

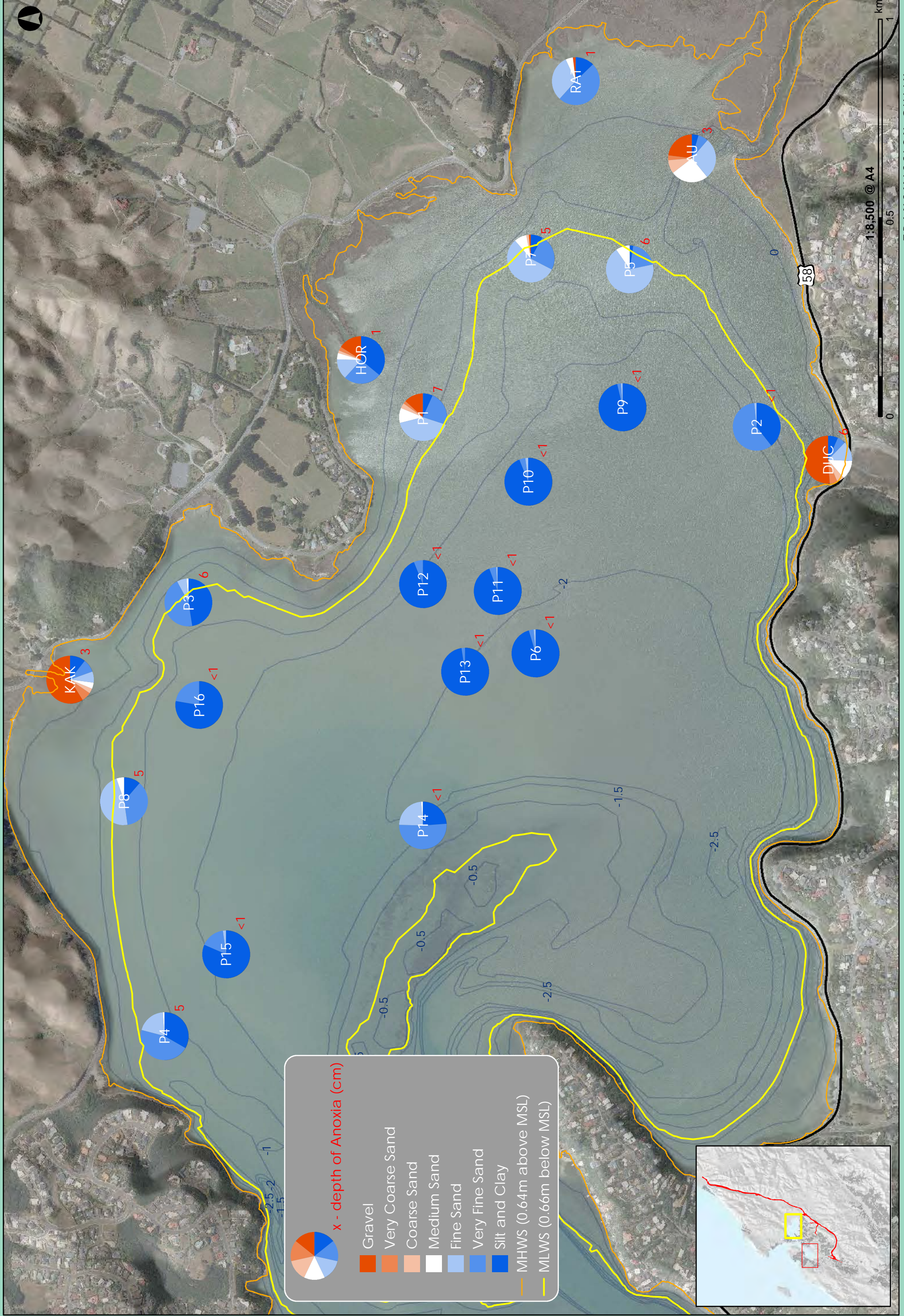
APPENDIX A: Table 10.3 : Typical characteristics of estuarine marine habitats with low, moderate and high ecological values (from Technical Report 10).

Ecological value	Characteristics
Low	<ul style="list-style-type: none"> • Benthic invertebrate community degraded with low species richness and diversity. • Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with few/no sensitive taxa present. • Marine sediments dominated by smaller grain sizes. • Shallow depth of oxygenated surface sediment. • Elevated contaminant concentrations in surface sediment, above ISQG-high or ARC-red effects threshold concentrations⁵⁶. • Invasive, opportunistic and disturbance tolerant species dominant. • Minimal habitat and feeding areas for fish and birds present. • Seagrass beds not present. • Saltmarsh habitat disconnected, absent or highly modified. • Habitat highly modified.
Moderate	<ul style="list-style-type: none"> • Benthic invertebrate community typically has moderate species richness and diversity. • Benthic invertebrate community has both (organic enrichment and mud) tolerant and sensitive taxa present. • Marine sediments typically comprise approximately 50-70% smaller grain sizes. • Depth of oxygenated surface sediment typically >0.5 cm. • Contaminant concentrations in surface sediment generally below ISQG-high or ARC-red effects threshold concentrations. • Few invasive opportunistic and disturbance tolerant species present. • Habitats and feeding areas for birds and fish present but modified or small. • Seagrass areas patchy or small. • Connects to saltmarsh habitat limited or modified. • Habitat modification limited.

⁵⁶ ANZECC (2000) Interim Sediment Quality Guideline (ISQG) High contaminant threshold concentrations or Auckland Regional Council's Environmental Response Criteria Red contaminant threshold concentrations (Auckland Regional Council, 2004).

Ecological value	Characteristics
High	<ul style="list-style-type: none"> • Benthic invertebrate community typically highly diverse with high species richness. • Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and mud. • Marine sediments typically comprise <50% smaller grain sizes. • Depth of oxygenated surface sediment typically >1.0 cm. • Contaminant concentrations in surface sediment rarely exceed low effects threshold concentrations. • Habitats and feeding areas for birds and fish present and largely unmodified. • Keystone species present (e.g. significant cockle beds). • Seagrass beds present. • Natural connections to saltmarsh habitat present. • Habitat largely unmodified.

