necked stint	*Calidris ruficollis*	Migrant	Migrant[SO]						■			✓		
Reef heron	*Egretta sacra sacra*	Threatened	Nationally Endangered[CI CR DPT SO Sp]						■			✓		✓

SPECIES		THREAT CLASSIFICATION [63]		HABITAT								SOURCE		
				Native forest	Exotic Forest	Scrub / shrubland	Farmland / open country	Freshwater / wetlands	Coastal / Estuary	Oceanic	Urban/Residential	OSNZ (2640, 6590)	NZBIRDS ONLINE Whangarei Hrbr [64]	Northport surveys
Royal spoonbill	*Platalea regia*	At Risk	Naturally Uncommon[Inc RR SO Sp]										✓	✓
Turnstone	*Arenaria interpres*	Migrant	Migrant[SO]									✓	✓	
Variable oystercatcher	*Haematopus unicolor*	At Risk	Recovering[CI Inc]									✓		✓
White-faced heron	*Egretta novaehollandiae*	Not Threatened	Not Threatened[SO]									✓	✓	✓
White-fronted tern	*Sterna s. striata*	At Risk	Declining[CI CR DPT]									✓	✓	✓
Wrybill	*Anarhynchus frontalis*	Threatened	Nationally Increasing[RR CD CR]										✓	✓
Arctic skua	*Stercorarius parasiticus*	Migrant	Migrant[SO]									✓		
Australasian gannet	*Morus serrator*	Not Threatened	Not Threatened[CI De* Inc SO]									✓	✓	
Buller's shearwater	*Puffinus bulleri*	At Risk	Declining[CD CR DPT OL St]									✓		
Fluttering shearwater	*Puffinus gavia*	At Risk	Relict[CDB RR]									✓		
Northern blue penguin	*Eudyptula minor iredalei*	At Risk	Declining[CI CR DPS DPT]									✓		
Rock pigeon	*Columba livia*	Introduced	Introduced & Naturalised[SO]									✓		
Barbary dove	*Streptopelia risoria*	Introduced	Introduced & Naturalised[SO Sp]									✓		
Myna	*Acridotheres tristis*	Introduced	Introduced & Naturalised[SO]									✓	✓	

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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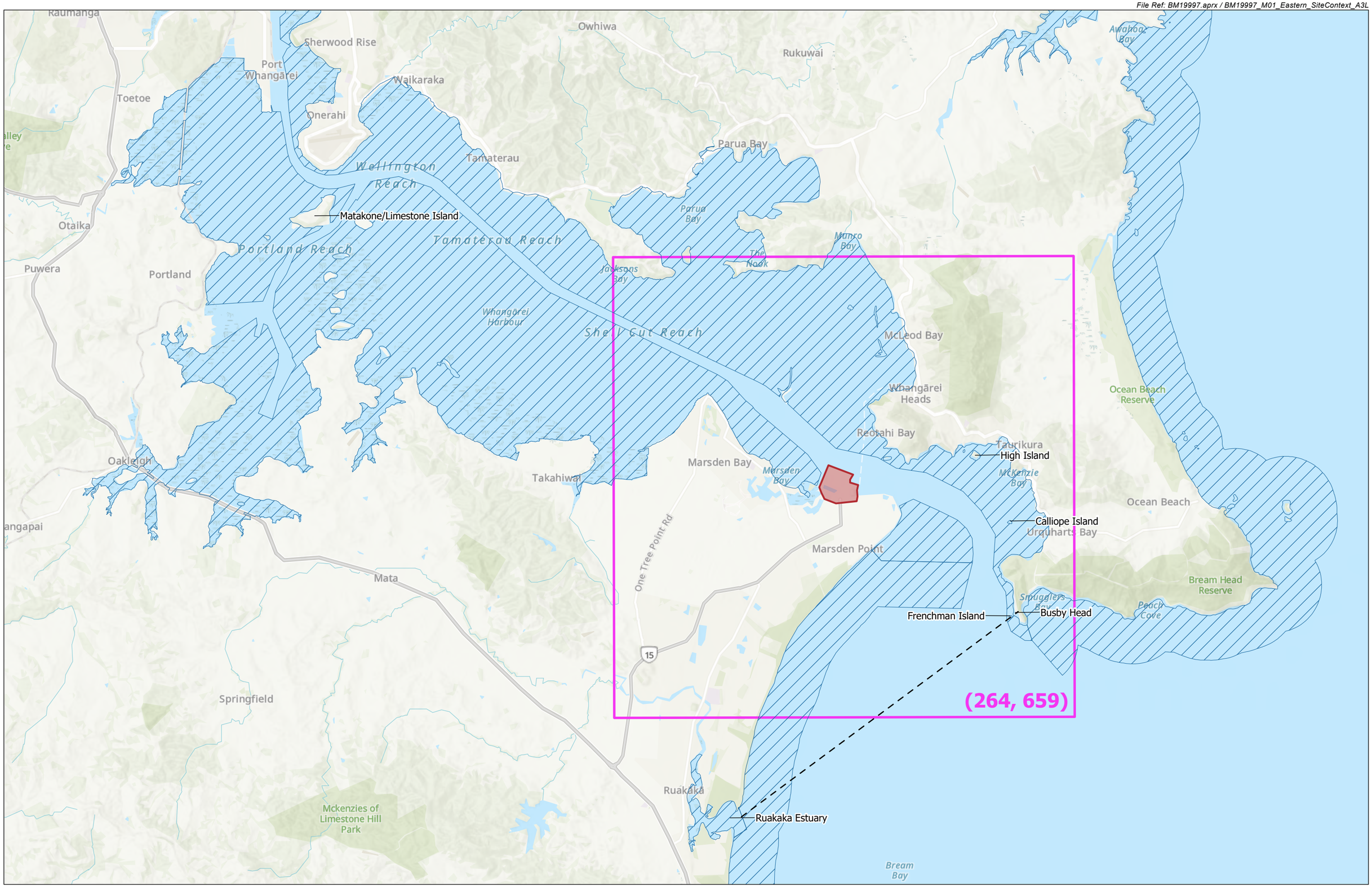

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1:75,000 @ A3

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Northport
- OSNZ Atlas Square
- Significant Bird Area - Proposed Regional Plan (Decisions Version)

Data Sources: 4Sight Consulting, Northland Regional Council, Ornithological Society of NZ, Basemap Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., Esri, NASA, NGA, USGS

