REPORT

Tonkin+Taylor

Ecological Effects Assessment Volume 2: Appendices

Beachlands South Private Plan Change

Prepared for
Beachlands South Limited Partnership
Prepared by
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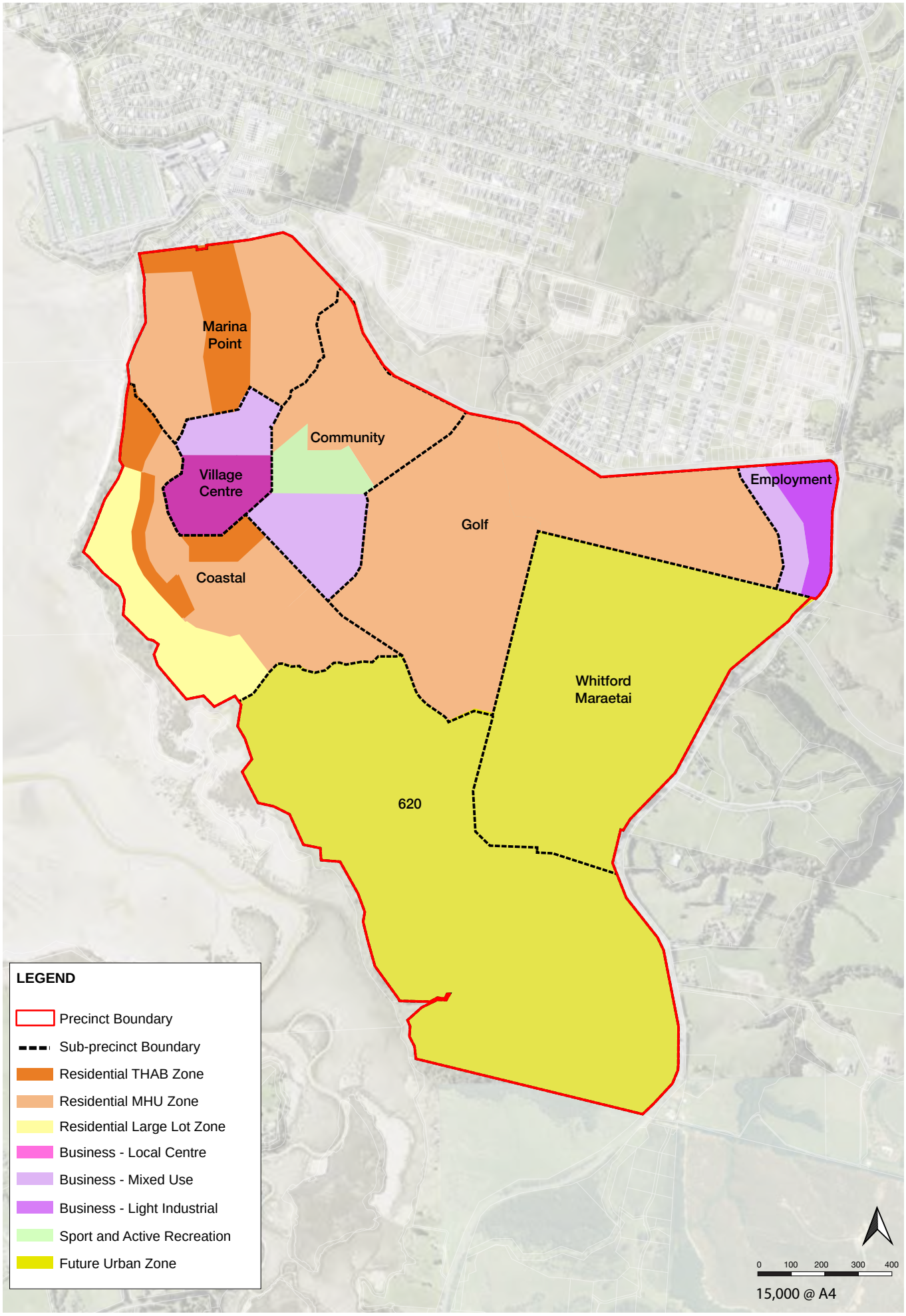
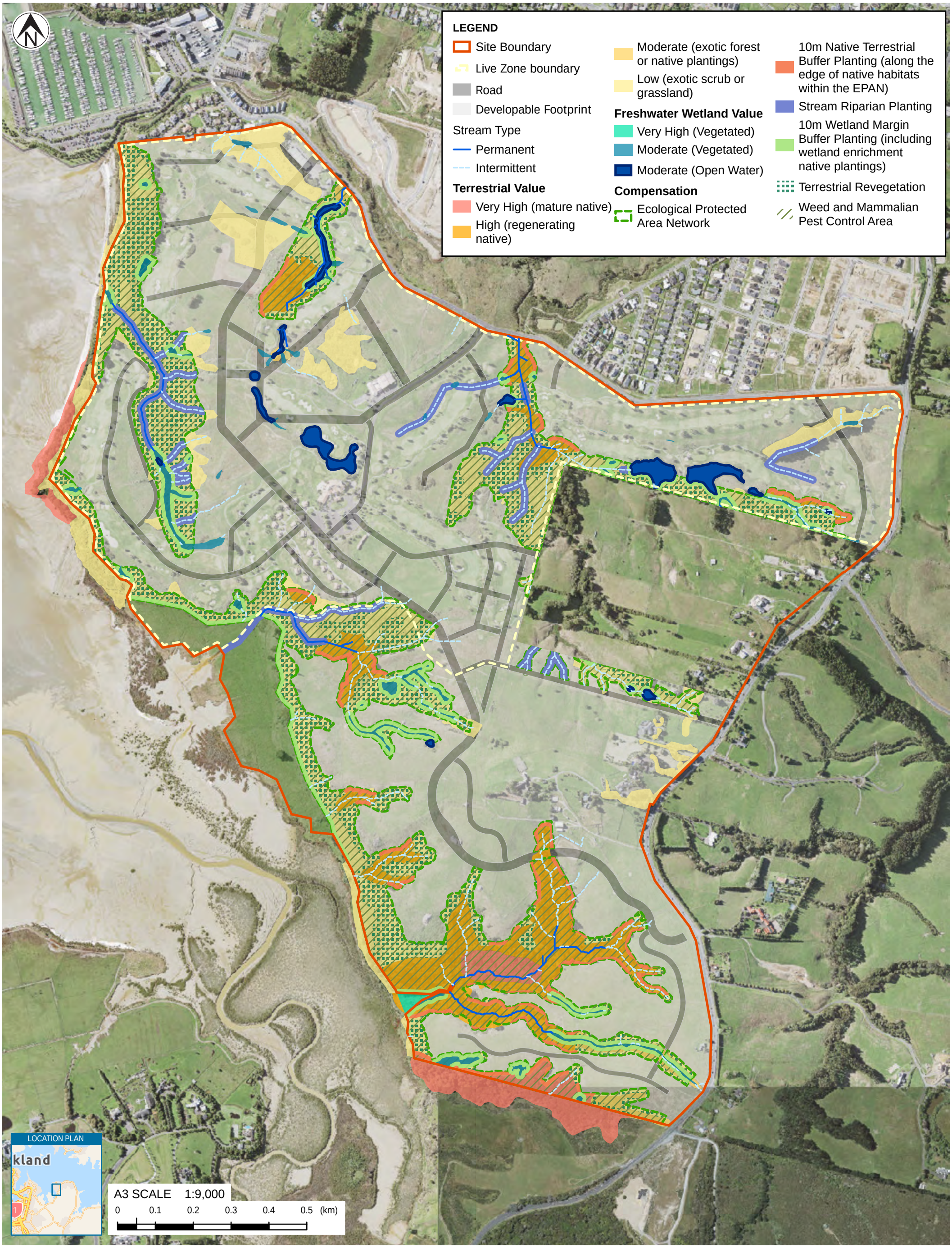
Appendix A Combined Ecology Tables and Figures

- **Figure 1– PPC area map**
- **Figure 2 – Habitat Restoration and Enhancement Map**
- **EcIAG (2018) summary tables**
- **Draft National Policy Statement for Indigenous Biodiversity offsetting and compensation principles**

Appendix A - Figure 1





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CLIENT **BEACHLANDS SOUTH LIMITED PARTNERSHIP**
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TITLE PROPOSED TERRESTRIAL, STREAM AND WETLAND COMPENSATION MEASURES
SCALE (A3) 1:9,000 FIG No. FIGURE 1. REV 0

Appendix A Table 1: Ecological values assigned to habitats (adapted from EIANZ, 2018).

Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community.	
Matters	**Attributes to be considered**
Representativeness	Attributes for representative vegetation and aquatic habitats: • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present Attributes for representative species and species assemblages: • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/ distinctiveness	Attributes for rare/distinctive vegetation and habitats: • Naturally uncommon, or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National priority for protection Attributes for rare/distinctive species or species assemblages: • Habitat supporting nationally 'Threatened' or 'At Risk' species, or locally uncommon species • Regional or national distribution limits of species or community • Unusual species or assemblages • Endemism
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations – pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	• Site history, and local environmental conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) • Size, shape and buffering • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Appendix A Table 2: Ecological values assigned to species (adapted from EIANZ, 2018).

Value	Species values
Very high	Nationally Threatened - Endangered, Critical or Vulnerable.
High	Nationally At Risk – Declining.
Moderate	Nationally At Risk - Recovering, Relict or locally uncommon or rare.
Low	Not Threatened Nationally, common locally.
Negligible	Exotic species, including pests.

Appendix A Table 3: Scoring for sites or areas combining values for four matters in Table 1

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in Table 4. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder; or Area rates High for 1 of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder; or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Low or Very Low for remainder.

Appendix A Table 4: Criteria for describing magnitude of effect (EIANZ, 2018).

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline[1] conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR

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

[1]Baseline conditions are defined as 'the conditions that would pertain in the absence of a proposed action' (EIANZ, 2018).

Appendix A Table 5: Timescale for duration of effects (EIANZ, 2018).

Timescale	Description
Permanent	Effects continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years)
Long-term	Where there is likely to be substantial improvement after a 25 year period (e.g. the replacement of mature trees by young trees that need > 25 years to reach maturity, or restoration of ground after removal of a development) the effect can be termed 'long term'.
Temporary[1]	Long term (15-25 years or longer – see above) Medium term (5-15 years) Short term (up to 5 years) Construction phase (days or months)

[1]Note that in the context of some planning documents, 'temporary' can have a defined timeframe.

Appendix A Table 6: Criteria for describing overall levels of adverse ecological effects (EIANZ, 2018).

Ecological Value / Magnitude	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low

Appendix A Table 7: Ecological values assigned to freshwater ecology (adapted from Roper-Lindsay *et al*., 2018)[1]

Value	Explanation	Characteristics
Very High	A reference quality watercourse in condition close to its pre-human condition with the expected assemblages of flora and fauna and no contributions of contaminants from human induced activities including agriculture. Negligible degradation e.g., stream within a native forest catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 120 or greater. EPT richness and proportion of overall benthic invertebrate community typically high. SEV scores high, typically >0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat natural and unmodified.
High	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barriers, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation e.g., exotic forest or mixed forest/agriculture catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 80-100 or greater. EPT richness and proportion of overall benthic invertebrate community typically moderate to high. SEV scores moderate to high, typically 0.6-0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. No pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat largely unmodified.

Value	Explanation	Characteristics
Moderate	A watercourse which contains fragments of its former values but has a high proportion of tolerant fauna, obvious water quality issues and/or sedimentation issues. Moderate to high degradation e.g., high-intensity agriculture catchment.	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 40-80. EPT richness and proportion of overall benthic invertebrate community typically low. SEV scores moderate, typically 0.4-0.6. Fish communities typically moderate diversity of only 3-4 species. Pest or invasive fish species (excluding trout and salmon) may be present. Stream channel and morphology typically modified (e.g., channelised). Stream banks may be modified or managed and may be highly engineered and/or have evidence of significant erosion. Riparian vegetation may have a well-established closed canopy. Habitat modified.
Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation e.g., modified urban stream.	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 60 or lower. EPT richness and proportion of overall benthic invertebrate community typically low or zero. SEV scores low to moderate, typically less than 0.4. Fish communities typically low diversity of only 1-2 species. Pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology typically modified (e.g. channelised). Stream banks often highly modified or managed and may be highly engineered and/or have evidence of significant erosion. Riparian vegetation typically without a well-established closed canopy. Habitat highly modified.

1 - Boffa Miskell Limited have developed these assessment criteria and applied them to a wide range of projects.

Appendix A Table 8: Characteristics of estuarine and marine areas/habitats and associated ecological values[1]

Ecological Value	Characteristics
Very High	• Benthic invertebrate community typically has very high diversity, species richness and abundance. • Benthic invertebrate community is dominated by taxa that are sensitive to organic enrichment and mud. • Marine sediments typically comprise < 25 % silt and clay grain sizes (mud). • Surface sediment oxygenated with no anoxic sediment present. • Annual average sedimentation rates typically less than 1 mm above background levels. • Contaminant concentrations in surface sediment significantly below ISQG-low and AC ERC-Orange effects threshold concentrations[2]. • Water column contaminant values typically at or better than ANZWQG 99 % species protection level. • Fish community typically has very high diversity, species richness and abundance. • Invasive opportunistic and disturbance tolerant species absent. • Vegetation likely to be nationally important and recognised as such. • Macroalgae sequences intact and provides significant habitat for native fauna. • Habitat unmodified.
High	• Benthic invertebrate community typically has high diversity, species richness and abundance. • Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and mud. • Marine sediments typically comprise < 50 % silt and clay grain sizes. • Surface sediment oxygenated. • Annual average sedimentation rates typically less than 2 mm above background levels. • Contaminant concentrations in surface sediment rarely exceed ISQG-low and AC ERC-Orange effects threshold concentrations. • Water column contaminant values typically between ANZWQG 95 % and 99 % species protection levels. • Fish community typically has high diversity, species richness and abundance. • Invasive opportunistic and disturbance tolerant species largely absent. • Vegetation likely to be regionally important and recognised as such. • Macroalgae provides significant habitat for native fauna. • Habitat largely unmodified.
Moderate	• Benthic invertebrate community typically has moderate species richness, diversity and abundance. • Benthic invertebrate community has both tolerant and sensitive taxa to organic enrichment and mud present. • Marine sediments typically comprise < 75 % silt and clay grain sizes. • Shallow depth of oxygenated surface sediment. • Annual average sedimentation rates typically less than 5 mm above background levels. • Contaminant concentrations in surface sediment generally below ISQG-high or AC ERC-Red effects threshold concentrations. • Water column contaminant values typically between ANZWQG 90 % and 95 % species protection levels. • Fish community typically has moderate species richness, diversity and abundance.

	• Few invasive opportunistic and disturbance tolerant species present. • Vegetation likely to be important at the level of the ecological district. • Macroalgae provides moderate habitat for native fauna. • Habitat modification limited.
Low	• Benthic invertebrate community degraded with low species richness, diversity and abundance. • Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with few/no sensitive taxa present. • Marine sediments dominated by silt and clay grain sizes (>75 %). • Surface sediment predominantly anoxic (lacking oxygen). • Annual average sedimentation rates typically less than 10 mm above background levels. • Elevated contaminant concentrations in surface sediment, above ISQG-high or AC ERC-Red effects threshold concentrations. • Water column contaminant values typically between ANZWQG 80 % and 90 % species protection levels. • Fish community depleted with low species richness, diversity and abundance. • Invasive, opportunistic and disturbance tolerant species dominant. • Vegetation has limited ecological value other than as local habitat for tolerant native species. • Macroalgae provides minimal/limited habitat for native fauna. • Habitat highly modified.
Negligible	• Benthic invertebrate community degraded with very low species richness, diversity and abundance. • Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with no sensitive taxa present. • Marine sediments dominated by silt and clay grain sizes (>85 %). • Surface sediment anoxic (lacking oxygen). • Annual average sedimentation rates typically greater than 10 mm above background levels. • Elevated contaminant concentrations in surface sediment, above ISQG-high effects threshold concentrations. • Water column contaminant values typically at or worse than ANZWQG 80 % species protection levels. • Fish community depleted with very low species richness, diversity and abundance. • Invasive, opportunistic and disturbance tolerant species highly dominant. • Vegetation/macroalgae absent or so sparse as to provide very limited ecological value. • Habitat extremely modified.

1 - Note that the characteristics of marine and estuarine sites with ecological values have been developed by Dr Sharon De Luca, Boffa Miskell Ltd, to guide valuing estuarine environments, and to provide a transparent approach that can be replicated. The characteristics have been applied in Environment Court and Board of Inquiry hearings, including a number of NZTA projects (Transmission Gully, MacKays to Peka Peka, Puhoi to Warkworth) and the Ara Tūhono Project, Warkworth to Wellsford Section; Marine Ecology Report on which Table 2 is based.

2 - ANZWQG (2018) Interim Sediment Quality Guideline (ISQG) contaminant threshold concentrations or Auckland Regional Council's Environmental Response Criteria contaminant threshold concentrations (Auckland Regional Council, 2004).

Draft National Policy Statement for Indigenous Biodiversity - offsetting and compensation principles

Principles for biodiversity offsetting

The following sets out a framework and side by side comparison of biodiversity offsetting principles and biodiversity compensation principles as set out in Appendix 3 and 4 of the draft National Policy Statement for Indigenous Biodiversity (NPSIB), November 2019. Principles 1–12 must be *complied with* for an action to qualify as a biodiversity offset. Principles 13–14 should be *met* for an action to qualify as a biodiversity offset.

Appendix A Table 9: Draft National Policy Statement for Indigenous Biodiversity - offsetting and compensation principles

No.	Principle	Offsetting statement	Compensation statement
1	Adherence to mitigation hierarchy	A biodiversity offset is a commitment to redress [more than minor] residual adverse impacts. It should only be contemplated after steps to avoid, remedy and mitigate adverse effects have been demonstrated to have been sequentially exhausted and thus applies only to residual indigenous biodiversity impacts.	Biodiversity compensation is a commitment to redress [more than minor] residual adverse impacts. It must only be contemplated after steps to avoid, remedy, mitigate and offset adverse effects have been demonstrated to have been sequentially exhausted and thus applies only to residual biodiversity impacts.
2	Limits to offsetting / compensation	Many biodiversity values cannot be offset and if they are adversely affected then they will be permanently lost. These situations include where: i) residual adverse effects cannot be offset because of the irreplaceability or vulnerability of the indigenous biodiversity affected ii) there are no technically feasible or socially acceptable options by which to secure gains within acceptable timeframes iii) effects on indigenous biodiversity are uncertain, unknown or little understood, but potential effects are significantly adverse. In these situations, an offset would be inappropriate. This principle reflects a standard of acceptability for offsetting and a proposed offset must provide an assessment of these limits that supports its success.	In deciding whether biodiversity compensation is appropriate, a decision-maker must consider the principle that many indigenous biodiversity values are not able to be compensated for because: a) the indigenous biodiversity affected is irreplaceable or vulnerable b) there are no technically feasible or socially acceptable options by which to secure proposed gains within acceptable timeframes c) effects on indigenous biodiversity are uncertain, unknown or little understood, but potential effects are significantly adverse.
3	No net loss and preferably a net gain (offset)	The values to be lost through the activity to which the offset applies are counterbalanced by the proposed offsetting activity which is at least	The values to be lost through the activity to which the biodiversity compensation applies must be addressed by positive effects to

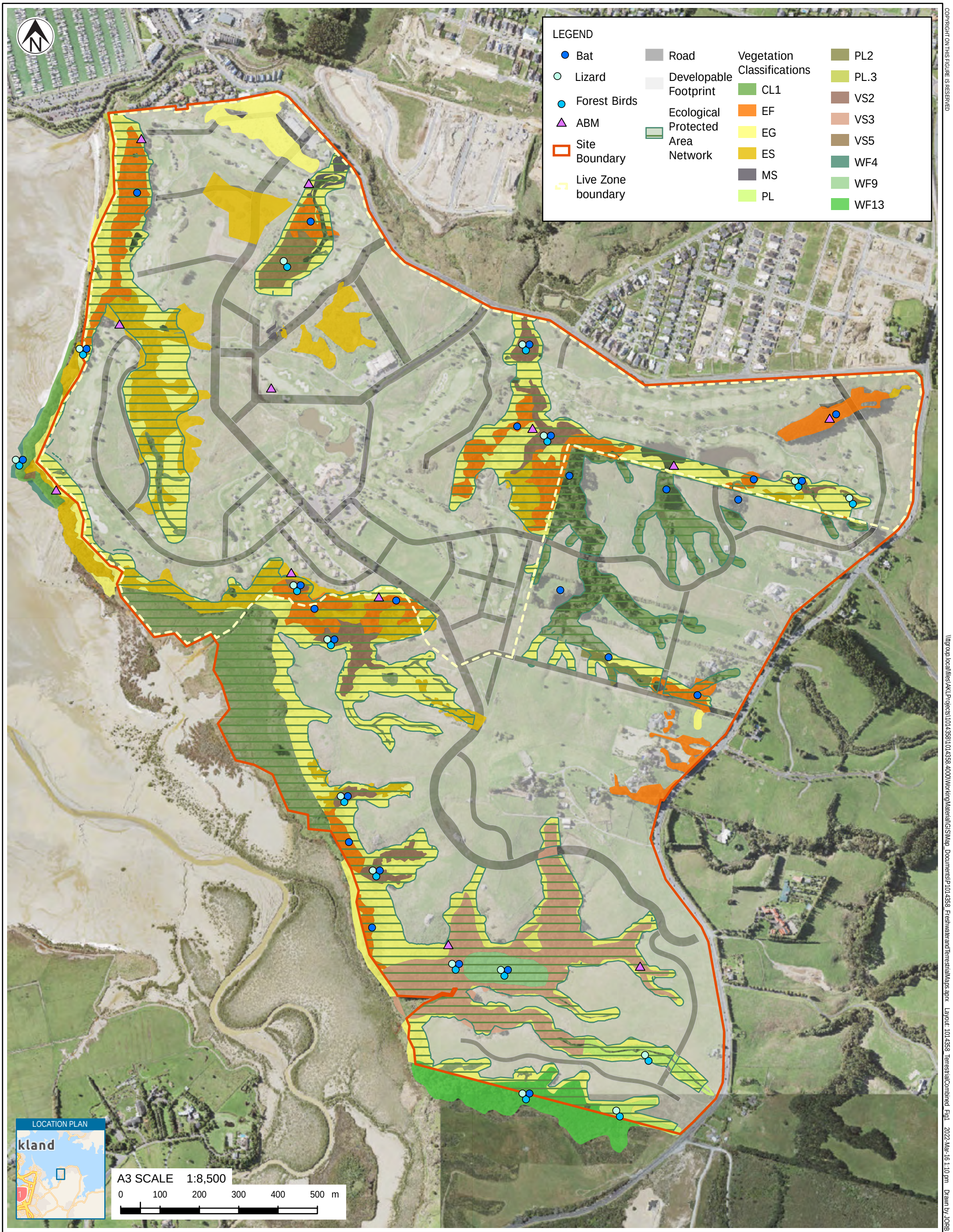
No.	Principle	Offsetting statement	Compensation statement
	OR Scale of biodiversity compensation (compensation)	commensurate with the adverse effects on indigenous biodiversity so that the overall result is no net loss and preferably a net gain in biodiversity. No net loss and net gain are measured by type, amount and condition at the impact and offset site and require an explicit loss and gain calculation.	indigenous biodiversity that are proportionate to the adverse effects on indigenous biodiversity.
4	Additionality	A biodiversity offset must achieve gains in indigenous biodiversity above and beyond gains that would have occurred in the absence of the offset, including that gains are additional to any remediation and mitigation undertaken in relation to the adverse effects of the activity. Offset design and implementation must avoid displacing activities harmful to indigenous biodiversity to other locations.	Biodiversity compensation must achieve gains in indigenous biodiversity above and beyond gains that would have occurred in the absence of the compensation, including that gains are additional to any remediation and mitigation undertaken in relation to the adverse effects of the activity. Compensation design and implementation must avoid displacing activities harmful to indigenous biodiversity to other locations.
5	Like-for-like	The ecological values being gained at the offset site are the same as those being lost at the impact site across types of indigenous biodiversity, amount of indigenous biodiversity (including condition), over time and spatial context.	N/A
6	Landscape context	Biodiversity offset actions must be undertaken where this will result in the best ecological outcome, preferably close to the location of development or within the same ecological district, and must consider the landscape context of both the impact site and the offset site, taking into account interactions between species, habitats and ecosystems, spatial connections and ecosystem function.	Biodiversity compensation actions must be undertaken where this will result in the best ecological outcome, preferably close to the location of development or within the same ecological district. The actions must consider the landscape context of both the impact site and the compensation site, taking into account interactions between species, habitats and ecosystems, spatial connections and ecosystem function.
7	Long-term outcomes	The biodiversity offset must be managed to secure outcomes of the activity that last as least as long as the impacts, and preferably in perpetuity.	The biodiversity compensation must be managed to secure outcomes of the activity that last as least as long as the impacts, and preferably in perpetuity.
8	Time lags	The delay between loss of indigenous biodiversity at the impact site and gain or maturity of indigenous biodiversity at the offset site must be	N/A

No.	Principle	Offsetting statement	Compensation statement
		minimised so that gains are achieved within the consent period.	
9	Trading up	When trading up forms part of an offset, the proposal must demonstrate that the indigenous biodiversity values gained are demonstrably of higher value than those lost, and the values lost are not indigenous taxa that are listed as Threatened, At-risk or Data deficient in the New Zealand Threat Classification System lists, or considered vulnerable or irreplaceable.	When trading up forms part of biodiversity compensation, the proposal must demonstrate the indigenous biodiversity values gained are demonstrably of higher indigenous biodiversity value than those lost. The proposal must also show the values lost are not indigenous taxa that are listed as Threatened, At-risk or Data deficient in the New Zealand Threat Classification System lists, or considered vulnerable or irreplaceable.
9	Financial contributions	N/A	Financial contributions must only be considered when there is no effective option available for delivering indigenous biodiversity gains on the ground. These contributions must be related to the indigenous biodiversity impact. When proposed, financial contributions must be directly linked to an intended indigenous biodiversity gain or benefit.
10	Offsets/compensation in advance	A biodiversity offset developed in advance of an application for resource consent must provide a clear link between the offset and the future effect. That is, the offset can be shown to have been created or commenced in anticipation of the specific effect and would not have occurred if that effect were not anticipated.	Biodiversity compensation developed in advance of an application for resource consent must provide a clear link between the compensation and the future effect. That is, the compensation can be shown to have been created or commenced in anticipation of the specific effect and would not have occurred if that effect were not anticipated.
11	Proposing a biodiversity offset	A proposed biodiversity offset must include a specific biodiversity offset management plan.	N/A
12	Science and matauranga Māori	The design and implementation of a biodiversity offset must be a documented process informed by science, including an appropriate consideration of matauranga Māori.	The design and implementation of biodiversity compensation must be a documented process informed by science, including an appropriate consideration of matauranga Māori.
13	Stakeholder participation	Opportunity for the effective participation of stakeholders should be demonstrated when planning for biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.	Opportunity for the effective participation of stakeholders should be demonstrated when planning for biodiversity compensation, including evaluation, selection, design, implementation and

No.	Principle	Offsetting statement	Compensation statement
		Stakeholders are best engaged early in the offset consideration process.	monitoring. Stakeholders are best engaged early in the process.
14	Transparency	The design and implementation of a biodiversity offset and communication of its results to the public should be undertaken in a transparent and timely manner. This includes transparency of the loss and gain calculation and the data that informs a biodiversity offset.	The design and implementation of biodiversity compensation and communication of its results to the public should be undertaken in a transparent and timely manner.

Appendix B: Terrestrial Ecology Tables and Figures

- **Figure 1– Terrestrial values map**
- **Table 1– List of terrestrial plants within the site boundary**
- **Table 2– Weather data during the acoustic bat survey**



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NOTES: Basemap New Zealand Imagery.lyr: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.

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TITLE TERRESTRIAL VEGETATION AND FAUNA
SCALE (A3) 1:8,500 FIG No. FIGURE 1. REV 0

Appendix B Table 1: List of terrestrial plants within the site boundary

Species name	Common name	Threat classification
Acacia mearnsii	Black wattle	Introduced
Agave spp.	Yucca	Introduced
Alocasia brisbanensis	Elephant ear	Introduced
Arthropodium cirratum	Rengarenga	Not Threatened
Astelia hastata	Tank lily	Not Threatened
Astelia solandri	Perching lily	Not Threatened
Austroblechnum novaezelandiae	Kiokio	Not Threatened
Beilschmiedia taraire	Taraire	Not Threatened
Beilschmiedia tawa	Tawa	Not Threatened
Carex spp.	Carex	Not Threatened
Cenchrus clandestinus	Kikuyu grass	Introduced
Coprosma macrocarpa subsp. minor		Not Threatened
Coprosma propinqua x robusta		Not Threatened
Coprosma robusta	Karamu	Not Threatened
Cordyline australis	Cabbage tree	Not Threatened
Cortaderia selloana	Pampas	Introduced
Corynocarpus laevigatus	Karaka	Not Threatened
Cyathea dealbata	Silverfern	Not Threatened
Cyathea medullaris	Mamaku	Not Threatened
Dacrydium dacrydioides	Kahikatea	Not Threatened
Dactylis glomerata	Cocksfoot	Introduced
Dendroconche scandens	Fragrant fern	Not Threatened
Dicksonia squarrosa	Whekī	Not Threatened
Doodia australis	Rasp fern	Not Threatened
Daucus carota	Wild carrot	Introduced
Dysoxylum spectabile	Kohekohe	Not Threatened
Gahnia lacera	Cutty grass	Not Threatened
Freycinetia banksii	Kiekie	Not Threatened
Geniostoma ligustrifolium var. ligustrifolium	Hangehange	Not Threatened
Hedycarya arboreus	Pigeonwood	Not Threatened
Homalanthus populifolius	Queensland poplar	Introduced
Ipomea indica	Blue morning glory	Introduced
Knightia excelsa	Rewarewa	Not Threatened
Kunzea robusta	Kānuka	Threatened - Nationally Vulnerable

Species name	Common name	Threat classification
Leptospermum scoparium	Mānuka	At Risk - Declining
Ligustrum sinense	Chinese privet	Introduced
Lonicera japonica	Japanese honeysuckle	Introduced
Lotus corniculatus	Birdsfoot trefoil	Introduced
Melicytus ramiflorus	Māhoe	Not Threatened
Metrosideros excelsa	Pōhutukawa	Threatened - Nationally Vulnerable
Metrosideros perforata	Akatea	Threatened - Nationally Vulnerable
Myrsine australis	Red matipo	Not Threatened
Nephrolepis cordifolia	Ladder fern	Introduced
Olearia angulata	Olearia angulata	At Risk - Naturally Uncommon
Oplismenus hirtellus subsp. *imbecillis*	Basket grass	Not Threatened
Phormium tenax	Harakeke	Not Threatened
Phyllocladus trichomanoides	Tanekaha	Not Threatened
Pinus radiata	Monterey pine	Introduced
Piper excelsum	Kawakawa	Not Threatened
Pittosporum eugenioides	Lemonwood	Not Threatened
Plantago lanceolata	Narrow-leaved plantain	Introduced
Podocarpus totara	Tōtara	Not Threatened
Prumnopitys taxifolia	Mataī	Not Threatened
Pseudopanax crassifolius	Lancewood	Not Threatened
Pteris macilenta	Sweet fern	Not Threatened
Pteris tremula	Trembling brake	Not Threatened
Pyrrosia eleagnifolia	Leatherleaf fern	Not Threatened
Ranunculus repens	Creeping buttercup	Introduced
Rhopalostylis sapida	Nīkau	Not Threatened
Ripogonum scandens	Supplejack	Not Threatened
Rubus cissoides	Bush lawyer	Not Threatened
Rubus fruticosus agg.	Blackberry	Introduced
Salix cinerea	Grey willow	Introduced
Solanum mauritianum	Woolly nightshade	Introduced
Sophora microphylla	Small-leaved kōwhai	Not Threatened
Stenotaphrum secundatum	Buffalo grass	Introduced
Tradescantia fluminensis	Tradescantia	Introduced
Ulex europaeus	Gorse	Introduced
Vitex lucens	Pūriri	Not Threatened
Zantedeschia aethiopica	Arum lily	Introduced

Appendix B Table 2: Weather data during the acoustic bat survey recorded at Mangere Weather Station and retrieved from CliFlo (Station No. 43711).

Date	Min. temperature 2-hours after sunset (°C)	Rainfall 2-hours after sunset (mm)	Overnight minimum relative humidity (%)
12/02/2021	17.3	0	67
13/02/2021	18.8	0	69
14/02/2021	20.2	0	92
15/02/2021	20.5	0.2	57
16/02/2021	19.6	0	56
17/02/2021	16.7	0	56
18/02/2021	14.8	0	76
19/02/2021	16.7	0	78
20/02/2021	17.2	0	84
21/02/2021	19	0	77
22/02/2021	18.8	0	71
23/02/2021	20.7	0	60

Note: Yellow cells indicate sub-optimal weather conditions.

Appendix C: Freshwater Wetland Tables and Figures

- **Figure 1– Freshwater Wetland Values Map**
- **Figure 2 – Wetland Delineation Protocol Steps**
- **Legal opinion on the definition of 'Natural' Wetland**

LEGEND

- Grey Duck and Pāteke
- Shag
- DabChick
- Australasian Bittern
- Marsh Crake
- Spotless Crake
- Bird Observed
- ARD Location
- Site Boundary
- Live Zone boundary
- Road
- Developable Footprint
- Ecological Protected Area Network
- Coastal vegetated wetland (mangrove wetland)
- Coastal vegetated wetland (non-mangrove-wetlands)
- Constructed freshwater wetlands (Open water)
- Constructed freshwater wetland exotic
- Constructed freshwater wetland (>50% native plant species)
- Natural freshwater wetland exotic
- Natural freshwater wetland (>50% native plant species)
- Natural freshwater wetland (species composition unknown)
- Wetland Enrichment Planting and 10m Margin Buffer Planting

Note: All wetlands in the golf course footprint were deemed to be 'Constructed' wetlands on the basis that the entire golf course was earth worked and constructed in 1996. See legal opinion in Volume 2, Appendix C for further discussion.

Wetland Activity Status Overview

A natural wetland, as defined in clause 3.21 of the National Policy Statement Freshwater Management (NPS-FM), means a wetland as defined in the RMA that is not:
a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or
b) a geothermal wetland; or
c) any area of improved pasture that, at the commencement date, is dominated by (i.e. comprises > 50%) exotic pasture species and is subject to temporary rain-derived water pooling.

Part 3, subpart 1 of the National Environmental Standards – Freshwater (NES-F) sets out the standards designed to protect existing natural wetlands. Most importantly regulation 53 specifies two prohibited activities:
(1): Earthworks within a natural wetland is a prohibited activity if it results, or is likely to result, in the complete or partial drainage of all or part of a natural wetland (unless another activity status applies under regulations 38-51); and
(2): The taking, use, damming, diversion, or discharge of water within a natural wetland is a prohibited activity if it results, or is likely to result, in the complete or partial drainage of all or part of a natural wetland (and does not have another status under regulations 38-51).