APPENDIX B: HARBOUR FIGURES

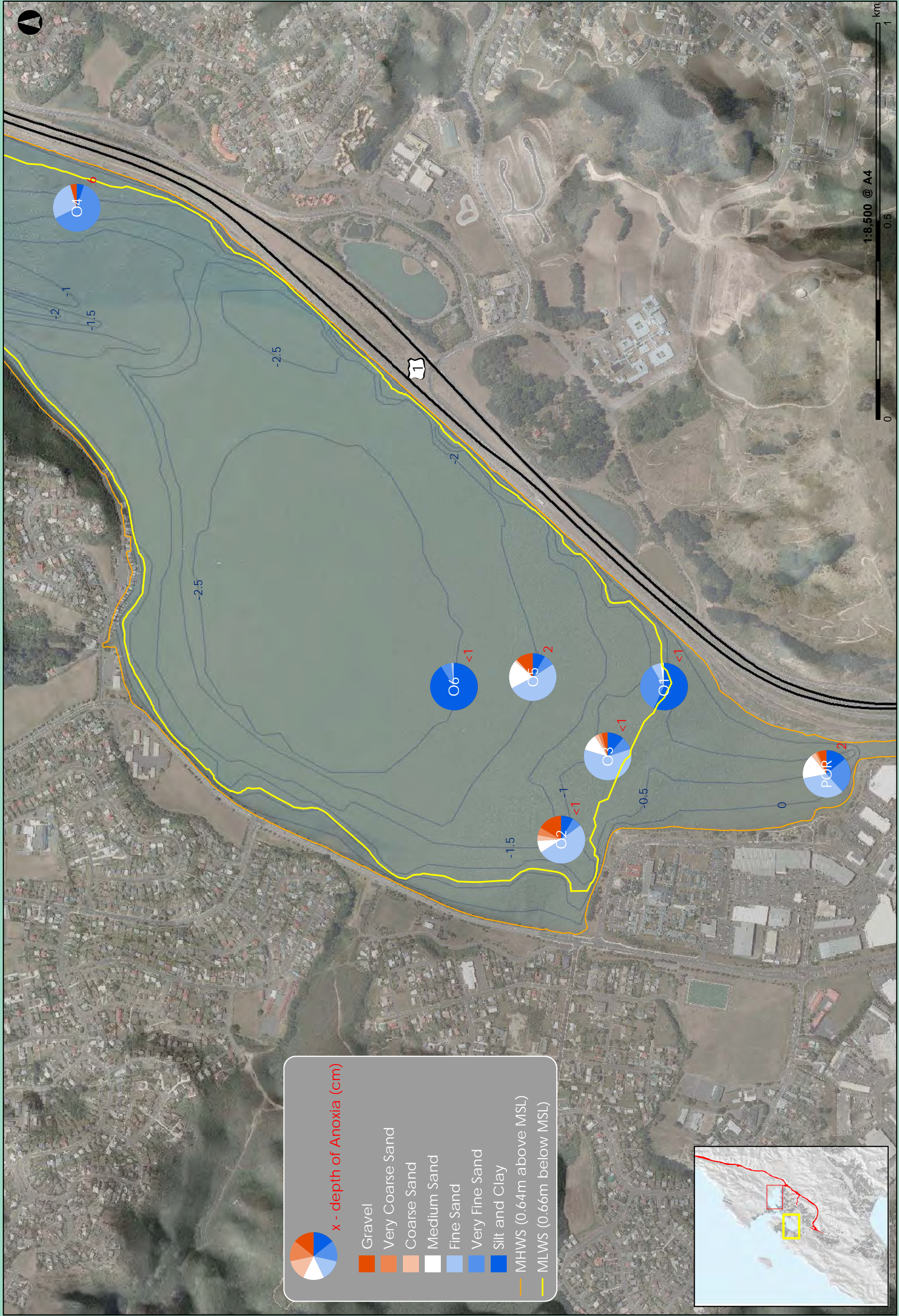


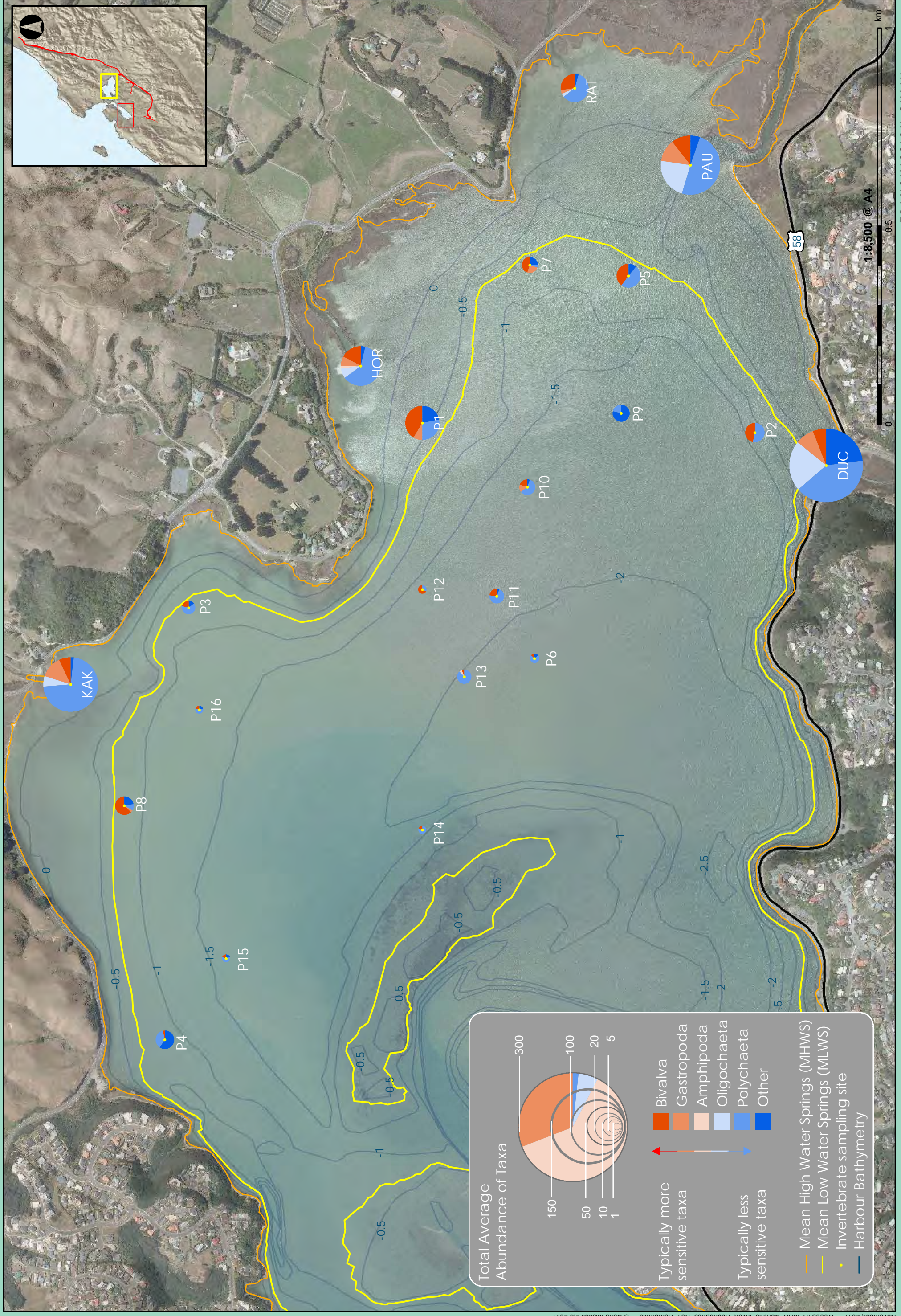
November 2011 W09034A_MAR_SamplingSedimentParticleSize_R01_A4mb.mxd © Boffa Miskell Ltd 2011

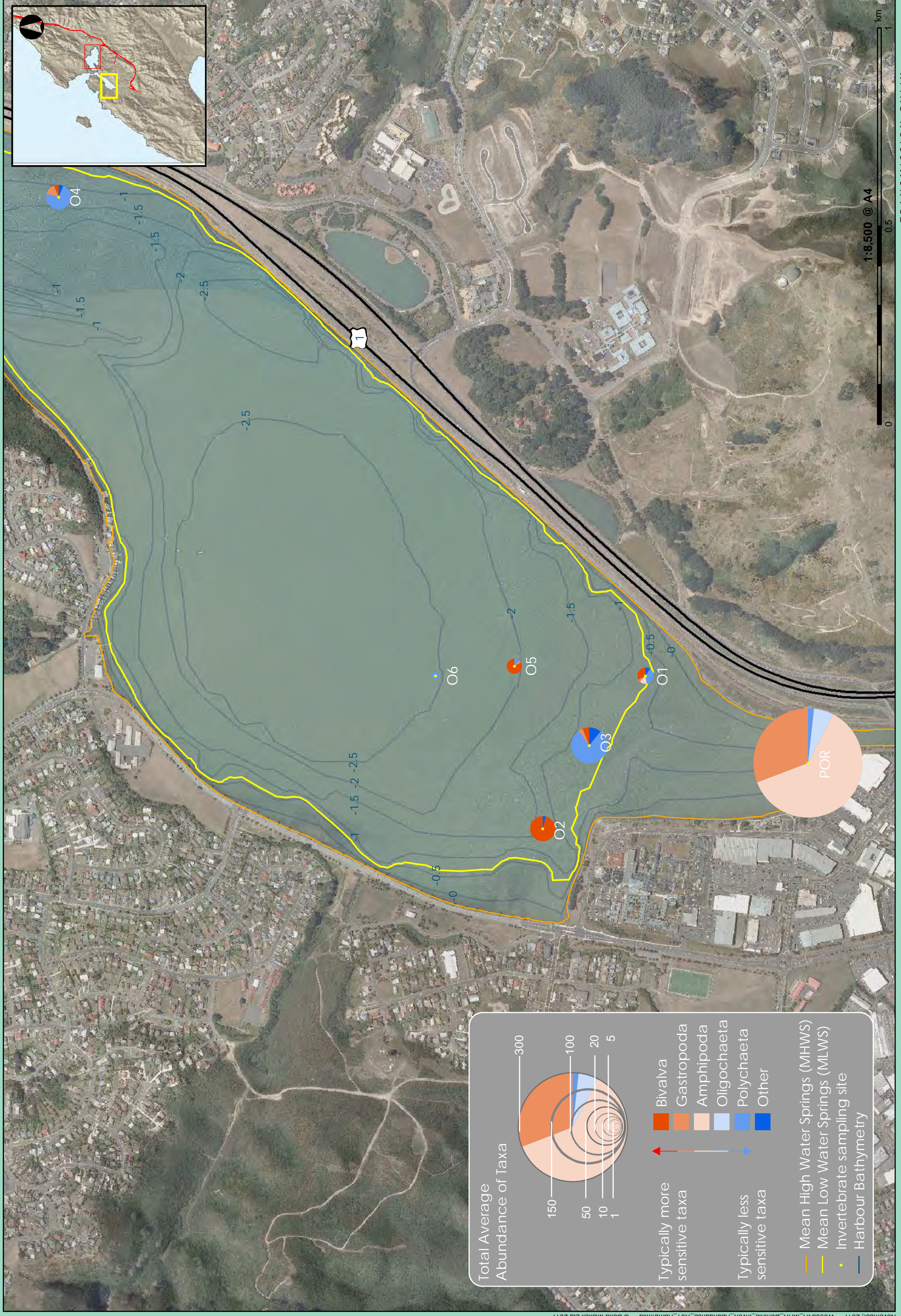
x - depth of Anoxia (cm)

- Gravel
- Very Coarse Sand
- Coarse Sand
- Medium Sand
- Fine Sand
- Very Fine Sand
- Silt and Clay

— MHWS (0.64m above MSL)
— MLWS (0.66m below MSL)