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

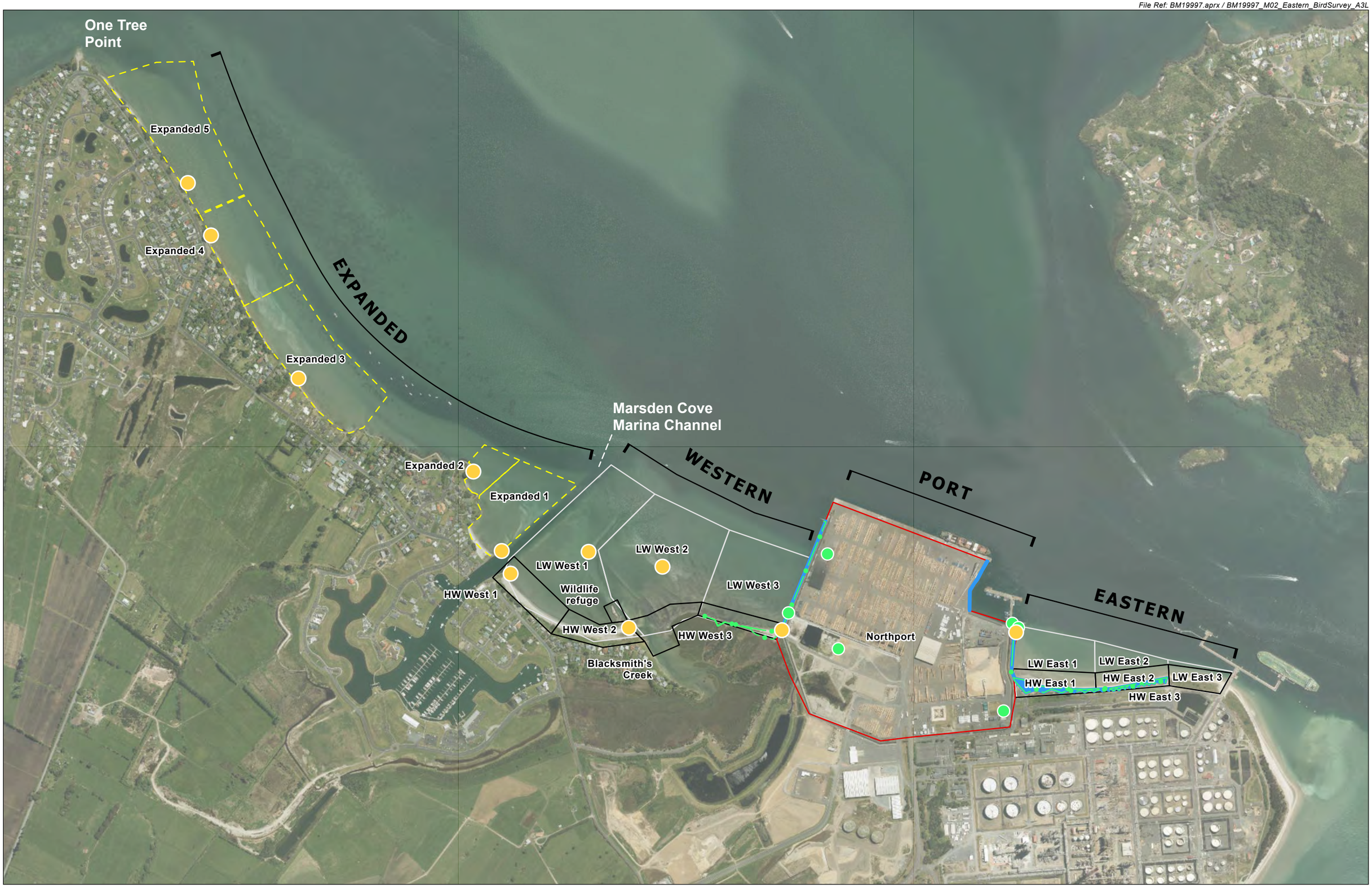
VFG Eastern Expansion - Site Context

Date: 03 October 2022 | Revision: 0

Plan prepared for NorthPort by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 1



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Data Sources: 4Sight Consulting, Boffa Miskell, Aerial Imagery: LINZ Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Northport
- Low Water Compartment
- High Water Compartment
- Expanded Compartment
- Penguin Survey
- Wading Bird Observer Points
- Nesting Survey Observer Points
- Nesting Survey

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

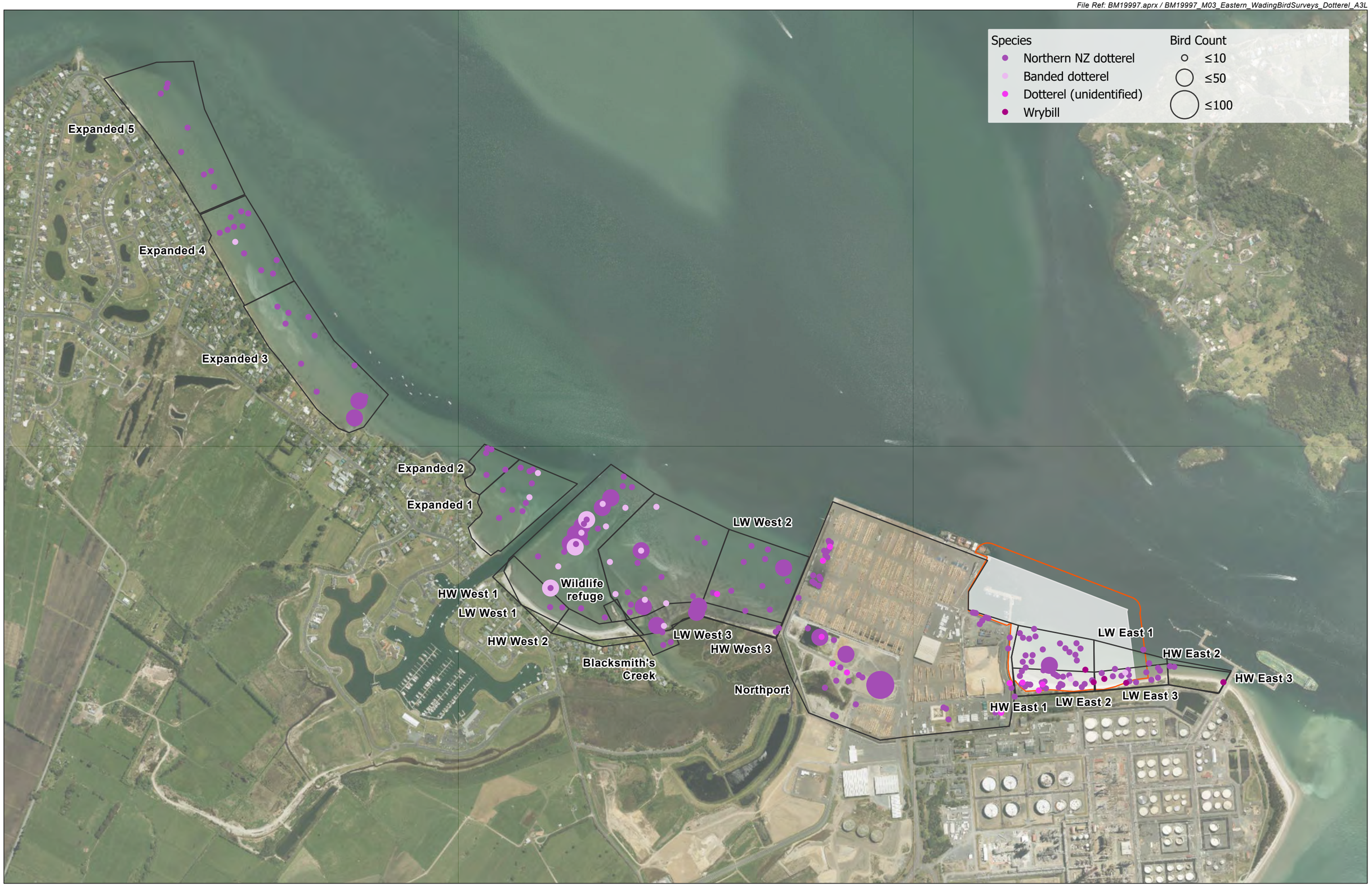
VFG Eastern Expansion - Bird Survey Locations