The NES-F also includes other activity statuses for earthworks, vegetation clearance, or the taking, use, damming, diversion, or discharge of water within and up to a 100m setback from a natural wetland.

LOCATION PLAN

A3 SCALE 1:11,000

0 0.1 0.2 0.3 0.4 0.5 (km)

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NOTES:
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APPROVED DCM Mar.22 DATE

PROJECT No.	1014358.4000		
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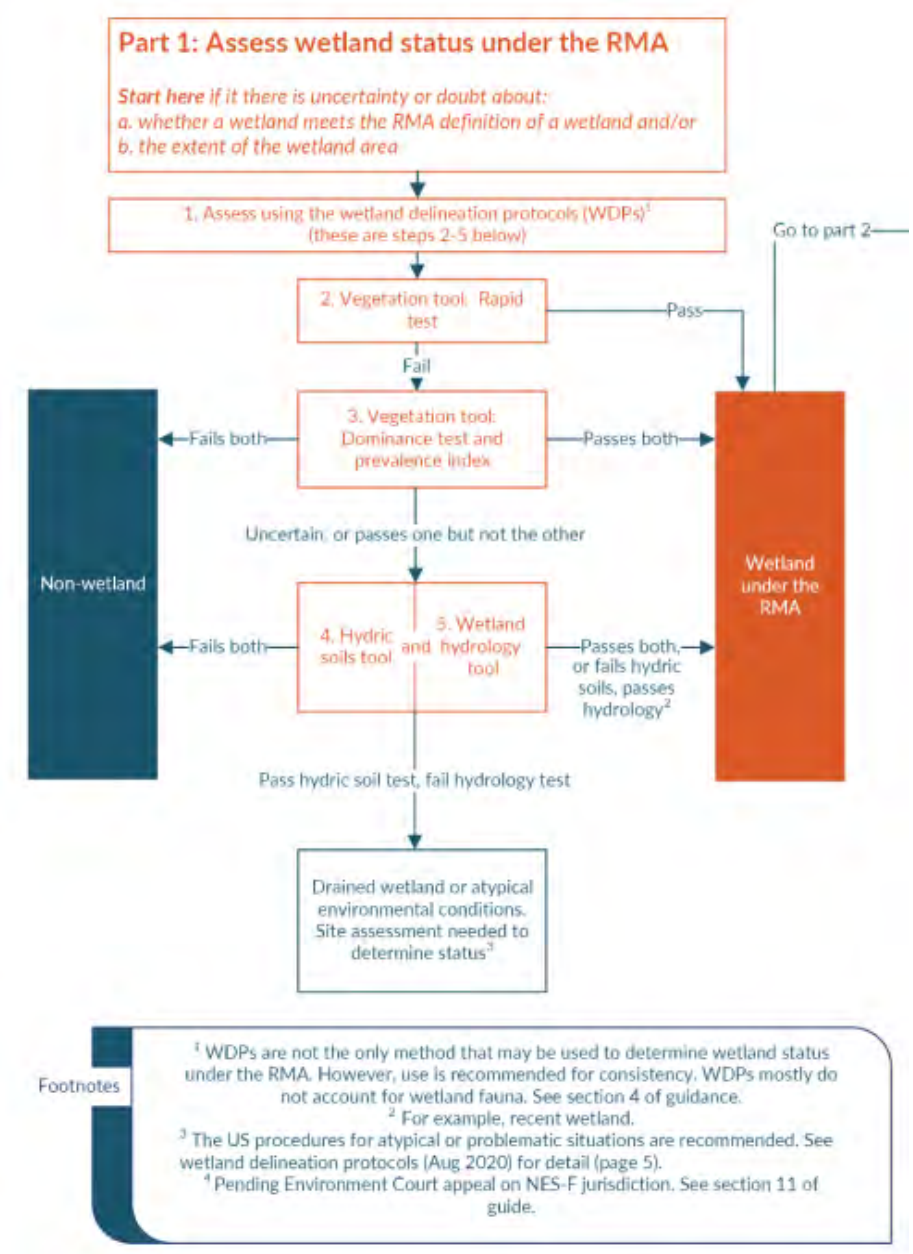
CHECKED	ANTH	MAR.22	

CLIENT **BEACHLANDS SOUTH LIMITED PARTNERSHIP**
PROJECT **BEACHLANDS PLAN CHANGE**
TITLE WETLAND DELINEATION AND BIRD HABITATS
SCALE (A3) 1:11,000 FIG No. FIGURE 1. REV 0

Wetland Delineation Protocol Steps



Simpson Grierson

28 March 2022

Beachlands South LP

For: John Dobrowolski

Email: John.Dobrowolski@russellgroup.co.nz

Partner Reference
W S Loutit - Auckland

Writer's Details
Direct Dial: +64-9-977 5256
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Sent by Email

Dear John

Advice regarding interpretation of wetland definition in National Policy Statement for Freshwater Management

1. You have asked for legal advice regarding the correct interpretation to be applied to the National Policy Statement for Freshwater Management 2020 (**NPS-FM**)'s definition of "natural wetland". We understand that this letter will be provided to Beachlands South LP (**BSLP**)'s consultant ecologists and will be included as an attachment to the Freshwater Wetland Ecological Effects Assessment that will be lodged in support of BSLP's private plan change (**PPC**) application.

2. We understand that:

   (a) The Formosa golf course comprises approximately 170 ha of the PPC area;

   (b) Extensive earthworks were undertaken over the entirety of the golf course site in 1996 as part of the development of the golf course; and

   (c) During the earthworks stage and development of the golf course all existing wetlands onsite were constructed to contribute to amenity values (e.g. open water ponds) and/or for the purposes of water management (e.g. storage or drainage). The latter wetlands were constructed via re-contouring of the landform to optimise the operation and functioning of the golf course.

3. We have been asked to provide our opinion on the correct interpretation of the "natural wetland" definition in the NPS-FM, given that all of the wetlands on the golf course site were created as a result of earthworks/construction activities. The definition provides:

> *"natural wetland means a wetland (as defined in the Act) that is not:*
> *(a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or*
> *(b) a geothermal wetland; or*
> *(c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain derived water pooling*

4. Our interpretation of the exclusion in (a) above is that if a wetland was constructed "by artificial means" it is excluded from the definition of a "natural wetland". If the wetland would not be there "but for" the artificial structure or construction works, then it follows that it was constructed (intentionally or unintentionally) by artificial means. This is the plain and ordinary meaning of the phrase "wetland constructed by artificial means".

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5. We have reviewed the non-statutory guidance released by the Ministry for the Environment (**Ministry**) in September 2021, titled *Defining 'natural wetlands' and 'inland natural wetlands'* (**Guidance**).

6. In our view the way the Guidance interprets the phrase "constructed by artificial means" is contrary to this plain and ordinary interpretation. The Guidance introduces the concept of "induced wetlands" (a term which is not used in the NPS-FM or National Environmental Standards for Freshwater (**NES**)) and provides at Section 6:

> *'Induced wetlands' are wetlands that have resulted from any human activity, except the deliberate construction of a wetland or waterbody by artificial means (see section 5). They are considered 'natural wetlands'.*
>
> *In a highly modified landscape, as we have across New Zealand, wetlands often result from human activities or changes to the landscape. Many wetlands that we have today have historically been induced through these activities, such as deforestation, and have often developed significant values over time and warrant protection.*
>
> *Wetlands that have been **unintentionally induced** through human activities, for example, as a consequence of in-stream works such as culverts, or through the effects of increased sedimentation caused by deforestation, or as a result of climate change, are not considered wetlands constructed by artificial means. The term 'constructed' in 'wetlands constructed by artificial means' reflects a **deliberate course of action** to create and maintain over time a wetland or waterbody. So, induced wetlands are captured by the definition of 'natural wetland', meaning the Freshwater NES, Stock Exclusion regulations and NPS-FM apply.*

7. In this manner the Guidance is attempting to narrow or limit what is a "constructed wetland" to something that has an ongoing specific purpose and requires maintenance associated with that purpose. The Guidance introduces the term "unintentionally induced" and says that those wetlands should not be considered to be wetlands constructed by artificial means. It also refers to the need for a "deliberate course of action".

8. Importantly, however, the statutory definition is located in the NPS-FM and does not include any element of whether the wetland was intentionally or unintentionally constructed. This requirement for a specific "intention" has no basis in the statutory documents, nor does the concept of induced wetlands.

9. A non-statutory document cannot change the interpretation or meaning of definitions or rules in statutory documents. It is not lawful or appropriate for the Ministry to seek to limit the types of wetlands that fall within the exclusion for "wetlands constructed by artificial means" through a non-statutory guidance document. The intention of the NPS-FM and NES is clear on its wording and the new concept of "induced wetlands" seeks to limit, or is contrary to, those statutory documents.

10. Recent decisions of the Environment Court support the view that this non-statutory Guidance cannot alter the meaning of a statutory instrument:

    (a) In *Federated Farmers v Northland Regional Council* the Court expressed concerns regarding the Guidance (including that the authorship is not disclosed) and noted that it has no regulatory force. The Court commented "We have put aside any implied directions in the guideline, but the entire Court is uneasy at the implications of the documents and its potential ramifications" [1]; and

1 *Federated Farmers v Northland Regional Council* [2022] NZEnvC 016 at [29].

(b) Similarly in *Greater Wellington Regional Council v Adams* the Court confirmed that the Guidance cannot alter the definition contained in the NPS-FM:[2]

> *Firstly, we note that NPS-FM is a statutory instrument established under Part 5 (ss 45-55) RMA, changes to which must be effected in accordance with s 53.* ***The proposition that a definition contained in such a statutory instrument might be altered in some way or its application affected by operation of non-statutory instruments such as the Guidance document and hydrology tool is one with which we have extreme difficulty as a legal proposition****. The Guidance document appears to be just that, "guidance", the application of which is tempered by caveats in the document itself which we will refer to shortly but one of which makes it clear that the Guidance document does not purport to alter laws, official guidelines or requirements, a category which the definition contained in NPS-FM must surely fall into.*

11. Our view, therefore, is that the correct interpretation of the NPS-FM is that wetlands that have been created through improvement and development works on the Formosa golf course are wetlands constructed by artificial means, and are not "natural wetlands" for the purpose of the NPS-FM definition. This is the plain and ordinary meaning of the definition. If the wetland would not be there "but for" the construction works, then it follows that it was constructed (intentionally or unintentionally) by artificial means.

Yours faithfully
SIMPSON GRIERSON

Bill Loutit / Sarah Mitchell
Partner / Senior Associate

2 *Greater Wellington Regional Council v Adams* [2022] NZEnvC 25 at [136]

Appendix D: Stream Ecology Tables and Figures

- **Figure 1 – Stream Classification Map**
- **Figure 2 – Stream Assessment Sites and Impacts**
- **Table 1 – Intermittent stream classification**
- **Tables 2 to 4 – Water quality results**
- **Table 5 – Macroinvertebrate data**
- **Tables 6 and 7 – SEV summary scores**
- **ECR calculations**

LEGEND

- Site Boundary
- Live Zone boundary
- Road
- Developable Footprint
- Ecological Protected Area Network

Stream Type

- Permanent
- Intermittent
- Ephemeral
- Not Assessed

Assessed Wetlands

- Coastal vegetated wetland (mangrove wetland)
- Coastal vegetated wetland (non-mangrove-wetlands)
- Constructed freshwater wetlands (Open water)
- Constructed freshwater wetland exotic
- Constructed freshwater wetland (>50% native plant species)
- Natural freshwater wetland exotic
- Natural freshwater wetland (>50% native plant species)
- Natural freshwater wetland (species composition unknown)

Pine Harbour Ferry Terminal
Pine Harbour
Ninth View
Jack Lachlan Dr
Cadw
Kaiawa St
Mahu
Karo Rd
Town Dr
Whitford Maraetai Rd
Lydiard Pl
Kibblewhite Ave
Motukaraka Dr
Northern Catchment
Western Catchment
Formosa Golf Resort
Eastern Catchment
Southern Catchment
620 Catchment
Okaroro Dr

LOCATION PLAN

A3 SCALE 1:9,000

0 0.1 0.2 0.3 0.4 0.5 (km)

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1	Second version	JORB	ANTH	16/03/22

APPROVED: DCM DATE: MAR 22

PROJECT No. 1014358.4000

DESIGNED	JORB	MAR.22
DRAWN	JORB	MAR.22
CHECKED	ANTH	MAR.22

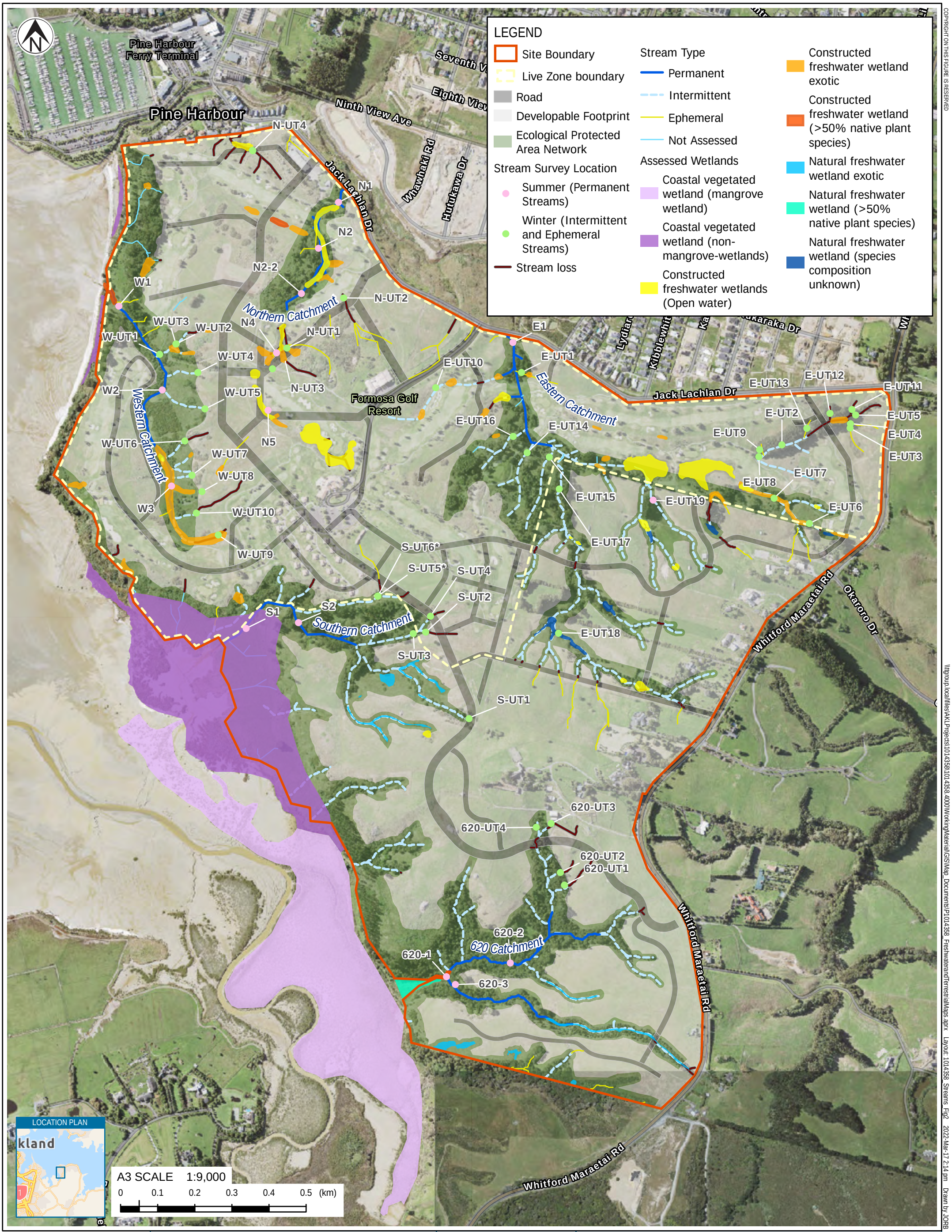
CLIENT **BEACHLANDS SOUTH LIMITED PARTNERSHIP**

PROJECT **BEACHLANDS PLAN CHANGE**

TITLE STREAM CLASSIFICATION

SCALE (A3) 1:9,000 FIG No. FIGURE 1. REV 1

\\ttgroup.local\files\AKL\Projects\1014358\1014358.4000\WorkingMaterial\GIS\Map_Documents\P1014358_FreshwaterandTerrestrialMaps.aprx Layout: 1014358_Streams_Fig1 2022-Mar-17 2:14 pm Drawn by:JORB



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CHECKED	ANTH	MAR.22	

CLIENT **BEACHLANDS SOUTH LIMITED PARTNERSHIP**
PROJECT **BEACHLANDS PLAN CHANGE**
TITLE STREAM ASSESSMENT SITES AND STREAM LOSS IMPACTS
SCALE (A3) 1:9,000 FIG No. FIGURE 2. REV 1

Table D1: Stream classification of upper tributaries watercourses indicated as potentially directly impacted by the proposed plan change. Classification criteria follows the Auckland Unitary Plan Practice and Guidance note[1].

Criteria	620_UT1	620_UT2	620_UT3	620_UT4	620_UT5	S_UT1	S_UT2	S_UT3	S_UT4	S_UT5	S_UT6	N_UT1	N_UT2
Has natural pools	✓	x	✓	x	✓	x	x	✓	✓	x	✓	x	x
Well defined channel, such that bed and banks can be distinguished	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	x	x
Contains surface water more than 48 hr after rain event which results in stream flow.	✓	?	✓	?	✓	?	?	✓	✓	?	✓	x	x
Rooted terrestrial vegetation is not established across entire cross-sectional width of channel	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organic debris resulting from floods can be seen on the floodplain	✓	x	x	x	x	x	x	x	x	x	x	x	x
Evidence of substrate sorting processes, including scour and deposition	✓	x	✓	x	x	x	x	✓	✓	x	✓	x	x

Criteria	N_UT3	N_UT4	W_UT1	W_UT2	W_UT3	W_UT4	W_UT5	W_UT6	W_UT7	W_UT8	W_UT9	W_UT10	E_UT1
Has natural pools	✓	✓	x	✓	✓	x	x	x	x	x	✓	✓	x
Well defined channel, such that bed and banks can be distinguished	✓	✓	✓	x	✓	x	✓	✓	x	x	✓	✓	x
Contains surface water more than 48 hr after rain event which results in stream flow	✓	x	✓	?	✓	x	?	?	?	x	✓	✓	?
Rooted terrestrial vegetation is not established across entire cross-sectional width of channel	✓	✓	✓	✓	x	✓	✓	x	x	✓	✓	✓	x
Organic debris resulting from floods can be seen on the floodplain	✓	x	x	x	x	x	✓	x	x	x	✓	✓	x
Evidence of substrate sorting processes, including scour and deposition	✓	✓	x	x	✓	x	x	✓	x	x	✓	✓	x

Criteria	E_UT2	E_UT3	E_UT4	E_UT5	E_UT6	E_UT7	E_UT8	E_UT9	E-UT10	E_UT11	E_UT12	E_UT13	E_UT14
Has natural pools	✓	x	x	x	x	✓	x	x	✓	x	x	x	✓
Well defined channel, such that bed and banks can be distinguished	✓	x	x	✓	x	✓	?	x	✓	✓	✓	✓	✓
Contains surface water more than 48 hr after rain event which results in stream flow	✓	x	?	?	?	✓	✓	x	✓	?	?	?	✓
Rooted terrestrial vegetation is not established across entire cross-sectional width of channel	✓	✓	✓	✓	✓	✓	✓	x	✓	x	✓	x	✓
Organic debris resulting from floods can be seen on the floodplain	✓	x	x	x	x	✓	x	x	x	x	x	x	✓
Evidence of substrate sorting processes, including scour and deposition	✓	x	x	x	x	✓	x	x	✓	x	x	x	✓

Criteria	E_UT15	E_UT16	E_UT17	E_UT18	E_UT19	E-UT18 upper tributaries*
Has natural pools	x	✓	✓	✓	✓	X
Well defined channel, such that bed and banks can be distinguished	✓	✓	✓	✓	✓	X
Contains surface water more than 48 hr after rain event which results in stream flow	?	✓	✓	✓	✓	X
Rooted terrestrial vegetation is not established across entire cross-sectional width of channel	x	✓	✓	✓	✓	X
Organic debris resulting from floods can be seen on the floodplain	x	✓	✓	✓	✓	X
Evidence of substrate sorting processes, including scour and deposition	x	✓	✓	✓	✓	X

*Tributaries as indicated in yellow as “Ephemeral Stream” in Appendix D; Figures 1 and 2

Table D2: Water quality (spot field measurements and laboratory analyses) results from samples taken during stream ecological surveys in March and April 2021.

Site	Date	Time	Temp (°C)	DO (%)	DO (mg/l)	Turbidity (NTU)	pH	Electrical conductivity (mS/m)	TSS (g/m3)	Chemical Oxygen Demand (g O2/m3)	Faecal Coliforms (cfu / 100mL)	Escherichia coli (cfu / 100mL)
			Field measurements					*Laboratory analyses*				
N1	12/03/2021	8:45	19.3	6.9	0.6	21	7	34.3	16	38	800	600
N2	12/03/2021	10:15	-	-	-	2.3	3.6	52.9	6	6	60	60
N4	12/03/2021	13:30	-	-	-	29	6.8	26.7	29	66	11,000	11,000
N5	12/03/2021	14:15	30.2	154.6	12.3	103	7.3	19.8	101	90	2,300	2,300
E1	16/03/2021	12:30	-	3.5	-	25	7	25.8	17	66	3,900	3,700
S1	15/03/2021	13:00	19.1	49.0	4.54	65	6.6	37.9	119	42	1,100	1,000
S2	16/03/2021	10:30	20.5	31.0	2.98	3.4	7.2	37	3	32	5,800	4,800
W1	15/03/2021	8:53	14.8	57.7	5.84	52	7.3	44.6	47	53	3,900	2,000
W2	15/03/2021	10:10	16.2	15.0	1.4	39	5.6	24.6	22	48	2,600	1,200
W3	15/03/2021	11:30	20.1	25.4	2.33	165	6.4	13.7	78	92	5,600	3,500
620-1	15/04/2021	9:15	12	99	10.4	3.4	7.2	33.7	*1.5**	48	220	220
620-2	15/04/2021	11:30	11.8	98.4	10.35	0.79	7.3	30	*1.5**	*12.5**	900	700
620-3	15/04/2021	13:00	11.9	98.9	10.36	4.9	7.3	26	16	*12.5**	280	230

** Concentrations below laboratory detection limits, values have been halved and italicised.*

Table D3: Metal concentrations in water quality samples taken during stream ecological surveys in March and April 2021.

Site	Date	Total Hardness (g/m3 as CaCO3)	Dissolved Calcium (g/m3)	Dissolved Magnesium (g/m3)	Dissolved Copper (g/m3)	Total Copper (g/m3)	Dissolved Zinc (g/m3)	Total Zinc (g/m3)
N1	12/03/2021	109	30	8.1	*0.00025**	*0.000265**	*0.0005**	*0.00055**
N2	12/03/2021	129	38	8.3	0.0032	0.0032	0.33	0.33
N4	12/03/2021	70	18.1	6	*0.00025**	0.00088	*0.0005**	0.0021
N5	12/03/2021	28	6	3.1	*0.00025**	0.00078	0.0011	*0.00055**
E1	16/03/2021	60	13.2	6.6	*0.00025**	*0.000265**	0.0019	0.0022
S1	15/03/2021	97	24	9.1	*0.00025**	*0.000265**	0.0024	0.0031
S2	16/03/2021	96	18.4	12.2	*0.00025**	*0.000265**	0.0021	0.0014
W1	15/03/2021	168	51	9.6	*0.00025**	0.00088	0.0026	0.0041
W2	15/03/2021	33	6.2	4.3	0.0019	0.0026	0.023	0.021
W3	15/03/2021	29	7.1	2.7	0.0032	0.0057	0.0067	0.0131
620-1	15/04/2021	119	29	11.4	*0.00025**	*0.000265**	*0.0005**	*0.00055**
620-2	15/04/2021	95	22	9.9	0.0005	0.00063	*0.0005**	0.0021
620-3	15/04/2021	73	16.5	7.7	0.0007	0.00055	*0.0005**	*0.00055**

** Concentrations below laboratory detection limits, values have been halved and italicised*

Table D4: Nutrient concentrations in water quality samples taken during stream ecological surveys in March and April 2021.

Site	Date	Total Nitrogen (g/m^3)	Total Ammoniacal-N (g/m^3)	Nitrite-N (g/m^3)	Nitrate-N (g/m^3)	Nitrate-N + Nitrite-N (g/m^3)	Soluble Inorganic Nitrogen (g/m3)	Total Kjeldahl Nitrogen (g/m^3)	Total Phosphorus (g/m^3)	Dissolved Reactive Phosphorus (g/m^3)
N1	12/03/2021	1.01	0.011	*0.001**	*0.001**	*0.001**	0.012	1.01	0.086	*0.002**
N2	12/03/2021	0.36	0.092	*0.001**	0.014	0.014	0.106	0.35	0.013	*0.002**
N4	12/03/2021	1.56	*0.005**	*0.001**	*0.01**	*0.01**	0.015	1.56	0.2	*0.002**
N5	12/03/2021	1.68	*0.005**	*0.001**	*0.001**	*0.001**	0.006	1.68	0.106	*0.002**
E1	16/03/2021	0.99	0.31	0.005	*0.001**	0.006	0.316	0.98	0.131	0.013
S1	15/03/2021	0.68	0.23	0.005	*0.001**	0.005	0.235	0.67	0.164	0.035
S2	16/03/2021	0.71	0.2	0.019	0.056	0.075	0.275	0.63	0.052	0.015
W1	15/03/2021	0.64	0.168	0.004	0.014	0.018	0.186	0.62	0.062	0.008
W2	15/03/2021	0.82	0.159	0.003	*0.001**	0.004	0.163	0.82	0.163	0.034
W3	15/03/2021	1.89	0.026	0.007	*0.001**	0.005	0.031	1.88	0.43	0.029
620-1	15/04/2021	0.51	0.181	0.005	0.024	0.028	0.209	0.48	0.177	0.119
620-2	15/04/2021	0.48	0.015	0.003	0.127	0.13	0.145	0.35	0.182	0.134
620-3	15/04/2021	0.56	0.015	0.005	0.125	0.13	0.145	0.42	0.09	0.039

** Concentrations below laboratory detection limits, values have been halved and italicised*

Table D5: Macroinvertebrate Results

T&T Steven Pratt (Hamilton) 200Fixed count + scan for rare taxa rare taxa Job No. 1014358.4000 phase 04	MCI TV	MCI-sb TV	620-1 15-Apr-21 HB	620-2 15-Apr-21 HB	620-3 15-Apr-21 HB
Ephemeroptera					
Arachnocolus	8	8.1	-	-	3
Zephlebia	7	8.8	-	2	3
Odonata					
Antipodochlora	6	6.3	1	1	-
Austrolestes	6	0.7	1	-	-
Hemiptera					
Microvelia	5	4.6	1	14	6
Coleoptera					
Elmidae	6	7.2	1	-	-
Enochrus	5	2.6	-	-	1
Hydrophilidae	5	8.0	-	-	1
Diptera					
Chironomus	1	3.4	1	8	-
Corynoneura	2	1.7	1	-	1
Hexatomini	5	6.7	-	-	1
Paradixa	4	8.5	1	8	6
Paralimnophila	6	7.4	-	-	1
Paucispinigera	6	7.7	-	-	2
Polypedilum	3	8.0	6	9	8
Stratiomyidae	5	4.2	-	1	1
Tanypodinae	5	6.5	17	10	2
Zelandotipula	6	3.6	-	-	1
Trichoptera					
Hydrobiosis	5	6.7	1	-	-
Hydropsyche - Orthopsyche	9	7.5	-	-	1
Polyplectropus	8	8.1	1	4	4
Triplectides	5	5.7	1	-	-
ACARINA	5	5.2	1	2	3
MOLLUSCA					
Gundlachia = Ferrissia	3	2.4	3	-	32
Lymnaeidae	3	1.2	-	1	-
Physa = Physella	3	0.1	6	-	1
Potamopyrgus	4	2.1	43	23	103
Sphaeriidae	3	2.9	2	1	3
PLATYHELMINTHES	3	0.9	-	1	-
NEMERTEA	3	1.8	-	1	1
OLIGOCHAETA	1	3.8	7	8	1
HIRUDINEA	3	1.2	9	1	1
CRUSTACEA					
Copepoda	5	2.4	11	21	-
Ostracoda	3	1.9	95	14	21
Paracalliope	5	5.5	3	80	1
Number of taxa (incl. rare taxa)			22	20	26
Number of rare taxa			7	5	6
Number of individuals			213	210	209
Percentage counted			35.00	25.00	20.00
%EPT richness (excl. Hydroptilidae)			13.64	10.00	15.38
%EPT abundance (excl. Hydroptilidae)			1.41	2.86	5.26
MCI			83	82	94
QMCI			3.52	4.36	3.97
MCI-sb			86	87	99
QMCI-sb			2.73	4.62	3.18
ASPM			0.18	0.17	0.22

Rare Taxa
10 specimens in vial
Samples processed by John Stark (Stark Environmental Ltd)
Data entry and calculations by John Stark

T&T Dean Miller, Steven Pratt 200Fixed count + scan for rare taxa	MCI TV	MCI-sb TV	W1 15-Mar-21 SB	W2 15-Mar-21 SB	W3 15-Mar-21 SB	N1 13-Mar-21 SB	N2 12-Mar-21 SB
Job No. 1014358.4000R							
Odonata							
Austrolestes	6	0.7	-	-	-	-	-
Xanthocnemis	5	1.2	-	-	-	47	1
Hemiptera							
Anisops	5	2.2	-	-	-	-	-
Microvelia	5	4.6	37	-	1	11	7
Coleoptera							
Enochrus	5	2.6	-	-	-	4	4
Hydraenidae	8	6.7	-	-	-	1	9
Hydrophilidae	5	8.0	1	-	-	1	-
Liodessus	5	4.9	-	-	1	-	-
Scirtidae	8	6.4	-	-	-	-	-
Diptera							
Ceratopogonidae	3	6.2	-	-	-	-	1
Chironomus	1	3.4	6	-	11	1	-
Corynoneura	2	1.7	-	-	-	-	-
Culicidae	3	1.2	1	5	15	1	6
Ephydridae	4	1.4	-	-	-	1	-
Hexatomini	5	6.7	-	-	-	-	1
Molophilus	5	6.3	-	1	-	-	-
Muscidae	3	1.6	-	-	-	-	-
Orthocladiinae	2	3.2	1	-	-	1	2
Paradixa	4	8.5	38	-	-	-	-
Paralimnophila	6	7.4	-	1	-	-	7
Paucispinigera	6	7.7	-	-	-	-	-
Polypedilum	3	8.0	-	1	-	-	40
Psychodidae	1	6.1	1	1	-	-	-
Stratiomyidae	5	4.2	-	-	-	11	-
Tanypodinae	5	6.5	2	-	-	-	-
Tanytarsus	3	4.5	-	-	-	1	-
Zelandotipula	6	3.6	-	-	-	-	2
Trichoptera							
Polyplectropus	8	8.1	-	-	-	-	-
Triplectides	5	5.7	-	-	-	-	-
Collembola	6	5.3	1	-	-	12	6
ACARINA	5	5.2	5	80	1	3	17
MOLLUSCA							
Gundlachia = Ferrissia	3	2.4	-	-	-	-	-
Lymnaeidae	3	1.2	-	-	1	1	-
Physa = Physella	3	0.1	13	-	7	1	-
Potamopyrgus	4	2.1	33	-	-	-	3
Sphaeriidae	3	2.9	7	1	-	-	-
PLATYHELMINTHES	3	0.9	1	-	4	64	6
NEMATODA	3	3.1	-	-	2	-	13
NEMERTEA	3	1.8	-	-	-	-	-
OLIGOCHAETA	1	3.8	5	37	21	5	44
HIRUDINEA	3	1.2	1	-	-	38	2
CRUSTACEA							
Cladocera	5	0.7	-	-	-	-	-
Copepoda	5	2.4	10	2	6	2	1
Ostracoda	3	1.9	42	-	137	1	1
Paracalliope	5	5.5	1	-	-	-	-
Paraleptamphopus	5	5.5	-	3	1	-	1
Paratya	5	3.6	-	-	-	-	-
Number of taxa (incl. rare taxa)			19	10	13	20	21
Number of rare taxa			1	0	4	3	0
Number of individuals			206	132	208	207	174
Percentage counted			30.00	100.00	10.00	10.00	100.00
%EPT richness (excl. Hydroptilidae)			0.00	0.00	0.00	0.00	0.00
%EPT abundance (excl. Hydroptilidae)			0.00	0.00	0.00	0.00	0.00
MCI			71	74	69	78	85
QMCI			3.78	3.75	2.79	3.90	3.39
MCI-sb			77	98	59	63	79
QMCI-sb			3.87	4.66	2.12	1.94	4.95
ASPM			0.12	0.12	0.12	0.13	0.14