Total Average Abundance of Taxa

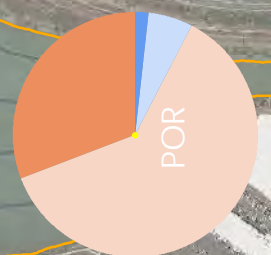
300
150
100
50
20
10
5
1

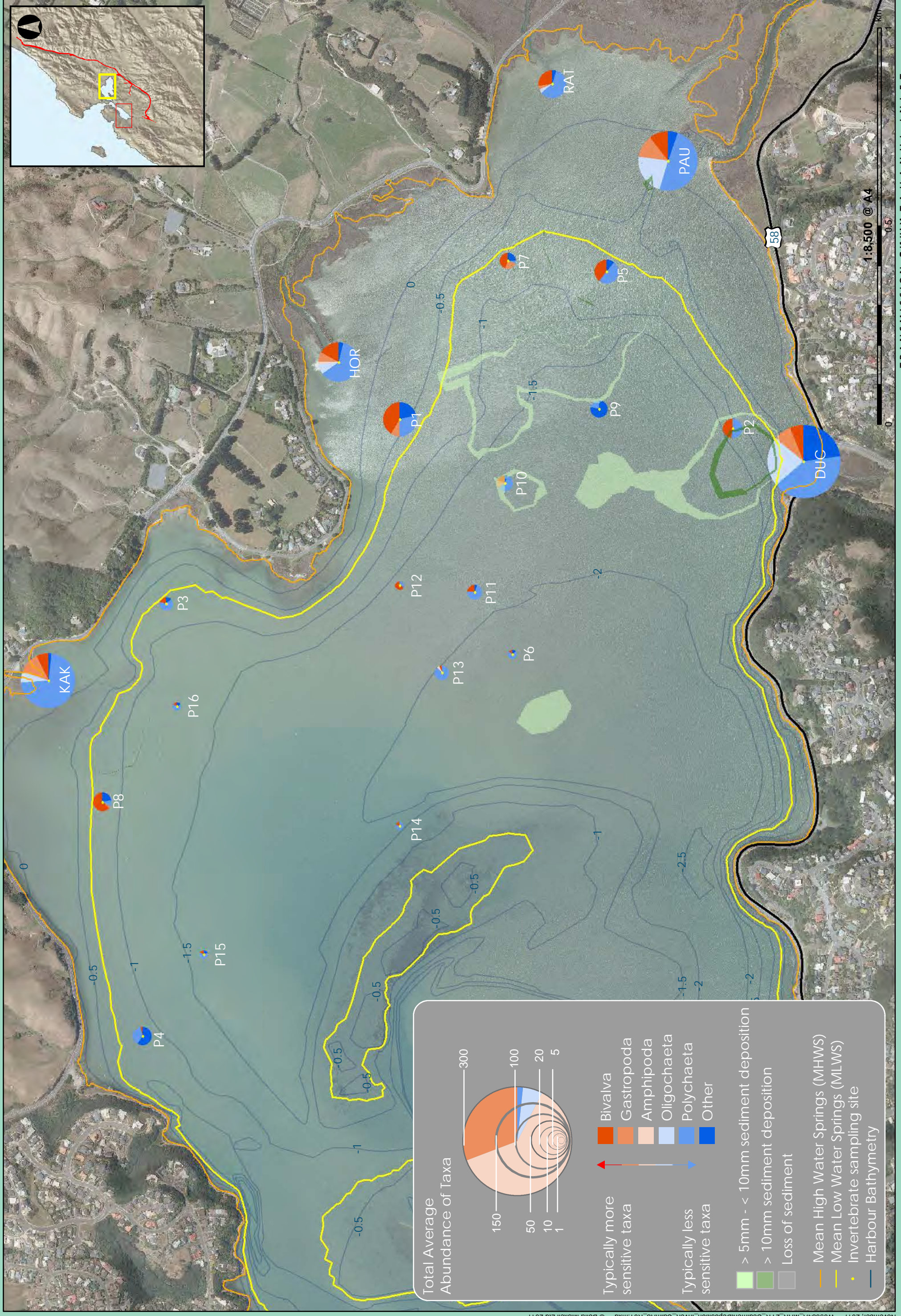
Typically more sensitive taxa (indicated by red arrow)

Typically less sensitive taxa (indicated by blue arrow)

- Bivalva
- Gastropoda
- Amphipoda
- Oligochaeta
- Polychaeta
- Other

- Mean High Water Springs (MHWS)
- Mean Low Water Springs (MLWS)
- Invertebrate sampling site
- Harbour Bathymetry

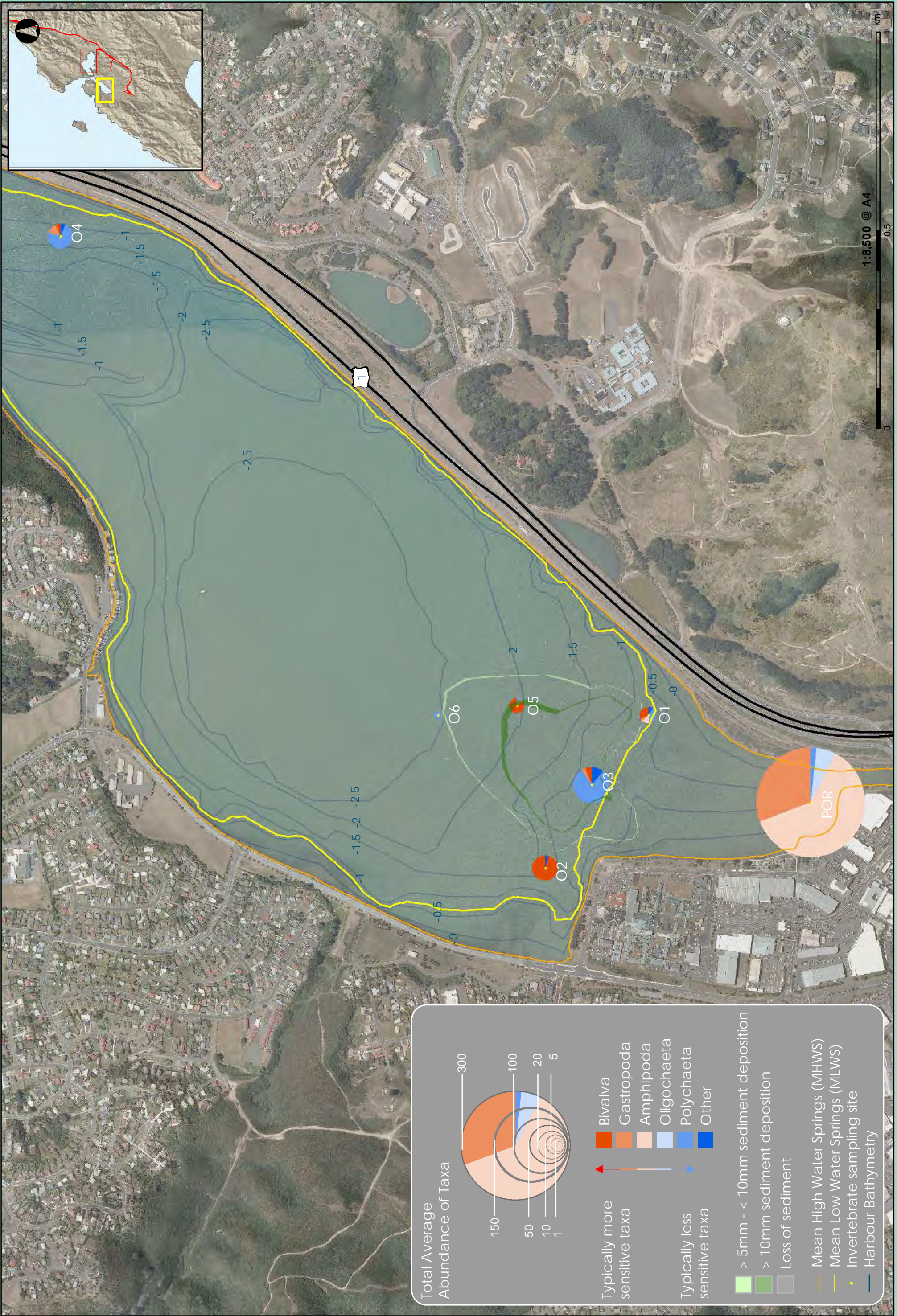




1:8,500 @ A4

INVERTEBRATE ABUNDANCE AND THRESHOLD SEDIMENT DEPOSITION
 2 yr event in all catchments modelled, calm wind, 3 days post peak of storm

November, 2011 W090344A_MAR_2YR_SedimentDeposition_Invert_CalmA3_R01.mxd © Boffa Miskell Ltd 2011