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 2



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Data Sources: 4Sight Consulting, Northport, Boffa Miskell, Basemap Imagery: Land Information New ZealandEagle Technology, Land Information New Zealand, GEBCO, Community maps contributors
Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND
- Compartment
- Coastal Disturbance Zone
- Reclamation

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Surveys: Dotterels

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 3

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0 300 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

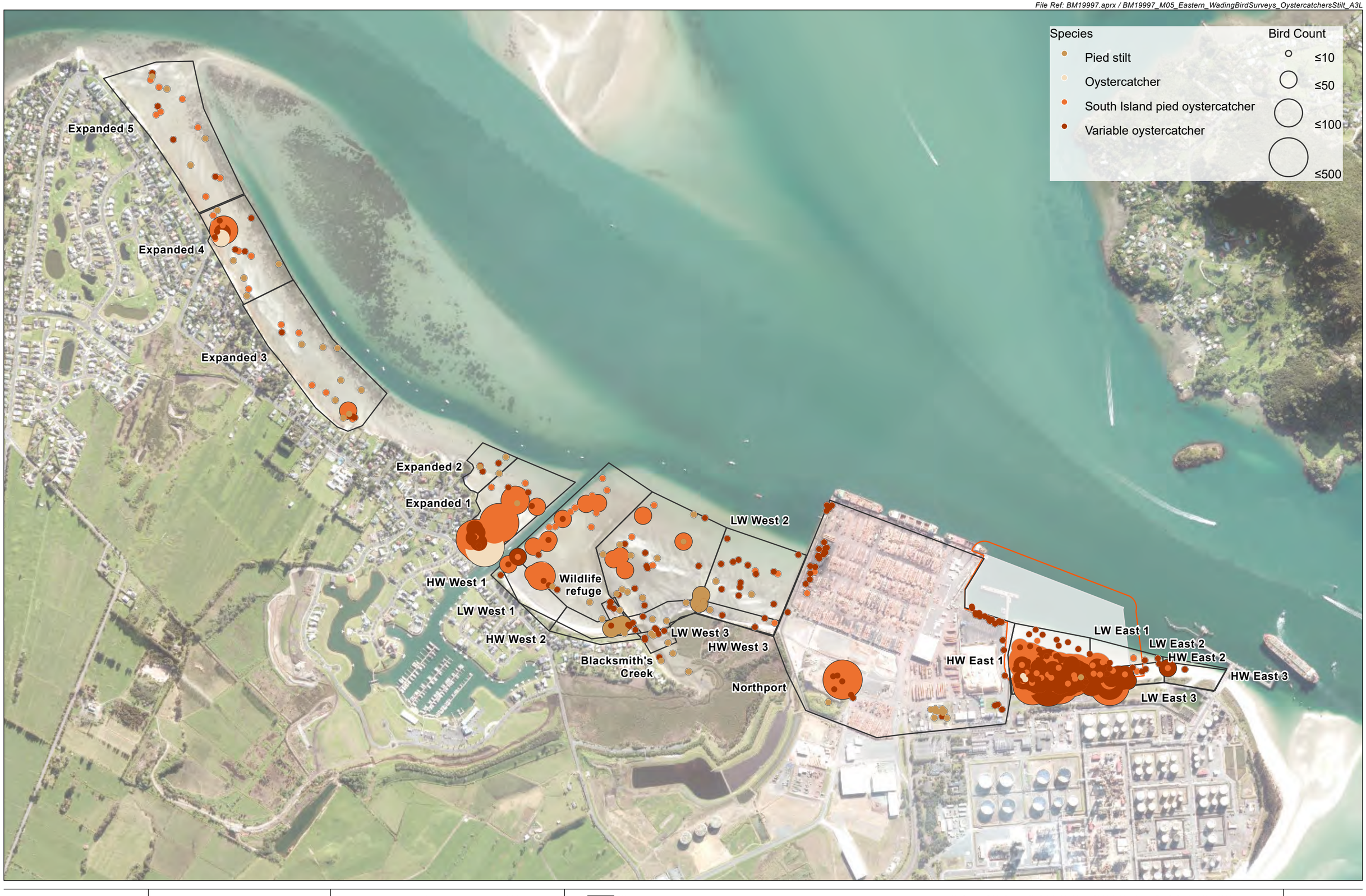
VFG Eastern Expansion - Wading Bird Surveys: International Migrant waders

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 4



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0 300 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Compartment

Reclamation

Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

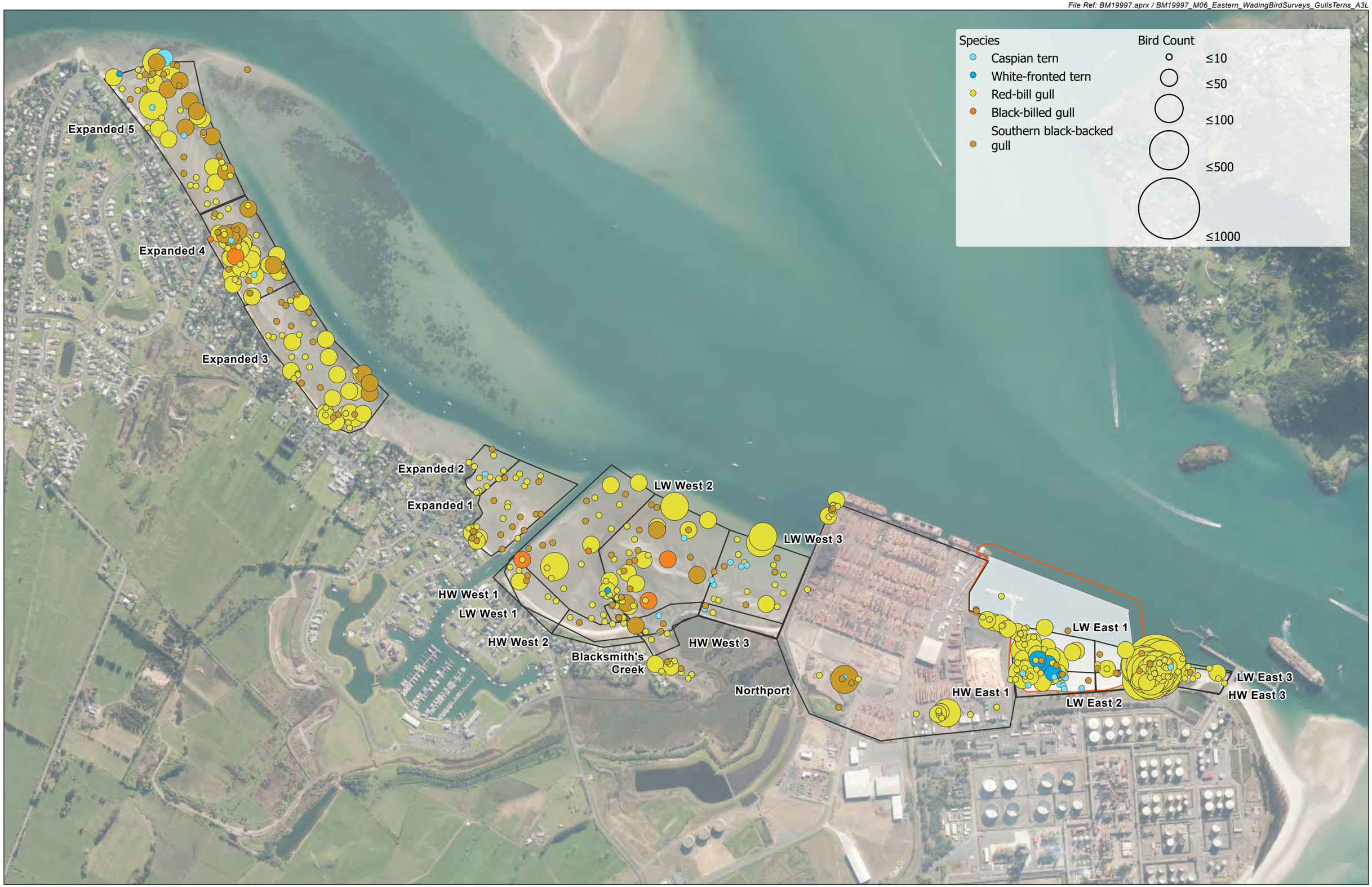
VFG Eastern Expansion - Wading Bird Surveys: Oystercatchers stilt

