Seagrass (*Zostera muelleri* subsp. *novazelandica*) survey, Point Howard, Lowry Bay, York Bay and Hutt River Estuary, December 2018

Prepared for:

Hutt City Council

8 March 2019

Sustainability Solutions Ltd

Mapua

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COVER PHOTOGRAPH: Seagrass bed, north of Cheviot Road bus stop, Lowry Bay. Sediment retention by seagrass is evident in the raised seagrass beds. Photo taken close to extreme low water of spring tides, indicating maximum exposure. Photo: PC280715, 2018-12-28, 1653 hours, NZ Daylight time.

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SUMMARY

1. The Hutt City Council (HCC) Eastern Bays proposed shared path project (SPP) includes the construction of a 3.5 m wide shared path at Point Howard, Lowry Bay and York Bay, which will result in beach reclamation between *c.* 0.5–3.5 m in width. It proposes to undertake 'beach nourishment' to reinstate the existing beach dimensions and associated amenity and recreational values that would be lost by this reclamation. This beach nourishment is expected to shift beach tidal zones seaward and may spread nourishment sediments into the intertidal and subtidal zones.

2. This may adversely impact seagrass (*Zostera muelleri* subsp. *novazelandica*, rimurēhia), an At Risk - Declining vascular plant indigenous to New Zealand. This report describes the results of a single (snapshot) survey in December 2018 to confirm the presence and extent of seagrass at the three locations, and to gain preliminary information on its site status and environmental parameters. The status of other past seagrass records around Wellington Harbour also was investigated, including surveying the Hutt River Estuary.

3. The survey covered about 740 m of sand and gravel beaches at the three Eastern Bays beaches, and about 800 m on the western side of the Hutt River Estuary. Boundaries of seagrass areas were mapped using a high precision GPS. Ten quadrats that were subjectively located to represent seagrass cover variability were sampled for cover of seagrass, marine algae and sediments; seagrass blade length; and dominant surface sediment particle sizes. By establishing the seaward boundary of seagrass occurrences out to 60–80 cm deep below spring low tide levels, we consider it unlikely that we missed any deeper occurrences.

4. Seagrass was not found at York Bay, Point Howard, or at the Hutt Estuary. Three seagrass occurrences were found at Lowry Bay, with a total area of 1940 m^2, all in the low intertidal and shallow subtidal zones. The northern occurrence had high density seagrass (typically 75–100% cover); the central occurrence had low density and patchy seagrass (<1% to 5–25% cover, and the southern occurrence had a range of cover densities.

5. A small number of flowering shoots was observed at all three seagrass occurrences. The finding of flowering is significant because sexual reproduction facilitates dispersal, enhances genetic diversity, and is an indicator of seagrass health because it is correlated with seagrass bed density.

6. Three records of seagrass in Wellington Harbour were known prior to the survey, the largest at the Hutt River Estuary/Seaview. The available evidence indicates two of these occurrences are no longer extant, and the occurrence in Lowry Bay is now the only known one remaining in Wellington Harbour.

1 INTRODUCTION

The Hutt City Council (HCC) Eastern Bays proposed shared path project (SPP) includes the construction of a 3.5 m wide shared path at Point Howard, Lowry Bay and York Bay, which will result in beach reclamation between *c.*0.5–3.5 m in width. It proposes to undertake 'beach nourishment' to reinstate the existing beach dimensions and associated amenity and recreational values that would be lost by this reclamation. This beach nourishment is expected to shift beach tidal zones seaward and may spread nourishment sediments into the intertidal and subtidal zones.

Seagrasses are marine flowering plants (angiosperms). New Zealand's seagrass (*Zostera muelleri* subsp. *novazelandica*, rimurēhia) is an indigenous subspecies that is classified as At Risk – Declining (de Lange et al. 2017). It is typically found in intertidal and shallow subtidal estuarine and marine habitats. Limited historical evidence suggests that seagrass in New Zealand has experienced extensive declines since the late nineteenth and early twentieth centuries (Morrison et al. 2014). Seagrass is known to occur at Lowry Bay (East Harbour Environmental Association 1998; Stevens, Robertson & Robertson 2004), potentially within the scope of the proposed beach nourishment, while its presence or absence at Point Howard and York Bay are unknown.