Rare Taxa

10 specimens in vial

Samples processed by John Stark, & Yvonne Stark

Data entry and calculations by John Stark

200Fixed count + scan for rar MCI TV		MCI-sb TV	N2-2 12-Mar-21 SB	N4 12-Mar-21 SB	N5 12-Mar-21 SB	S1 15-Mar-21 SB	S2 16-Mar-21 HB	E1 16-Mar-21 HB
Job No. 1014358.4000R								
Odonata								
Austrolestes	6	0.7	-	-	-	-	1	3
Xanthocnemis	5	1.2	-	-	23	-	-	4
Hemiptera								
Anisops	5	2.2	-	-	1	3	-	4
Microvelia	5	4.6	30	18	-	10	8	7
Coleoptera								
Enochrus	5	2.6	1	6	2	-	1	1
Hydraenidae	8	6.7	-	1	-	-	-	-
Hydrophilidae	5	8.0	-	-	-	-	-	-
Liodessus	5	4.9	-	1	-	6	-	-
Scirtidae	8	6.4	-	2	-	-	-	-
Diptera								
Ceratopogonidae	3	6.2	-	-	-	-	-	-
Chironomus	1	3.4	2	49	1	9	2	2
Corynoneura	2	1.7	-	1	-	-	-	-
Culicidae	3	1.2	138	8	-	16	2	-
Ephydridae	4	1.4	-	3	-	-	-	-
Hexatomini	5	6.7	-	-	-	-	-	1
Molophilus	5	6.3	-	-	-	1	-	-
Muscidae	3	1.6	-	1	-	-	-	-
Orthocladiinae	2	3.2	-	1	2	1	-	-
Paradixa	4	8.5	-	-	-	-	1	3
Paralimnophila	6	7.4	-	-	-	-	-	-
Paucispinigera	6	7.7	-	-	-	1	-	1
Polypedilum	3	8.0	-	-	-	-	-	-
Psychodidae	1	6.1	1	-	-	-	-	-
Stratiomyidae	5	4.2	-	1	-	1	-	-
Tanypodinae	5	6.5	1	-	-	1	1	15
Tanytarsus	3	4.5	-	-	-	-	-	-
Zelandotipula	6	3.6	1	-	-	1	-	1
Trichoptera								
Polyplectropus	8	8.1	-	-	-	-	-	2
Triplectides	5	5.7	-	-	-	-	-	1
Collembola	6	5.3	1	1	-	-	-	1
ACARINA	5	5.2	2	1	-	5	2	4
MOLLUSCA								
Gundlachia = Ferrissia	3	2.4	-	-	-	-	1	1
Lymnaeidae	3	1.2	-	-	-	-	-	1
Physa = Physella	3	0.1	-	-	-	-	-	9
Potamopyrgus	4	2.1	29	-	-	76	136	105
Sphaeriidae	3	2.9	-	-	-	16	7	4
PLATYHELMINTHES	3	0.9	1	4	-	1	-	6
NEMATODA	3	3.1	9	20	-	14	-	1
NEMERTEA	3	1.8	-	-	-	-	-	3
OLIGOCHAETA	1	3.8	14	40	1	27	2	5
HIRUDINEA	3	1.2	4	1	1	-	3	1
CRUSTACEA								
Cladocera	5	0.7	-	-	-	-	-	1
Copepoda	5	2.4	1	5	-	4	-	2
Ostracoda	3	1.9	-	43	2	21	36	15
Paracalliope	5	5.5	-	-	-	-	4	4
Paraleptamphopus	5	5.5	-	-	-	-	-	-
Paratya	5	3.6	-	-	-	-	2	2
Number of taxa (incl. rare taxa)			15	20	8	19	16	30
Number of rare taxa			5	4	0	1	2	6
Number of individuals			235	207	33	214	209	210
Percentage counted			20.00	25.00	100.00	30.00	50.00	20.00
EPT richness (excl. Hydroptilidae)			0.00	0.00	0.00	0.00	0.00	6.67
%EPT abundance (excl. Hydroptilidae)			0.00	0.00	0.00	0.00	0.00	1.43
MCI			75	80	63	79	76	86
QMCI			3.30	2.54	4.39	3.33	3.80	4.02
MCI-sb			69	66	49	74	70	70
QMCI-sb			2.11	3.08	1.62	2.76	2.35	2.76
ASPM			0.12	0.13	0.10	0.13	0.13	0.17

Rare Taxa
10 specimens in vial
Samples processed by John Stark, & Yvonne Stark
Data entry and calculations by John Stark

Bottle No.			620_UT1	620_UT3	S_UT3	S_UT4	S_UT6
Sample No.							
Site Name							
Taxa	MCI score	MCI-sb score					
Mayfly Zephlebia	7	8.8					
Caddisfly Oxyethira	2	1.2		1			
Damselfly Xanthocnemis	5	1.2					
Bug Mesovelia	5	5					
Beetle Antiporus	5	3.5					
Beetle Hydrophilidae	5	8					
Beetle Scirtidae	8	6.4					
True Fly Chironomus	1	3.4		7			
True Fly Culicidae	3	1.2		8			
True Fly Hexatomini	5	6.7				1	
True Fly Limonia	6	6.3		1			
True Fly Orthocladiinae	2	3.2		4			
True Fly Paradixa	4	8.5		1	1		1
True Fly Paralimnophila	6	7.4					
True Fly Polypedilum	3	8					
True Fly Sciomyzidae	3	3					
True Fly Tanypodinae	5	6.5	1	9			
True Fly Zelandotipula	6	3.6	3	4		4	1
Moth Hygraula	4	1.3					
Collembola	6	5.3		1	1	3	3
Crustacea Copepoda	5	2.4					
Crustacea Isopoda	5	4.5	200	21		8	54
Crustacea Ostracoda	3	1.9		232			
Crustacea Paracorophium	5	5.5	1				
Crustacea Paraleptamphop	5	5.5	7	2	28	180	158
Crustacea Talitridae	5	5					
SPIDERS Dolomedes	5	6.2	3		2		3
Mollusc Gyraulus	3	1.7				2	
Mollusc Physa	3	0.1					
Mollusc Potamopyrgus	4	2.1				9	
Mollusc Sphaeriidae	3	2.9					
OLIGOCHAETES	1	3.8	1	2	1	4	2
FLATWORMS	3	0.9		1			
Rhabdocoel Flatworms	3	0.9					
NEMERTEANS	3	1.8					
Number of Taxa			7	14	5	8	7
EPT Value			0	0	0	0	0
Number of Individuals			216	294	33	211	222
% EPT (taxa number)			0	0	0	0	0
Sum of recorded scores			35.6	55.8	29.3	33.2	37.4
SBMCI Value			101.71	79.71	117.20	83.00	106.86
Sum of abundance load			983.7	695.2	184	1100.5	1166.2
QMCI-sb Value			4.55	2.36	5.58	5.22	5.25
			1/2 scanned for VA taxa	1/4 scanned for VA taxa		1/2 scanned for VA taxa	1/2 scanned for VA taxa

Bottle No.			E_UT2	E_UT7	E_UT10	E_UT14	E_UT16	W_UT9
Sample No.								
Site Name								
Taxa	MCI score	MCI-sb score						
Mayfly Zephlebia	7	8.8	4					
Caddisfly Oxyethira	2	1.2						
Damselfly Xanthocnemis	5	1.2	13					
Bug Mesovelia	5	5			2			
Beetle Antiporus	5	3.5			2			
Beetle Hydrophilidae	5	8	1				1	
Beetle Scirtidae	8	6.4					6	
True Fly Chironomus	1	3.4		1				
True Fly Culicidae	3	1.2					1	
True Fly Hexatomini	5	6.7				1		
True Fly Limonia	6	6.3						
True Fly Orthocladiinae	2	3.2						
True Fly Paradixa	4	8.5	5	17	1		1	
True Fly Paralimnophila	6	7.4	3					
True Fly Polypedilum	3	8		1				
True Fly Sciomyzidae	3	3	1					1
True Fly Tanypodinae	5	6.5	24	3				
True Fly Zelandotipula	6	3.6			2			
Moth Hygraula	4	1.3			1			
Collembola	6	5.3	1			2	19	5
Crustacea Copepoda	5	2.4			1			
Crustacea Isopoda	5	4.5		2	24		2	4
Crustacea Ostracoda	3	1.9	55	2	67			
Crustacea Paracorophium	5	5.5			1			
Crustacea Paraleptamphop	5	5.5		200	1	240	196	
Crustacea Talitridae	5	5						1
SPIDERS Dolomedes	5	6.2	1	2	1			
Mollusc Gyraulus	3	1.7	1				1	1
Mollusc Physa	3	0.1			1			48
Mollusc Potamopyrgus	4	2.1	38	4		4	7	12
Mollusc Sphaeriidae	3	2.9	56	1				
OLIGOCHAETES	1	3.8	7	8	53		2	21
FLATWORMS	3	0.9		9	45		13	11
Rhabdocoel Flatworms	3	0.9					1	
NEMERTEANS	3	1.8		2		2		3
Number of Taxa			14	13	14	5	12	10
EPT Value			1	0	0	0	0	0
Number of Individuals			210	252	202	249	250	107
% EPT (taxa number)			7.14	0	0	0	0	0
Sum of recorded scores			67.3	56	52.7	21.4	48.8	28.2
SBMCI Value			96.14	86.15	75.29	85.60	81.33	56.40
Sum of abundance load			669	1354	530.9	1349.3	1280.4	179.3
QMCI-sb Value			3.19	5.37	2.63	5.42	5.12	1.68
				1/2 scanned for VA taxa		1/4 scanned for VA taxa	1/2 scanned for VA taxa	

Bottle No.			E-UT17	
			3/10/2021	
Sample No.				
Site Name				
Taxa	MCI score	MCI-sb score		
Stonefly Acroperla	5	5.1		1
Caddisfly Oxyethira	2	1.2		6
Caddisfly Paroxyethira	2	3.7		1
Caddisfly Polyplectropus	8	8.1		2
Bug Microvelia	5	4.6		1
Beetle Hydrophilidae	5	8		21
Beetle Liodessus	5	4.9		2
Beetle Scirtidae	8	6.4		1
Beetle Staphylinidae	5	6.2		1
True Fly Austrosimulium	3	3.9		70
True Fly Chironomus	1	3.4		3
True Fly Corynoneura	2	1.7		2
True Fly Hexatomini	5	6.7		1
True Fly Nothodixa	4	9.3		1
True Fly Orthocladiinae	2	3.2		6
True Fly Paradixa	4	8.5		2
True Fly Polypedilum	3	8		5
True Fly Tanypodinae	5	6.5		1
True Fly Tanytarsini	3	4.5		10
True Fly Zelandotipula	6	3.6		7
Collembola	6	5.3		5
Crustacea Cladocera	5	0.7		1
Crustacea Isopoda	5	4.5		3
Crustacea Paraleptamphopus	5	5.5		3
Crustacea Phreatogammarus	5	5		2
Crustacea Talitridae	5	5		1
MITES	5	5.2		5
Mollusc Potamopyrgus	4	2.1		48
OLIGOCHAETES	1	3.8		4
FLATWORMS	3	0.9		1
Number of Taxa				30
EPT Value				2
Number of Individuals				217
% EPT (taxa number)				6.67
Sum of recorded scores				145.50
SBMCI Value				97.00
Sum of abundance load				897.80
QMCI-sb Value				4.14

13/16 examined for 200 count

Table D6: Stream Ecological Valuation summary scores for stream ecological monitoring sites visited in March and April 2021.

Function Type	Function	Northern				Eastern	Southern		Western			620		
		N1	N2	N2-2	N5*	E1	S1	S2	W1	W2	W3	620-1	620-2	620-3
Hydraulic	Natural flow regime maintained	0.67	0.92	0.94	0.33	0.64	0.66	0.61	0.80	0.74	0.8	0.83	0.83	0.93
	Connectivity to floodplain intact / Floodplain effectiveness	0.40	0.73	0.56	0.00	0.35	0.08	0.68	0.61	0.43	0.36	0.52	0.40	0.91
	Connectivity for species migrations	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30	1.00	1.00	1.00	1.00	1.00
	Connectivity to groundwater intact	0.75	0.85	0.89	0.60	0.95	0.71	0.95	0.67	0.69	0.67	0.93	0.92	0.97
Biogeochemical	Water temperature controlled	0.06	0.88	0.60	0.00	0.40	0.08	0.60	0.38	0.50	0.14	0.8	0.8	0.84
	Dissolved oxygen maintained	0.17	0.50	0.50	0.17	0.50	0.17	0.50	0.45	0.20	0.34	0.34	0.40	0.34
	Organic matter input maintained	0.50	0.40	0.70	0.10	0.60	0.50	0.50	0.50	0.40	0.20	1.00	1.00	0.80
	Instream particles retained	0.40	0.92	0.92	0.00	0.96	0.74	0.91	0.60	0.66	0.60	0.90	0.90	0.96
	Decontamination of pollutants	0.50	0.74	0.71	0.49	0.54	0.36	0.80	0.64	0.68	0.45	0.98	1.0	0.99
Habitat provision	Fish spawning habitat intact	0.11	0.56	0.28	0.05	0.53	0.05	0.05	0.09	0.10	0.05	0.16	0.10	0.10
	Habitat for aquatic fauna intact	0.30	0.54	0.51	0.18	0.65	0.23	0.53	0.54	0.42	0.34	0.74	0.75	0.68
Biodiversity	Fish fauna intact	0.23	0.23	0.23	0.23	0.77	0.00	0.50	0.23	0.00	0.00	0.57	0.57	0.47
	Invertebrate fauna intact	0.09	0.28	0.21	0.08	0.23	0.20	0.15	0.24	0.29	0.11	0.31	0.25	0.37
	Riparian vegetation intact	0.18	0.56	0.41	0.00	0.31	0.09	0.34	0.44	0.19	0.14	0.80	0.70	0.52
Overall SEV score		**0.383**	**0.651**	**0.606**	**0.232**	**0.546**	**0.349**	**0.580**	**0.464**	**0.449**	**0.370**	**0.705**	**0.688**	**0.706**

*N5 was collected on site however features of this location are more akin to a wetland and has been assessed and accounted for separately within the wetland report.

Table D7: Stream Ecological Valuation summary scores for stream ecology assessment sites visited in March and April 2021.

Function Type	Function	Northern		Eastern									Southern			Western		620	
		N-UT3	N-UT4	E-UT2	E-UT7	E-UT8	E-UT10	E-UT14	E-UT16	E-UT17	E-UT18	E-UT19	S-UT3	S-UT4	S-UT6	W-UT3	W-UT9	620-UT1	620-UT3
Hydraulic	Natural flow regime maintained	0.40	0.67	0.27	0.18	0.40	0.35	0.87	0.67	0.14	0.53	0.67	0.67	0.67	0.47	0.87	0.14	0.56	0.40
	Connectivity to floodplain intact / Floodplain effectiveness	0.20	0.10	0.50	0.68	0.37	0.14	0.34	0.11	0.68	0.18	0.30	0.16	0.10	0.10	0.19	0.10	0.06	0.29
	Connectivity for species migrations	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Connectivity to groundwater intact	0.73	0.87	0.81	0.97	0.73	0.79	0.80	0.87	0.95	0.83	0.75	0.87	0.87	0.87	0.95	0.71	0.81	0.73
Biogeochemical	Water temperature controlled	0.36	0.22	0.58	0.36	0.06	0.20	0.44	0.48	0.52	0.18	0.04	0.80	0.64	0.58	0.80	0.48	0.32	0.02
	Dissolved oxygen maintained	0.60	0.50	0.34	0.68	1.00	0.50	0.50	0.50	1.00	0.34	0.45	1.00	1.00	1.00	1.00	1.00	1.00	0.50
	Organic matter input maintained	0.00	0.00	0.47	0.25	0.00	0.00	0.20	0.00	0.70	0.01	0.20	0.25	0.03	0.00	0.20	0.00	0.00	0.00
	Instream particles retained	0.20	0.80	0.84	0.20	0.00	0.30	0.60	0.47	0.32	0.20	0.40	0.80	0.42	0.66	0.92	0.56	0.55	0.20
	Decontamination of pollutants	0.55	0.47	0.74	0.77	0.74	0.46	0.60	0.57	0.32	0.41	0.20	0.90	0.62	0.62	0.50	0.50	0.60	0.63

Function Type	Function	Northern		Eastern									Southern			Western		620	
		N-UT3	**N-UT4**	**E-UT2**	**E-UT7**	**E-UT8**	**E-UT10**	**E-UT14**	**E-UT16**	**E-UT17**	**E-UT18**	**E-UT19**	**S-UT3**	**S-UT4**	**S-UT6**	**W-UT3**	**W-UT9**	**620-UT1**	**620-UT3**
Habitat provision	Fish spawning habitat intact	0.05	0.05	0.23	0.18	0.05	0.05	0.16	0.40	0.23	0.53	0.05	0.05	0.05	0.05	0.12	0.05	0.16	0.05
	Habitat for aquatic fauna intact	0.34	0.29	0.46	0.27	0.31	0.31	0.46	0.43	0.60	0.46	0.38	0.60	0.46	0.44	0.50	0.44	0.39	0.20
Biodiversity	Fish fauna intact	0.29	0.29	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.63	0.63	0.63	0.00	0.00	0.71	0.71
	Invertebrate fauna intact	0.21*	0.21*	0.48	0.37	0.48*	0.23	0.26	0.30	0.85	0.85	0.85	0.41	0.29	0.38	0.18*	0.18	0.33	0.42
	Riparian vegetation intact	0.13	0.00	0.30	0.33	0.16	0.02	0.00	0.00	0.12	0.28	0.24	0.00	0.00	0.00	0.03	0.00	0.07	0.12
Overall SEV score		**0.361**	**0.391**	**0.498**	**0.513**	**0.447**	**0.379**	**0.513**	**0.482**	**0.538**	**0.471**	**0.392**	**0.581**	**0.484**	**0.485**	**0.519**	**0.369**	**0.468**	**0.377**

*TN: No macroinvertebrate sample was collected at this site. Invertebrate data has been used from closest representative site for this score.

SEV Scores and Stream Wet Widths

SEVi-P Potential scores without fish and invertebrate biodiversity functions

Function category	Function	Site																	
		N-UT3 P	N-UT4 P	E-UT2 P	E-UT7 P	E-UT8 P	E-UT10 P	E-UT14 P	E-UT16 P	S-UT2 P	S-UT4 P	S-UT6* P	W-UT3 P	W-UT9 P	620-UT1 P	620-UT3 P	E_UT17	E_UT18	E_UT19
Hydraulic	NFR	0.400	0.667	0.268	0.180	0.400	0.355	0.867	0.667	0.667	0.667	0.467	0.867	0.138	0.560	0.400	0.136	0.533	0.667
Hydraulic	FLE	0.680	0.200	0.639	0.940	0.940	0.600	0.600	0.200	0.200	0.200	0.200	0.666	0.196	0.280	1.000	0.980	0.902	0.980
Hydraulic	CSM	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	0.000
Hydraulic	CGW	0.733	0.867	0.813	0.967	0.733	0.787	0.800	0.867	0.867	0.867	0.867	0.947	0.707	0.813	0.733	0.947	0.833	0.750
Haydraulic mean score		**0.703**	**0.683**	**0.430**	**0.772**	**0.768**	**0.685**	**0.817**	**0.683**	**0.683**	**0.683**	**0.633**	**0.870**	**0.510**	**0.663**	**0.783**	**0.516**	**0.817**	0.599
Biogeochemical	WTC	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.520	0.180	0.800
Biogeochemical	DOM	0.600	0.503	0.335	0.675	1.000	0.503	0.503	0.503	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.335	0.450
Biogeochemical	OMI	0.500	0.500	1.000	1.000	1.000	1.000	1.000	1.000	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Biogeochemical	IPR	0.200	0.800	0.840	0.200	0.200	0.440	0.600	0.735	0.800	0.710	0.800	0.920	0.560	0.560	0.200	0.320	0.200	0.400
Biogeochemical	DOP	0.893	0.740	0.900	0.773	0.839	0.760	0.796	0.837	0.900	0.717	0.616	0.808	0.603	0.900	0.900	0.624	0.710	0.502
Biogeochemical mean score		**0.599**	**0.668**	**0.775**	**0.690**	**0.768**	**0.701**	**0.740**	**0.775**	**0.800**	**0.745**	**0.743**	**0.806**	**0.693**	**0.752**	**0.680**	**0.593**	**0.385**	**0.530**
Habitat provision	FSH	0.050	0.050	0.225	0.175	0.050	0.050	0.156	0.400	0.050	0.050	0.050	0.119	0.050	0.156	0.050	0.225	0.525	0.050
Habitat provision	HAF	0.520	0.484	0.558	0.412	0.567	0.507	0.593	0.569	0.663	0.582	0.582	0.611	0.593	0.598	0.463	0.713	0.614	0.554
Habitat provision mean score		**0.285**	**0.267**	**0.391**	**0.293**	**0.308**	**0.279**	**0.374**	**0.485**	**0.357**	**0.316**	**0.316**	**0.365**	**0.322**	**0.377**	**0.257**	**0.469**	**0.569**	**0.302**
Biodiversity	RVI	0.800	0.000	0.346	0.494	0.760	0.136	0.000	0.000	0.000	0.000	0.000	0.152	0.000	0.560	0.720	0.309	0.680	0.680
Biodiversity mean score		**0.800**	**0.000**	**0.346**	**0.494**	**0.760**	**0.136**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.152**	**0.000**	**0.560**	**0.720**	**0.309**	**0.680**	**0.680**
Overall SEV score		**0.598**	**0.551**	**0.560**	**0.635**	**0.691**	**0.578**	**0.643**	**0.631**	**0.621**	**0.591**	**0.573**	**0.699**	**0.512**	**0.644**	**0.647**	**0.523**	**0.584**	**0.528**

SEVc-C Current scores without fish and invert biodiversity functions

Function category	Function	Site																	
		N1	N2	N2-2	N-UT4	E1	S1	S2	W1	W2	W3	620-1	620-2	620-3	E-UT7	E-UT8	E-UT10	E_UT14	E_UT16
Hydraulic	NFR	0.670	0.920	0.940	0.670	0.640	0.660	0.610	0.800	0.740	0.800	0.830	0.830	0.930	0.180	0.400	0.350	0.867	0.667
Hydraulic	FLE	0.400	0.730	0.560	0.100	0.350	0.080	0.680	0.610	0.430	0.360	0.520	0.400	0.910	0.680	0.370	0.140	0.336	0.000
Hydraulic	CSM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.300	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hydraulic	CGW	0.750	0.850	0.890	0.870	0.950	0.710	0.950	0.670	0.690	0.670	0.930	0.920	0.970	0.970	0.730	0.790	0.800	0.867
Haydraulic mean score		**0.705**	**0.875**	**0.848**	**0.660**	**0.735**	**0.613**	**0.810**	**0.595**	**0.715**	**0.708**	**0.820**	**0.788**	**0.953**	**0.708**	**0.630**	**0.570**	**0.751**	**0.633**
Biogeochemical	WTC	0.060	0.880	0.600	0.220	0.400	0.080	0.600	0.380	0.500	0.140	0.800	0.800	0.840	0.360	0.060	0.200	0.440	0.480
Biogeochemical	DOM	0.170	0.500	0.500	0.500	0.500	0.170	0.500	0.450	0.200	0.340	0.340	0.400	0.340	0.680	1.000	0.500	0.503	0.503
Biogeochemical	OMI	0.500	0.400	0.700	0.000	0.600	0.500	0.500	0.500	0.400	0.200	1.000	1.000	0.800	0.250	0.000	0.000	0.200	0.000
Biogeochemical	IPR	0.400	0.920	0.920	0.800	0.960	0.740	0.910	0.600	0.660	0.600	0.900	0.900	0.960	0.200	0.000	0.300	0.600	0.465
Biogeochemical	DOP	0.500	0.740	0.710	0.470	0.540	0.360	0.800	0.640	0.680	0.450	0.980	1.000	0.990	0.770	0.740	0.460	0.596	0.567
Biogeochemical mean score		**0.326**	**0.688**	**0.686**	**0.398**	**0.600**	**0.370**	**0.662**	**0.514**	**0.488**	**0.346**	**0.804**	**0.820**	**0.786**	**0.452**	**0.360**	**0.292**	**0.468**	**0.403**
Habitat provision	FSH	0.110	0.560	0.280	0.050	0.530	0.050	0.050	0.090	0.100	0.050	0.160	0.100	0.100	0.180	0.050	0.050	0.156	0.400
Habitat provision	HAF	0.300	0.540	0.510	0.290	0.650	0.230	0.530	0.540	0.420	0.340	0.740	0.750	0.680	0.270	0.310	0.310	0.459	0.432
Habitat provision mean score		**0.205**	**0.550**	**0.395**	**0.170**	**0.590**	**0.140**	**0.290**	**0.315**	**0.260**	**0.195**	**0.450**	**0.425**	**0.390**	**0.225**	**0.180**	**0.180**	**0.308**	**0.416**
Biodiversity	RVI	0.180	0.560	0.410	0.000	0.310	0.090	0.340	0.440	0.190	0.140	0.800	0.700	0.520	0.330	0.160	0.020	0.000	0.000
Biodiversity mean score		**0.180**	**0.560**	**0.410**	**0.000**	**0.310**	**0.090**	**0.340**	**0.440**	**0.190**	**0.140**	**0.800**	**0.700**	**0.520**	**0.330**	**0.160**	**0.020**	**0.000**	**0.000**
Overall SEV score		**0.420**	**0.717**	**0.668**	**0.414**	**0.619**	**0.389**	**0.623**	**0.502**	**0.501**	**0.424**	**0.750**	**0.733**	**0.753**	**0.489**	**0.402**	**0.343**	**0.496**	**0.448**

SEVc-C Current scores without fish and invert biodiversity functions

Function category	Function	Site							
		E_UT17	E_UT18	E_UT19	S-UT4	W-UT3	S-UT6	S2	S2
Hydraulic	NFR	0.136	0.533	0.667	0.667	0.867	0.470	0.607	0.260
Hydraulic	FLE	0.680	0.184	0.300	0.104	0.190	0.100	0.720	0.680
Hydraulic	CSM	0.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000
Hydraulic	CGW	0.947	0.833	0.750	0.867	0.947	0.870	0.947	0.947
Haydraulic mean score		**0.441**	**0.638**	**0.429**	**0.659**	**0.751**	**0.610**	**0.818**	**0.722**
Biogeochemical	WTC	0.520	0.180	0.040	0.640	0.800	0.580	0.640	0.600
Biogeochemical	DOM	1.000	0.335	0.450	1.000	1.000	1.000	0.503	0.335
Biogeochemical	OMI	0.700	0.010	0.200	0.033	0.200	0.000	1.000	1.000
Biogeochemical	IPR	0.320	0.200	0.400	0.420	0.920	0.660	0.913	0.913
Biogeochemical	DOP	0.324	0.410	0.202	0.617	0.498	0.620	0.800	0.800
Biogeochemical mean score		**0.573**	**0.227**	**0.258**	**0.542**	**0.684**	**0.572**	**0.771**	**0.730**
Habitat provision	FSH	0.225	0.525	0.050	0.050	0.119	0.050	0.050	0.050
Habitat provision	HAF	0.596	0.462	0.383	0.457	0.500	0.440	0.536	0.523
Habitat provision mean score		**0.410**	**0.493**	**0.216**	**0.253**	**0.309**	**0.245**	**0.293**	**0.287**
Biodiversity	RVI	0.282	0.120	0.240	0.000	0.028	0.000	0.357	0.257
Biodiversity mean score		**0.282**	**0.120**	**0.240**	**0.000**	**0.028**	**0.000**	**0.357**	**0.257**
Overall SEV score		**0.477**	**0.399**	**0.307**	**0.488**	**0.589**	**0.483**	**0.673**	**0.614**

Stream widths for intermittent streams

SEV cross-section		N-UT3	N-UT4	E-UT2	E-UT7	E-UT8	E-UT10	E-UT14	E-UT16	S-UT3	S-UT4	S-UT6*	W-UT3	W-UT9	620-UT1	620-UT3	E_UT17	E_UT18	E_UT19
Stream wet width (m)	1	0.07	0.4	1.1	0.28	0.17	0.2	0.1	0.95	0.11	0.16	0.38	0.15	0.16	0.25	0.23	0.58	E_UT17	1.5
	2	0.07	0.3	0.37	0.7	0.52	0.12	0.48	0.8	0.07	0.1	0.22	0.16	0.55	0.3	0.35	0.55	E_UT17	1
	3	0.08	0.17	0.26	0.55	0.2	0.12	0.76	0.38	0.35	0.22	0.2	0.28	0.38	0.35	0.63	0.37	E_UT17	1.1
	4	0.1	0.14	0.3	0.5	0.15	0.28	0.32	0.48	0.35	0.26	0.15	0.3	0.35	0.12	0.35	0.346	0.48	0.346
	5	0.13	0.2	0.9	0.21	0.12	0.32	0.58	0.3	0.3	0.18	0.32	0.27	0.42	0.18	0.59	0.6	0.03	0.6
	6	0.07	0.2	0.15	0.32	0.21	0.17	0.49	0.15	0.09	0.4	0.3	0.28	0.4	0.2	0.56	0.57	0.15	0.57
	7	0.09	0.1	0.93	0.27	0.39	0.34	0.22	0.45	0.12	0.05	0.09	0.27	0.3	0.33	0.35	0.86	0.45	0.86
	8	0.05	0.1	0.4	0.47	0.3	0.4	0.38	0.38	0.3	0.35	0.11	0.13	0.29	0.01	0.43	0.85	0.38	0.85
	9	0.08	0.1	0.33	0.41	0.38	0.4	0.37	0.18	0.25	0.45	0.3	0.35	0.3	0.15	0.55	0.7	0.18	0.7
	10	0.1	0.1	0.55	0.68	0.65	0.34	0.15	0.1	0.32	0.26	0.18	0.28	0.32	0.015	0.95	0.61	0.1	0.61
Wetted width min (m)		0.05	0.10	0.15	0.21	0.12	0.12	0.10	0.10	0.07	0.05	0.09	0.13	0.16	0.01	0.23	0.35	0.03	0.35
Wetted width max (m)		0.13	0.40	1.10	0.70	0.65	0.40	0.76	0.95	0.35	0.45	0.38	0.35	0.55	0.35	0.95	0.86	0.48	1.50
Mean wetted width (m)		0.08	0.18	0.53	0.44	0.31	0.27	0.39	0.42	0.23	0.24	0.23	0.25	0.35	0.19	0.50	0.60	0.25	0.81
Median wetted width (m)		0.08	0.155	0.385	0.44	0.255	0.3	0.375	0.38	0.275	0.24	0.21	0.275	0.335	0.19	0.49	0.59	0.18	0.775

Stream loss length and area for intermittent streams (no permanent streams impacted)

Site	N-UT2	N-UT3	N-UT4	E-UT2	E-UT5*	E-UT8	E-UT10	E-UT11*	E-UT12*	E-UT13*	E-UT20*	S-UT2	S-UT3	S-UT4	S-UT5*
Stream linear length lost	82.09	94.00	423.00	50.00	77.00	150.00	387.00	40.00	35.00	33.00	50.00	86.00		40.35	30.06
Stream area lost based on median width	6.57	7.52	65.57	19.25	19.64	38.25	116.10	10.20	8.93	8.42	7.75	23.65		9.68	6.31
Site	**S-UT6***	**W-UT3**	**W-UT5**	**W-UT6**	**W-UT9**	**W-UT10**	**620-UT1**	**620-UT2**	**620-UT3**	**620-UT5**	**E_UT17**	**E_UT18**	**E_UT19**	**Adjacent to E-UT19**	
Stream linear length lost	30.53	43.19	5.00	59.89	92.47	150.57	99.09	44.03	115.00	33.00	18.00	150.00	18.00	150.00	
Stream area lost based on median width	6.41	11.88	1.38	16.47	30.98	50.44	18.83	8.37	56.35	6.27	13.95	88.50	4.50	37.50	

*Dry at time of survey. Median width for UT8 applied for the purposes of giving a an approximate width (this is a conservative overestimate).