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 5



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0 300 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Surveys: Gulls & Terns

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 6

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0 300 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Surveys: Herons & Royal Spoonbill

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 7

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0 300 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Compartment

Reclamation

Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Surveys: Shags

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 8

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0 200 m

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Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and northern NZ dotterel

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 9

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and banded dotterel

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 10

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0 200 m

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Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and wrybill

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 11

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and bar-tailed godwit

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 12

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and lesser knot

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 13

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Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

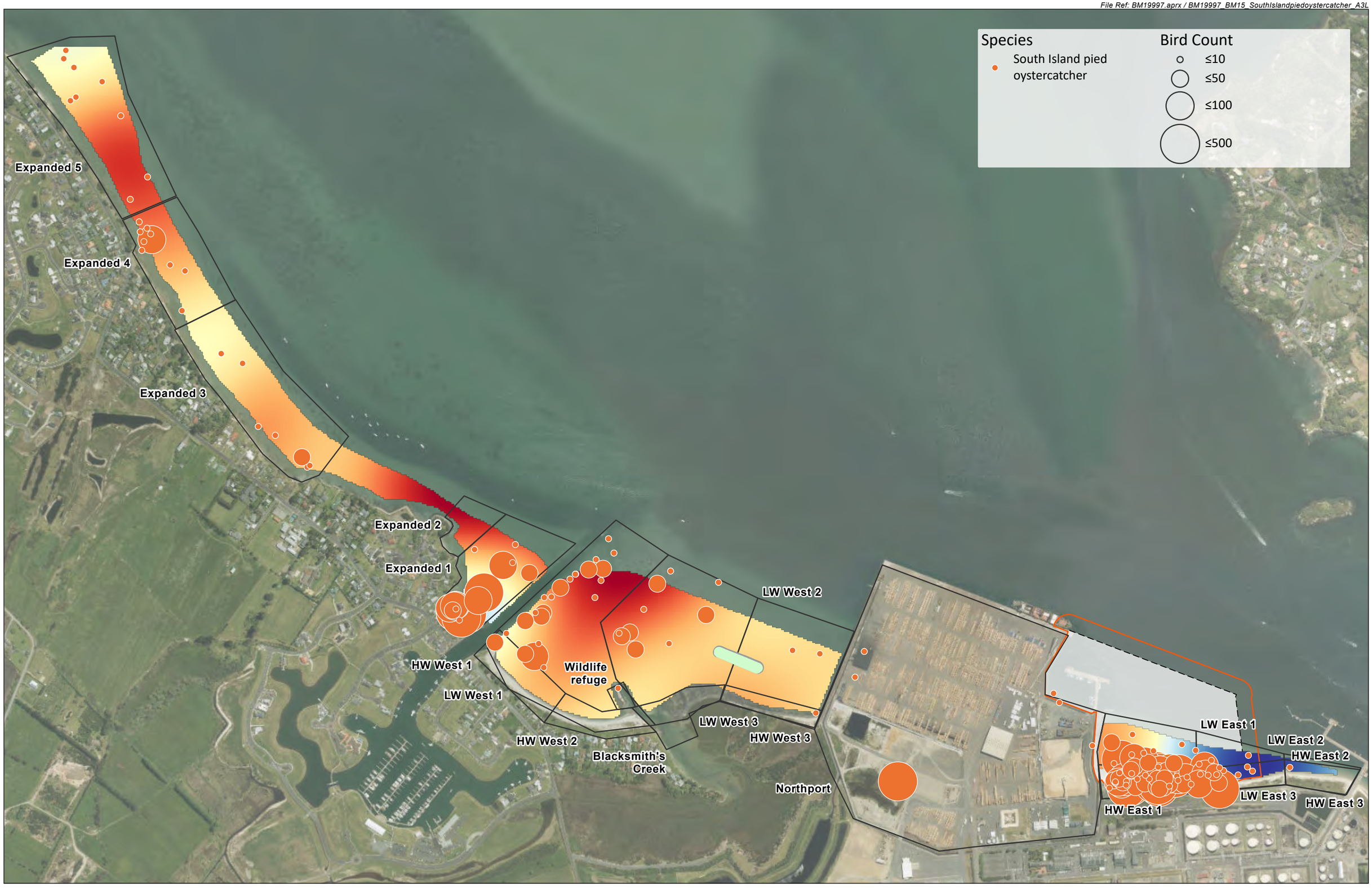
Benthic macroinvertebrate and pied stilt

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 14



Boffa Miskell

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0 200 m

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Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and South Island pied oystercatcher

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 15

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Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