Total Average Abundance of Taxa

300
150
100
50
20
10
5
1

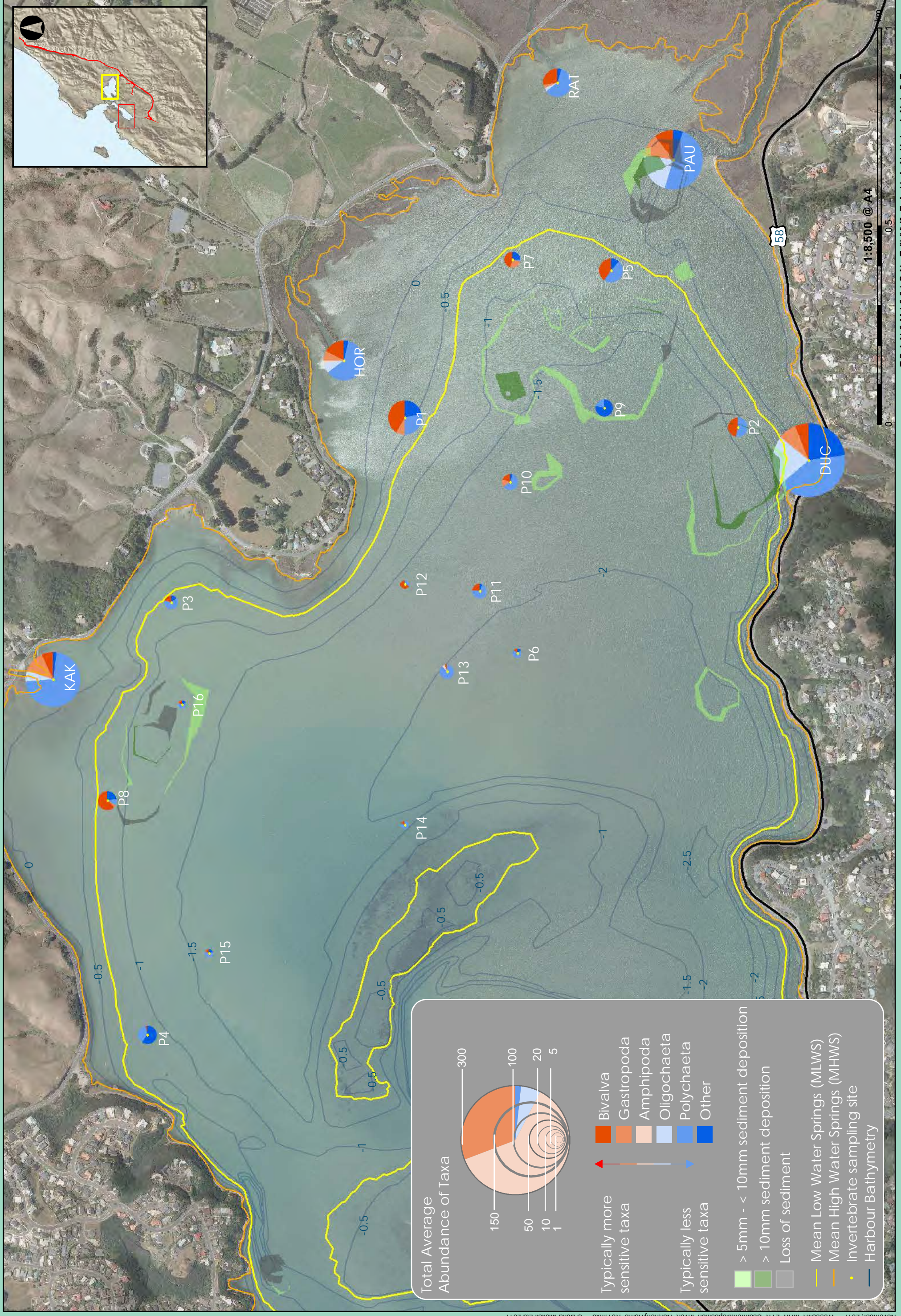
Typically more sensitive taxa

Typically less sensitive taxa

- > 5mm - < 10mm sediment deposition
- > 10mm sediment deposition
- Loss of sediment
- Mean High Water Springs (MHWS)
- Mean Low Water Springs (MLWS)
- Invertebrate sampling site
- Harbour Bathymetry

■ Bivalva
■ Gastropoda
■ Amphipoda
■ Oligochaeta
■ Polychaeta
■ Other

November, 2011 W090344.MAR_2YR_SedimentDeposition_Invert_CalmA3_R01.mxd © Boffa Miskell Ltd 2011





Total Average Abundance of Taxa

Typically more sensitive taxa (Red arrow pointing left)

- Bivalva
- Gastropoda
- Amphipoda

Typically less sensitive taxa (Blue arrow pointing right)

- Oligochaeta
- Polychaeta
- Other

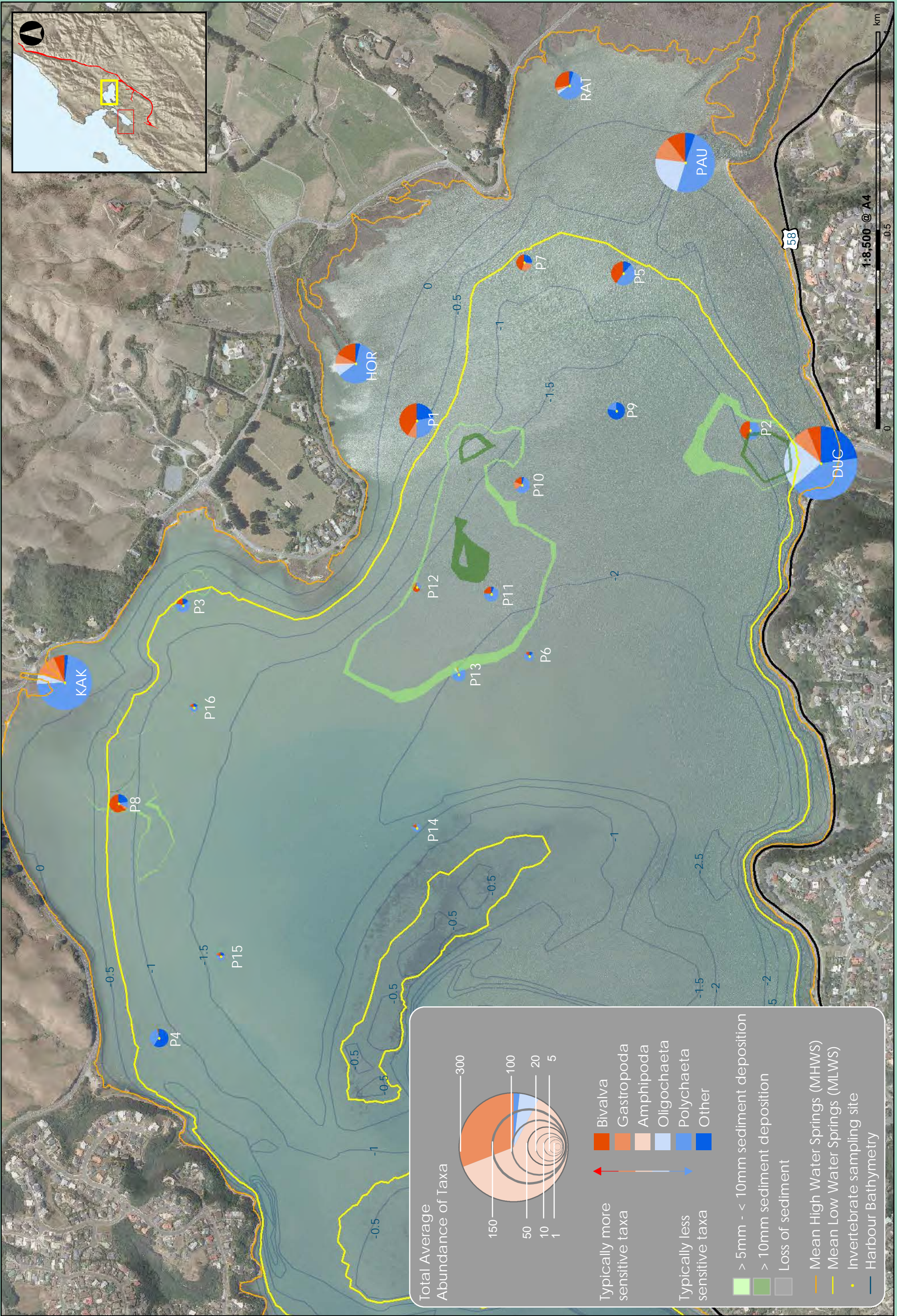
Sediment Deposition Legend:

- > 5mm - < 10mm sediment deposition (Light Green)
- > 10mm sediment deposition (Dark Green)
- Loss of sediment (Grey)

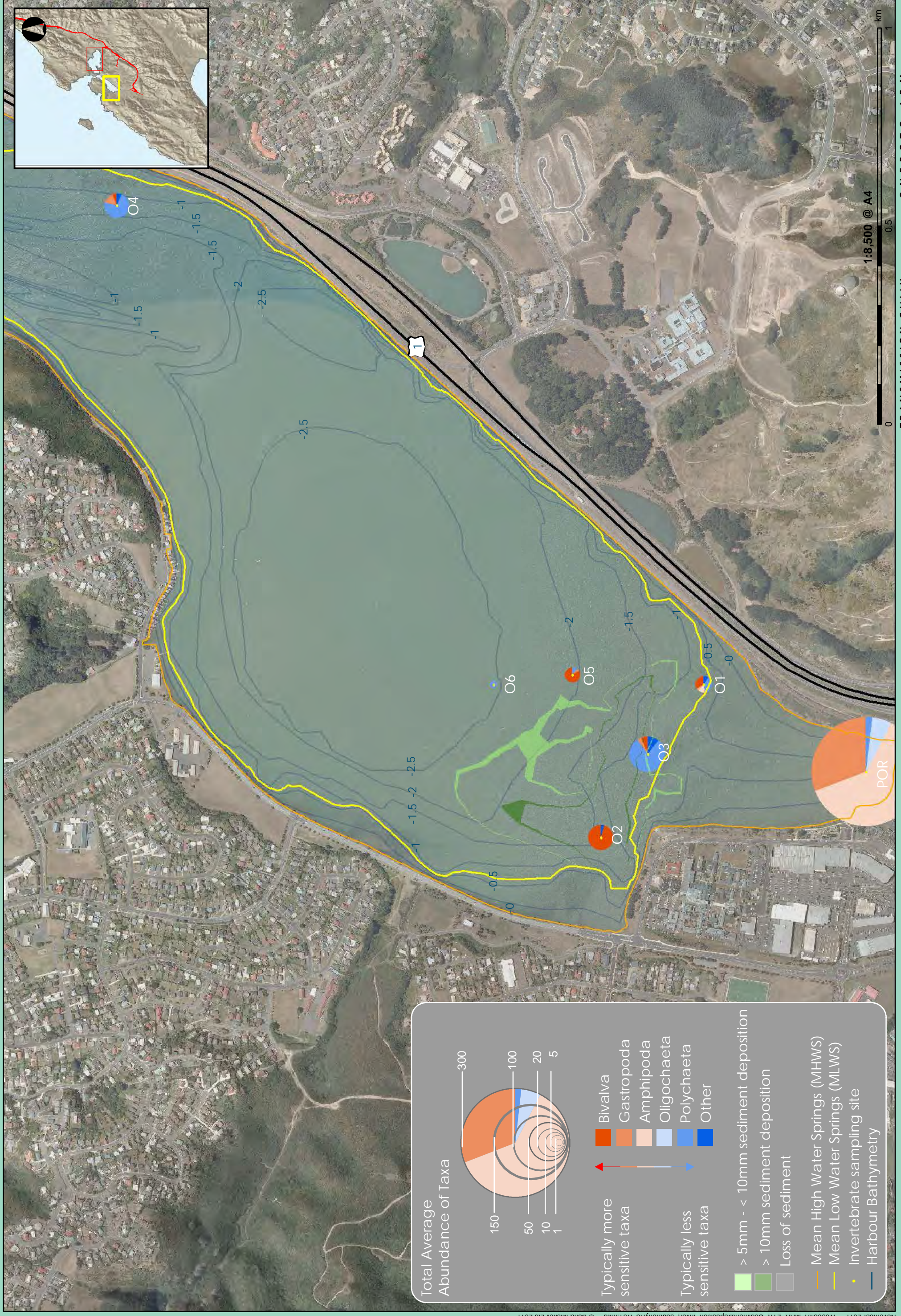
Other Features Legend:

- Mean Low Water Springs (MLWS) (Yellow line)
- Mean High Water Springs (MHWS) (Orange line)
- Invertebrate sampling site (Red dot)
- Harbour Bathymetry (Blue line)

November, 2011 W090344.MAR_2YR_SedimentDeposition_Invert_Northerly3mb_R01.mxd © Boffa Miskell Ltd 2011



November 2011 W09034A_MAR_2YR_SedimentDeposition_Invert_southernA3_R01.mxd © Boffa Miskell Ltd 2011



Total Average Abundance of Taxa

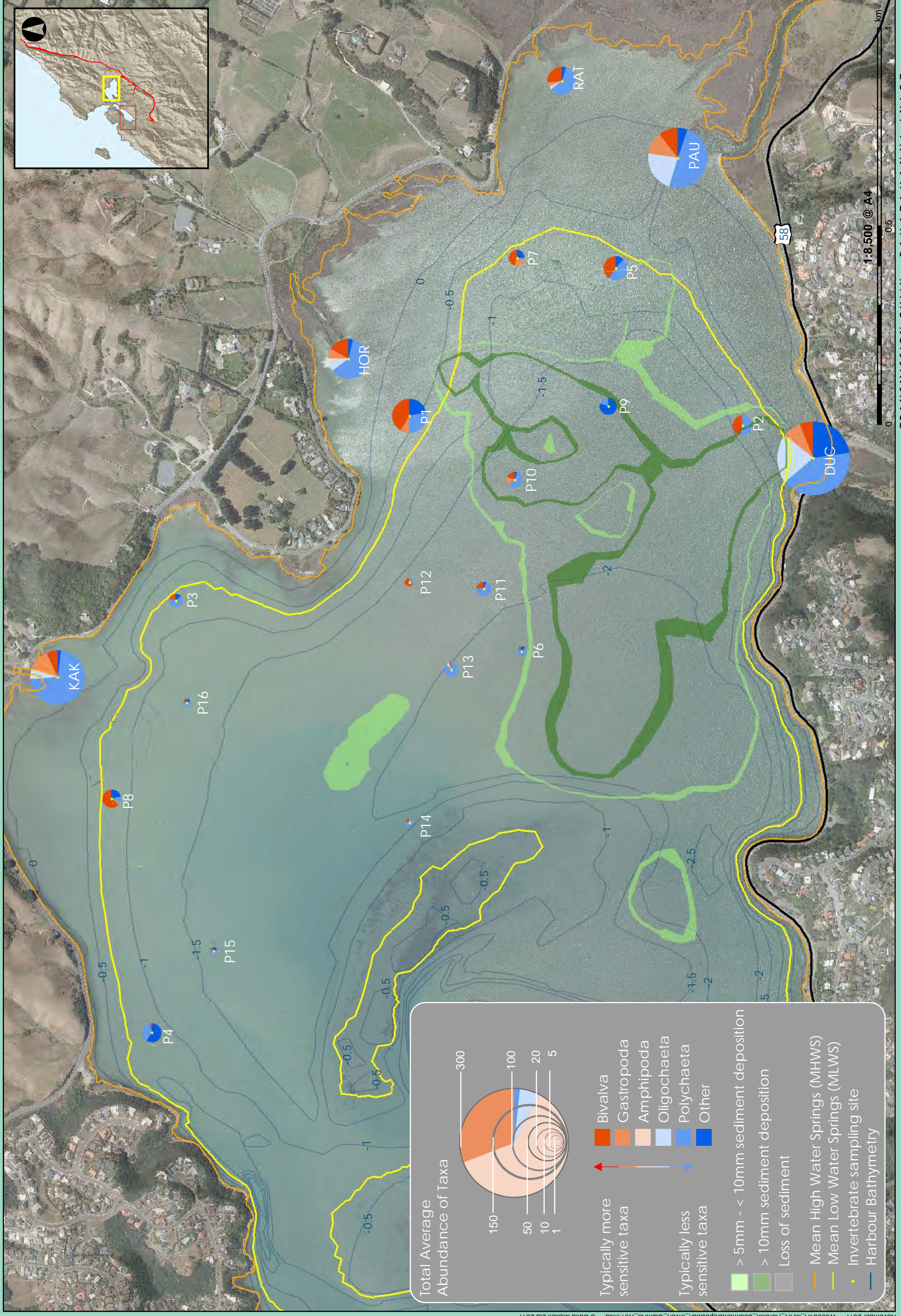
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10
5
1