Stream widths for permanent reaches and area available for offset

SEV cross-section		N1	N2	N2-2	E1	S1	S2	W1	W2	W3
Stream wet width (m)	1	0.70	1.05	0.70	1.60	1.10	1.10	0.40	0.55	0.70
	2	0.80	0.25	0.80	1.80	0.50	0.20	0.50	0.45	1.10
	3	0.70	0.48	0.70	0.90	0.35	1.20	0.80	0.40	0.80
	4	0.80	0.65	0.80	0.40	1.40	2.40	1.20	0.55	0.70
	5	0.60	0.54	0.60	1.30	0.80	0.90	0.90	0.70	0.50
	6	0.50	0.25	0.50	1.40	0.35	0.60	1.40	0.60	0.20
	7	0.70	0.55	0.70	1.30	0.20	0.10	0.90	0.20	0.15
	8	0.60	1.00	0.60	1.50	0.20	0.90	0.75	0.50	0.20
	9	0.70	0.12	0.70	0.55	0.15	0.45	0.75	0.30	0.20
	10	-	0.00	0.00	1.35	0.45	1.20	1.00	0.03	0.20
Wetted width min (m)		0.50	0.00	0.00	0.40	0.15	0.10	0.40	0.03	0.15
Wetted width max (m)		0.80	1.05	0.80	1.80	1.40	2.40	1.40	0.70	1.10
Mean wetted width (m)		0.68	0.49	0.61	1.21	0.55	0.91	0.86	0.43	0.48
Median wetted width (m)		0.70	0.51	0.70	1.33	0.40	0.90	0.85	0.48	0.35
Stream linear length approx		45.00	206.00	65.00	50.00	250.00	115.00	328.40	212.79	88.87
Stream area using median		31.50	105.06	45.50	66.25	100.00	103.50	279.14	101.07	31.10

Stream widths for remaining intermittent reaches (non-impacted reaches available for offset)

Site	Southern	Western	E-UT6	E_UT7	E_UT14	E_UT16	E_UT19	E_UT18	E_UT17	E_UT14	E_UT16
Stream linear length approx	955.0	783.0	233.4	233.3	277.8	236.5	1158.0	1679.0	420.0	0.1	1.0
Stream area using median	229.2	215.3	102.7	102.7	163.9	42.6	897.5	1301.2	325.5	0.8	0.4

ECR Calculations for the Live Zone

ECR	=	[(SEVi-P - SEVi-I)	/	(SEVm-P - SEVm-C)]	x 1.5

Live Zone Catchment	Impact reach	SEVi-P	SEVi-I	Offset reach	SEVm-P	SEVm-C	= ECR
Eastern Catchment	E-UT2	0.56	0.0	E1 - piped reach	0.7	0.20	1.68
	E-UT13	0.56	0.0	E1 - piped reach	0.7	0.20	1.68
	E-UT12	0.56	0.0	E1 - piped reach	0.7	0.20	1.68
	E-UT5	0.56	0.0	E-UT18	0.7	0.40	2.80
	E-UT11	0.56	0.0	E-UT8	0.7	0.40	2.82
	E-UT20	0.55	0.0	E-UT7	0.7	0.49	3.92
Northern Catchment	N-UT2	0.60	0.0	W1	0.7	0.50	4.52
	N-UT3	0.60	0.0	E-UT10	0.7	0.34	2.52
	N-UT4	0.55	0.0	E-UT10	0.7	0.34	2.32
	N-UT4	0.55	0.0	W1	0.7	0.50	4.17
	N-UT4	0.55	0.0	S-UT6 (lower trib)	0.7	0.48	3.80
Southern Catchment	S-UT2	0.62	0.0	S1	0.7	0.39	2.99
	S-UT4	0.59	0.0	S1	0.7	0.39	2.85
	S-UT5*	0.57	0.0	S2	0.7	0.62	11.10
	S-UT6*	0.57	0.0	W2	0.7	0.50	4.32
	S-UT7	0.57	0.0	W1	0.7	0.50	4.34
Western Catchment	W-UT3	0.70	0.0	W1	0.7	0.50	5.29
	W-UT5	0.70	0.0	W1	0.7	0.50	5.29
	W-UT6	0.70	0.0	W1	0.7	0.50	5.29
	W-UT10	0.51	0.0	W2	0.7	0.50	3.86
	W-UT10	0.51	0.0	Western tribs	0.7	0.59	6.89

ECR Offset Calculations for the Live Zone

Catchment Order	Impact reach	Linear length	Area lost	ECR	Stream area needed	Stream area available	Offset reach	Balance	Comment
1 - Western Catchment	W-UT3	43.2	11.9	5.29	62.8	279.1	W1	216.3	Working number
	W-UT5	5.0	1.4	5.29	7.3	216.3	W1	209.1	Working number
	W-UT6	59.9	16.5	5.29	87.1	209.1	W1	122.0	Surplus applied to S-UT7
	W-UT10	150.6	20.4	3.86	78.9	101.1	W2	22.2	Surplus applied to S-UT6
			30.0	6.89	206.8	215.3	Western tribs	8.5	Gain
2 - Southern Catchment	S-UT2	86.0	23.7	2.99	70.8	100.0	S1	29.2	Working number
	S-UT4	40.4	9.7	2.85	27.6	29.2	S1	1.6	Gain
	S-UT5*	30.1	6.3	11.10	70.1	103.5	S2	33.4	Gain
	S-UT6*	30.5	6.4	4.32	27.7	22.2	W2	-5.5	Minor deficit
	S-UT7	25.0	6.4	4.34	27.8	122.0	W1	94.2	Surplus applied to N-UT2
3 - Northern Catchment	N-UT2	82.1	6.6	4.52	29.7	94.2	W1	64.5	Surplus applied to N-UT4
	N-UT3	94.0	7.5	2.52	18.9	116.1	E-UT10	97.2	Working number
	N-UT4	423.0	41.0	2.32	95.0	97.2	E-UT10	2.2	Gain
	N-UT4		15.0	4.17	62.5	64.5	W1	2.0	Gain
	N-UT4		9.6	3.80	36.5	37.8	S-UT6 (lower reach)	1.3	Gain
4 - Eastern Catchment	E-UT2	50.0	19.3	1.68	32.4	66.3	E1 (piped)	33.9	Working number
	E-UT13	33.0	8.4	1.68	14.1	33.9	E1 (piped)	19.7	Working number
	E-UT12	35.0	8.9	1.68	15.0	19.7	E1 (piped)	4.7	Gain
	E-UT5	77.0	19.6	2.80	54.8	88.5	E-UT18 Tribs	33.7	Gain
	E-UT11	40.0	10.2	2.82	28.7	38.3	E-UT8	9.5	Surplus applied to E-UT20
	E-UT20	50.0	6.0	3.92	23.5	26.4	E-UT7	2.9	Gain
	E-UT20		1.8	2.82	5.1	9.7	E-UT8	4.6	Gain

Appendix E: Coastal Marine Ecology Tables and Figures

- **Figure 1. Auckland Council Significant Ecological Areas – Marine and Terrestrial**
- **Figure 2. Habitat map and survey locations**
- **Figure 3. Bird Counts:**
    - **Figure 3a. March 5th**
    - **Figure 3b. March 22nd**
    - **Figure 3c. March 23rd**
    - **Figure 3d. March 24th**
    - **Figure 3e. April 19th**
    - **Figure 3f. May 13th**
- **Table 1 – Coastal avifauna survey results**
- **Table 2 – Infauna raw data**
- **Epifauna quadrat photographs**
- **Laboratory transcripts**

\\ttgroup.local\files\AKLProjects\1014358\1014358.4000\WorkingMaterial\GIS\Map_Documents\P1014358_FreshwaterandTerrestrialMaps.aprx Layout: 1014358_SEAs_Fig1_Land 2022-Mar-11 6:11 pm Drawn by JORB

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NOTES:

Hybrid Reference Layer: LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS. World Imagery: Waikato Regional, Maxar. New Zealand Imagery.lyr: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, ©

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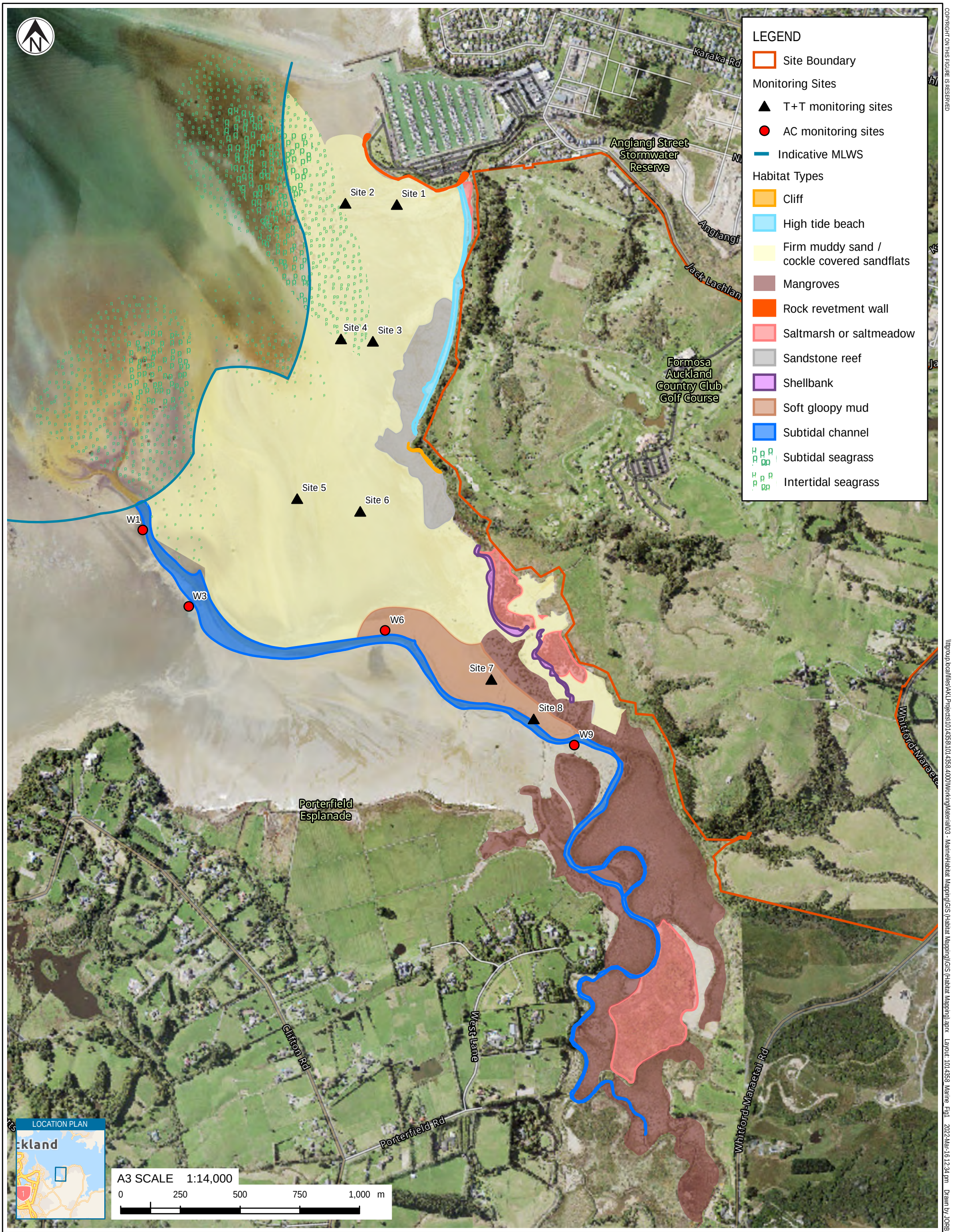
TITLE AUCKLAND COUNCIL SIGNIFICANT ECOLOGICAL AREAS

SCALE (A4) 1:35,000 FIG No. FIGURE 1. REV 0



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NOTES: Stream lines derived from overland flow paths produced by Auckland Council. Licensed for reuse under Creative Commons 4.0.
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0	First version	KARO	JORB	16/03/22

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TITLE MARINE HABITATS AND MONITORING SITES
SCALE (A3) 1:14,000 FIG No. FIGURE 2. REV 0

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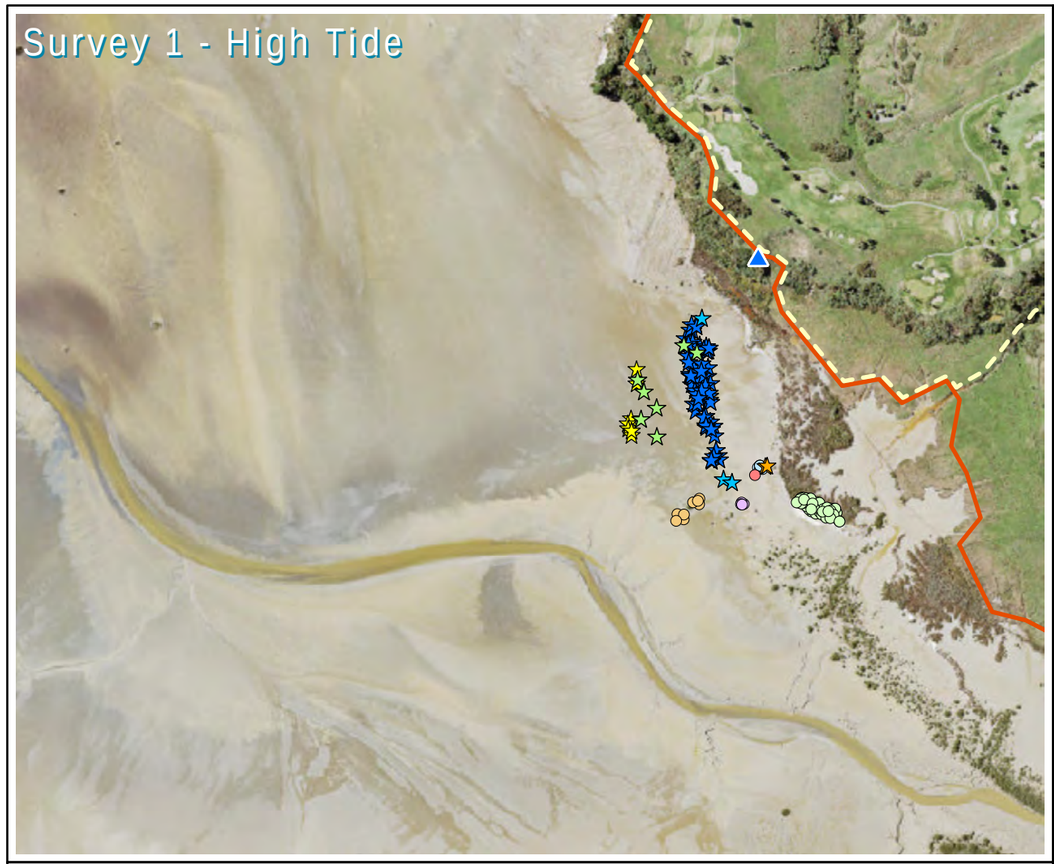

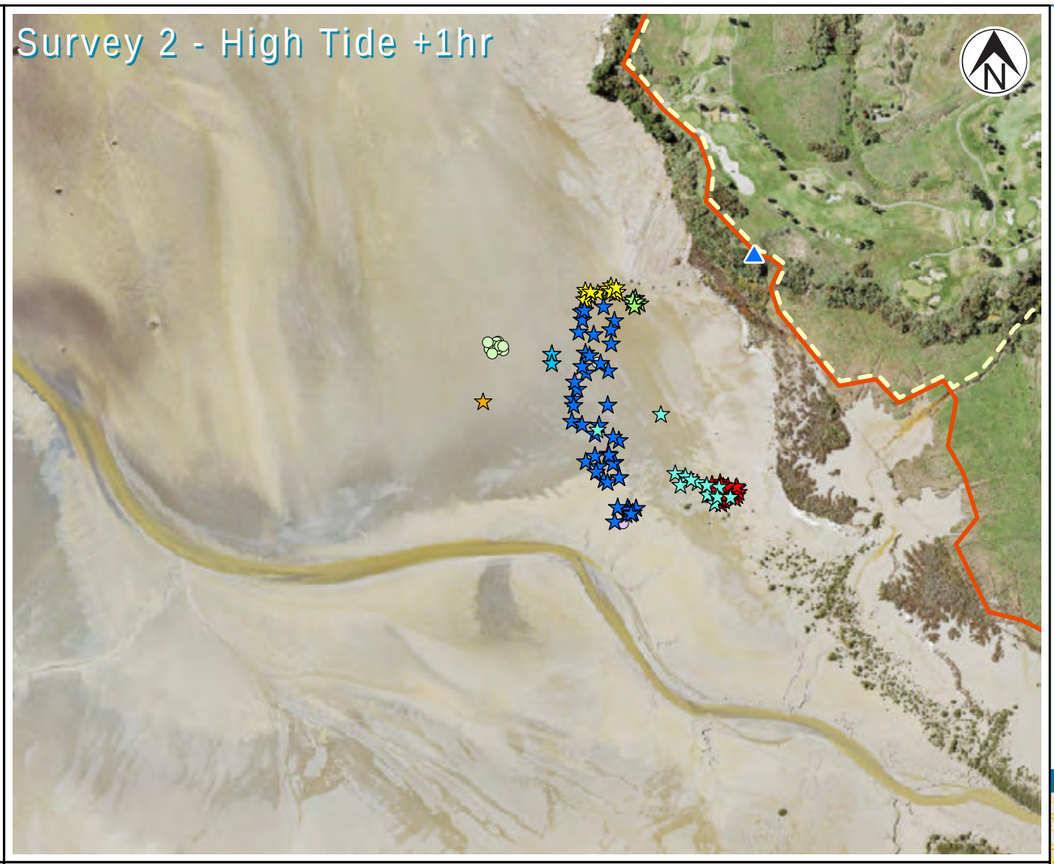

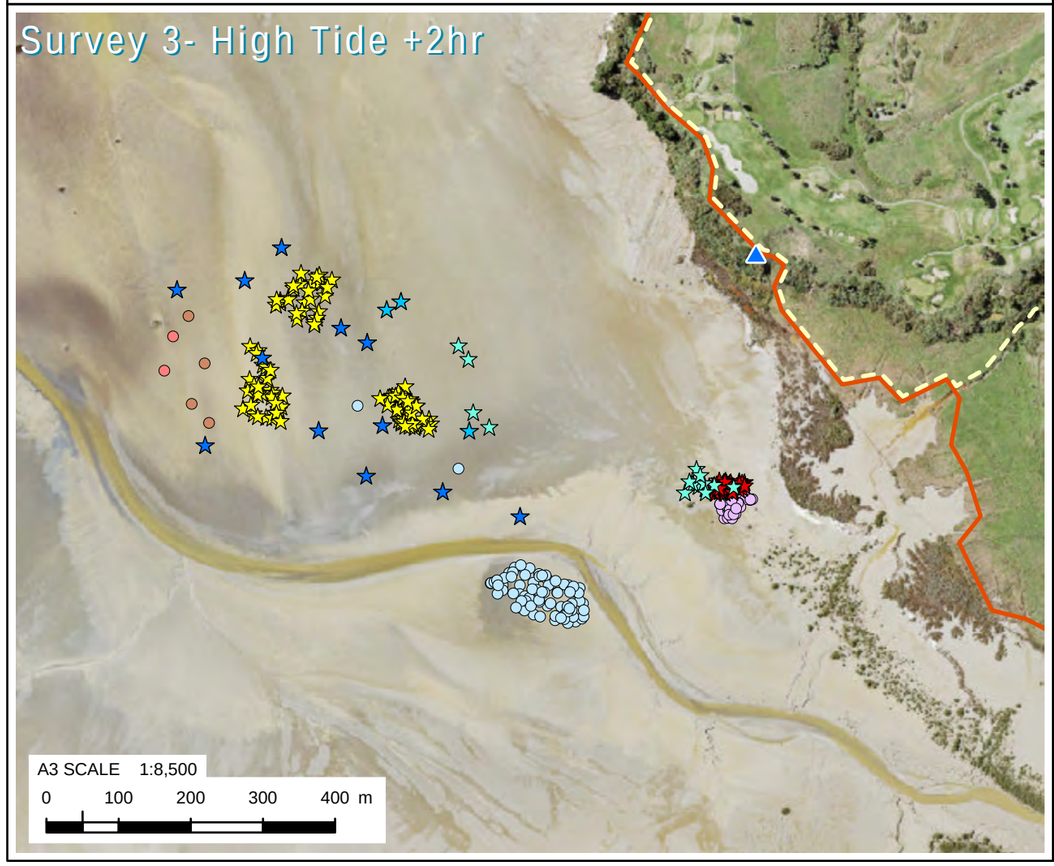

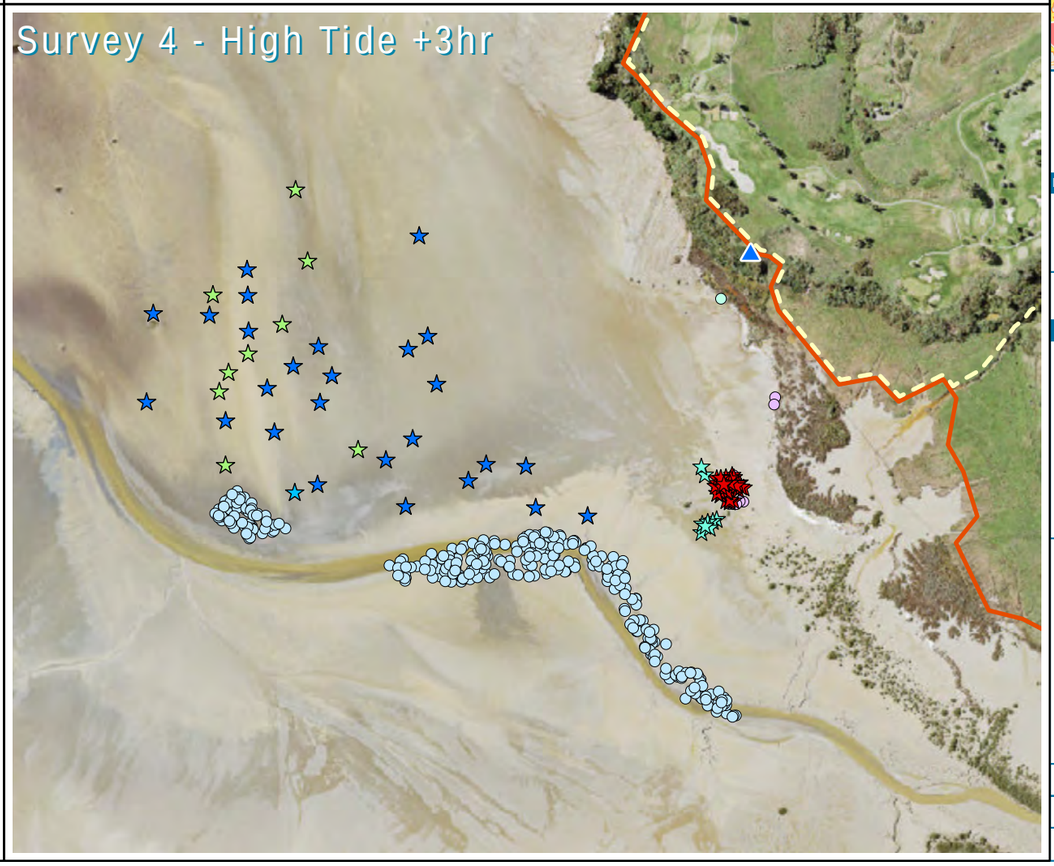

LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

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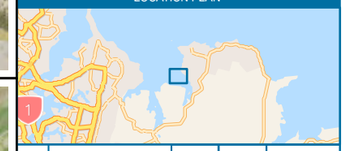
LOCATION PLAN



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COASTAL BIRD SURVEY
5TH OF MARCH 2021

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FIG No. FIGURE 3A.

SCALE (A3) 1:8,500 REV 0

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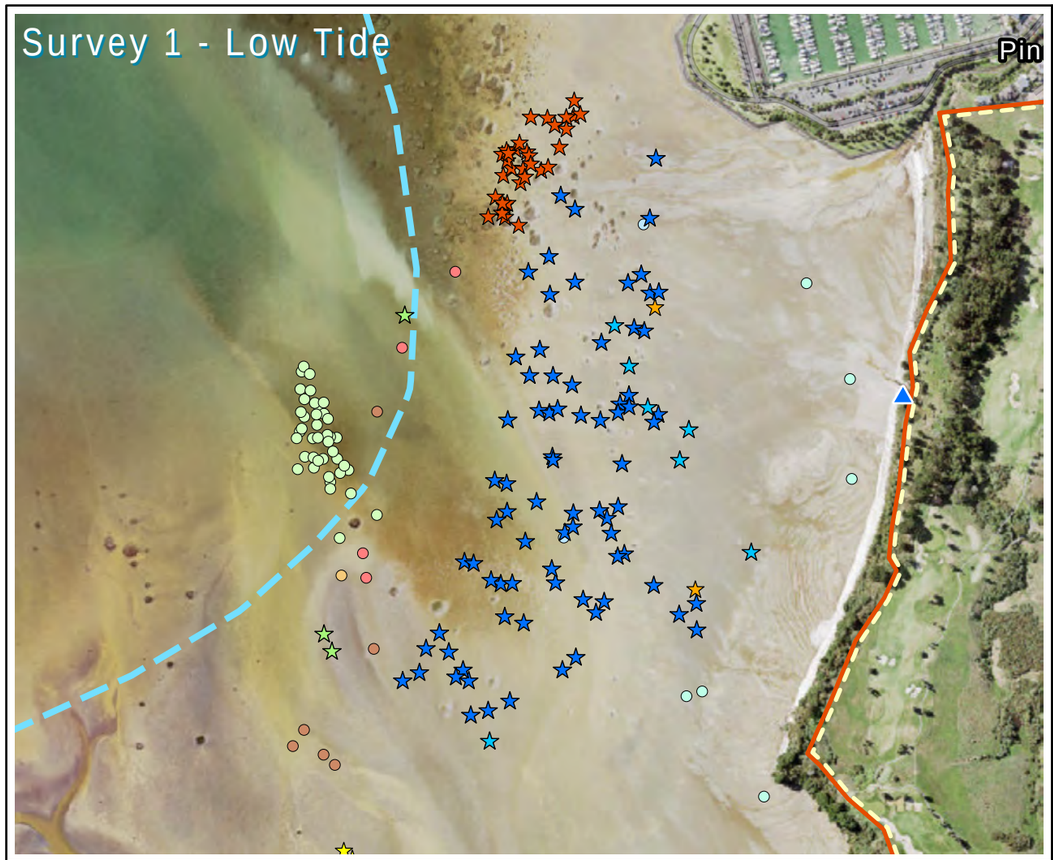

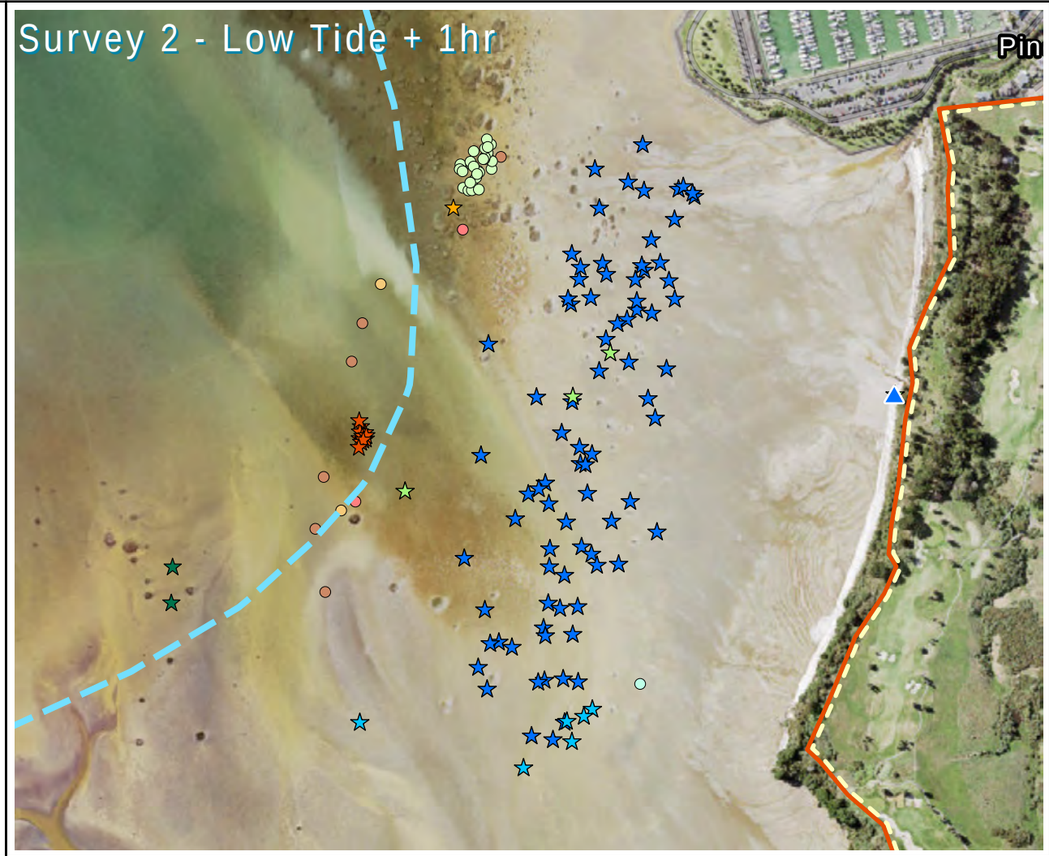

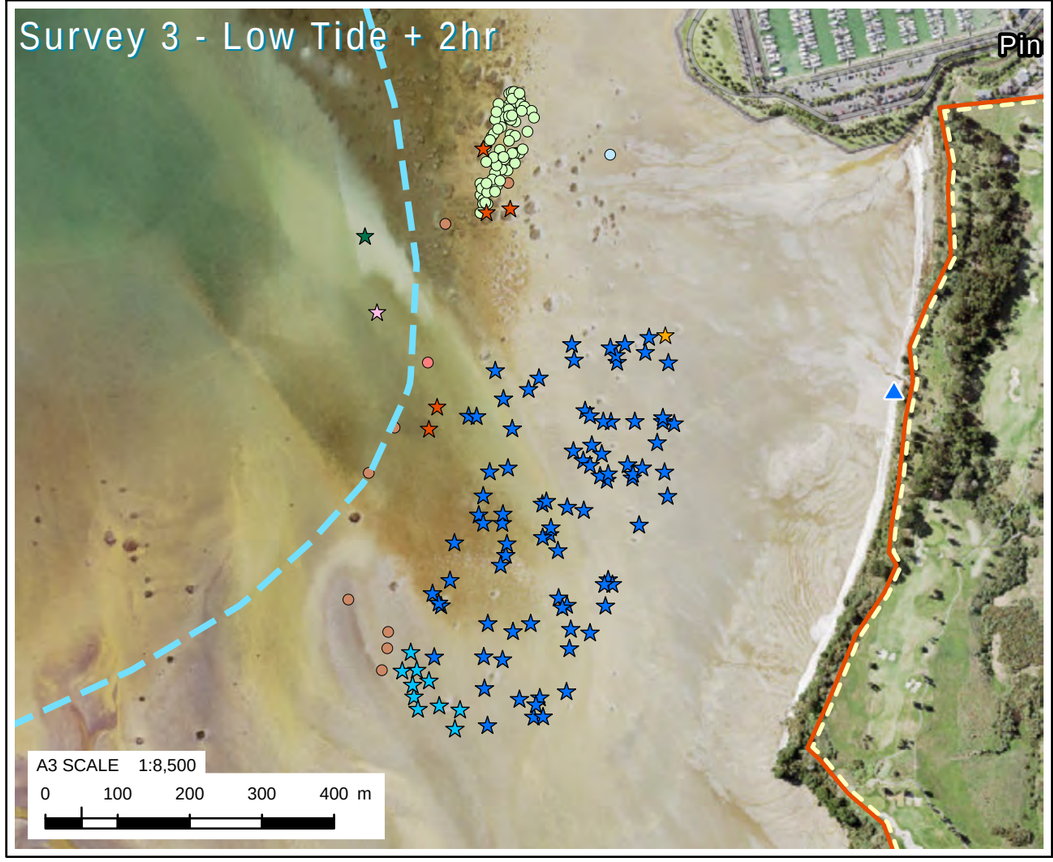

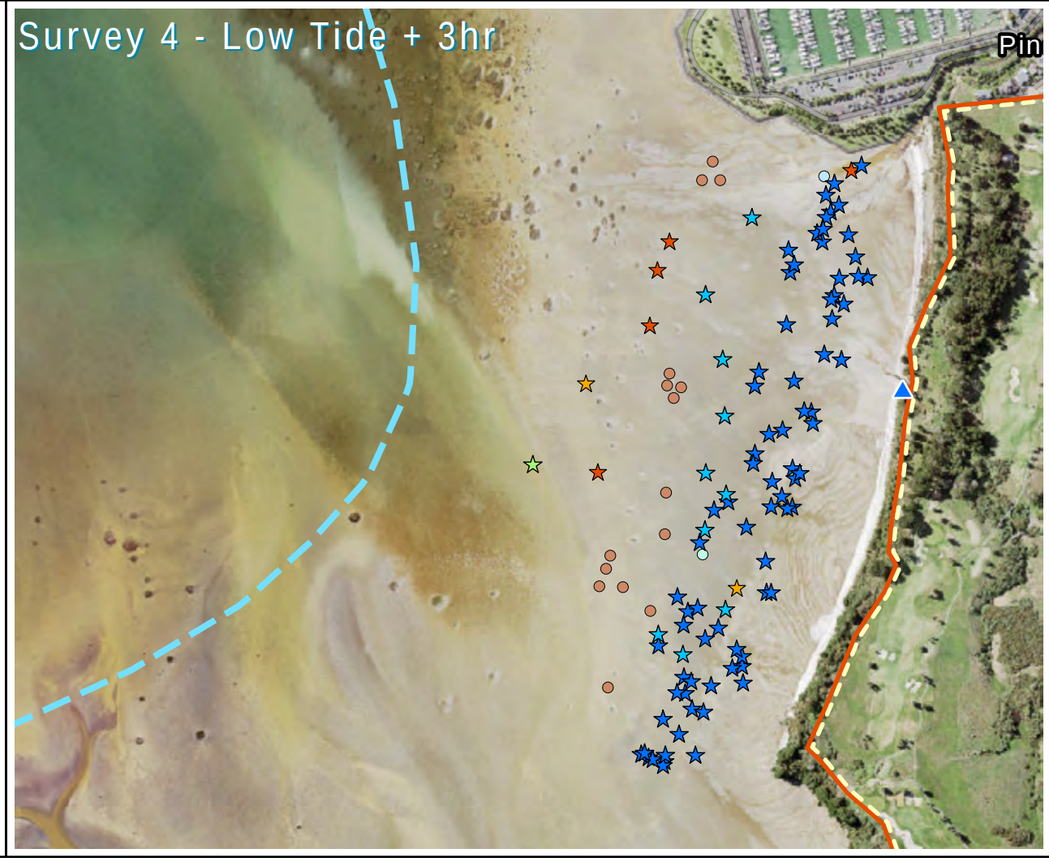

LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

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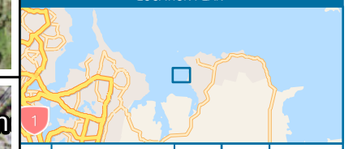
LOCATION PLAN



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COASTAL BIRD SURVEY
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FIG No.	FIGURE 3B.
SCALE (A3)	1:8,500
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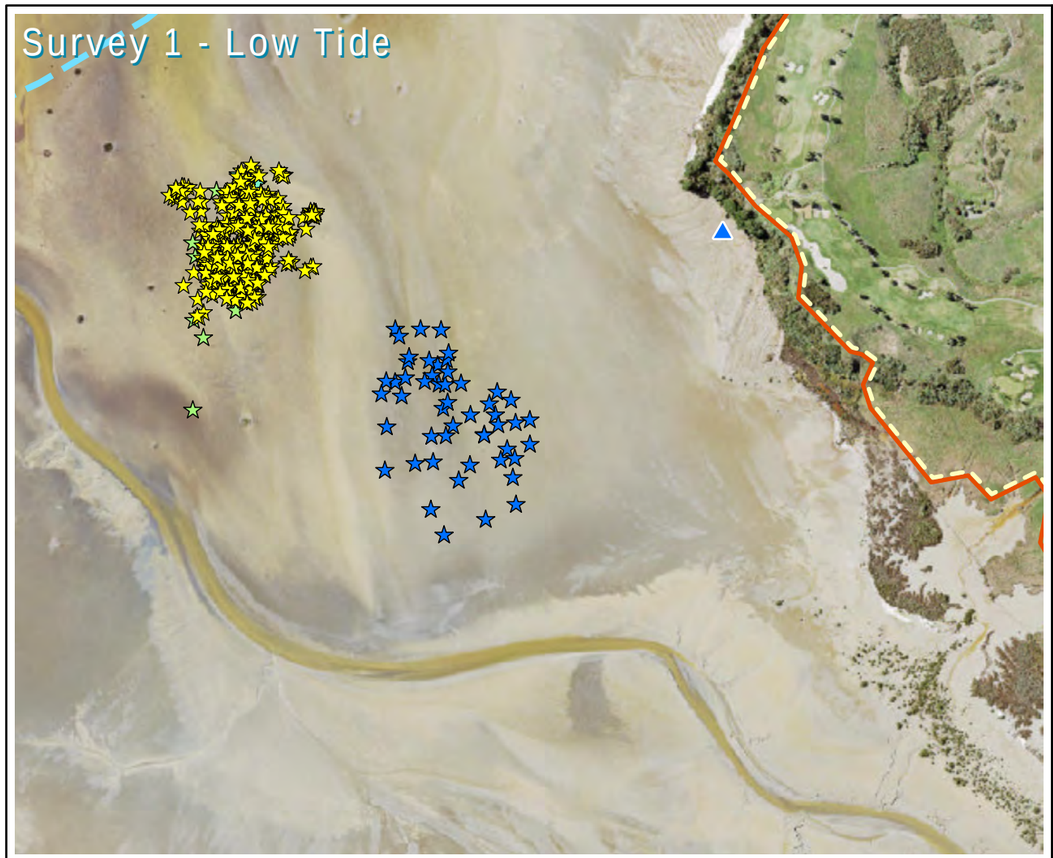