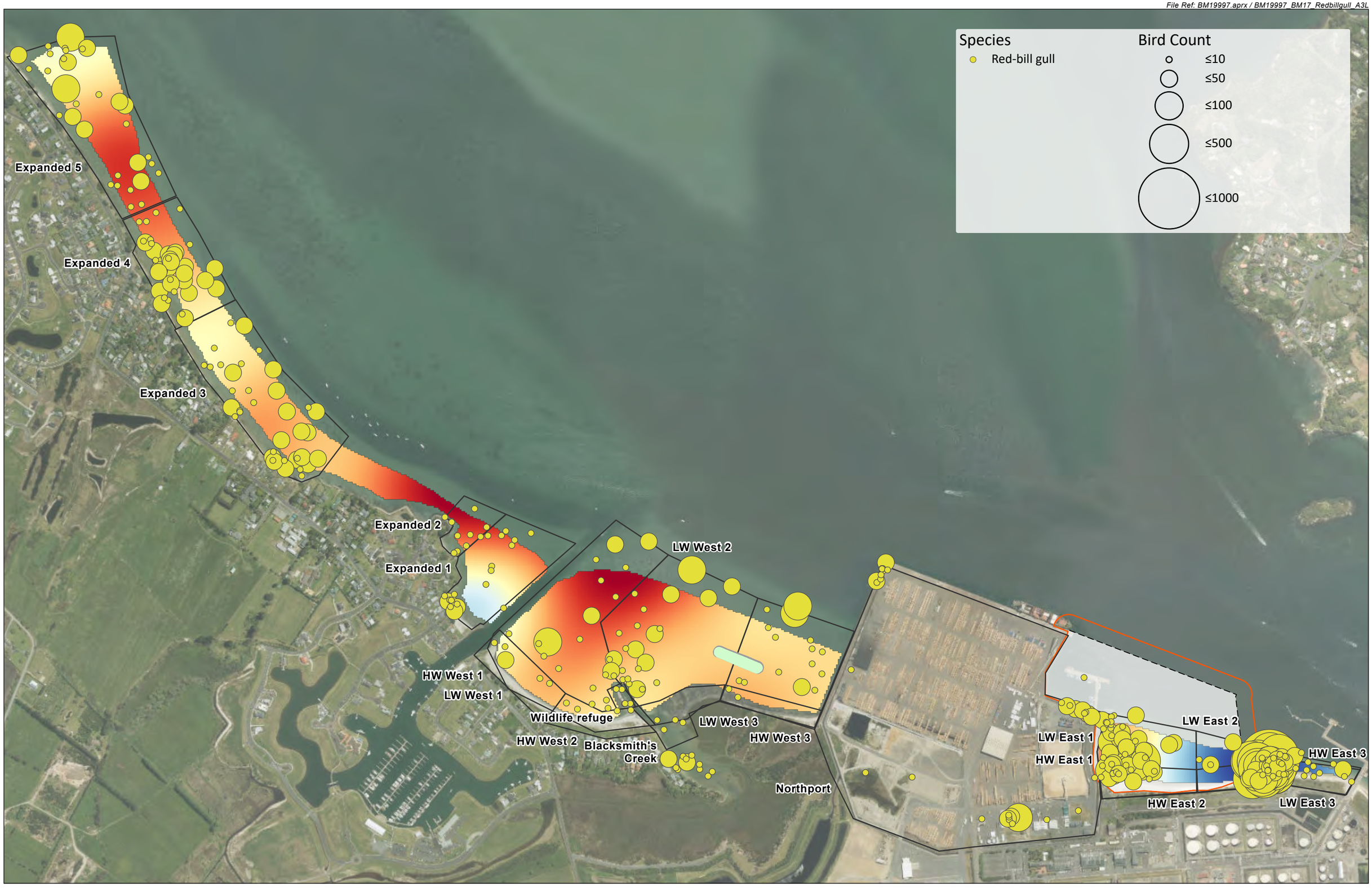
Benthic macroinvertebrate and variable oystercatcher

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 16



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0 200 m

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Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and red-bill gull

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 17

Boffa Miskell

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and black-billed gull

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 18

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting, Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and southern black-backed gull

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 19

0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and reef heron

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 20

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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

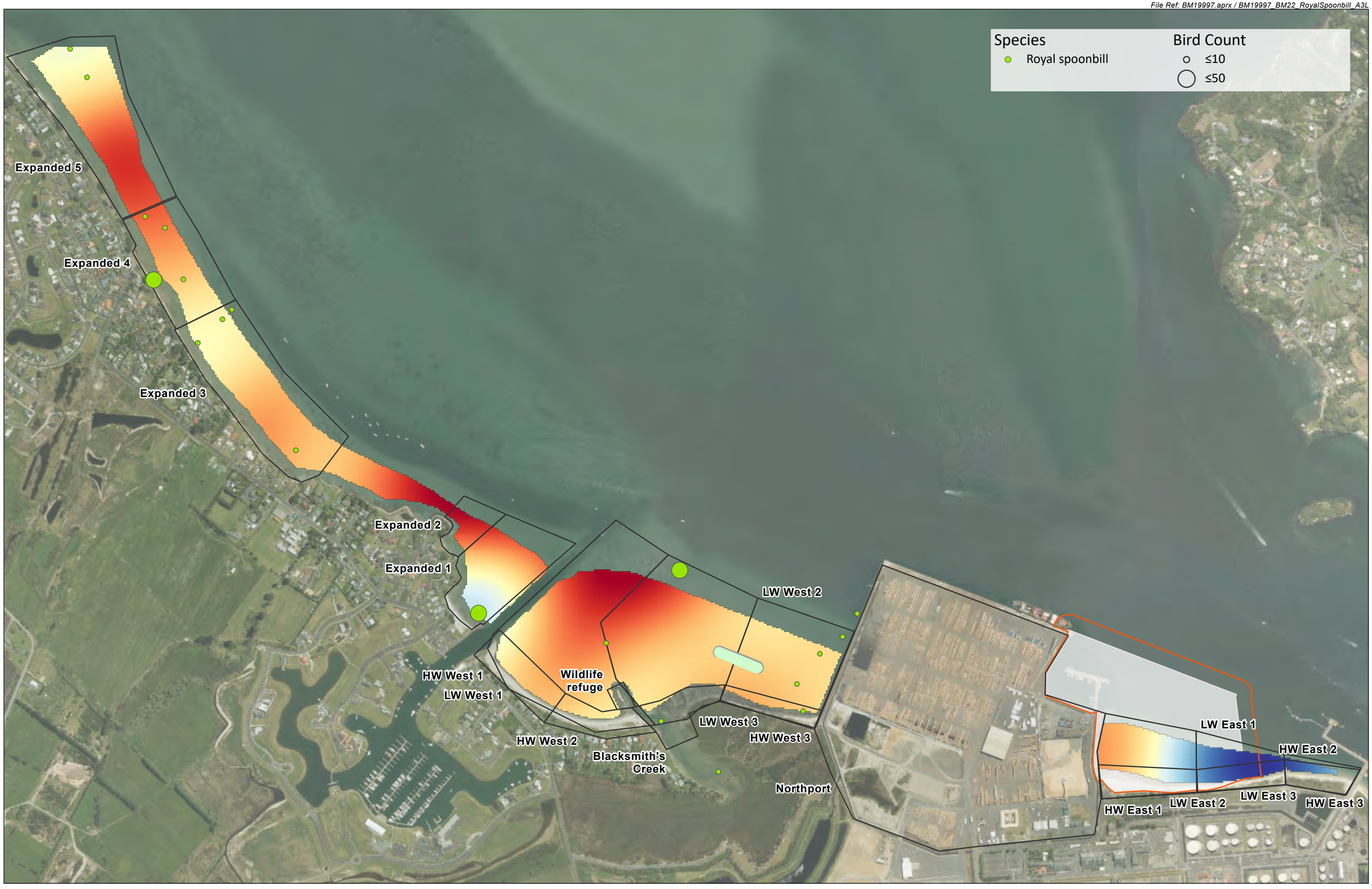
Benthic macroinvertebrate and white-faced heron

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 21



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0 200 m

1:10,000 @ A3

Data Sources: 4Sight Consulting. Coast & Catchment, Northport, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Individual macroinvertebrates
High: 190
Low: 35