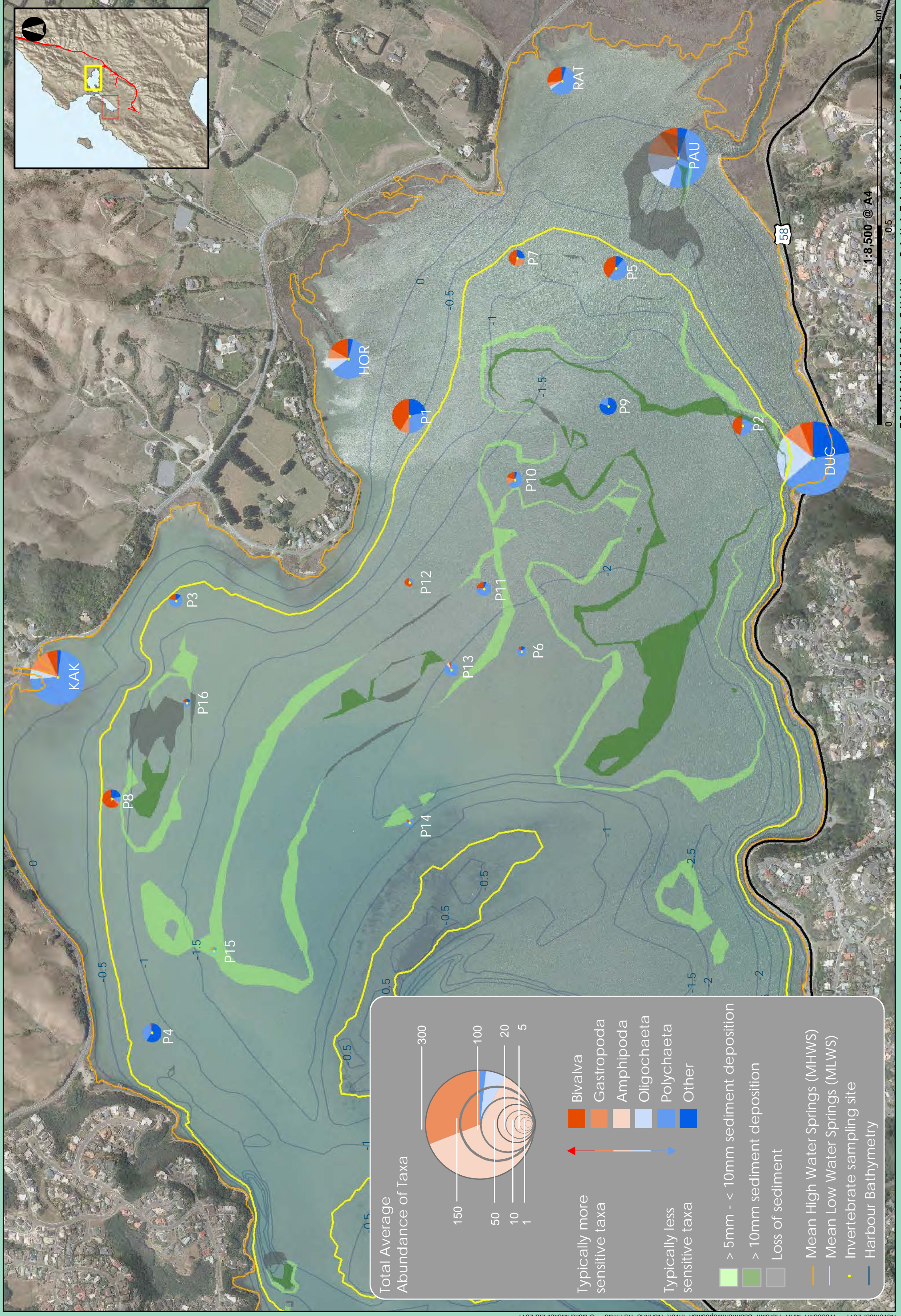
Typically more sensitive taxa

Typically less sensitive taxa

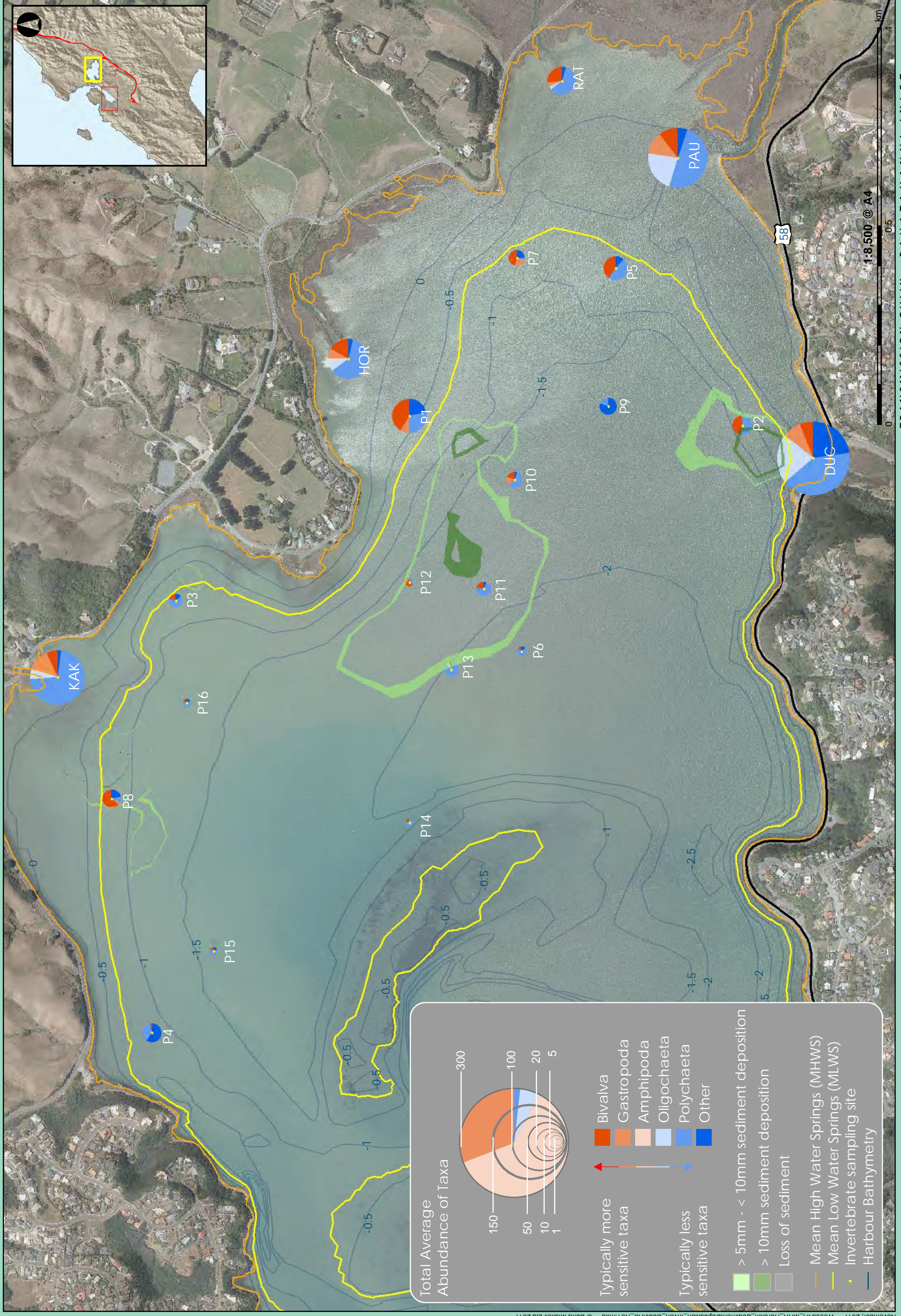
- > 5mm - < 10mm sediment deposition
- > 10mm sediment deposition
- Loss of sediment
- Mean High Water Springs (MHWS)
- Mean Low Water Springs (MLWS)
- Invertebrate sampling site
- Harbour Bathymetry

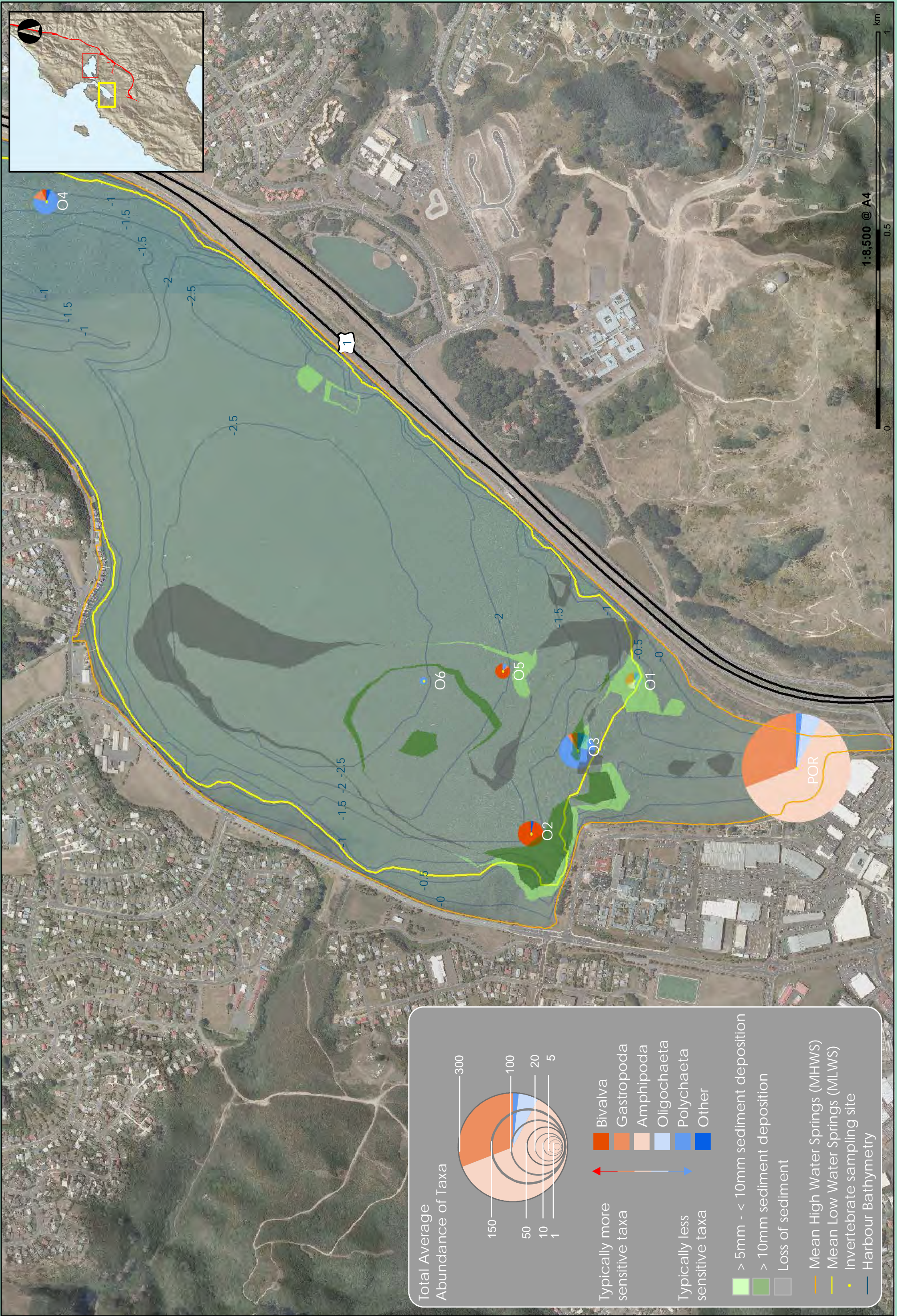
■ Bivalva
■ Gastropoda
■ Amphipoda
■ Oligochaeta
■ Polychaeta
■ Other