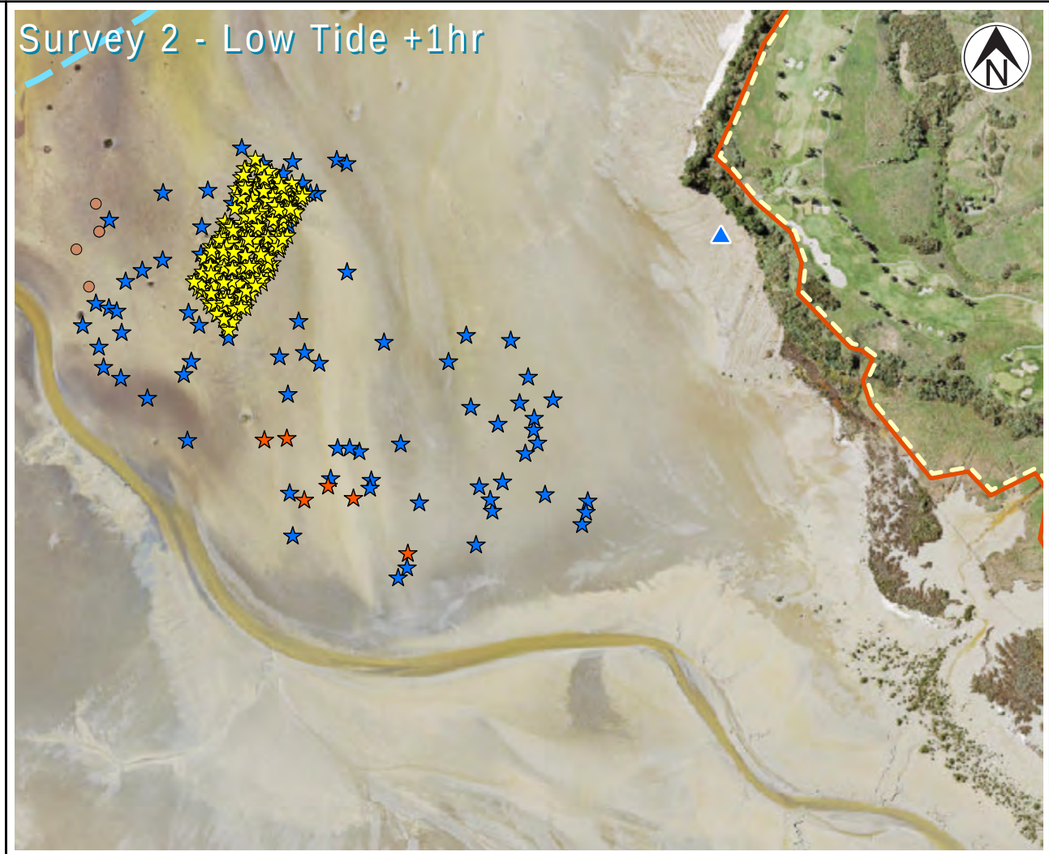

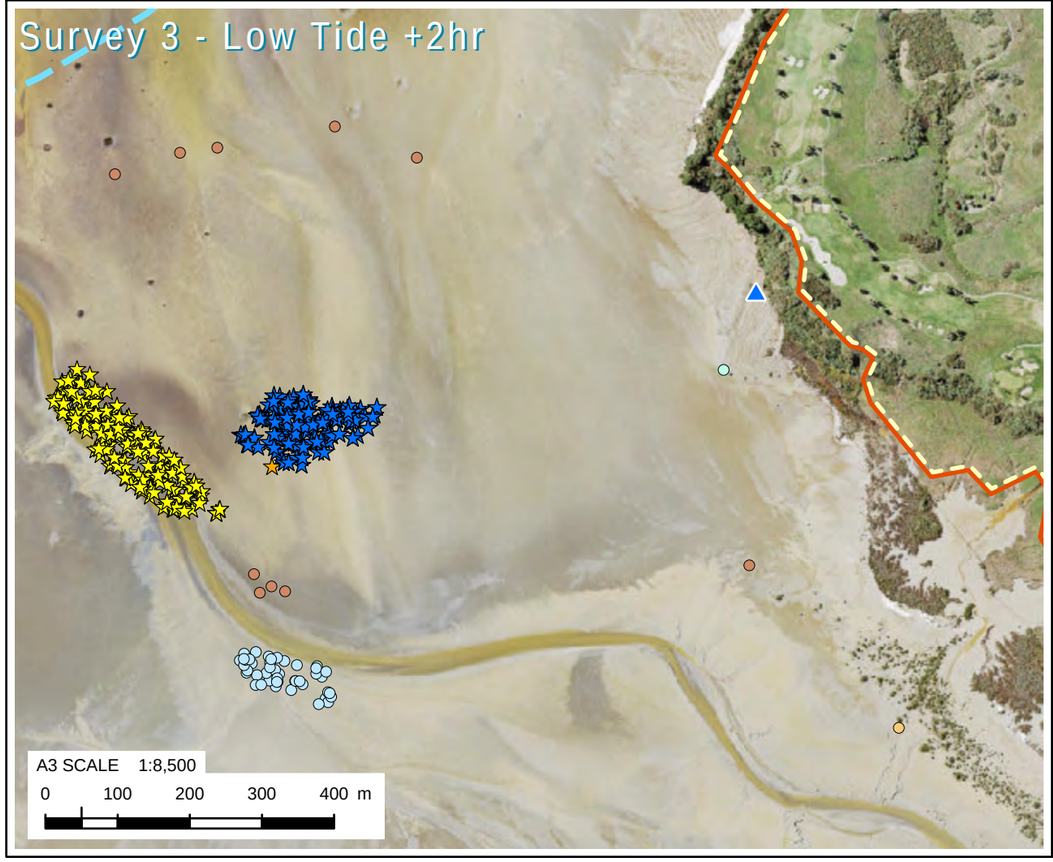

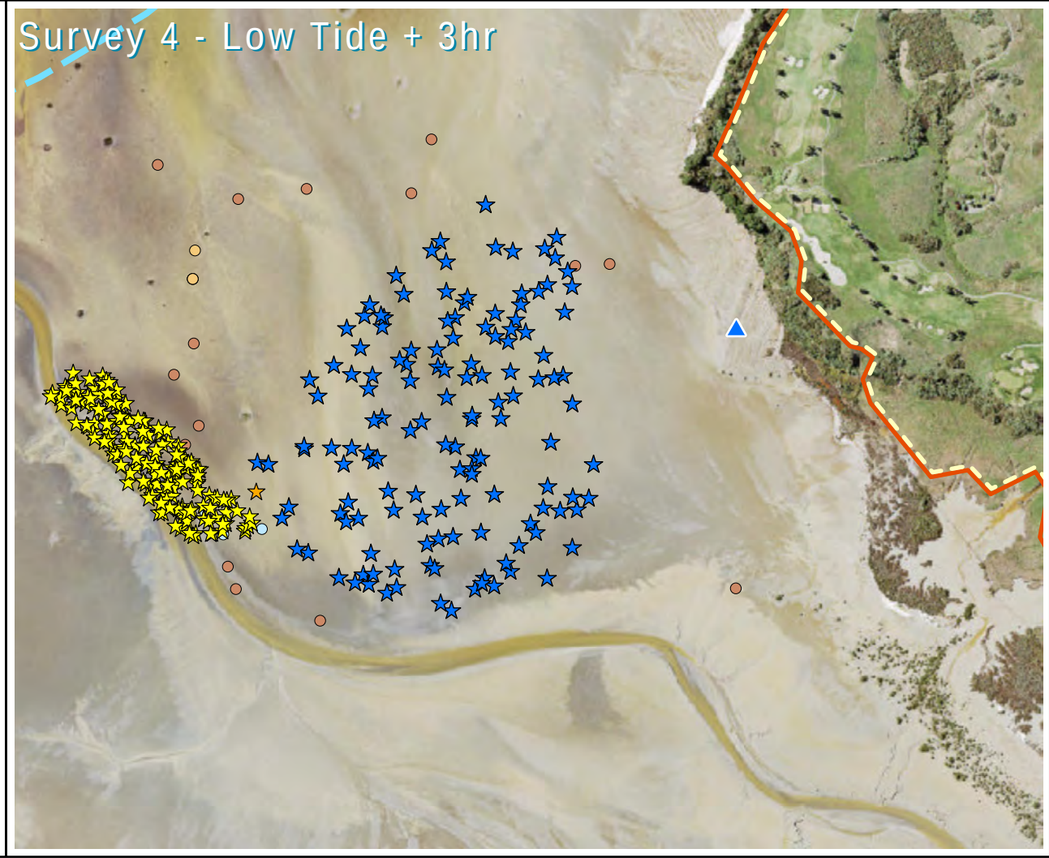

LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

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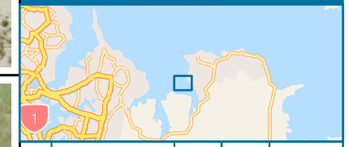
LOCATION PLAN



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23RD OF MARCH 2021

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FIG No. FIGURE 3C.

SCALE (A3) 1:8,500 REV 0

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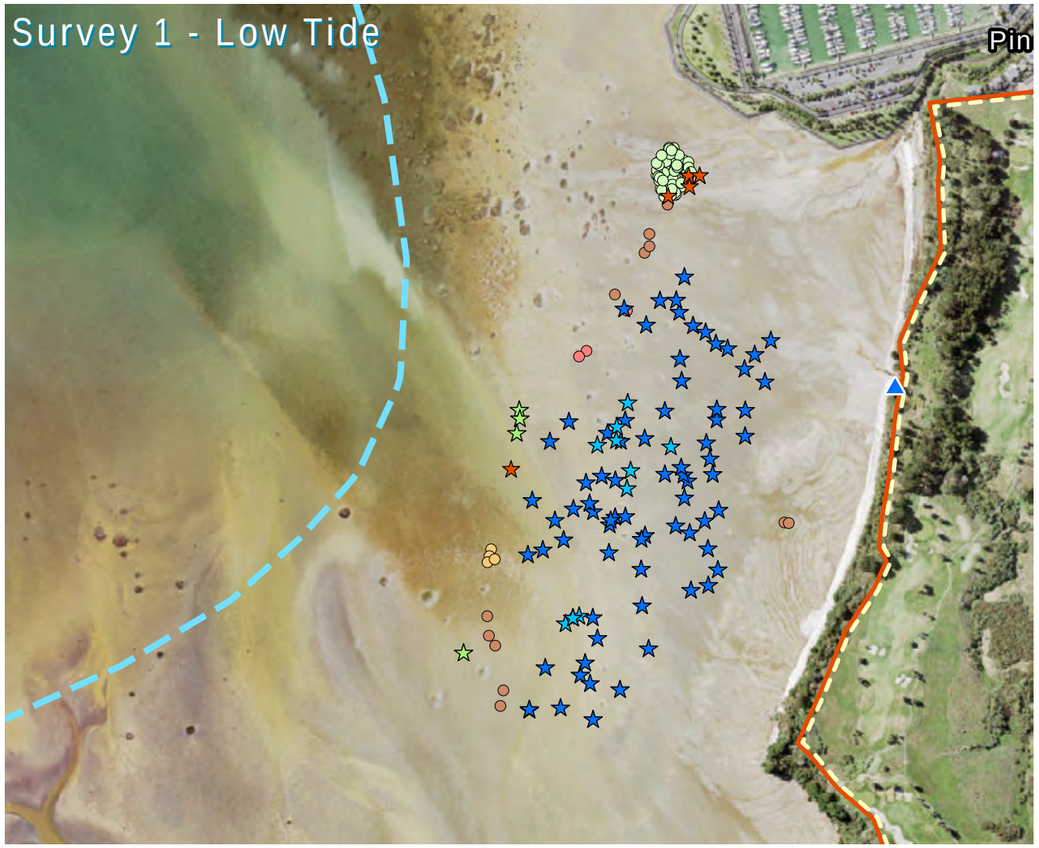

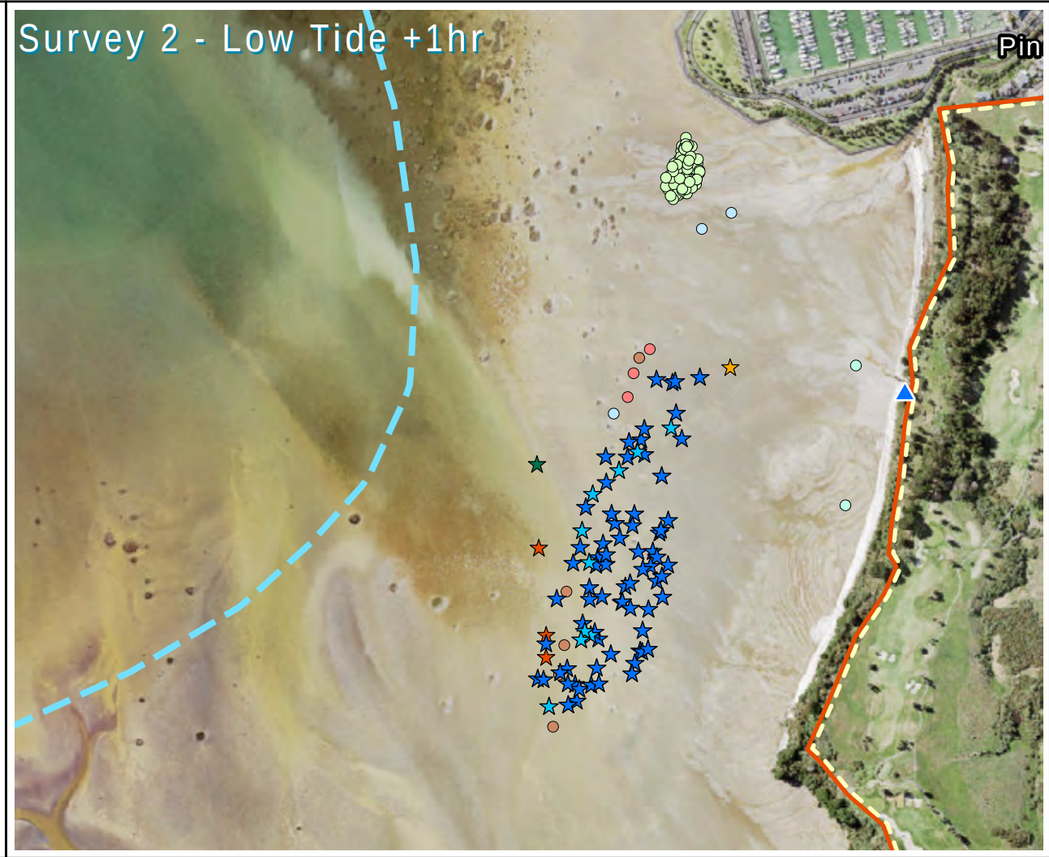

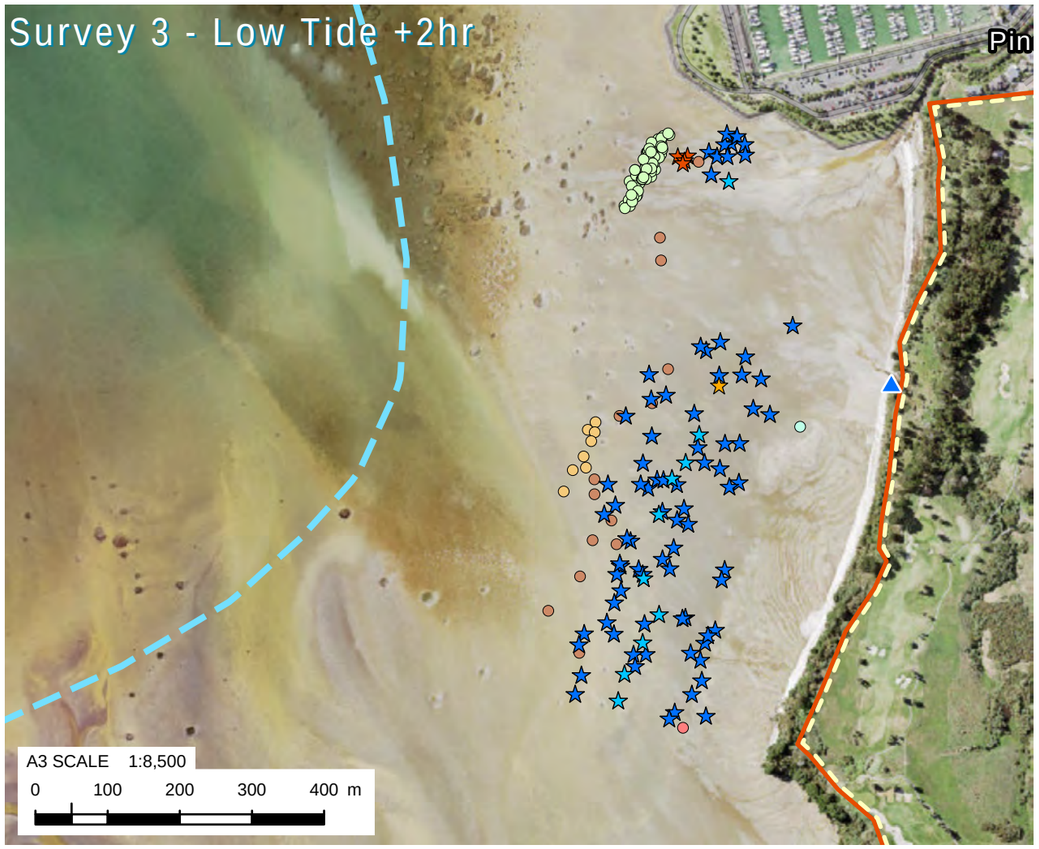

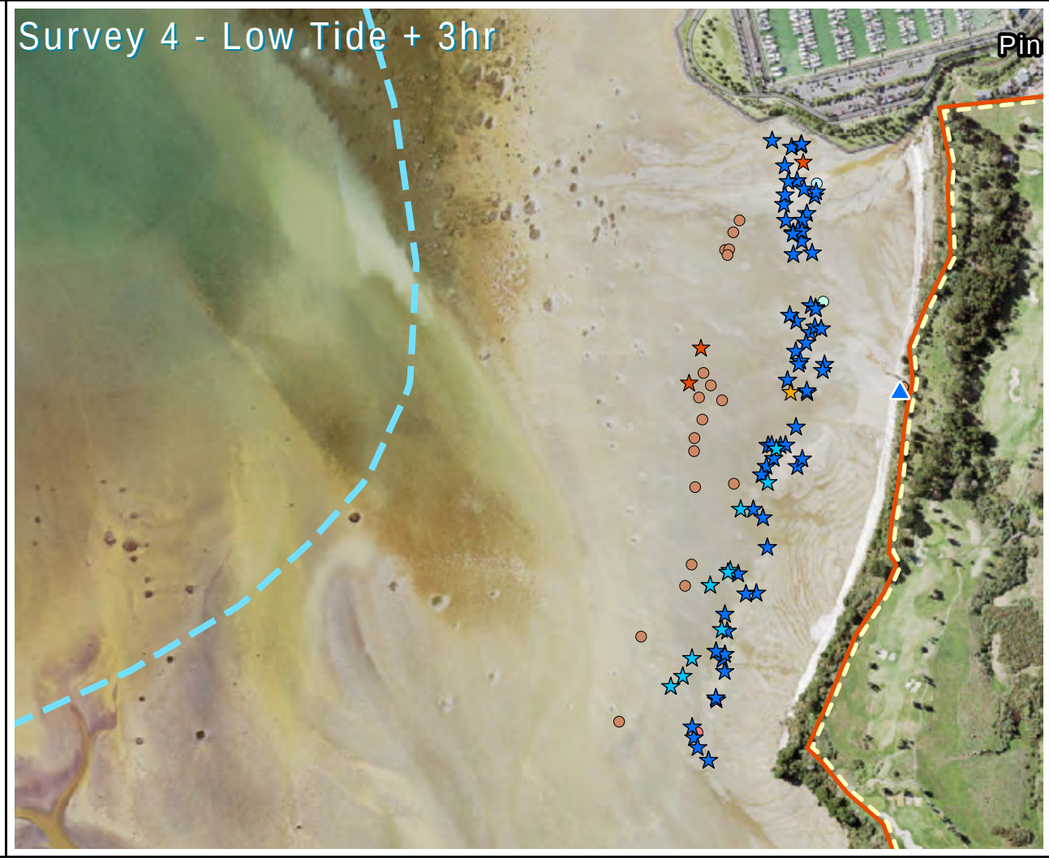

LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

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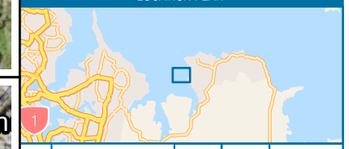

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COASTAL BIRD SURVEY
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PROJECT No.	1014358.4000
FIG No.	FIGURE 3D.
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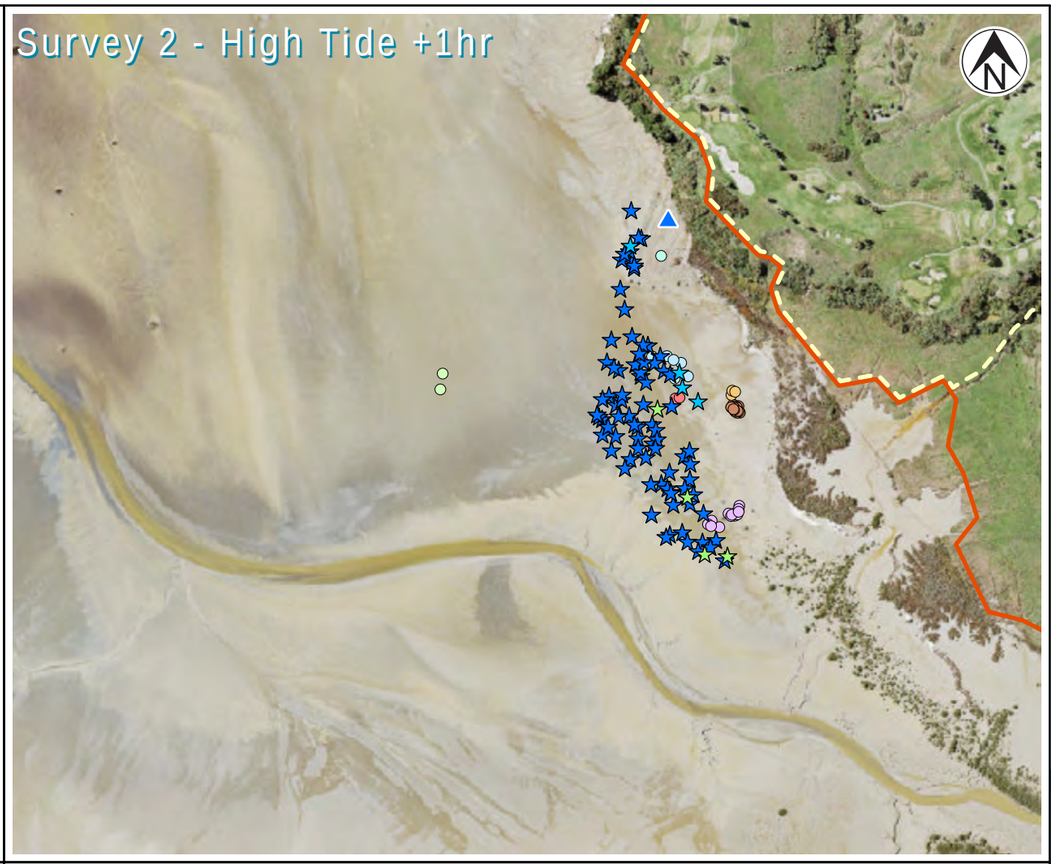

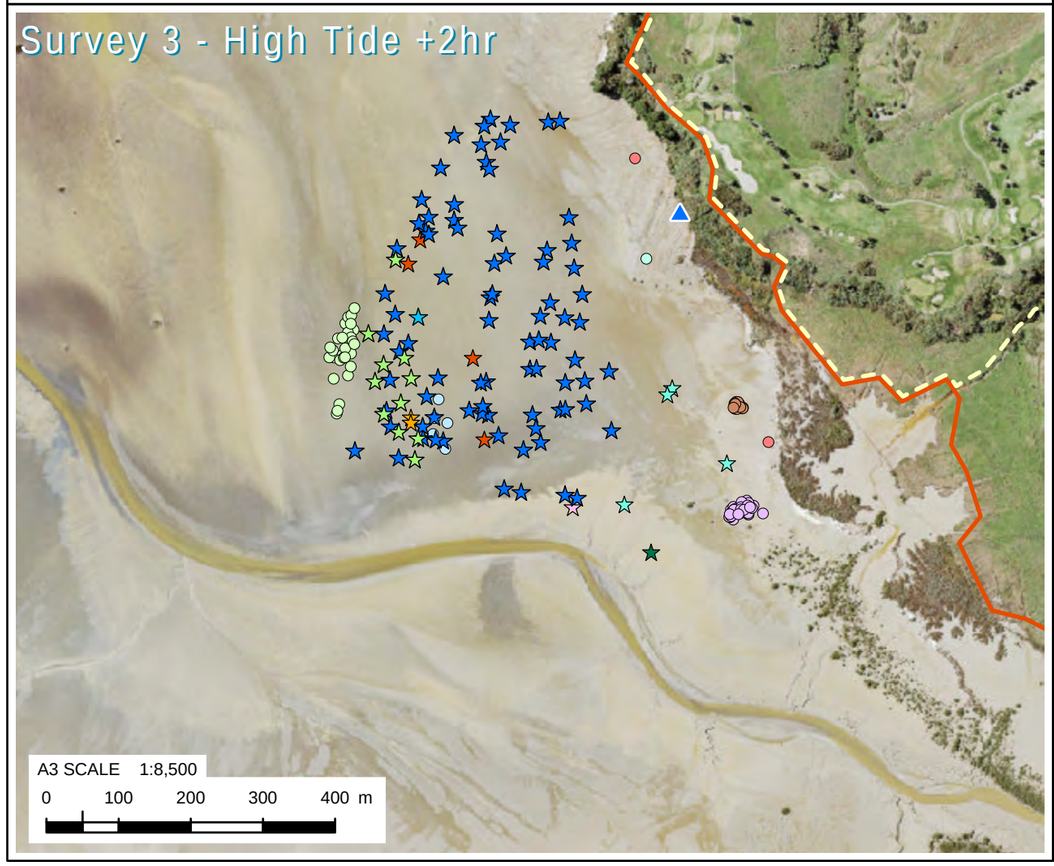

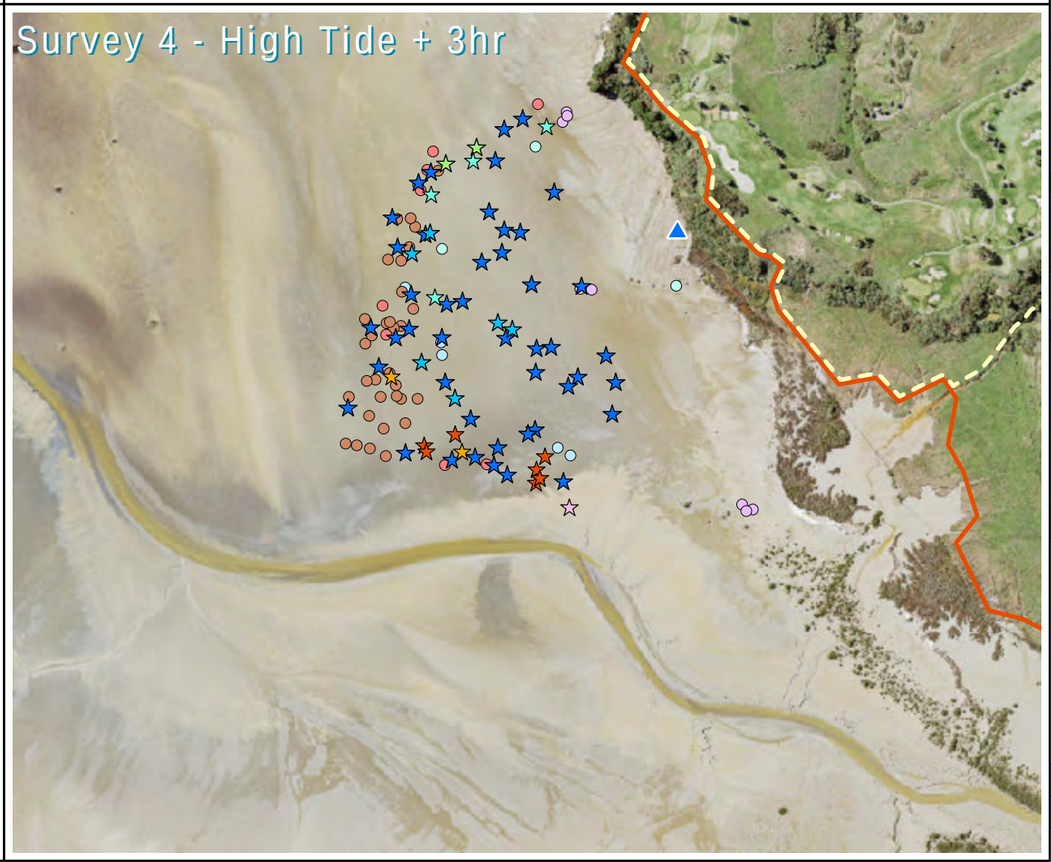

LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

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LOCATION PLAN

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COASTAL BIRD SURVEY
19TH OF APRIL 2021

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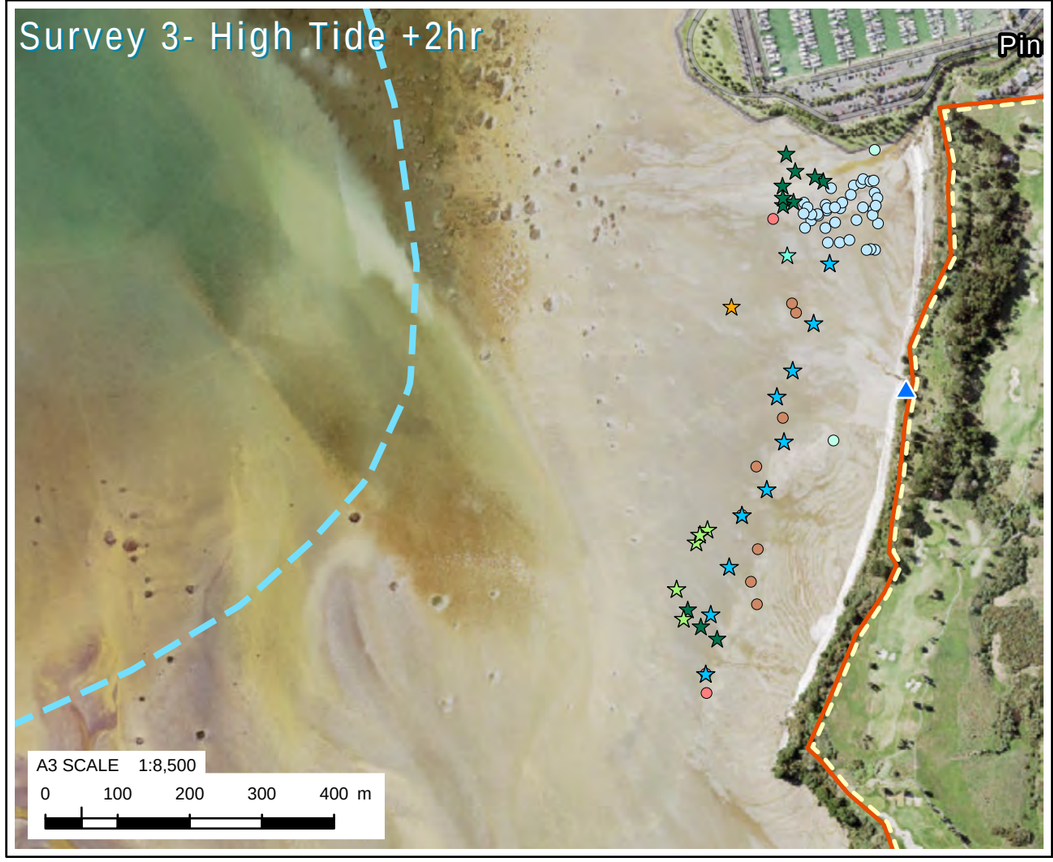
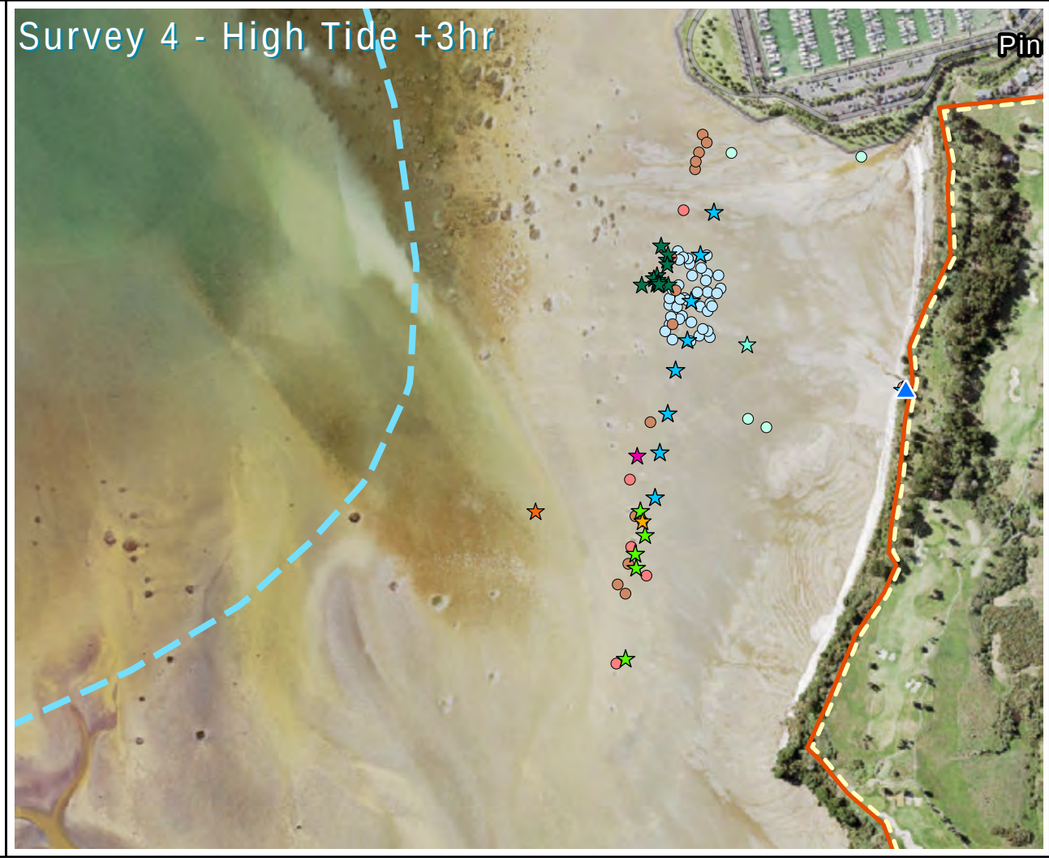
FIG No. FIGURE 3E.

SCALE (A3) 1:8,500 REV 0

\\ttgroup.local\files\AKLProjects\1014358\1014358.4000\WorkingMaterial\GIS\Map_Documents\1014358_Beachlands_Coastal_Birds_Figures_Updated.aprx Layout: Bird count May 13th 2022-Mar-16 9:22 am Drawn by JORB





LEGEND

- Site Boundary
- Survey Location
- Live boundary
- Indicative MLWS

Threatened

- Caspian tern
- New Zealand dotterel

At Risk

- SI pied oystercatcher (Declining)
- Eastern bar-tailed godwit (Declining)
- Royal spoonbill (Naturally uncommon)
- Banded dotterel (Declining)
- Lesser knot (Declining)
- Little shag (Relict)
- Red-billed gull (Declining)
- Pied shag (Recovering)
- Variable oystercatcher (Recovering)

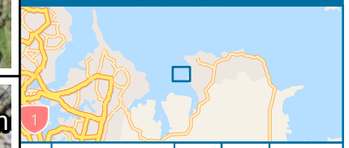
Non Threatened or Introduced

- Kingfisher
- White-faced heron
- Pied stilt
- Spur winged plover
- Black-backed gull
- Canada goose
- Black Swan

NOTES

Basemap: Sourced from LINZ and licensed for reuse under Creative Commons 4.0

LOCATION PLAN



REV	DESCRIPTION	GIS	CHK	DATE
0	First version	JORB	CHSA	16/03/22

DESIGNED	JORB	MAR.22
DRAWN	JORB	MAR.22
CHECKED	CHSA	MAR.22

DCM MAR 22

APPROVED DATE

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BEACHLANDS SOUTH LIMITED PARTNERSHIP

BEACHLANDS ECOLOGICAL SERVICES

COASTAL BIRD SURVEY
13TH OF MAY 2021

PROJECT No. 1014358.4000

FIG No. FIGURE 3F.