Reclamation
Coastal Disturbance Zone
Avifauna survey compartment
Initial Sandbank Footprint
Final Sandbank Footprint

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

Benthic macroinvertebrate and royal spoonbill

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 22

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0 250 m

1:7,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Dredge Area
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

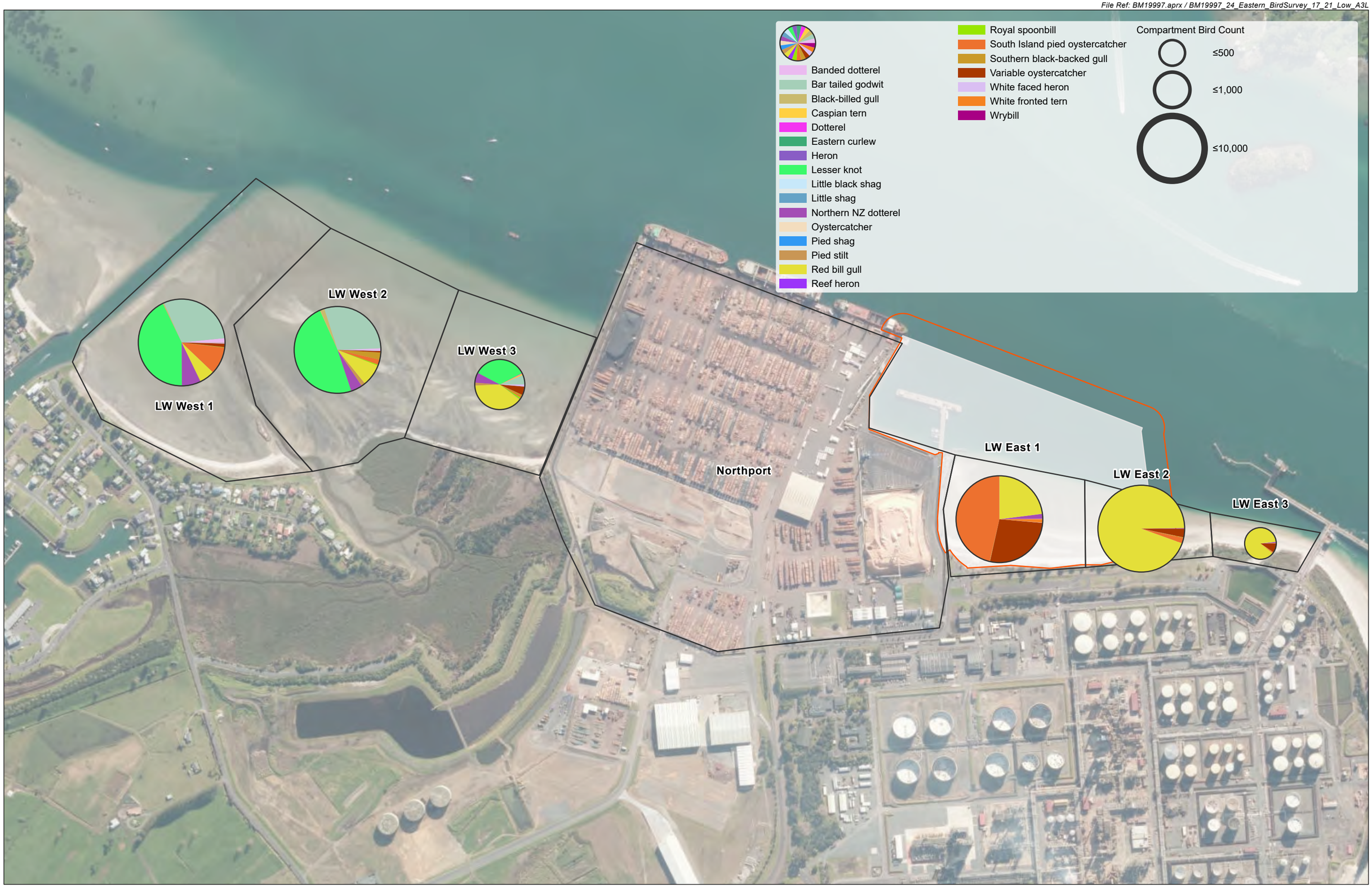
VFG Eastern Expansion - Wading Bird Survey: 2017 - 2021 (High Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 23



Boffa Miskell

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0 250 m

1:7,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Dredge Area
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

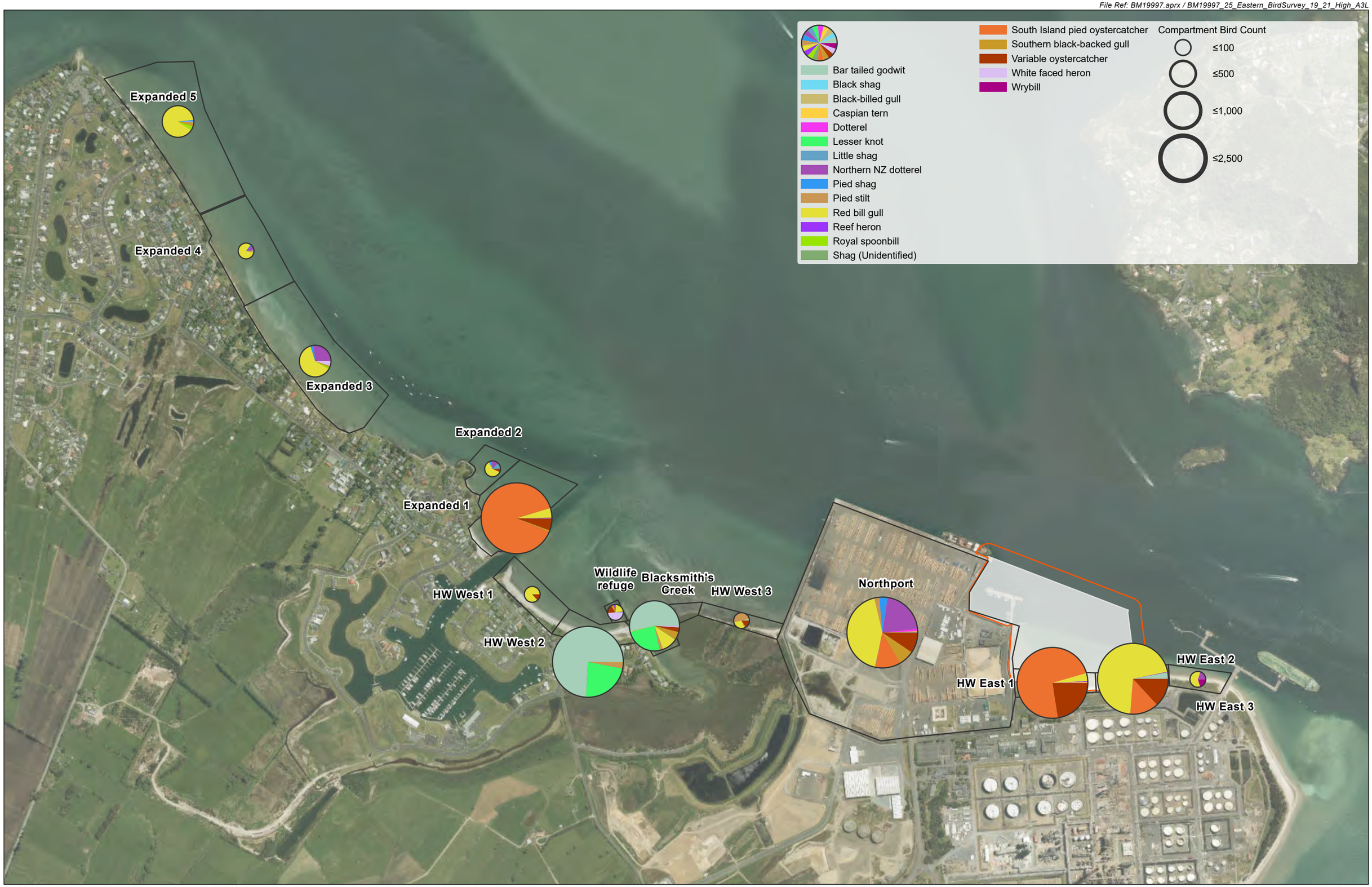
VFG Eastern Expansion - Wading Bird Survey: 2017 - 2021 (Low Mid Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 24