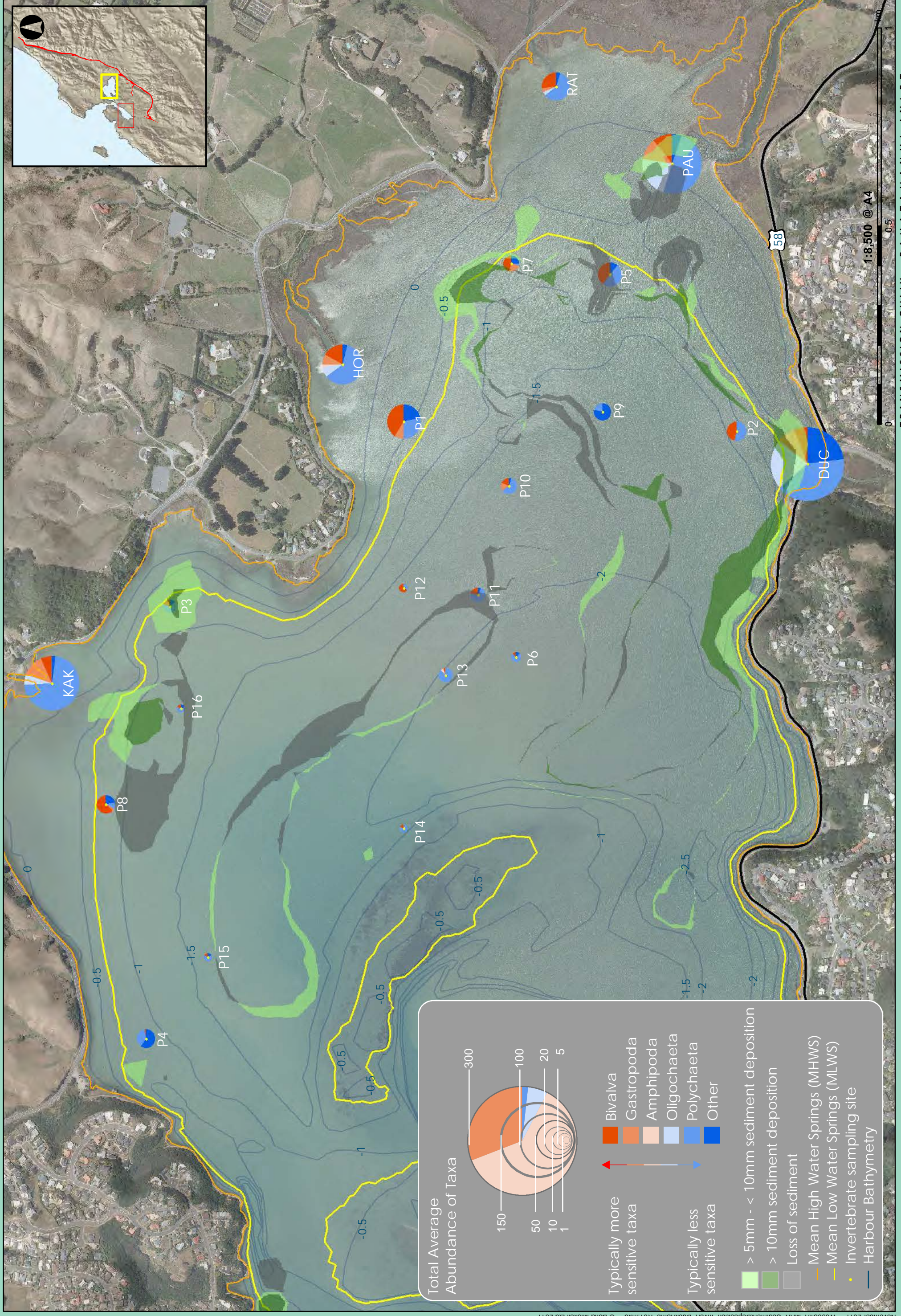




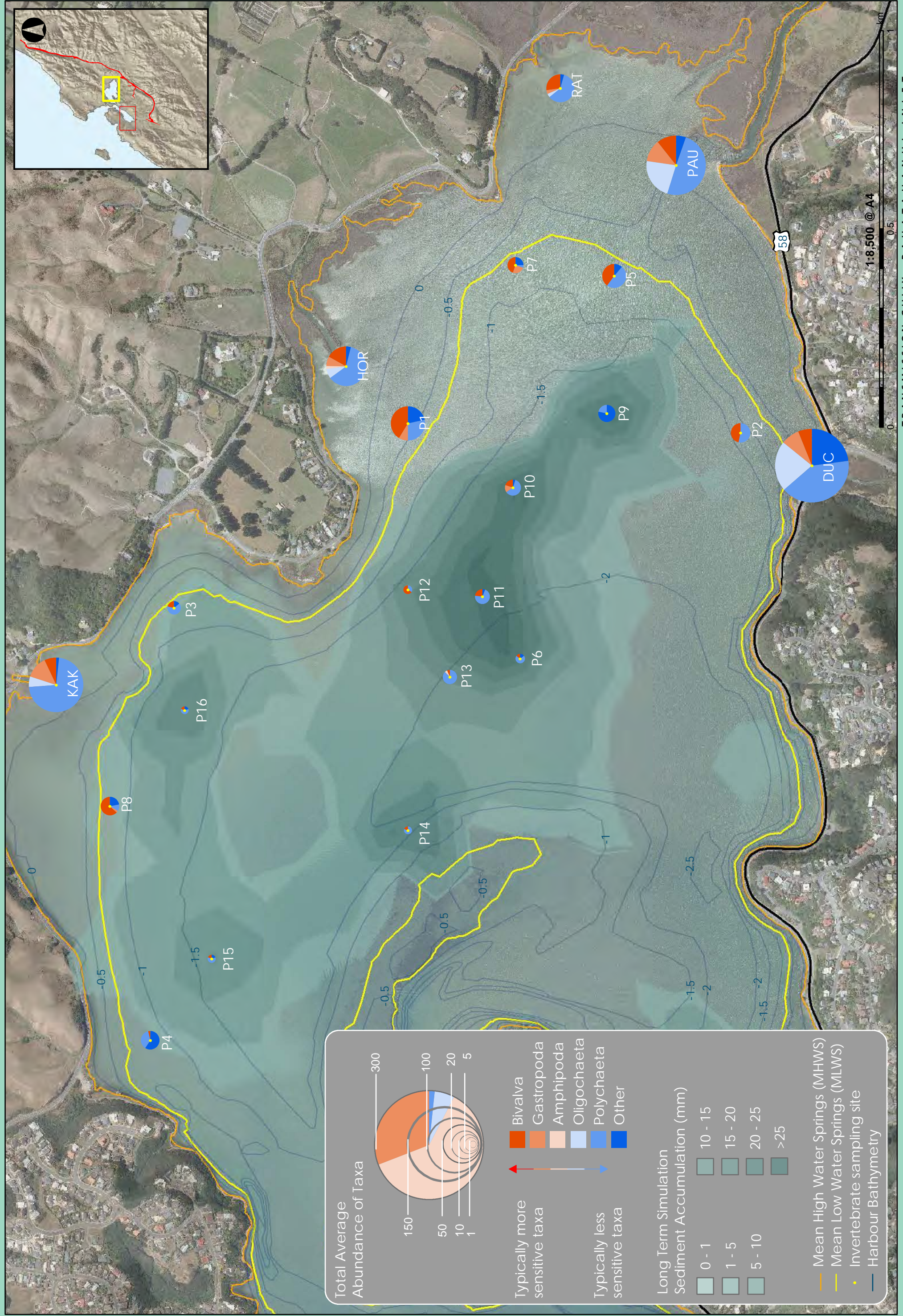
November 2011 W09034A_MAR_Horokiri_SedimentDeposition_Invert_NorthA3_R01.mxd © Boffa Miskell Ltd 2011



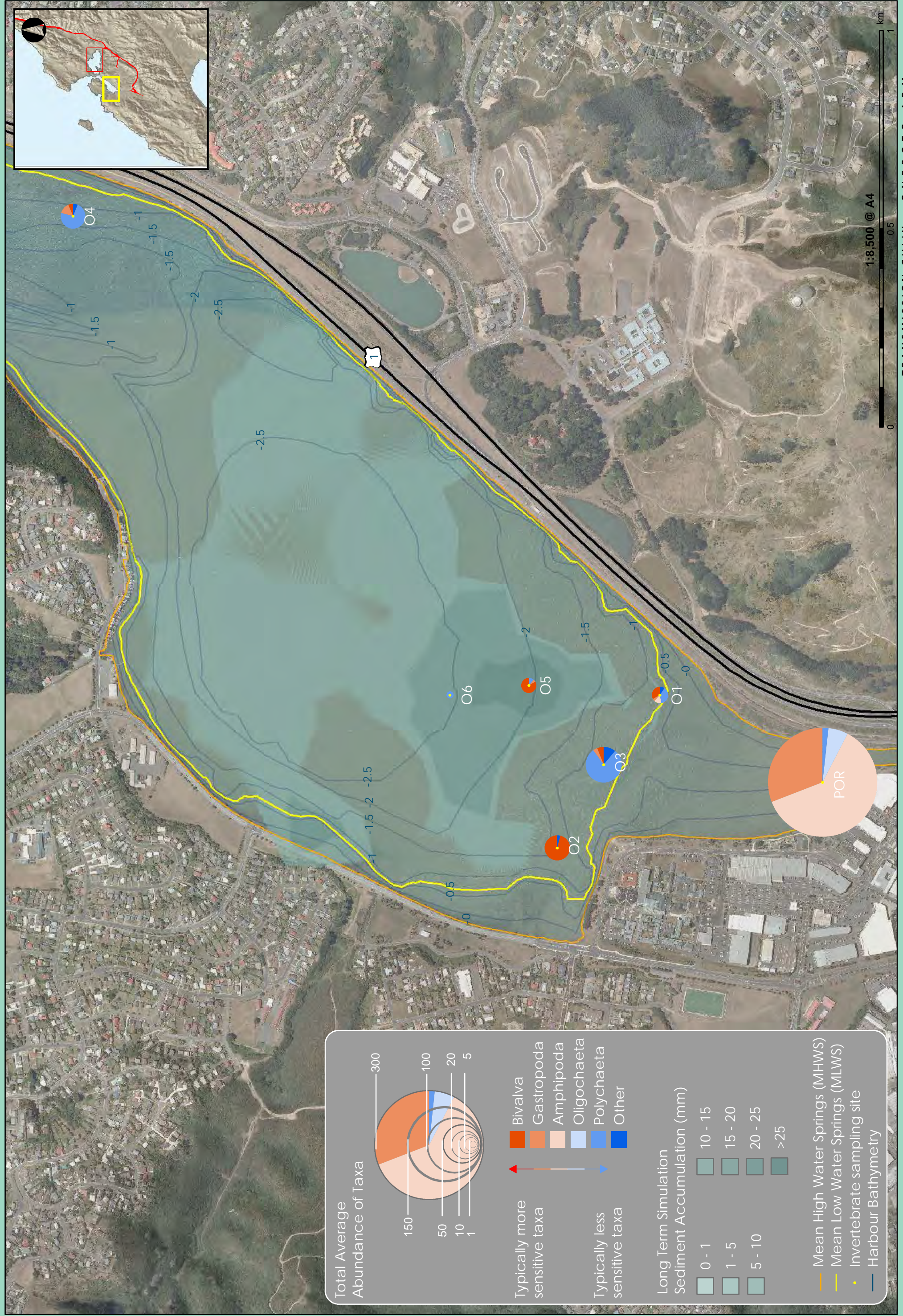




November 2011 W09034A_MAR_SedimentDeposition_Invert_Duck3mb_R01.mxd © Boffa Miskell Ltd 2011