SCALE (A3) 1:8,500 REV 0

Appendix E Table 1: Coastal birds observed during February – March 2021 survey and total number recorded. * = Effects assessment for this species addressed in terrestrial report. ** = Effects assessment for this species in wetland report.

Common name	Species name	Threat status[1]	Location observed and highest number observed at any one time	
			North beach (22 Mar, 24 Mar, 13 May)	**South beach** (5 Mar, 23 Mar, 19 Apr)
Australasian gannet	*Morus serrator*	Not threatened	Desktop assessment only	
Banded rail	*Gallirallus philippensis*	At risk - declining	0	0
			1	0
			0	0
Bar-tailed godwit	*Limosa lapponica*	At risk - declining	25	27
			4	33
			5	11
Banded dotterel	*Charadrius bicinctus*	At risk - declining	0	42
			0	6
			0	0
Black-backed gull	*Larus dominicanus*	Not threatened	2	319
			3	46
			36	6
Black-billed gull	*Larus bulleri*	At risk - declining	Desktop assessment only	
Black shag	*Phalacrocorax carbo*	At Risk - Relict	Desktop assessment only	
Black swan	*Cygnus atratus*	Not Threatened	5	8
			8	3
			0	3
Canada goose	*Branta canadensis*	Introduced and naturalised	73	53
			66	0
			0	28
Caspian tern	*Hydroprogne caspia*	Threatened -	1	2

[1] Robertson, H. A., Baird, K., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., McArthur, N., O' Donnell, C. F. J., Sagar, P. M., Scofield, R. P. & Taylor, G. A. (2016). Conservation status of New Zealand birds. New Zealand Threat Classification Series 19. 27 p.

Common name	Species name	Threat status[1]	Location observed and highest number observed at any one time	
			North beach (22 Mar, 24 Mar, 13 May)	**South beach** (5 Mar, 23 Mar, 19 Apr)
		Nationally vulnerable	1	1
			1	2
Great knot	*Calidris tenuirostris*	Vagrant (IUCN threat classification of Endangered)[2]	Desktop assessment only	
Kingfisher*	*Todiramphus sanctus*	Not threatened	5	1
			2	1
			4	1
Lesser knot	*Calidrus canutus*	At risk - declining	2	100
			0	320
			0	0
Little black shag	*Phalacrocorax sulcirostris*	At risk - Naturally uncommon	Desktop assessment only	
Little shag	*Phalacrocorax melanoleucos*	At risk - relict	1	0
			0	0
			1	1
Mallard**	*Anas platyrhynchos*	Introduced and naturalised		
New Zealand dotterel	*Charadrius obscurus*	Threatened – Nationally increasing	1	14
			0	5
			1	4
Pacific golden plover	*Pluvialis fulva*	Migrant (IUCN threat classification of Least Concern)[3]	Desktop assessment only	
Pied shag	*Phalacrocorax varius*	At risk – Recovering	2	0
			1	0
			1	1
Pied stilt	*Himantopus*	Not threatened	8	4

[2] BirdLife International (2021) Species factsheet: *Calidris tenuirostris*. Downloaded from http://www.birdlife.org on 04/07/2021.

[3] BirdLife International (2021) Species factsheet: *Pluvialis fulva*. Downloaded from http://www.birdlife.org on 04/07/2021.

Common name	Species name	Threat status[1]	Location observed and highest number observed at any one time	
			North beach (22 Mar, 24 Mar, 13 May)	**South beach** (5 Mar, 23 Mar, 19 Apr)
	himantopus		19	22
			13	33
Red-billed gull	*Larus novaeholandiae*	At Risk – Declining	2	33
			5	2
			12	7
Red-necked stint	*Calidris reuficollis*	Migrant (IUCN classification of Near Threatened)[4]	Desktop assessment only	
Reef heron	*Egretta sacra*	Threatened – Nationally Endangered	Desktop assessment only	
Royal spoonbill	*Platalea regia*	At risk - naturally uncommon	0	0
			0	0
			1	0
Ruddy turnstone	*Calidris ruficollis*	Migrant (IUCN threat classification of Least Concern)[5]	Desktop assessment only	
Shore plover	*Thinornis novaeseelandiae*	Threatened – Nationally Critical	Desktop assessment only	
South Island pied oystercatcher	*Haematopus finschi*	At Risk - Declining	87	61
			82	138
			97	82
Spur-winged plover*	*Vanellus miles*	Not threatened	0	28
			0	0
			0	40
Variable oystercatcher	*Haematopus unicolor*	At Risk – Recovering	10	3
			10	10
			10	6
White-faced heron	*Egretta novaehollandiae*	Not threatened	4	2
			3	0

[4] BirdLife International (2021) Species factsheet: *Calidris ruficollis*. Downloaded from http://www.birdlife.org on 04/07/2021.
[5] BirdLife International (2021) Species factsheet: *Arenaria interpres*. Downloaded from http://www.birdlife.org on 04/07/2021.

Common name	**Species name**	**Threat status**[1]	**Location observed and highest number observed at any one time**	
			North beach (22 Mar, 24 Mar, 13 May)	**South beach** (5 Mar, 23 Mar, 19 Apr)
			7	8
White-fronted tern	*Sterna striata*	At Risk – Declining	Desktop assessment only	
Wrybill	*Anarhynchus frontalis*	Threatened - Nationally Increasing	Desktop assessment only	

Tonkin & Taylor. Susan Jackson

Identification & counts of Invertebrates in core samples from Sites 1-8 at Beachlands. Sampled 24 February 2021. Project ref 1014358.4000R

General Group	Taxa	Common Name	Site 1-A	Site 1-B	Site 1-C	Site 1-D	Site 1-E
Anthozoa	Anthopleura aureoradiata	Anemone		1	2		1
Anthozoa	Edwardsia sp.	Burrowing anemone					
Nemertea	Nemertea	Proboscis worms	2	1	1	1	2
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk	1				2
Gastropoda	Diloma subrostrata	Mud flat topshell		1		2	
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail					
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet	1	1	3	3	10
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell					
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail					1
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve					1
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	8	15	15	24	23
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)		2			
Bivalvia	Mysella sp.	Small bivalve					1
Bivalvia	Nucula hartvigiana	Nut Shell					
Bivalvia	Paphies australis	Pipi	1	2	2	5	6
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	2	1	3	1	
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm			2		
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm				5	
Polychaeta: Paraonidae	Paraonidae	Polychaete worm				1	
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm					
Polychaeta: Spionidae	Aonides trifida	Polychaete worm	5	5	1	1	12
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm					
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	3	44	23	14	100
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm					
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm					
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	1	2	1	2	2
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms					
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm		2			
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	6	7	5	3	7
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm		1			
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					

Cumacea	Cumacea	Cumaceans	1	2	1		1
Tanaidacea	Tanaid sp.	Tanaid Shrimp					
Isopoda	Exosphaeroma planulum	Isopod		2	2	4	2
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)					
Amphipoda	Amphipoda Unid.	Amphipod		1	6	1	
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab			1		
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod					
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods					
Cirripedia	Austrominius modestus	Estuarine Barnacle					
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**31**	**90**	**68**	**67**	**171**
	Count: No of Taxa		**11**	**17**	**15**	**14**	**15**
	SW_Diversity		**2.09520006**	**1.86520004**	**2.10669994**	**2.05209994**	**1.54289997**
	SW_Evenness		**0.87379998**	**0.65829998**	**0.77789998**	**0.77759999**	**0.5697**

GenGroup	**Taxa**	**Common Name**	**Site 1-01**	**Site 1-02**	**Site 1-03**	**Site 1-04**	**Site 1-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			16mm	16mm x 2	18mm	19mm	15mm x 3
			14mm	15mm	14mm x 3	17mm x 4	12mm x 2
			12mm	14mm	10mm x 2	12mm x 5	10mm x 4
			9mm x 2	12mm x 4	8mm	11mm	6mm
			4mm x 2	10mm x 5	2mm x 5	10mm x 3	5mm
			1mm	8mm	1mm x 3	8mm	3mm x 3
				1mm		5mm	2mm x 6
						2mm x 6	1mm x 3
						1mm x 2	
Bivalvia	Paphies australis	Pipi	**Pipi (mm)**				
			28mm	23mm	24mm	24mm	26mm
				15mm	20mm	21mm	24mm x3
						22m m	23mm
						18 mm	19mm
						17mm	

General Group	Taxa	Common Name	Site 2-A	Site 2-B	Site 2-C	Site 2-D	Site 2-E
Anthozoa	Anthopleura aureoradiata	Anemone	3		1	2	1
Anthozoa	Edwardsia sp.	Burrowing anemone					
Nemertea	Nemertea	Proboscis worms	2	2	1	1	2
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk	7	2		1	1
Gastropoda	Diloma subrostrata	Mud flat topshell	2		3	1	
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail			2	2	3
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet	3		11	8	
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell		2		2	4
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail	2	3	1	1	
Opisthobranchia	Haminoea zelandiae	Bubble shell			2		2
Bivalvia	Arthritica bifurca	Small bivalve					
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	42	30	32	25	9
Bivalvia	Felaniella (zemysia) zelandica	Bivalve	1		1		
Bivalvia	Macomona liliana	Wedge shell (Hanikura)	3	1	1	1	
Bivalvia	Mysella sp.	Small bivalve					
Bivalvia	Nucula hartvigiana	Nut Shell	23	26	23	23	2
Bivalvia	Paphies australis	Pipi			1		
Bivalvia	Soletellina sp.	Golden sunset shell	1				
Oligochaeta	Oligochaeta	Oligochaete worms	1			1	
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm				1	3
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm	1	7	8	10	7
Polychaeta: Spionidae	Aonides trifida	Polychaete worm	7	1	6	8	9
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm			2		
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	62	44	59	25	14
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm					
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm		1	1	4	
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm					1
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms	1	6	3	3	
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm					
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	2	2	2	1	2
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm	1			1	1
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm			1		
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans	1	1			
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod				2	
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)	2		3		
Amphipoda	Phoxocephalidae	Amphipod (family)				1	
Amphipoda	Amphipoda Unid.	Amphipod	4	1	18	68	8
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod			1	3	
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod		1		1	1
Copepoda	Copepoda	Copepods			1	1	1
Cirripedia	Austrominius modestus	Estuarine Barnacle					
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**171**	**130**	**184**	**197**	**71**
	Count: No of Taxa		**21**	**16**	**24**	**26**	**18**
	SW_Diversity		**2.01539993**	**1.89470005**	**2.25399995**	**2.26810002**	**2.51009989**
	SW_Evenness		**0.662**	**0.68339998**	**0.70920002**	**0.69620001**	**0.86839998**

GenGroup	**Taxa**	**Common Name**	**Site 2-01**	**Site 2-02**	**Site 2-03**	**Site 2-04**	**Site 2-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			15mm x 2	5mm x 2	19mm	13mm	18mm
			14mm	4mm x 2	17mm	10mm	15mm
			13mm x 2	3mm x 12	15mm x 2	4mm x 4	12mm x 2
			9mm	2mm x 8	12mm x 2	3mm x 4	9mm
			8mm x 4	1mm x 6	9mm x 2	2mm x 9	4mm
			4mm x 6		7mm	1mm x 6	3mm x 2
			3mm x 6		4mm		2mm
			2mm x 20		2mm x 12		
					1mm x 10		
Bivalvia	Paphies australis	Pipi			**Pipi (mm)**		
					16mm		

General Group	Taxa	Common Name	Site 3-A	Site 3-B	Site 3-C	Site 3-D	Site 3-E
Anthozoa	Anthopleura aureoradiata	Anemone	4	18	12	4	11
Anthozoa	Edwardsia sp.	Burrowing anemone			1		
Nemertea	Nemertea	Proboscis worms		2	2		
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk	1		6		
Gastropoda	Diloma subrostrata	Mud flat topshell	1	2	2		2
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail	2	2	4		
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet	6	24	12	3	9
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell					
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail					
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve		4			
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	38	34	31	34	24
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)	6	2	1	2	1
Bivalvia	Mysella sp.	Small bivalve					
Bivalvia	Nucula hartvigiana	Nut Shell	9	12	11	1	4
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	2	1		1	1
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm	5	4	4		2
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm	16	9	18	8	15
Polychaeta: Spionidae	Aonides trifida	Polychaete worm	6	8	4		6
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm		2	2		
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	36	82	50	22	48
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm		1			
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm		1	1		1
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm			1		1
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms	2	4	1		2
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm					
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms				1	2
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm		1	1		2
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans		2	2	3	1
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod		1			
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)	12	13	8		11
Amphipoda	Amphipoda Unid.	Amphipod	24	8	19	63	28
Decapoda	Alpheus sp.	Snapping shrimp		1			
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab			1		
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod					
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods		1			
Cirripedia	Austrominius modestus	Estuarine Barnacle					
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**170**	**239**	**194**	**142**	**171**
	Count: No of Taxa		**16**	**25**	**23**	**11**	**19**
	SW_Diversity		**2.26830006**	**2.3354001**	**2.45539999**	**1.58210003**	**2.2658**
	SW_Evenness		**0.81809998**	**0.72549999**	**0.78310001**	**0.65979999**	**0.76950002**

GenGroup	**Taxa**	**Common Name**	**Site 3-01**	**Site 3-02**	**Site 3-03**	**Site 3-04**	**Site 3-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			8mm	26mm	27mm	22mm	23mm
			5mm x 3	23mm x 2	22mm x 2	4mm x 3	20mm
			4mm x 5	19mm	20mm	3mm x 2	8mm
			3mm x 9	16mm	11mm	2mm x 15	4mm x 3
			2mm x 9	13mm	9mm	1mm x 13	3mm x 5
			1mm x 11	5mm	5mm x 2		2mm x 5
				4mm x 2			1mm x 8
				3mm x 3	3mm x 6		
				2mm x 6	2mm x 11		
				1mm x 16	1mm x 6		
Bivalvia	Paphies australis	Pipi					

General Group	Taxa	Common Name	Site 4-A	Site 4-B	Site 4-C	Site 4-D	Site 4-E
Anthozoa	Anthopleura aureoradiata	Anemone			1	1	1
Anthozoa	Edwardsia sp.	Burrowing anemone					
Nemertea	Nemertea	Proboscis worms		2	1		1
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk			1		
Gastropoda	Diloma subrostrata	Mud flat topshell				1	
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail					
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet			2	8	5
Gastropoda	Turbonilla sp.	Small spiral shell				1	
Gastropoda	Xymene sp.	Small snail		1			
Gastropoda	Zeacumantus lutulentus	Spireshell				2	
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail	2	1	1	1	
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve			1		1
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	10	19	31	32	26
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)		1	1		1
Bivalvia	Mysella sp.	Small bivalve					
Bivalvia	Nucula hartvigiana	Nut Shell	14	5	11	20	10
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms					1
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm	1				
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm			1		1
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					
Polychaeta: Paraonidae	Paraonidae	Polychaete worm	2	9	1		
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm	1	11		15	12
Polychaeta: Spionidae	Aonides trifida	Polychaete worm					2
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm	1				
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	5	14	3	29	43
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm					
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm	1	1	2		3
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm					
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms	3	1	3	1	
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm	3	4	5		1
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	1	4	4	7	
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm		1			
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans	2	6	9	3	6
Tanaidacea	Tanaid sp.	Tanaid Shrimp	1				

Isopoda	Exosphaeroma planulum	Isopod			1	3	1
Amphipoda	Corophiidae	Amphipod (family)	3	3	1	1	1
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)			1		
Amphipoda	Amphipoda Unid.	Amphipod	8	11	13	21	26
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod				1	
Ostracoda	Diasterope grisea	Ostracod			2	1	
Ostracoda	Euphilomedes agilis	Ostracod			1		
Ostracoda	Parasterope quadrata	Ostracod	2	4			
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod	1		1		1
Copepoda	Copepoda	Copepods		1			
Cirripedia	Austrominius modestus	Estuarine Barnacle					
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms	1			1	
	Count: No of Individuals		**62**	**99**	**98**	**149**	**143**
	Count: No of Taxa		**19**	**19**	**24**	**19**	**19**
	SW_Diversity		**2.51279998**	**2.51900005**	**2.43910003**	**2.24379992**	**2.11339998**
	SW_Evenness		**0.85339999**	**0.85549998**	**0.76749998**	**0.76200002**	**0.7177**

GenGroup	**Taxa**	**Common Name**	**Site 4-01**	**Site 4-02**	**Site 4-03**	**Site 4-04**	**Site 4-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			3mm	9mm	12mm	9mm	10mm
			2mm x 7	8mm x 2	10mm x 3	6mm	8mm
			1mm x 2	7mm	9mm	5mm x 3	7mm x 2
				3mm x 3	8mm	4mm x 3	6mm
				2mm x 2	7mm	3mm x 8	4mm x 3
				1mm x 10	4mm	2mm x 8	2mm x 14
					2mm x 15	1mm x 8	1mm x 4
					1mm x 8		
Bivalvia	Paphies australis	Pipi					

General Group	Taxa	Common Name	Site 5-A	Site 5-B	Site 5-C	Site 5-D	Site 5-E
Anthozoa	Anthopleura aureoradiata	Anemone		1			
Anthozoa	Edwardsia sp.	Burrowing anemone					
Nemertea	Nemertea	Proboscis worms			1		2
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk		1	2	1	1
Gastropoda	Diloma subrostrata	Mud flat topshell					
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail					
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet			1	2	
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell	1	1	2		2
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail					
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve				3	
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	3	5	11	14	18
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)	2	1	4	8	
Bivalvia	Mysella sp.	Small bivalve					
Bivalvia	Nucula hartvigiana	Nut Shell	2	3	4	7	25
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	8	8	1	2	
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm			1		
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm	1	8		1	
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					1
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm			1		3
Polychaeta: Spionidae	Aonides trifida	Polychaete worm				1	
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm	5	3	1	2	2
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	34	24	48	15	19
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm				1	
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					1
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm		3		1	3
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm			1		2
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms		1		1	1
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm	1				2
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	3	4	3	6	6
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm		1	1		1
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean			1		
Cumacea	Cumacea	Cumaceans	6	10	2		
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod				3	1
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)			2	15	5
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)					
Amphipoda	Amphipoda Unid.	Amphipod	2	4	6		2
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod					
Ostracoda	Parasterope quadrata	Ostracod			1		
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods					
Cirripedia	Austrominius modestus	Estuarine Barnacle					
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**68**	**78**	**94**	**83**	**97**
	Count: No of Taxa		**12**	**16**	**20**	**17**	**19**
	SW_Diversity		**1.77719998**	**2.28500009**	**1.95949996**	**2.37129998**	**2.28449988**
	SW_Evenness		**0.71520001**	**0.82410002**	**0.6541**	**0.83700001**	**0.77590001**

GenGroup	**Taxa**	**Common Name**	**Site 5-01**	**Site 5-02**	**Site 5-03**	**Site 5-04**	**Site 5-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			2mm	20mm	3mm x 5	4mm	10mm
			1mm x 2	4mm	2mm x 3	3mm	8mm
				3mm x 2	1mm x 3	2mm x 4	5mm x 4
				2mm		1mm x 8	4mm x 4
							3mm x2
							2mm
							1mm x 5
Bivalvia	Paphies australis	Pipi					

General Group	Taxa	Common Name	Site 6-A	Site 6-B	Site 6-C	Site 6-D	Site 6-E
Anthozoa	Anthopleura aureoradiata	Anemone	4	17	4	8	8
Anthozoa	Edwardsia sp.	Burrowing anemone		1	1		1
Nemertea	Nemertea	Proboscis worms	1	2	3	1	1
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk	2	3	1	2	1
Gastropoda	Diloma subrostrata	Mud flat topshell	4	5	2	3	3
Gastropoda	Lunella smaragdus	Cat's Eye		1			
Gastropoda	Micrelenchus tenebrosus	Grazing snail	7	6	3	11	2
Gastropoda	Neoguraleus sp.	Spiraled shell	1	1		1	
Gastropoda	Notoacmea sp.	Limpet	15	17	12	16	12
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell					
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail	1	1	2		
Opisthobranchia	Haminoea zelandiae	Bubble shell	2				
Bivalvia	Arthritica bifurca	Small bivalve			8	2	
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	45	66	74	51	34
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)	1	3	2		1
Bivalvia	Mysella sp.	Small bivalve	1		5		
Bivalvia	Nucula hartvigiana	Nut Shell	19	29	42	28	21
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	1				
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm					
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm		1	2	1	1
Polychaeta: Spionidae	Aonides trifida	Polychaete worm	12	25	15	6	1
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm					
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	127	241	119	212	144
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm		1			
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm					
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	4	6	6	5	7
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms	1	1	1	2	
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm					
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	1			1	
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm					
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm	1	3		3	
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans	1		1	1	
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod			2	1	
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)	1	12	14	10	6
Amphipoda	Amphipoda Unid.	Amphipod	7	4	2	10	1
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					2
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod	4	1	7	6	3
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod	1				
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods				1	
Cirripedia	Austrominius modestus	Estuarine Barnacle	1	13	1	12	4
Insecta	Dolichopodidae larvae	small fly larvae					
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**265**	**460**	**329**	**394**	**253**
	Count: No of Taxa		**27**	**25**	**24**	**24**	**19**
	SW_Diversity		**1.94640005**	**1.82910001**	**2.08450007**	**1.83179998**	**1.63919997**
	SW_Evenness		**0.59060001**	**0.56819999**	**0.6559**	**0.57639998**	**0.55669999**

GenGroup	**Taxa**	**Common Name**	**Site 6-01**	**Site 6-02**	**Site 6-03**	**Site 6-04**	**Site 6-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			28mm	26mm	19mm	26mm	23mm x 2
			22mm	22mm	18mm	18mm	20mm
			20mm x 2	21mm	15mm	5mm	10mm
			15mm	19mm	12mm	4mm x 3	6mm
			14mm	8mm	10mm	3mm x 6	3mm x 5
			3mm x 2	7mm	8mm	2mm x 22	2mm x 18
			2mm x 15	6mm x 2	4mm	1mm x 17	1mm x 6
			1mm x 22	3mm x 8	3mm x 12		
				2mm x 20	2mm x 37		
				1mm x 20	1mm x 18		
Bivalvia	Paphies australis	Pipi					

General Group	Taxa	Common Name	Site 7-A	Site 7-B	Site 7-C	Site 7-D	Site 7-E
Anthozoa	Anthopleura aureoradiata	Anemone	3				
Anthozoa	Edwardsia sp.	Burrowing anemone				1	1
Nemertea	Nemertea	Proboscis worms				1	
Sipuncula	Themiste sp.	Peanut worm					
Gastropoda	Cominella glandiformis	Mud Flat Whelk	3				1
Gastropoda	Diloma subrostrata	Mud flat topshell					
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail					
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet					
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell					
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail					
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve			2		
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	18	13	6	17	8
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)					
Bivalvia	Mysella sp.	Small bivalve	6	1	1	3	1
Bivalvia	Nucula hartvigiana	Nut Shell					
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	1				1
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm					
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm	13	3	4	3	4
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm					
Polychaeta: Spionidae	Aonides trifida	Polychaete worm		1	2		
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm					
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	1	2	2		
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm					
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm					
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm					
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms					
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm					
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms			1	1	
Polychaeta: Nereidae	Perinereis vallata	Rag worm					
Polychaeta: Glyceridae	Glyceridae	Polychaete worm					
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans					
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod					
Amphipoda	Corophiidae	Amphipod (family)					
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)					
Amphipoda	Amphipoda Unid.	Amphipod					
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab					
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab					
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod					
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods					
Cirripedia	Austrominius modestus	Estuarine Barnacle	2				
Insecta	Dolichopodidae larvae	small fly larvae			1	1	2
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**47**	**20**	**19**	**27**	**18**
	Count: No of Taxa		**8**	**5**	**8**	**7**	**7**
	SW_Diversity		**1.63530004**	**1.09440005**	**1.86790001**	**1.26779997**	**1.58109999**
	SW_Evenness		**0.78640002**	**0.68000001**	**0.89829999**	**0.65149999**	**0.8125**

GenGroup	**Taxa**	**Common Name**	**Site 7-01**	**Site 7-02**	**Site 7-03**	**Site 7-04**	**Site 7-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			18mm	15mm	2mm x 3	12mm x 2	10mm
			17mm	13mm x 2	1mm x 3	10mm x 2	2mm x 4
			11mm x 2	11mm		9mm x 3	1mm x 3
			10mm	5mm		7mm	
			2mm x 2	3mm		6mm	
			1mm x 11	2mm x 3		3mm	
				1mm x 4		2mm x 2	
						1mm x 5	
Bivalvia	Paphies australis	Pipi					

General Group	Taxa	Common Name	Site 8-A	Site 8-B	Site 8-C	Site 8-D	Site 8-E
Anthozoa	Anthopleura aureoradiata	Anemone					
Anthozoa	Edwardsia sp.	Burrowing anemone					
Nemertea	Nemertea	Proboscis worms					
Sipuncula	Themiste sp.	Peanut worm					1
Gastropoda	Cominella glandiformis	Mud Flat Whelk		1			
Gastropoda	Diloma subrostrata	Mud flat topshell					
Gastropoda	Lunella smaragdus	Cat's Eye					
Gastropoda	Micrelenchus tenebrosus	Grazing snail					
Gastropoda	Neoguraleus sp.	Spiraled shell					
Gastropoda	Notoacmea sp.	Limpet					
Gastropoda	Turbonilla sp.	Small spiral shell					
Gastropoda	Xymene sp.	Small snail					
Gastropoda	Zeacumantus lutulentus	Spireshell					
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail		1			
Opisthobranchia	Haminoea zelandiae	Bubble shell					
Bivalvia	Arthritica bifurca	Small bivalve		3			
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	1	3	1	1	
Bivalvia	Felaniella (zemysia) zelandica	Bivalve					
Bivalvia	Macomona liliana	Wedge shell (Hanikura)					
Bivalvia	Mysella sp.	Small bivalve					
Bivalvia	Nucula hartvigiana	Nut Shell					
Bivalvia	Paphies australis	Pipi					
Bivalvia	Soletellina sp.	Golden sunset shell					
Oligochaeta	Oligochaeta	Oligochaete worms	9	4	5	7	36
Polychaeta: Sphaerodoridae	Sphaerodoropsis sp.	Small polychaete worm					
Polychaeta: Orbiniidae	Orbinia papillosa	Polychaete worm					
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm					
Polychaeta: Paraonidae	Paraonidae	Polychaete worm					
Polychaeta: Paraonidae	Aricidea sp.	Polychaete worm					
Polychaeta: Spionidae	Aonides trifida	Polychaete worm					
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm			1		
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	2	11			1
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm		3			
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm					
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm					
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	1	2			
Polychaeta: Maldanidae	Maldanidae	Bamboo Worms					
Polychaeta: Syllidae	Sphaerosyllis sp.	Polychaete worm					
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms					
Polychaeta: Nereidae	Perinereis vallata	Rag worm		1			
Polychaeta: Glyceridae	Glyceridae	Polychaete worm			1		
Polychaeta: Nephtyidae	Aglaophamus sp.	Polychaete worm					
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm					
Crustacea	Nebalia sp.	Small crustacean					
Cumacea	Cumacea	Cumaceans					
Tanaidacea	Tanaid sp.	Tanaid Shrimp					

Isopoda	Exosphaeroma planulum	Isopod					
Amphipoda	Corophiidae	Amphipod (family)					7
Amphipoda	Haustoridae	Amphipod (family)					
Amphipoda	Lysianassidae	Amphipod (family)					
Amphipoda	Phoxocephalidae	Amphipod (family)					
Amphipoda	Amphipoda Unid.	Amphipod					
Decapoda	Alpheus sp.	Snapping shrimp					
Decapoda	Austrohelice crassa	Tunnelling Mud Crab	3			3	6
Decapoda	Halicarcinus whitei	Pill-box Crab					
Decapoda	Hemiplax hirtipes	Stalk-eyed Mud Crab		1			2
Ostracoda	Copytus novaezealandiae	Ostracod					
Ostracoda	Diasterope grisea	Ostracod					
Ostracoda	Euphilomedes agilis	Ostracod					
Ostracoda	Parasterope quadrata	Ostracod					
Ostracoda	Phylctenophora zealandica	Ostracod					
Ostracoda	Scleroconcha arcuata	Ostracod					
Copepoda	Copepoda	Copepods					
Cirripedia	Austrominius modestus	Estuarine Barnacle		1			
Insecta	Dolichopodidae larvae	small fly larvae				1	
Phoronida	Phoronus sp.	Horseshoe worms					
	Count: No of Individuals		**16**	**31**	**8**	**12**	**53**
	Count: No of Taxa		**5**	**11**	**4**	**4**	**6**
	SW_Diversity		**1.24399996**	**2.04060006**	**1.07350004**	**1.07509995**	**1.05019999**
	SW_Evenness		**0.773**	**0.85100001**	**0.7744**	**0.7755**	**0.58609998**

GenGroup	**Taxa**	**Common Name**	**Site 8-01**	**Site 8-02**	**Site 8-03**	**Site 8-04**	**Site 8-05**
Bivalvia	Austrovenus stutchburyi	Cockle (Huangi)	**Cockles (mm)**				
			3mm	30mm	3mm	1mm	
				3mm			
				1mm			

Bivalvia	Paphies australis	Pipi	

Site 1

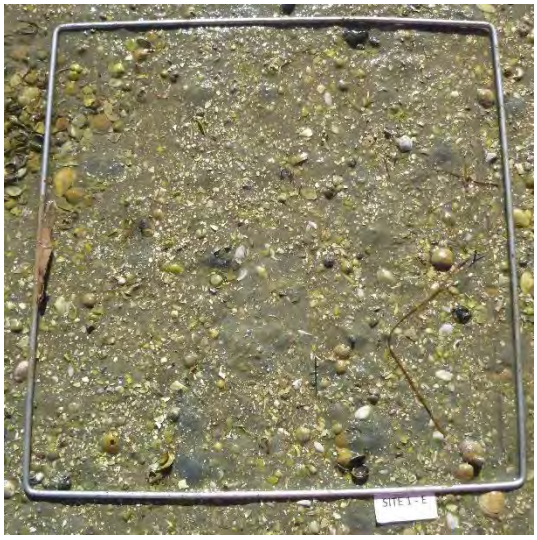
Site 1 – A

Site 1 – B

Site 1 – C

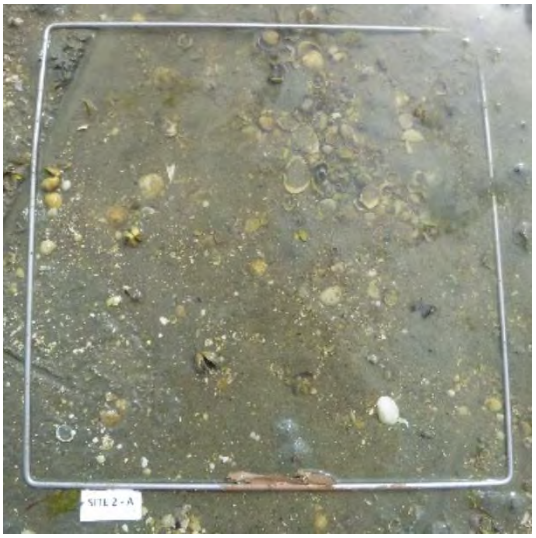
Site 1 - D

Site 1 – E

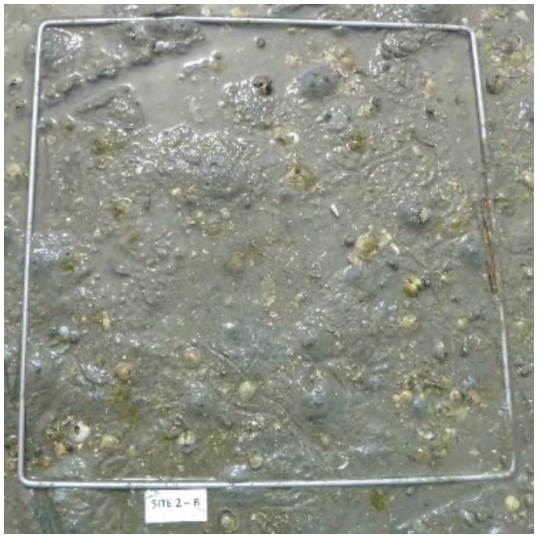


Site 2

Site 2 – A

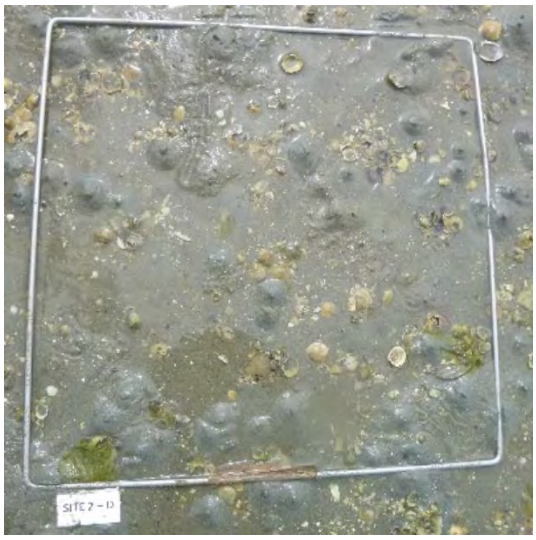


Site 2 – B



Site 2 – C

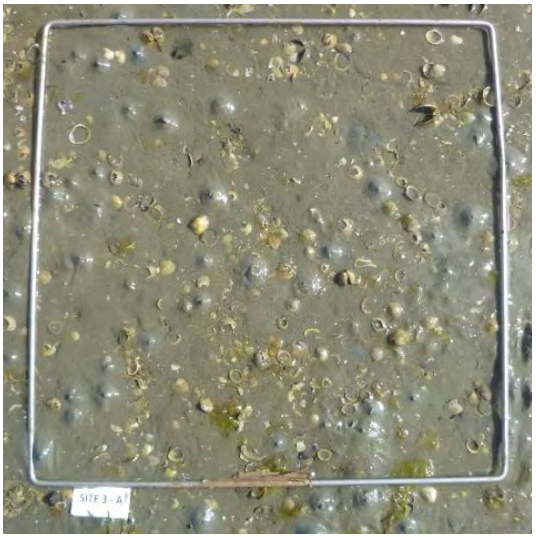
Site 2 – D



Site 2 – E

Site 3

Site 3 – A

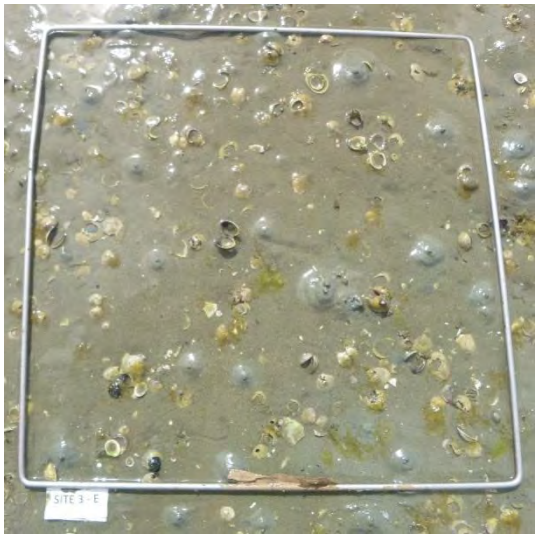


Site 3 – B

Site 3 – C

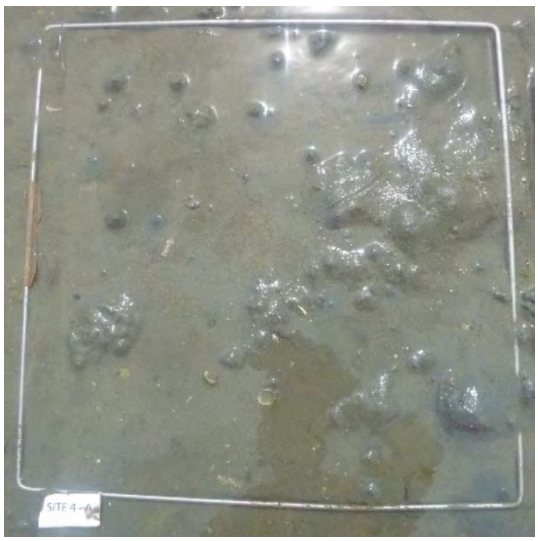
Site 3 – D

Site 3 – E



Site 4

Site 4 – A



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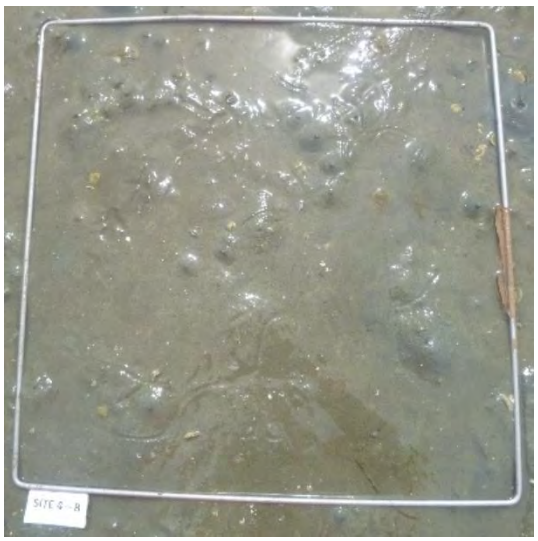
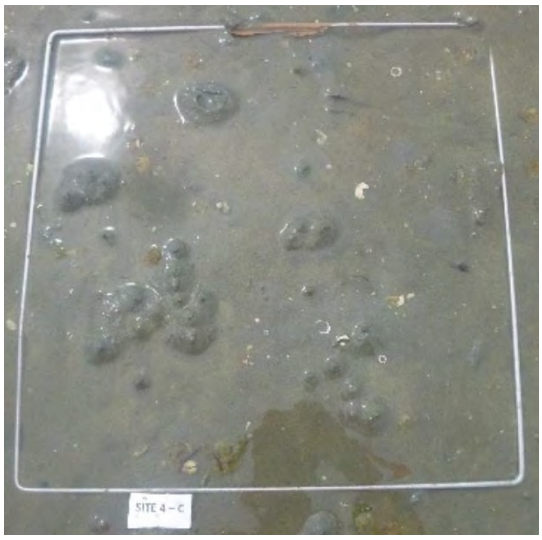
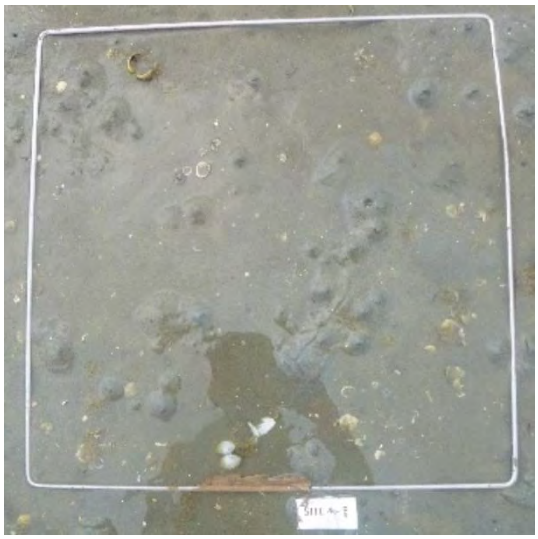