Boffa Miskell

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0 250 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Dredge Area
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

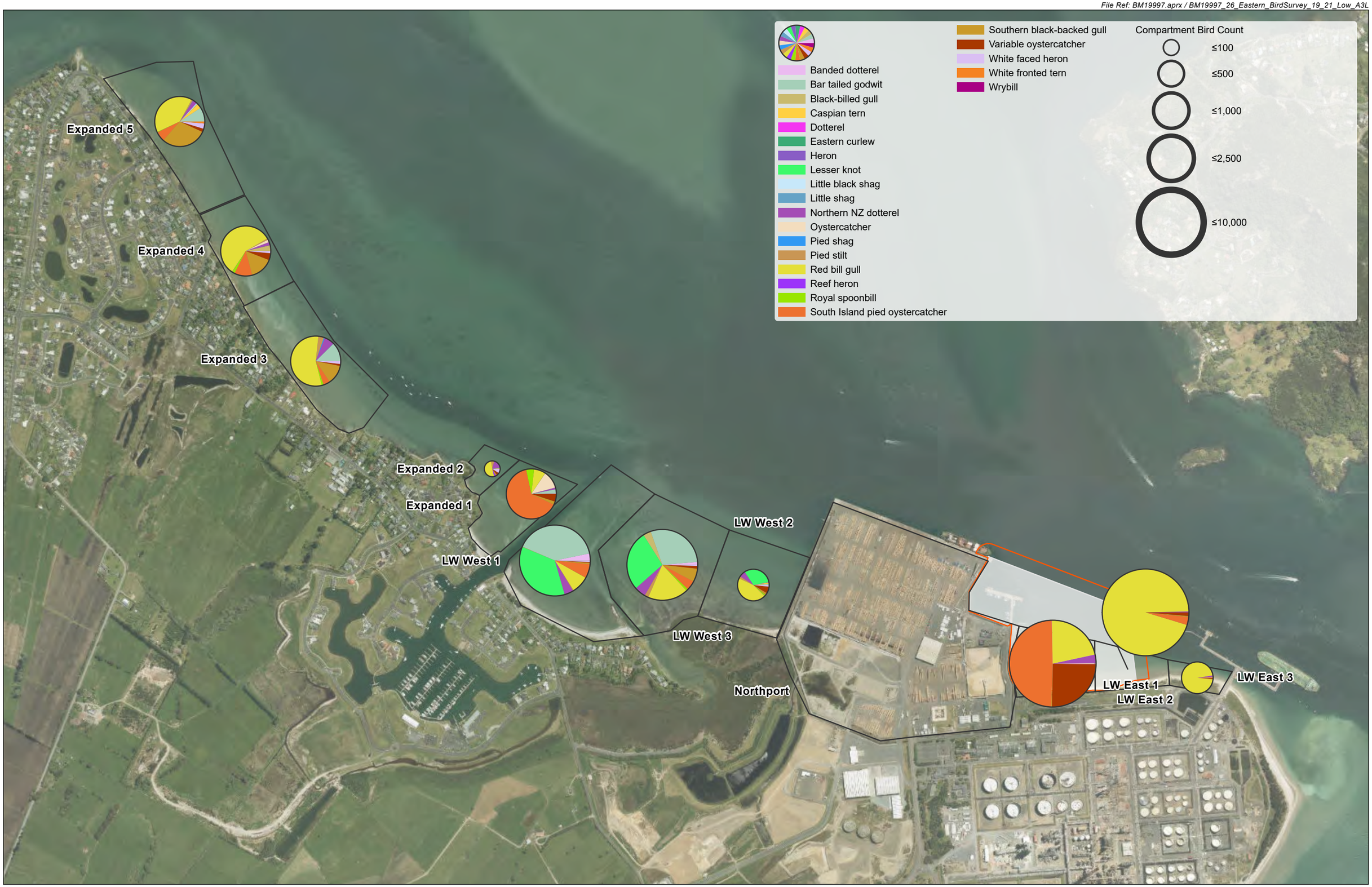
VFG Eastern Expansion - Wading Bird Survey: Dec 2019 - 2021 (High Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 25



Boffa Miskell

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0 250 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Dredge Area
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Survey: Dec 2019 - 2021 (Low Mid Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: KMa | Checked: LBu

Map 26

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0 150 m

1:5,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Aerial Imagery: LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Coastal Disturbance Zone
- Reclamation
- Nesting Survey
- Northern NZ dotterel
- Variable oystercatcher
- Pied stilt
- Dog indications