November 2011 W09034A_MAR_LTS_SedimentDeposition_InvertA3_R01.mxd © Boffa Miskell Ltd 2011



Total Average Abundance of Taxa

300
150
100
50
20
10
5
1

Typically more sensitive taxa

- Bivalva
- Gastropoda
- Amphipoda

Typically less sensitive taxa

- Oligochaeta
- Polychaeta
- Other

Long Term Simulation Sediment Accumulation (mm)

- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- >25

Mean High Water Springs (MHWS)

Mean Low Water Springs (MLWS)

Invertebrate sampling site

Harbour Bathymetry

APPENDIX C: REVISED SEDIMENT QUALITY MAPS

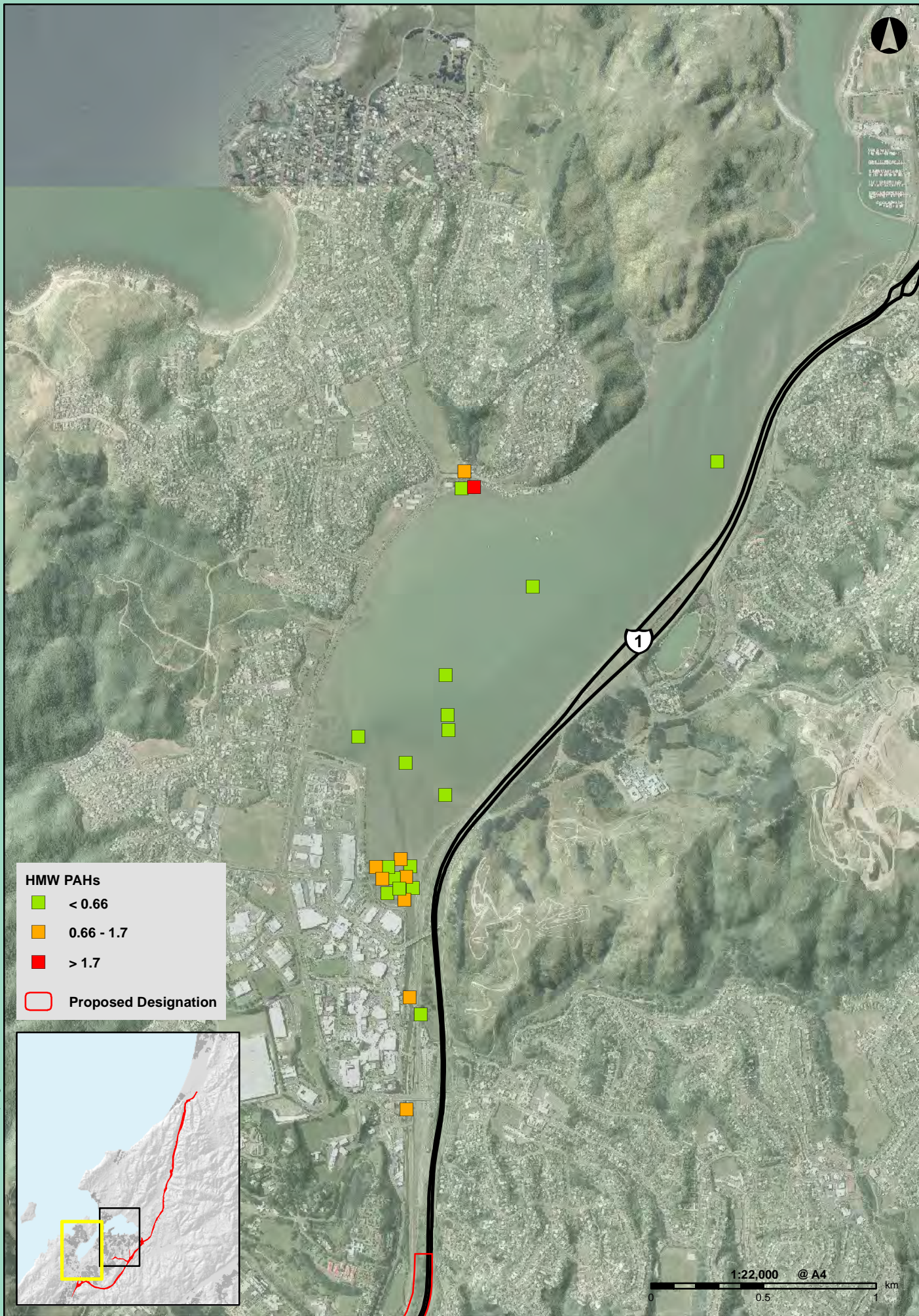
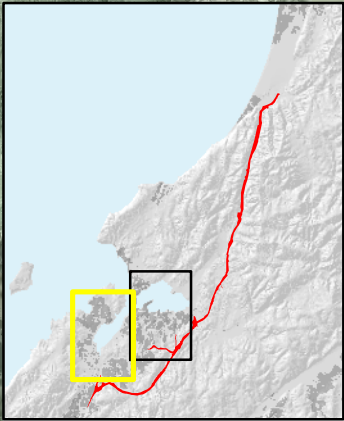


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HMW PAHs

- < 0.66
- 0.66 - 1.7
- > 1.7

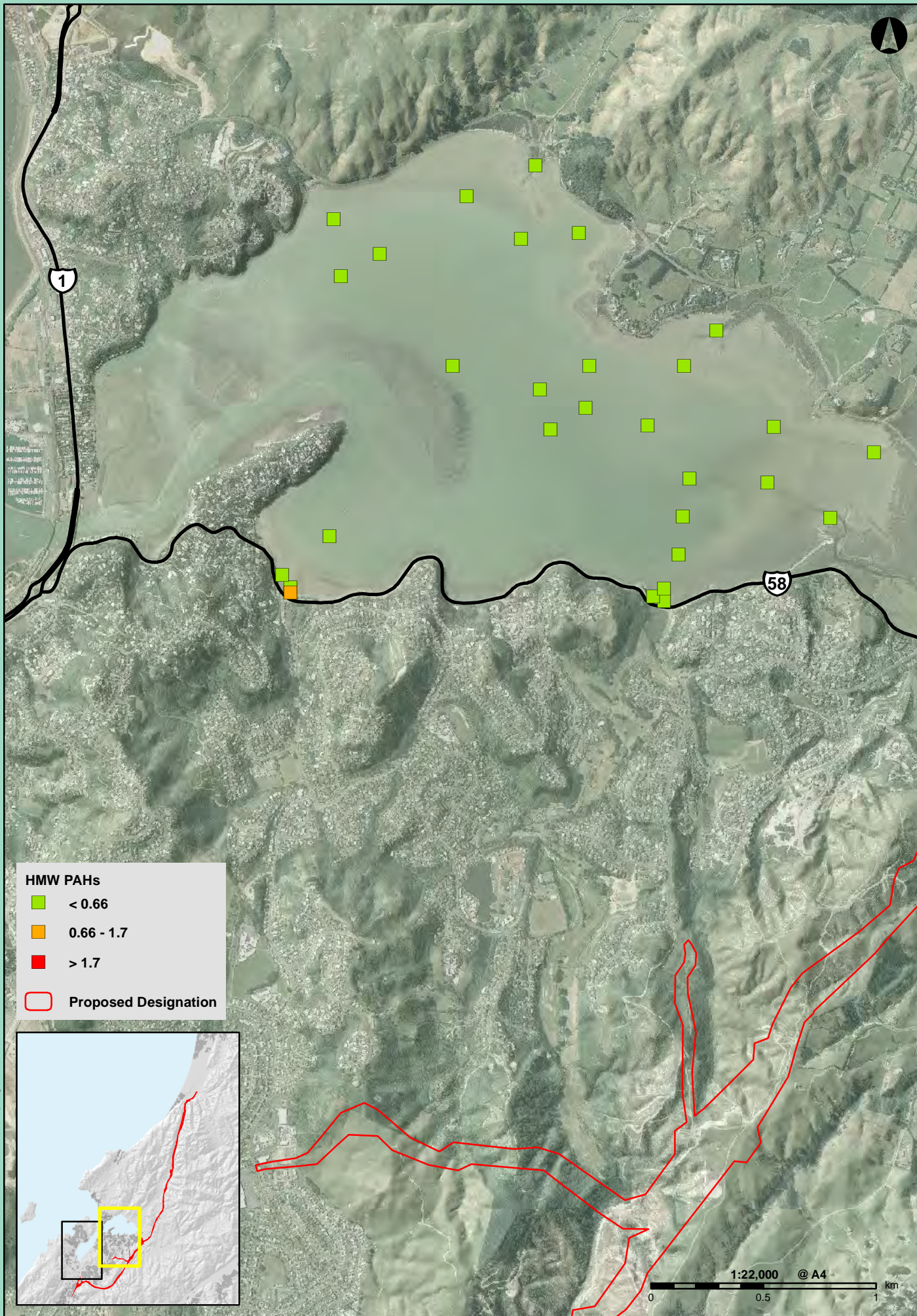
 Proposed Designation



1:22,000 @ A4
0 0.5 1 km



**TRANSMISSION GULLY
CONCENTRATION OF HMW-PAHs IN SEDIMENT 10.4g
ONEPOTO INLET**



November 11, 2011 W09034A_MAR_SamplingSediment_PAH_A4mb.mxd © Boffa Miskell Ltd 2011