Site 4 – C



Site 4 – D

Site 4 – E



Site 5

Site 5 – A

Site 5 – B

Site 5 – C

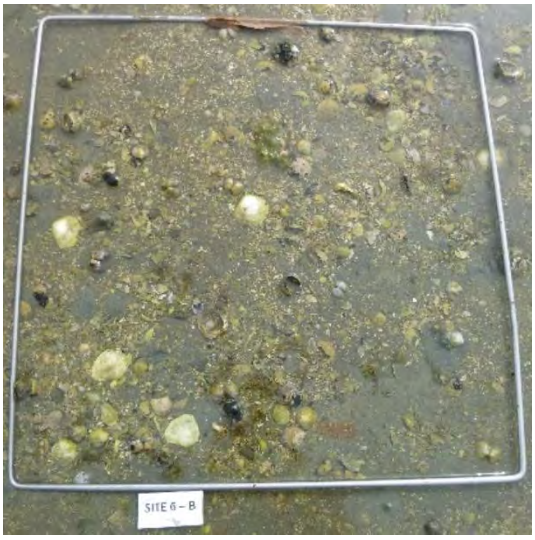
Site 5 - D

Site 5 – E

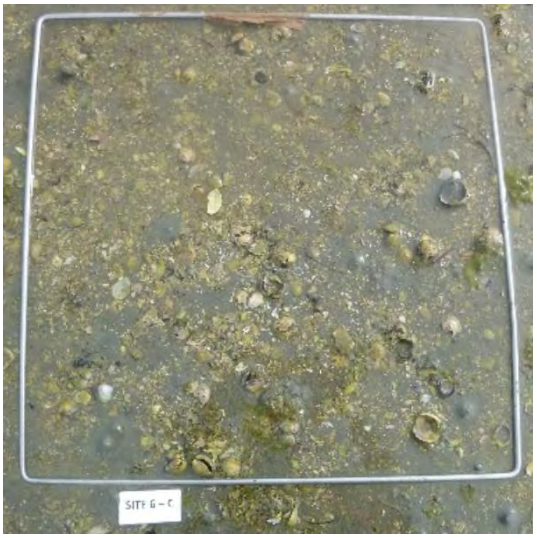
Site 6

Site 6 – A

Site 6 – B

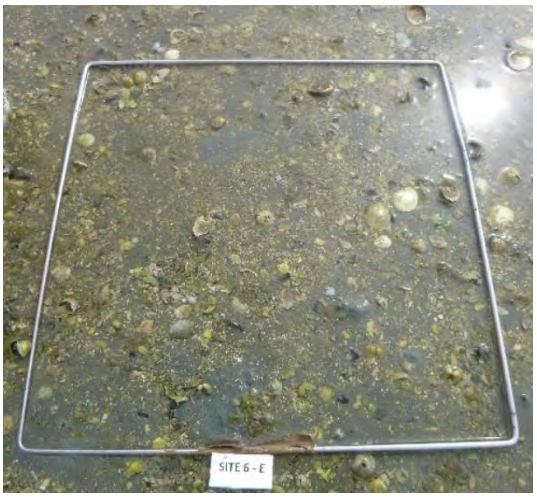


Site 6 – C



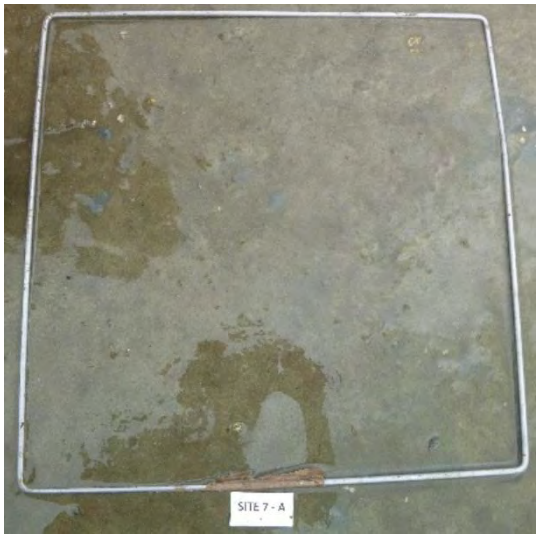
Site 6 – D

Site 6 – E

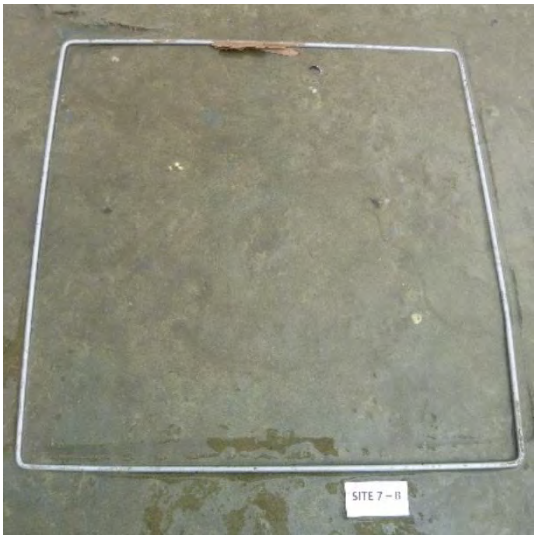


Site 7

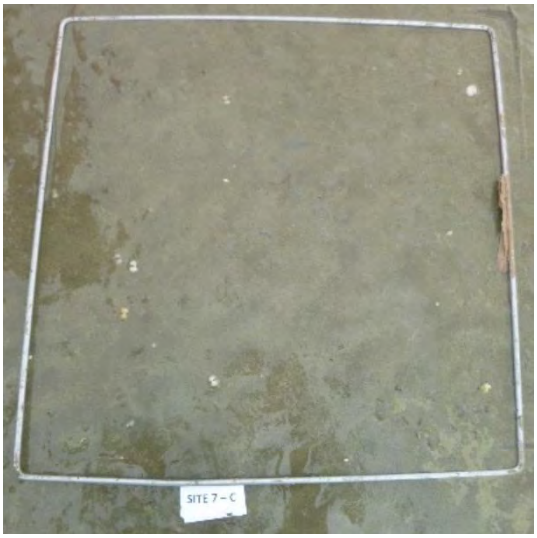
Site 7 – A



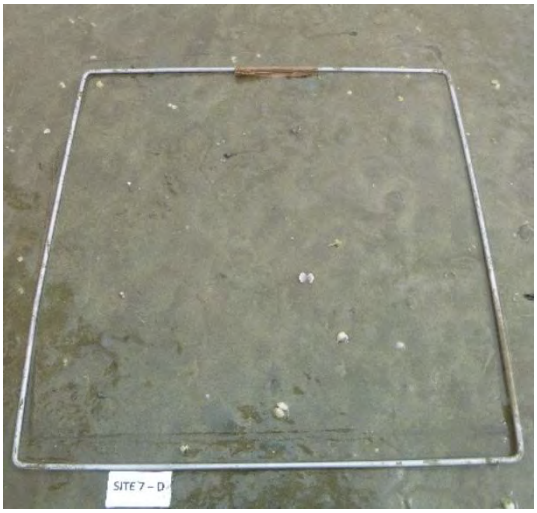
Site 7 – B



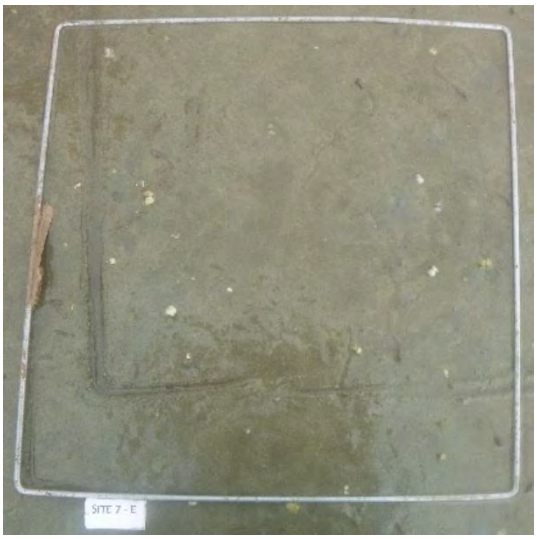
Site 7 – C



Site 7 – D

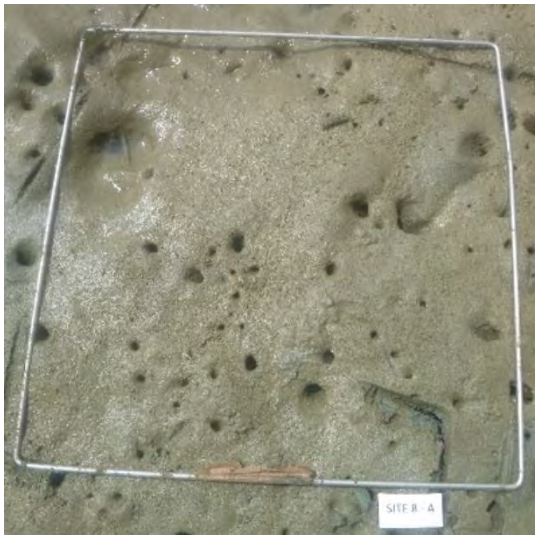


Site 7 – E

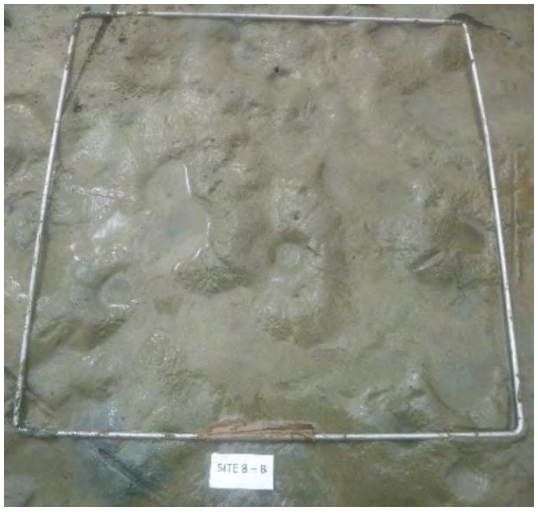


Site 8

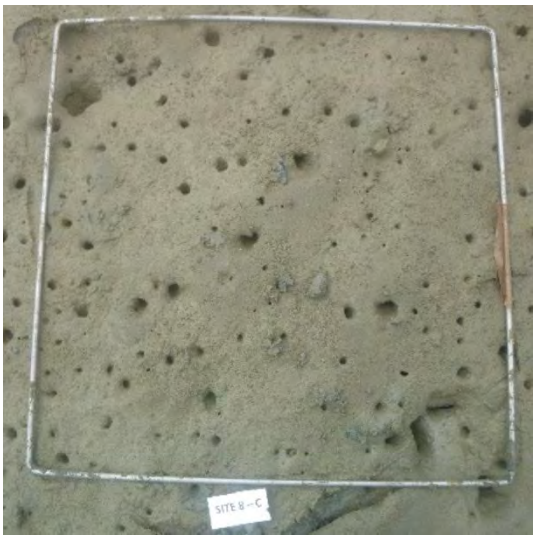
Site 8 – A



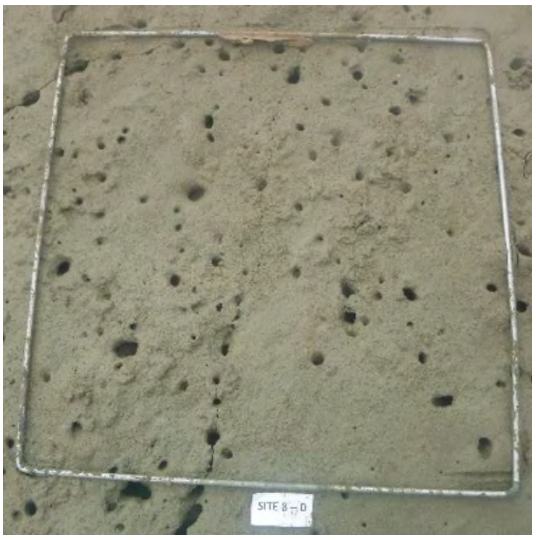
Site 8 – B



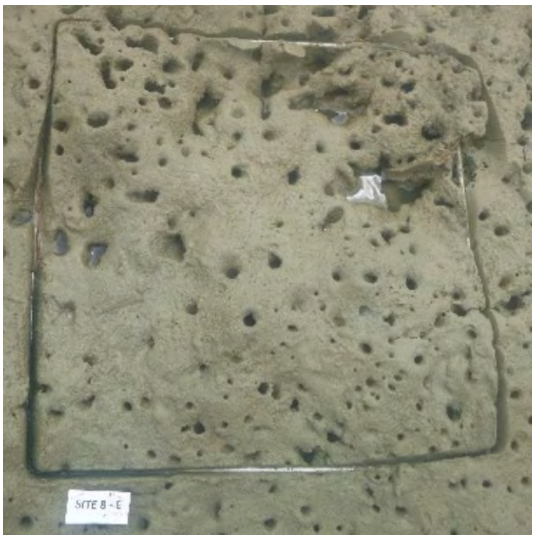
Site 8 – C



Site 8 – D



Site 8 – E



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W www.hill-laboratories.com

Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2572498	SUPv2
Contact:	Susan Jackson C/- Tonkin & Taylor PO Box 5271 Auckland 1141	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:** **Submitted By:**	31-Mar-2021 11-May-2021 110036 1014358.4000 1014358.4000 Susan Jackson	

Sample Type: Sediment

		Sample Name:	Site 1 24-Feb-2021 9:45 am	Site 2 24-Feb-2021 11:55 am	Site 3 24-Feb-2021 10:50 am	Site 4 25-Feb-2021 12:40 pm
		Lab Number:	2572498.1	2572498.2	2572498.3	2572498.4
Particle size analysis*‡			See attached report	See attached report	See attached report	See attached report
Total Recoverable Copper	mg/kg dry wt		1.84 ± 0.29	1.65 ± 0.27	1.10 ± 0.21	1.40 ± 0.24
Total Recoverable Lead	mg/kg dry wt		3.10 ± 0.38	2.89 ± 0.35	2.17 ± 0.27	3.04 ± 0.37
Total Recoverable Zinc	mg/kg dry wt		16.5 ± 2.7	14.6 ± 2.4	12.5 ± 2.1	15.2 ± 2.5
Chlorophyll a*‡	mg/kg as rcvd		8.1	5.4	4.4	5.0
Pheophytin a*‡	mg/kg as rcvd		3.3	3.4	2.4	3.4

		Sample Name:	Site 5 25-Feb-2021 11:45 am	Site 6 25-Feb-2021 10:30 am	Site 7 26-Feb-2021 11:15 am	Site 8 26-Feb-2021 12:45 pm
		Lab Number:	2572498.5	2572498.6	2572498.7	2572498.8
Particle size analysis*‡			See attached report	See attached report	See attached report	See attached report
Total Recoverable Copper	mg/kg dry wt		1.48 ± 0.25	1.27 ± 0.23	1.19 ± 0.22	2.74 ± 0.41
Total Recoverable Lead	mg/kg dry wt		3.06 ± 0.37	2.47 ± 0.30	2.68 ± 0.33	5.03 ± 0.61
Total Recoverable Zinc	mg/kg dry wt		14.9 ± 2.4	12.9 ± 2.1	14.1 ± 2.3	19.0 ± 3.1
Chlorophyll a*‡	mg/kg as rcvd		7.2	7.2	7.7	10.7
Pheophytin a*‡	mg/kg as rcvd		4.8	3.8	2.2	6.5

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Analyst's Comments

‡ Analysis subcontracted to an external provider. Refer to the Summary of Methods section for more details.

Appendix No.1 - Waikato University Report

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Chlorophyll a and Pheophytin a*		0.1 mg/kg as rcvd	1-8
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-8
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-8

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-8
Particle size analysis*	Malvern Laser Sizer particle size analysis from 0.05 microns to 3.4 mm. Samples are measured in volume %. Subcontracted to Earth Sciences Department, Waikato University, Hamilton.	-	1-8
Total Recoverable Copper	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.2 mg/kg dry wt	1-8
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.08 mg/kg dry wt	1-8
Total Recoverable Zinc	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.8 mg/kg dry wt	1-8
Chlorophyll a*	Extraction with 95% Ethanol, Spectroscopy. Subcontracted to NIWA, Hamilton. In-house.	0.1 mg/kg as rcvd	1-8
Pheophytin*	Extraction with 95% Ethanol, Spectroscopy. Subcontracted to NIWA, Hamilton. In-house.	0.1 mg/kg as rcvd	1-8

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 07-Apr-2021 and 11-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Analysis - Under

Malvern Instruments

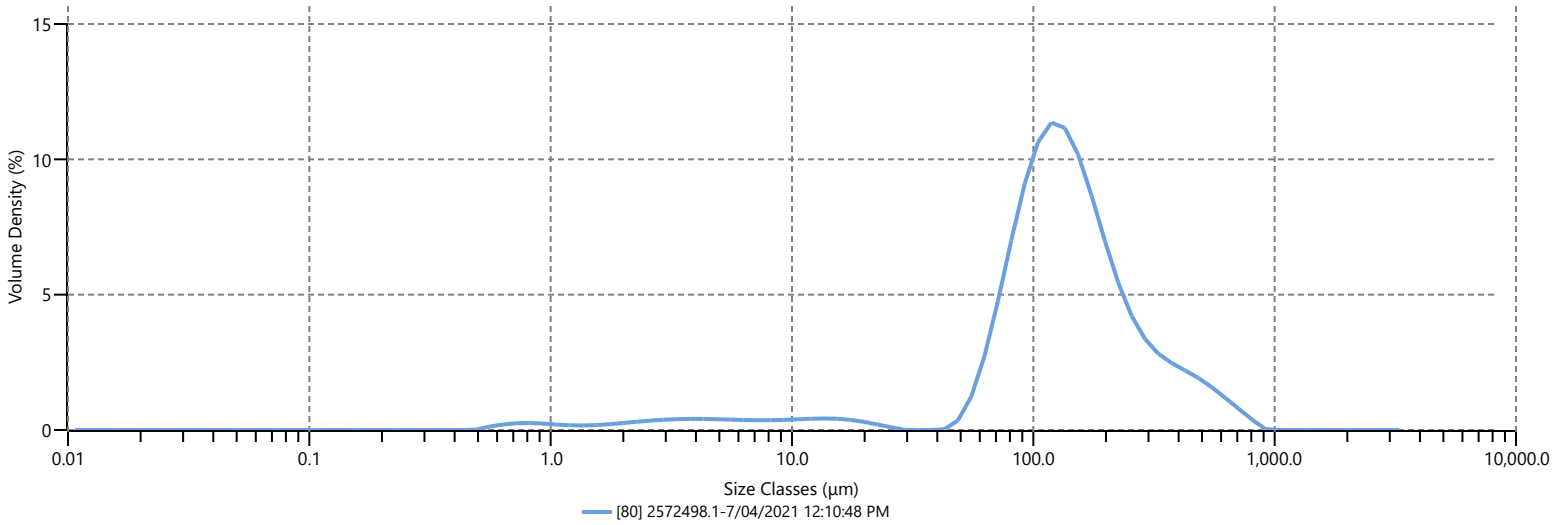
Measurement Details	
Sample Name	2572498.1
SOP File Name	Sediment.msop
Lab Number	2021064/1
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 12:10:48 PM
Measurement Date Time	7/04/2021 12:10:48 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.52 %
Laser Obscuration	13.44 %

Result	
Concentration	0.0546 %
Span	2.027
Uniformity	0.633
Specific Surface Area	219.8 m^2/kg
D [3,2]	27.3 µm
D [4,3]	166 µm
Dv (10)	62.0 µm
Dv (50)	132 µm
Dv (90)	329 µm
Volume Below (10) µm	5.69 %
Volume Below (20) µm	7.49 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	5.09	88.0	22.25	350	91.15	1410	100.00
0.0600	0.00	15.6	6.90	105	33.48	420	94.01	1680	100.00
0.120	0.00	31.0	7.86	125	46.21	500	96.33	2000	100.00
0.240	0.00	37.0	7.86	149	58.88	590	98.10	2380	100.00
0.490	0.00	44.0	7.86	177	69.57	710	99.36	2830	100.00
0.980	0.89	53.0	8.28	210	77.90	840	99.94	3360	100.00
2.00	1.80	63.0	10.27	250	83.77	1000	100.00		
3.90	3.35	74.0	14.44	300	88.22	1190	100.00		

Analysis - Under

Malvern Instruments

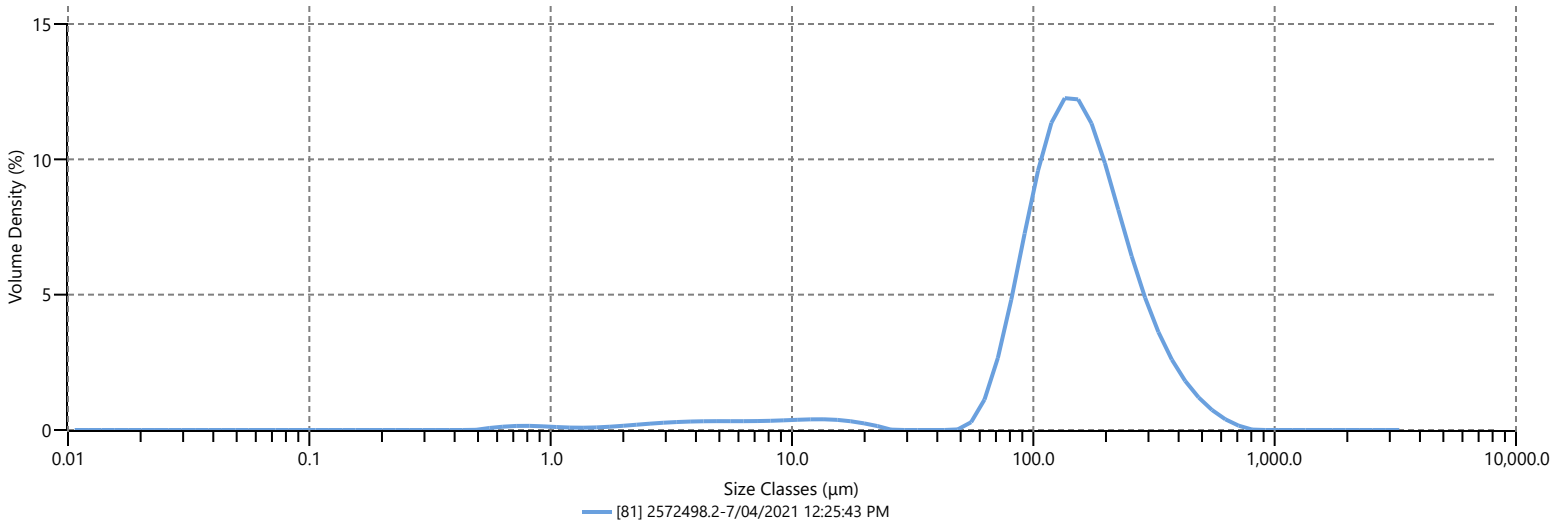
Measurement Details	
Sample Name	2572498.2
SOP File Name	Sediment.msop
Lab Number	2021064/2
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 12:25:43 PM
Measurement Date Time	7/04/2021 12:25:43 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.47 %
Laser Obscuration	11.71 %

Result	
Concentration	0.0663 %
Span	1.471
Uniformity	0.477
Specific Surface Area	154.1 m^2/kg
D [3,2]	38.9 µm
D [4,3]	170 µm
Dv (10)	77.8 µm
Dv (50)	149 µm
Dv (90)	297 µm
Volume Below (10) µm	4.15 %
Volume Below (20) µm	5.78 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	3.58	88.0	14.15	350	94.18	1410	100.00
0.0600	0.00	15.6	5.27	105	23.58	420	97.03	1680	100.00
0.120	0.00	31.0	6.00	125	35.89	500	98.70	2000	100.00
0.240	0.00	37.0	6.00	149	49.95	590	99.57	2380	100.00
0.490	0.00	44.0	6.00	177	63.30	710	99.93	2830	100.00
0.980	0.53	53.0	6.04	210	74.80	840	100.00	3360	100.00
2.00	1.02	63.0	6.67	250	83.64	1000	100.00		
3.90	2.10	74.0	8.81	300	90.30	1190	100.00		

Analysis - Under

Malvern Instruments

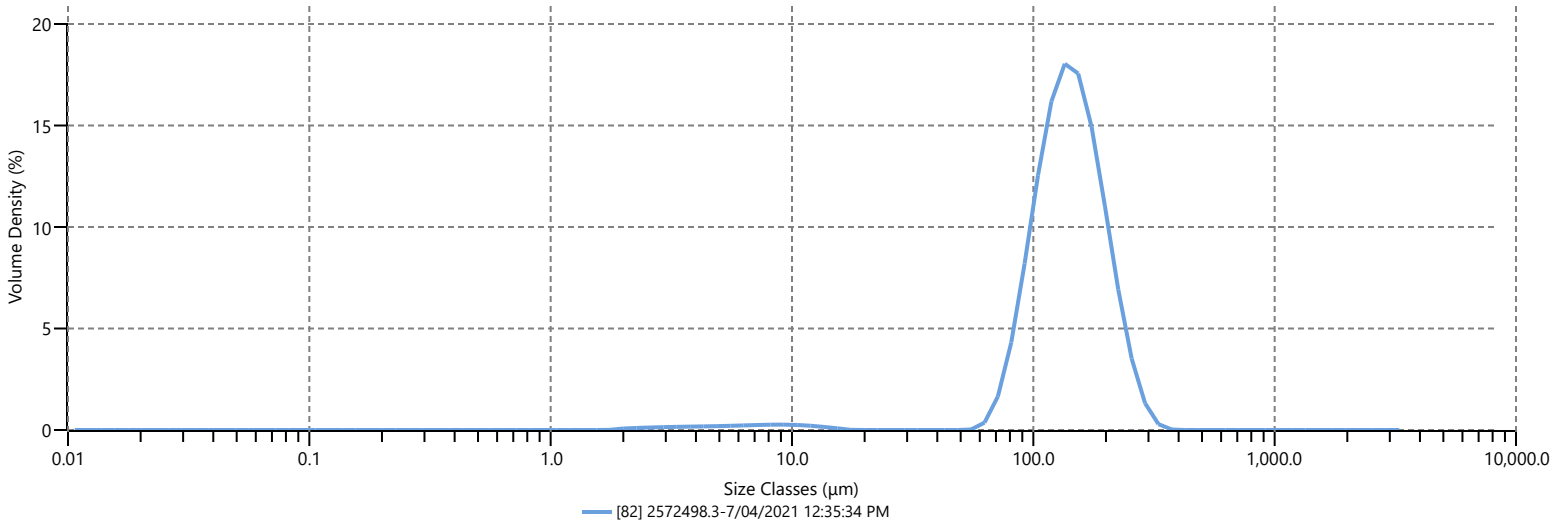
Measurement Details	
Sample Name	2572498.3
SOP File Name	Sediment.msop
Lab Number	2021064/3
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 12:35:34 PM
Measurement Date Time	7/04/2021 12:35:34 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.52 %
Laser Obscuration	14.66 %

Result	
Concentration	0.1679 %
Span	0.860
Uniformity	0.278
Specific Surface Area	72.08 m^2/kg
D [3,2]	83.2 µm
D [4,3]	145 µm
Dv (10)	90.4 µm
Dv (50)	140 µm
Dv (90)	210 µm
Volume Below (10) µm	1.97 %
Volume Below (20) µm	2.52 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	1.54	88.0	8.55	350	99.99	1410	100.00
0.0600	0.00	15.6	2.50	105	19.93	420	100.00	1680	100.00
0.120	0.00	31.0	2.52	125	37.08	500	100.00	2000	100.00
0.240	0.00	37.0	2.52	149	57.72	590	100.00	2380	100.00
0.490	0.00	44.0	2.52	177	76.28	710	100.00	2830	100.00
0.980	0.00	53.0	2.52	210	89.88	840	100.00	3360	100.00
2.00	0.03	63.0	2.65	250	96.88	1000	100.00		
3.90	0.60	74.0	3.77	300	99.56	1190	100.00		

Analysis - Under

Malvern Instruments

Malvern

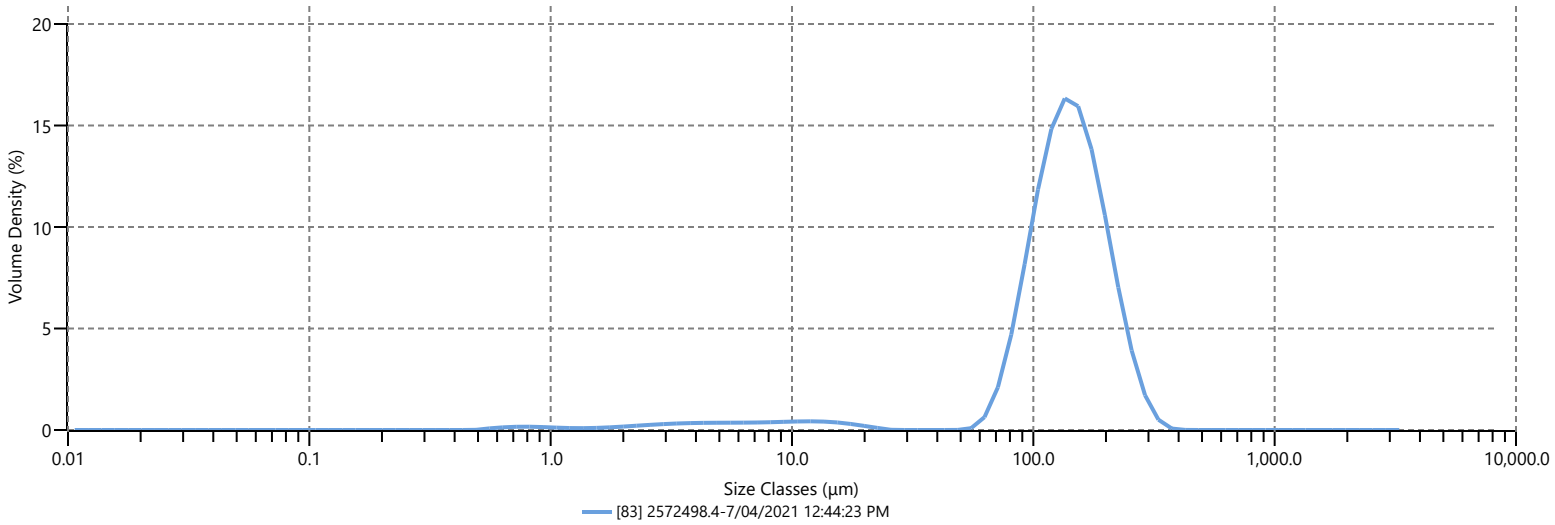
Measurement Details	
Sample Name	2572498.4
SOP File Name	Sediment.msop
Lab Number	2021064/4
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 12:44:23 PM
Measurement Date Time	7/04/2021 12:44:23 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.37 %
Laser Obscuration	13.82 %