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

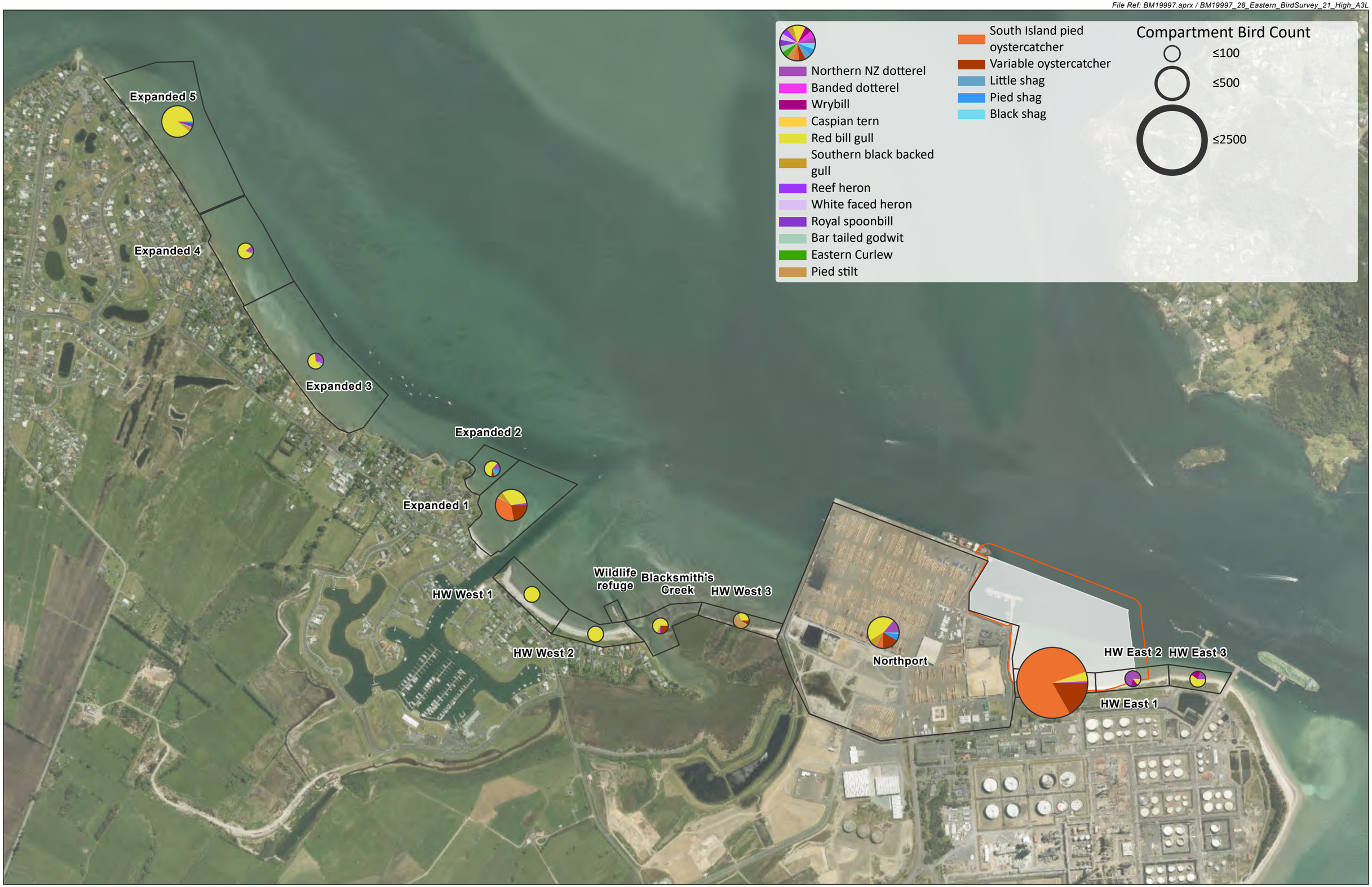
VFG Eastern Expansion - Nesting Birds

Date: 03 October 2022 | Revision: 1

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 27



Boffa Miskell

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0 250 m

1:12,000 @ A3

Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

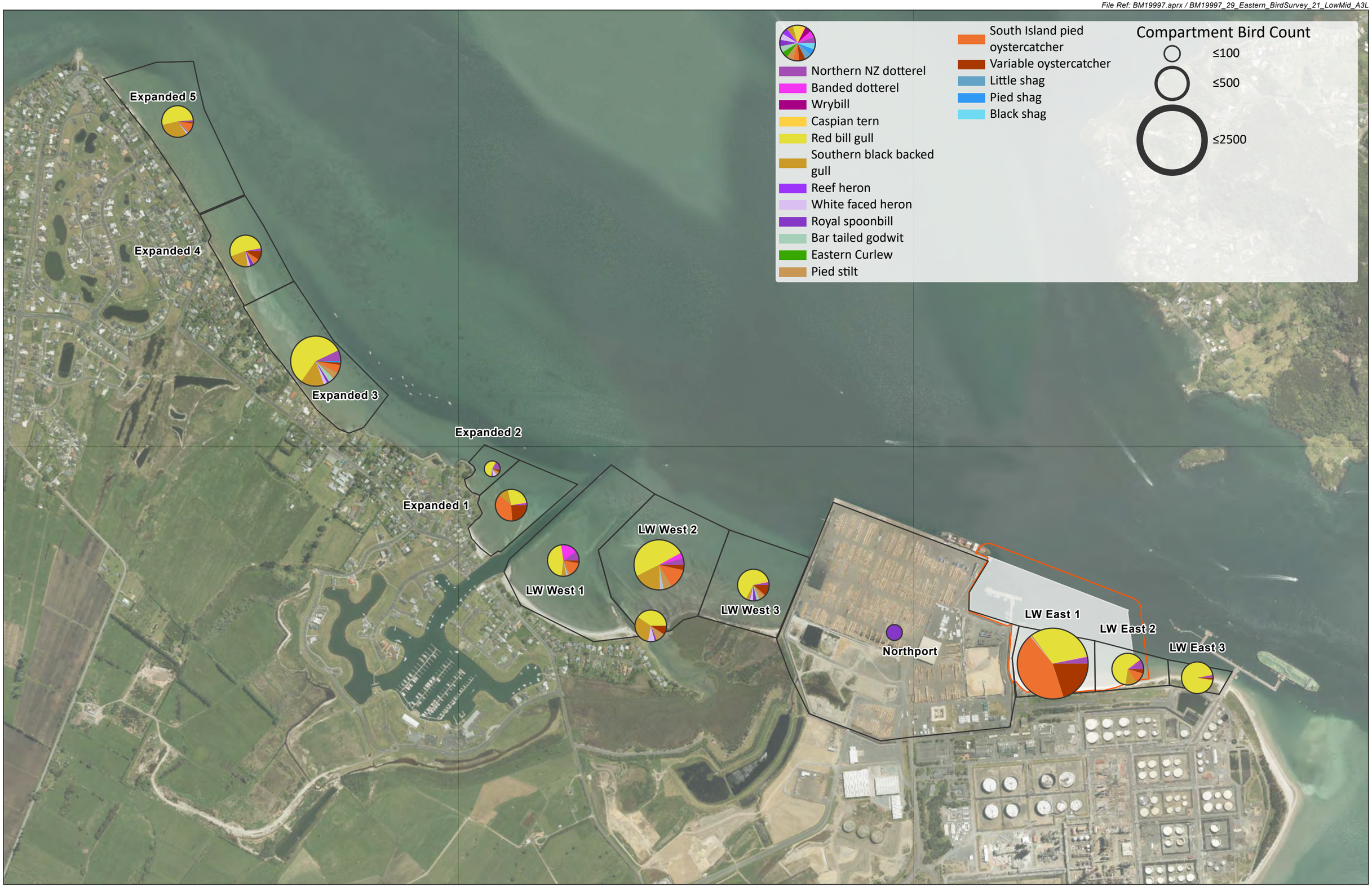
VFG Eastern Expansion - Wading Bird Survey: Winter 2021 (High Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 28



Boffa Miskell

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Data Sources: 4Sight Consulting, Boffa Miskell, Basemap Imagery: Land Information New Zealand Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Compartment
- Reclamation
- Coastal Disturbance Zone

NORTHPORT EXPANSION COASTAL BIRD ASSESSMENT

VFG Eastern Expansion - Wading Bird Survey: Winter 2021 (Low Mid Tide)

Date: 03 October 2022 | Revision: 0

Plan prepared for Northport by Boffa Miskell Limited

Project Manager: leigh.bull@boffamiskell.co.nz | Drawn: HHu | Checked: LBu

Map 29