Result	
Concentration	0.0736 %
Span	0.985
Uniformity	0.324
Specific Surface Area	165.7 m^2/kg
D [3,2]	36.2 µm
D [4,3]	140 µm
Dv (10)	79.8 µm
Dv (50)	137 µm
Dv (90)	215 µm
Volume Below (10) µm	4.53 %
Volume Below (20) µm	6.20 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	3.89	88.0	13.40	350	99.95	1410	100.00
0.0600	0.00	15.6	5.73	105	24.47	420	100.00	1680	100.00
0.120	0.00	31.0	6.37	125	40.31	500	100.00	2000	100.00
0.240	0.00	37.0	6.37	149	59.01	590	100.00	2380	100.00
0.490	0.00	44.0	6.37	177	75.99	710	100.00	2830	100.00
0.980	0.56	53.0	6.37	210	88.88	840	100.00	3360	100.00
2.00	1.09	63.0	6.65	250	96.09	1000	100.00		
3.90	2.26	74.0	8.19	300	99.27	1190	100.00		

Analysis - Under

Malvern Instruments

Malvern

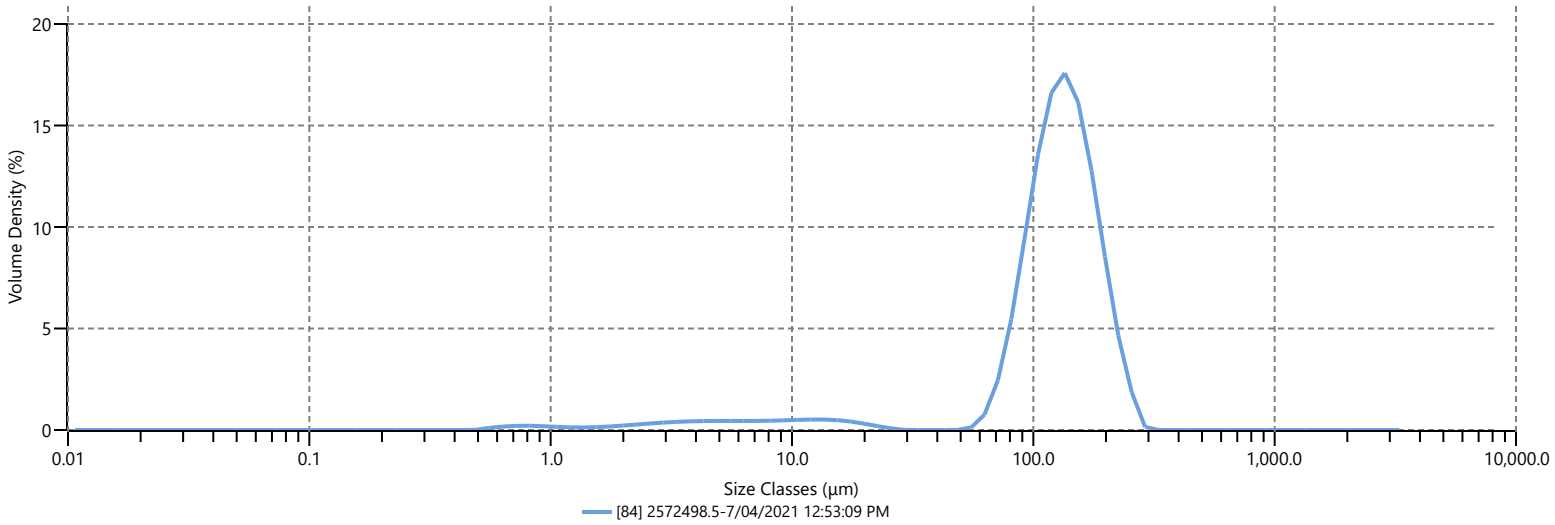
Measurement Details	
Sample Name	2572498.5
SOP File Name	Sediment.msop
Lab Number	2021064/5
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 12:53:09 PM
Measurement Date Time	7/04/2021 12:53:09 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.40 %
Laser Obscuration	16.69 %

Result	
Concentration	0.0741 %
Span	0.947
Uniformity	0.313
Specific Surface Area	202.8 m^2/kg
D [3,2]	29.6 µm
D [4,3]	128 µm
Dv (10)	72.4 µm
Dv (50)	128 µm
Dv (90)	194 µm
Volume Below (10) µm	5.69 %
Volume Below (20) µm	7.82 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	4.93	88.0	16.37	350	100.00	1410	100.00
0.0600	0.00	15.6	7.16	105	29.13	420	100.00	1680	100.00
0.120	0.00	31.0	8.16	125	47.03	500	100.00	2000	100.00
0.240	0.00	37.0	8.16	149	67.01	590	100.00	2380	100.00
0.490	0.00	44.0	8.16	177	83.56	710	100.00	2830	100.00
0.980	0.73	53.0	8.17	210	94.43	840	100.00	3360	100.00
2.00	1.43	63.0	8.53	250	98.99	1000	100.00		
3.90	2.92	74.0	10.33	300	100.00	1190	100.00		

Analysis - Under

Malvern Instruments

Malvern

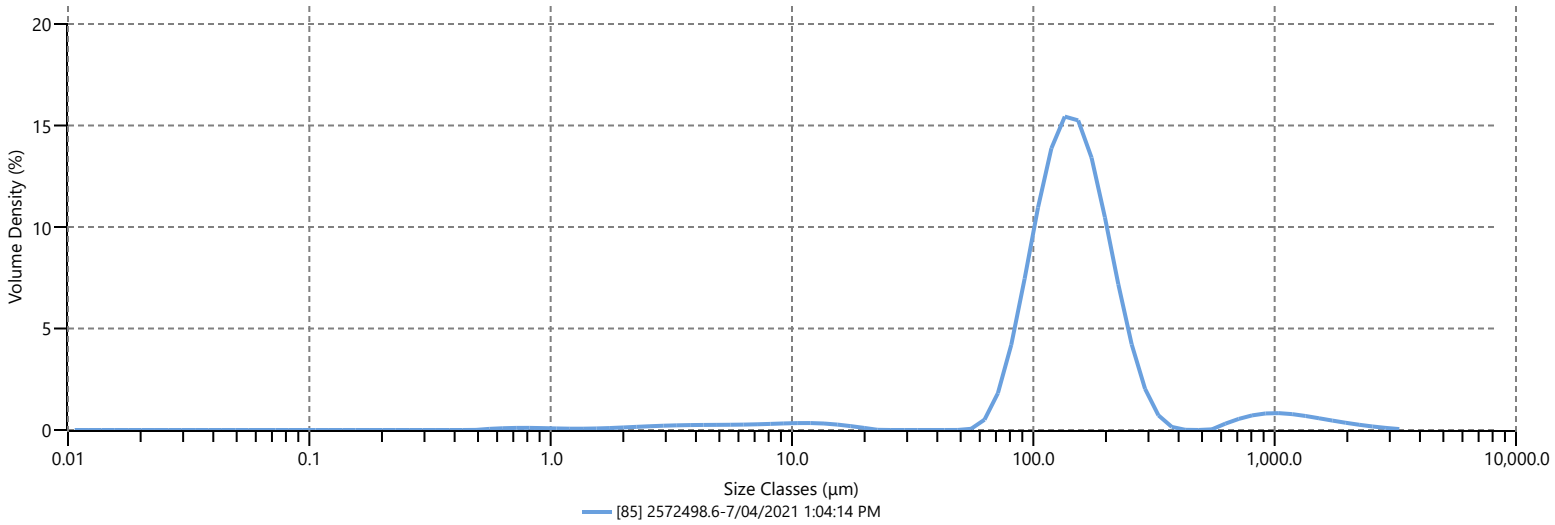
Measurement Details	
Sample Name	2572498.6
SOP File Name	Sediment.msop
Lab Number	2021064/6
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 1:04:14 PM
Measurement Date Time	7/04/2021 1:04:14 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.38 %
Laser Obscuration	15.04 %

Result	
Concentration	0.1049 %
Span	1.146
Uniformity	0.730
Specific Surface Area	126.4 m^2/kg
D [3,2]	47.5 µm
D [4,3]	208 µm
Dv (10)	86.7 µm
Dv (50)	144 µm
Dv (90)	252 µm
Volume Below (10) µm	3.29 %
Volume Below (20) µm	4.53 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	2.78	88.0	10.74	350	94.29	1410	98.29
0.0600	0.00	15.6	4.23	105	20.89	420	94.41	1680	98.94
0.120	0.00	31.0	4.57	125	35.66	500	94.41	2000	99.41
0.240	0.00	37.0	4.57	149	53.36	590	94.43	2380	99.73
0.490	0.00	44.0	4.57	177	69.69	710	94.91	2830	99.91
0.980	0.37	53.0	4.57	210	82.37	840	95.64	3360	99.99
2.00	0.74	63.0	4.78	250	89.80	1000	96.56		
3.90	1.59	74.0	6.09	300	93.36	1190	97.49		

Analysis - Under

Malvern Instruments

Malvern

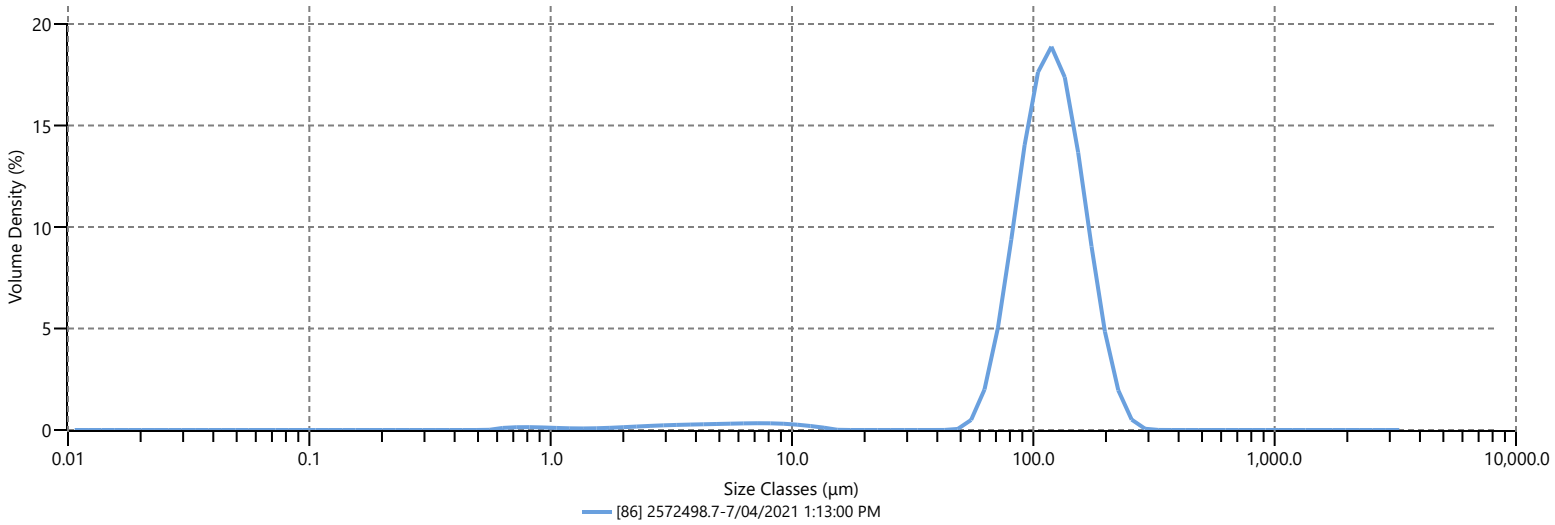
Measurement Details	
Sample Name	2572498.7
SOP File Name	Sediment.msop
Lab Number	2021064/7
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 1:13:00 PM
Measurement Date Time	7/04/2021 1:13:00 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.40 %
Laser Obscuration	14.15 %

Result	
Concentration	0.0857 %
Span	0.837
Uniformity	0.275
Specific Surface Area	143.6 m^2/kg
D [3,2]	41.8 µm
D [4,3]	119 µm
Dv (10)	75.6 µm
Dv (50)	116 µm
Dv (90)	173 µm
Volume Below (10) µm	3.70 %
Volume Below (20) µm	4.16 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	3.19	88.0	19.69	350	100.00	1410	100.00
0.0600	0.00	15.6	4.16	105	37.63	420	100.00	1680	100.00
0.120	0.00	31.0	4.16	125	58.89	500	100.00	2000	100.00
0.240	0.00	37.0	4.16	149	78.31	590	100.00	2380	100.00
0.490	0.00	44.0	4.16	177	91.31	710	100.00	2830	100.00
0.980	0.42	53.0	4.24	210	97.94	840	100.00	3360	100.00
2.00	0.86	63.0	5.34	250	99.74	1000	100.00		
3.90	1.79	74.0	9.30	300	99.99	1190	100.00		

Analysis - Under

Malvert Instruments

Malvern

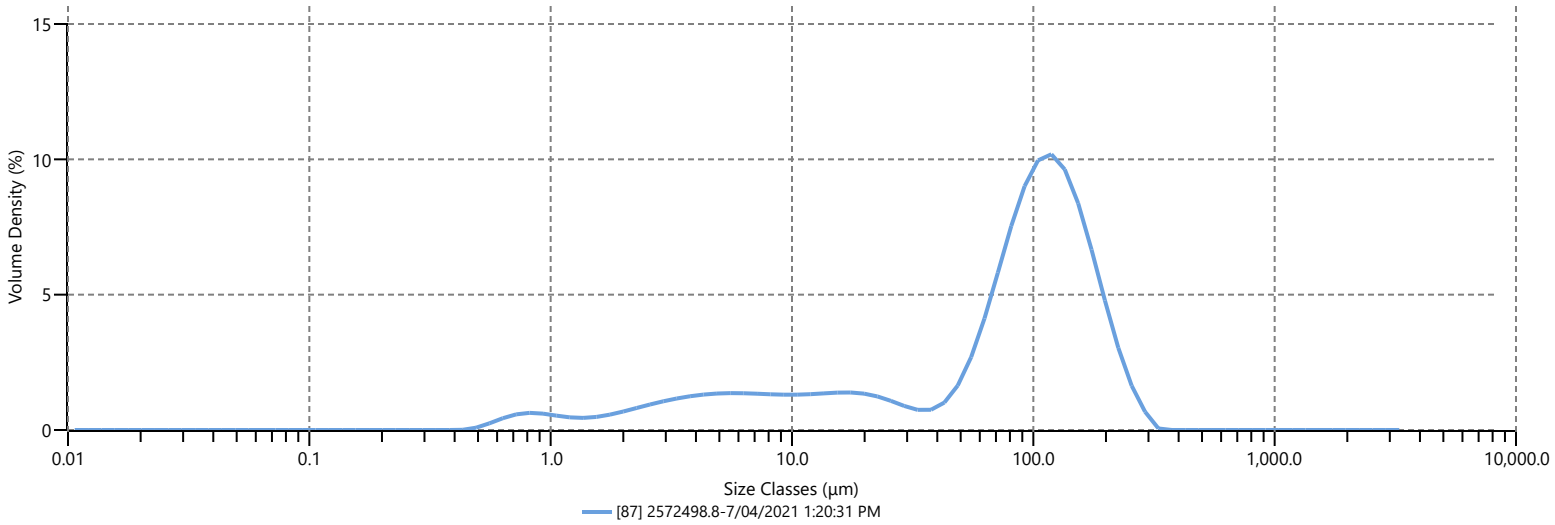
Measurement Details	
Sample Name	2572498.8
SOP File Name	Sediment.msop
Lab Number	2021064/8
Operator Name	hharveyw

Measurement Details	
Analysis Date Time	7/04/2021 1:20:31 PM
Measurement Date Time	7/04/2021 1:20:31 PM
Result Source	Measurement

Analysis	
Particle Name	Sediment
Particle Refractive Index	1.500
Particle Absorption Index	0.200
Dispersant Name	Water
Dispersant Refractive Index	1.330
Scattering Model	Mie
Analysis Model	General Purpose
Weighted Residual	0.46 %
Laser Obscuration	17.16 %

Result	
Concentration	0.0294 %
Span	1.905
Uniformity	0.585
Specific Surface Area	530.3 m^2/kg
D [3,2]	11.3 µm
D [4,3]	91.4 µm
Dv (10)	4.45 µm
Dv (50)	91.6 µm
Dv (90)	179 µm
Volume Below (10) µm	17.07 %
Volume Below (20) µm	23.19 %

Frequency (compatible)



Result

Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under	Size (µm)	% Volume Under
0.0500	0.00	7.80	14.95	88.0	47.65	350	100.00	1410	100.00
0.0600	0.00	15.6	20.96	105	58.52	420	100.00	1680	100.00
0.120	0.00	31.0	26.36	125	70.10	500	100.00	2000	100.00
0.240	0.00	37.0	27.21	149	80.97	590	100.00	2380	100.00
0.490	0.03	44.0	28.18	177	89.54	710	100.00	2830	100.00
0.980	2.12	53.0	30.14	210	95.46	840	100.00	3360	100.00
2.00	4.52	63.0	33.78	250	98.56	1000	100.00		
3.90	8.89	74.0	39.22	300	99.87	1190	100.00		

Appendix F: Biodiversity Compensation Model – Input Descriptions (Table 3.1 Baber et al. 2021a)

Appendix F Table 1: Biodiversity Compensation Model – Input Descriptions (Table 3.1 Baber et al. 2021a)

Model inputs	Description
Project reference/ name	**Instruction** Manually type project reference as applicable.
Biodiversity type	**Instruction** Manually type in the biodiversity type to which the BCM relates, e.g. terrestrial vegetation, kahikatea swamp forest, raupō wetland, indigenous fauna assemblage, lizard assemblage, kānuka or Australasian bittern. **Explanation** Models can be applied to broad habitat types (e.g. forest habitat or wetland habitat) for which impact scores for several specific forest or wetland habitat types can be independently determined (e.g. exotic wetland versus a raupō wetland). This approach is often taken when the same compensation action or actions are proposed for different impacts on different habitat types. For example, for a long-tailed bat BCM, native revegetation may be proposed as a common compensation measure to address effects associated with the loss of three habitat types (exotic plantation forest, exotic scrub and pasture).
Technical expert input(s)	**Instruction** Manually type in the names of all technical experts involved in contributing to and agreeing data inputs. **Explanation** Determining data inputs with maximum accuracy requires the involvement of experts, likely a team, including those experienced in implementing, monitoring and reporting on management actions. Evaluating the outputs of the BCM will equally benefit from interpretation by a representative team of suitability qualified and experienced experts.
Benchmark	**Instruction** Manually type in **5** (the benchmark is always 5). **Explanation** The benchmark of 5 is a reference measure score which constitutes a hypothetical but realistic potential state. Typically, this would include a large, contiguous, native-dominated terrestrial or wetland ecosystem type that has been subject to intensive mammalian pest control over the long-term with the full suite of indigenous flora and fauna present at or near carrying capacity. This habitat would generally be of such high quality that compensation actions would provide negligible additional ecological gain. The benchmark is always 5 so that it aligns with the Ecological Impact Assessment Guidelines (EcIAG, Roper-Lindsay *et al.* 2018). In broad terms the following numerical scores for ecological value align with the following ecological value categories: • < 1 = Negligible • 1 - < 2 = Low • 2 - < 3 = Moderate • 3 - < 4 = High • 4 - < 5 = Very High • 5 = Benchmark

How many habitat types OR sites are impacted	**Instruction** Select from the drop-down menu the number of different habitat type or sites/locations impacted. Up to 5 different habitat types or sites can be selected. **Explanation** When the affected biodiversity value constitutes a broad habitat type (e.g. native forest) there may be different habitat types that are impacted. For example, the biodiversity type 'native forest' may include pūriri forest, kānuka forest, and kauri forest. Each of these specific habitat types will likely require different impact contingencies and have different ecological value scores and should therefore be considered separately. When an affected biodiversity value includes a specific habitat type that is impacted at different sites or locations, considering these as separate may be warranted if the ecological value or the type of impacts differ across sites or locations. For example, a project may have different types and magnitude of impacts on a single 0.4 ha of kauri forest, (including 0.1 ha of total habitat loss through vegetation clearance and 0.3 ha of habitat degradation through edge effects and general disturbance associated with land use change). In this situation, the impacts on this kauri forest fragment could be separated out because the type and magnitude of effects differs. Equally though, the areas could be assessed as one, provided the impacts are appropriately captured in the assessment. If there are more than 5 habitat types or sites/locations impacted, a new BCM can be created, and the overall impact scores added.
Number of proposed compensation actions	**Instruction** Select from the drop-down menu the number of different compensation actions proposed. Up to 5 different compensation actions can be selected. **Explanation** Where compensation actions differ AND are undertaken in different locations or sites, or the spatial extent of the compensation action is different, then each action must be assessed independently. In some instances, different compensation actions in the same location can be lumped into a single compensation action (e.g. native revegetation and weed control), provided appropriate justification is given. Similarly, it may be appropriate to combine the same compensation action at different locations into a single compensation action, with appropriate explanation.
Net Gain target	**Instruction** Manually type in the desired Net Gain target as a percentage, e.g. if the number 20 is typed, this will be converted to 20 %. **Explanation** In general terms, the greater the assigned Net Gain outcome target, the greater the likelihood that No Net Loss or preferably Net Gain outcomes will be achieved. For compensation a Net Gain outcome target of 10 % is considered by the authors to be generally appropriate. This equates to a 10 % exceedance of No Net Loss, i.e. the Compensation Score is 10 % higher than the Impact Score. However, the selected Net Gain outcome target will need to be justified and should be assigned on a case-by-case basis.
Habitat/site impacts	**Instruction** Manually type the name of the habitat(s) or site(s) impacted. The number of named habitat(s) or site(s) will need to match the number of proposed compensation actions specified above.
Impact risk contingency	**Instruction** Select from the drop-down menu: 1 = Negligible or low risk/ Negligible or low value (calculated impact score is multiplied by 1.0 (+0 %))

	2 = Moderate risk/Moderate value (calculated impact score is multiplied by 1.05 (+5 %)) 3 = High risk/High value (calculated impact score is multiplied by 1.1 (+10 %)) 4 = Very high risk/Very high value (calculated impact score is multiplied by 1.2 (+20 %)) **Explanation** The impact risk contingency addresses the increased likelihood that adverse effects will result in the permanent and irreplaceable loss of significant biodiversity values when impacting on habitats or species that are of higher ecological value. The assigned ecological value is based on the EcIAG ecological value assessment. The risk contingency percentage multiplier is commensurate with the EcIAG assigned ecological value with the multiplier assigned to each ecological value category based on testing under a range of scenarios[6]. For avoidance of doubt, the impact risk contingency relates to the biodiversity type. For example: • If the model biodiversity type is 'long-tailed bat' then the impact risk contingency relates to the assigned ecological value for long-tailed bat and would therefore be the same across the different long-tailed bat habitat types that are impacted and included in the model (e.g. pasture versus shelterbelts, versus mature forest). • If the model biodiversity type is a broad habitat type, e.g. 'native forest', and the impacts relate to more specific habitat types that differ in their ecological value, then the impact risk contingency for each habitat type will be different (e.g. kauri forest versus young regenerating kānuka forest).
Impact uncertainty contingency	**Instruction** Select from the drop-down menu: 1 = Low uncertainty (calculated impact score is multiplied by 1.05 (+5 %)) 2 = Moderate uncertainty (calculated impact score is multiplied by 1.1 (+10 %)) 3 = High uncertainty (calculated impact score is multiplied by 1.2 (+20 %)) 4 = Very high uncertainty (the model will not work if this option is selected) **Explanation** By providing for a greater margin of error, the impact uncertainty contingency addresses the increased risk of permanent or irreplaceable biodiversity loss when impacting on more complex habitats, or on species for which there is less information regarding species-specific impacts associated with an effect. The rationale for category selection will need to be justified on ecological grounds. Where very high uncertainty exists in relation to adverse effects, this constitutes a limit to the use of the BCM model; project redesign or avoidance of effects should instead be considered. The percentage multipliers used for the impact uncertainty contingency levels have been assigned based on testing different multipliers under a range of scenarios.[7]
Areal extent of impact (ha)	**Instruction** Manually type in the areal extent of impact in hectares with respect to the value being considered (incorporating both direct and indirect effects).

[6] In general terms, the application of higher percentage multipliers was difficult to justify and generated predicted Net Loss outcomes when the converse would be expected. Similarly, the use of lower multipliers undermined confidence that predicted Net Gain model outputs would be achieved.

[7] In general terms, the application of higher percentage multipliers for each level of uncertainty category was difficult to justify and generated predicted Net Loss outcomes when the converse would be expected. Similarly, the use of lower percentage multipliers for each level of uncertainty category undermined confidence that predicted Net Gain model outputs would be achieved.

	Explanation If there is more than one habitat type or more than one site of the same habitat type, then impact (ha) will relate to that specific habitat or site. However, the total habitat loss (ha) will be automatically summed and factored into the impact score calculations.
Value prior to impact	**Instruction** Manually type in a numerical score between 0 and 5 that relates to the value score prior to impact relative to the benchmark value score of 5. **Explanation** The assigned value score in all instances must relate explicitly to the biodiversity type that the model relates to. Adequate detail must be provided to justify the assigned ecological value score based on desktop and field investigations. This enables an understanding of the adequacy and certainty surrounding the assessment and should include an explanation of why the value score was neither higher nor lower. **Habitat value scores:** For habitats, the ecological value prior to impact relates to the representativeness, rarity and distinctiveness, diversity and pattern, and ecological context associated with the habitats/vegetation types within a project footprint as assessed against the benchmark. Refer to Section 5.2 and Table 4 of the Ecological Impact Assessment Guidelines (EcIAG, Roper-Lindsay *et al.* 2018), the detail of which would be provided in the Assessment of Ecological Effects report for the Project. In broad terms: • < 1 = Negligible • 1 - < 2 = Low • 2 - < 3 = Moderate • 3 - < 4 = High • 4 - < 5 = Very High • 5 = Benchmark NB: • In some instances, consideration of loss of 'potential value' may be required for impact values (e.g. for natural inland wetlands under the National Policy Statement for Freshwater Management 2020 (NPS FM)). This should be considered in the context of the value affected and the potential value if it were restored (using best practice, reasonable efforts). Ensure that the reporting outputs are clear as to whether the 'existing' or 'potential' values were used to quantify the compensation measures. • The EcIAG (Roper-Lindsay *et al.* 2018) assessment of ecological value does not assess the contribution that a particular habitat type may make to ecological functioning or the provision of ecosystem services. We recommend that these factors are also considered when assessing the value of impacted habitats. **Species or species assemblage value scores:** The EcIAG (Roper-Lindsay *et al.* 2018) does not include criteria for determining habitat suitability for a given species. Since habitat suitability is a key component of a magnitude of effects assessment, this will ideally be addressed in subsequent versions of the EcIAG. In the interim we set out proposed criteria below: • 0 = Habitat not suitable. • < 1 = Marginal habitat that may be used but is not important for any part of the species or species assemblage life-cycle(s). • 1 - < 2 = Relatively low value habitat that provides some but not all of a species or species assemblages life-history requirements and/or the habitat is of low quality and

	the relative abundance within the habitat is low compared to other habitat types. • 2 - < 3 = Relatively moderate value habitat that provides for most, if not all, of a species or species assemblage's life-history requirements and/or the habitat quality is of moderate quality and the relative abundance within the habitat is moderate compared to other habitat types. • 3 - < 4 = Relatively high value habitat that would typically provide for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) for life-history requirements. The habitat quality is high and the relative abundance within the habitat is, or is likely to be, high compared to other habitat types. • 4 - < 5 = Relatively very high value habitat that provides for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) needed for life-history requirements. The habitat quality is very high and the relative abundance within the habitat is or is likely to be very high compared to other habitat types. Likely to be a local hotspot for that species. • 5 = Highest quality habitat and/or relative abundance for a given species or species assemblage, likely to be a regional hotspot or benchmark with the species or species assemblage at carrying capacity. As with habitat scores, adequate detail must be included from desktop and field investigations to provide transparent justification for each value score. The reader needs to understand the adequacy and certainty surrounding the assessment and requires an explanation of why the score was neither higher nor lower. The model assumes a static rather than temporally dynamic biodiversity baseline at the impact site. The predicted NNL/NG outcome is therefore relative to pre-impact values. In instances where population densities or relative abundance appear higher in seemingly less suitable habitats than in more suitable habitats, this will need to be addressed and reflected in the relative value scores.
Value <u>after</u> impact	**Instruction** Manually type in a numerical score between 0 and 5 that relates to the value score <u>after</u> the impact relative to the benchmark value score of 5. **Explanation** The explanation for determining the habitat or species scores after impact is the same as the method for determining these scores prior to impact except that the assessment value score relates to the impact site after the impact has occurred. NB: • The drop in ecological value relates to the magnitude of impact based on the EcIAG, which is a function of the extent, intensity, frequency and permanence of the impact. It is important to factor in all types of impacts associated with the project which may range from earthworks, vegetation and sedimentation to increased exposure to artificial lighting or noise, or domestic mammalian predators. • The model does not accept a value score of 0 as the formula will not work, but it does allow for a score of 0.001 (virtually zero).
Compensation action(s)	**Instruction** Manually enter the compensation action proposed. The number of different compensation measures (habitat(s) or site(s)) will need to match the number of proposed compensation actions specified above. **Explanation** The compensation action relates to each type of habitat creation, restoration, or enhancement activity that is proposed, e.g. native revegetation into existing pasture and/or weed and mammalian pest control in existing forest.

	As long as it is explained, it is appropriate to lump different compensation types where they are applied as a total package within a particular habitat or site (e.g. bush retirement coupled with weed control and mammalian pest control).
Discount rate	**Instruction** Manually enter a discount rate. **Explanation** The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s). A discount rate of 3 % is recommended. This is the same as the discount rate recommended in the BOAM user guide (Maseyk *et al.* 2015), which is informed by research in Gibbons *et al.* 2015. That said, we note that a discount rate of 3 % rewards benefits that deliver faster than those that take longer but provide greater ecological outcomes in the longer term, i.e. it punishes the tortoise and rewards the hare). For example, revegetation may deliver greater biodiversity gains in the long term for habitats than mammalian pest control, but all else being equal, a discount rate of 3 % will favour mammalian pest control over revegetation because gains would be predicted to occur almost immediately after commencement of pest control operations.
Finite end-point	**Instruction** Manually enter the number of years between impact and assessment of biodiversity gain at the compensation site(s) resulting from compensation actions. **Explanation** The finite end-point is the time period (years) over which to calculate NPBV. This equates to the time between the commencement of proposed compensation action(s) and an assessment of the associated benefits for the affected biodiversity value (e.g. native revegetation at 20 years). For pest control this time period would be short because biodiversity gains occur almost immediately after commencement of pest control operations. However, these biodiversity gains will diminish once the pest control is terminated, and this needs to be addressed when applying the model. The finite end-point should generally be tied to the duration of the biodiversity management and monitoring programmes that are used to verify that the benefits at compensation sites have been achieved. For instance, if the finite end point is set at 10 years from commencement of compensation, then the biodiversity management and monitoring programme should be undertaken for 10 years (but possibly longer if predicted biodiversity gains are not achieved and adaptive management or contingency measures are required).
Compensation confidence contingency	**Instruction** Select from the drop-down menu: 1 = Very high confidence (> 90 %) 2 = High confidence (75 % - 90 %) 3 = Moderate confidence (50 - 75 %) 4 = Low confidence (< 50 %) (The model will not work if this option is selected). **Explanation** The approach used to assign compensation confidence contingency is aligned with the approached used in Maseyk *et al.* (2015) except that the term 'offset' has been changed to 'compensation'.

	The compensation confidence contingency relates to the level of confidence in the likely success of the proposed compensation measures and methodology (see above). This reflects that even well-established management methods sometimes fail to achieve targets for a multitude of reasons. The model does not consider confidence in the implementer of the proposed compensation. Nor does it consider likelihood of abandonment of the project post-impact but prior to the implementation of compensation actions. • Very high confidence: The proposed compensation measure uses methods that are well tested and repeatedly proven to achieve intended biodiversity gains; evidence-based expert opinion is that success is very likely. Likelihood of success is > 90 %. Calculated biodiversity gain is multiplied by 0.925. • High confidence: The proposed compensation measure uses methods that are well known, often implemented, and which have been proven to succeed greater than 75 % of the time. However, complicating factors and/or expert opinion precludes greater confidence in this compensation measure. Likelihood of success is greater than 75 % but less than 90 %. Calculated biodiversity gain is multiplied by 0.825. • Moderate confidence: The proposed compensation measure uses methods that have either been successfully implemented in New Zealand or in the situation and context relevant to the compensation site but infrequently, or the outcomes of the proposed compensation measures are not well proven or documented, or success rates elsewhere have been shown to be variable. Likelihood of success is > 50 % but < 75 %. Calculated biodiversity gain is multiplied by 0.625. • Low confidence: Should not use the compensation measure and the model will not work if this option is selected on the basis that uncertainty is too high.
Areal extent (ha) of compensation action	**Instruction** Manually enter the areal extent (ha) of the proposed compensation action.
	Instruction Manually type in a numerical value score between 0 and 5 that relates to the value score at the compensation site(s) prior to implementation of compensation action(s). **Explanation** Adequate detail must be provided to justify the assigned ecological value score based on desktop and field investigations and assessed using EcIAG (Roper-Lindsay *et al.* 2018 or an updated version). This enables an understanding of the adequacy and certainty surrounding the assessment and should include an explanation of why the value score prior to the implementation of the compensation action(s) was neither higher nor lower. The EcIAG (Roper-Lindsay *et al.* 2018) assessment of ecological value does not include an assessment of value in relation to ecological functioning or the provision of ecosystem services. We recommend that these factors are also considered when assessing the habitat value associated with a compensation action(s). Note that the model does not accept a value score of 0 as the formula will not work, but it does allow for a score of 0.001 (virtually 0).
Value score after compensation measure	**Instruction** Manually type in a numerical value score between 0 and 5 that relates to the value score at the compensation site(s) after implementation of compensation action(s) as assessed at the finite end point (years). **Explanation** Adequate detail must be provided to justify the assigned ecological value score after implementation of compensation actions based on desktop and field investigations and

	assessed using EcIAG (Roper-Lindsay *et al.* 2018 or an updated version). This enables an understanding of the adequacy and certainty surrounding the assessment and should include an explanation of why the compensation value score after implementation of the compensation action(s) was neither higher nor lower. The EcIAG (Roper-Lindsay *et al.* 2018) assessment of ecological value does not include an assessment of value in relation to ecological functioning or the provision of ecosystem services. We recommend that these factors are also considered when assessing the habitat value associated with a compensation action(s).

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