Policy 11 of the New Zealand Coastal Policy Statement (NZCPS; Department of Conservation 2010) requires the avoidance of adverse effects of SPP activities on seagrass as an listed At Risk indigenous taxon, and avoidance of significant adverse effects and mitigation of other adverse effects on eelgrass (seagrass) ecosystems. Seagrass beds are listed as a habitat with significant indigenous biodiversity values in the coastal marine area in Schedule F5 of the Proposed Natural Resources Plan for the Wellington Region (Greater Wellington Regional Council 2015).

This report describes the results of a single (snapshot) survey in December 2018 to confirm the presence and extent of seagrass at the three locations and to gain preliminary information on its site status and environmental parameters. The status of other past seagrass records around Wellington Harbour was also investigated, including surveying the Hutt River Estuary.

2 SURVEY METHODS

The survey was undertaken primarily on 22, 24 and 28 December 2018, to coincide with the spring low tides for the month. Summer survey timing was favourable for seagrass growth and its conspicuousness for survey[1]. Following discovery of a single flowering seagrass plant in the drift of a rising tide at the planned end of the survey, the survey scope was extended to investigate briefly the frequency of flowering where seagrass had been found (9 January 2019).

[1] Seagrass above-ground biomass may be significantly reduced in winter: up to 53% at Elsdon in nearby Porirua Harbour (Duncan 2017).

The survey areas were walked by one observer (Hutt Estuary) or two observers (Eastern Bays) in a zigzag pattern parallel to the shore. Walking survey coverage on the seaward side extended into water up to 60–80 cm deep below low tide levels (subtidal). Survey by snorkelling was used to test the seaward boundary of seagrass occurrences at Point Howard, but not at Lowry Bay (because of low visibility) nor York Bay (because no seagrass was found at shallower depths). Given the primary limitation on the maximum depth of seagrass is light availability (de Boer 2007), we consider that it is unlikely that there are any seagrass occurrences deeper than 60-80 cm below low tide level.

The following data or observations were collected or recorded where seagrass was found[2]:

a. Boundaries of seagrass areas (using a high precision Trimble® Geoexplorer 6000 GPS with typically sub-metre accuracy after differential correction).

b. Ten 50 x 50 cm^2 quadrats[3] were subjectively located within the observed extent of seagrass to represent seagrass cover variability. These were sampled for:

   i. date, time, GPS location, water depth (which can be related to tidal stages)

   ii. cover of seagrass, marine algae and sediments, each visually estimated on a six-point canopy cover scale: <1%, 1–5%, 5–25%, 25–50%, 50–75% and 75–100%

   iii. seagrass blade length

   iv. dominant surface sediment particle sizes: silt, sand, gravel, pebble, cobble, boulders (Udden-Wentworth scale)

   v. other observations e.g. animals, sediment movement, anthropogenic influences (including shoreline infrastructures).

The survey covered about 740 m of sand and gravel beaches: Point Howard (115 m), Lowry Bay (405 m) and York Bay (220 m) (**Figure 1**). Adjoining coastal reaches were traversed to characterise non-beach habitats. The Hutt River Estuary on its western side was surveyed from about 130 m above the Waione St bridge down to the river mouth (total length 800 m, excluding a small boat harbour) (**Figure 2)**.

To investigate seagrass flowering, the water's edge where seagrass had been found was walked from north to south and seagrass shoots found in the beach wrack were inspected for flowering.

Information on previous seagrass records for the site and elsewhere in Wellington Harbour was sought from the literature, databases, and conversations with beach users.

Shellfish observations of potential interest for a concurrent EOS Ecology infauna survey for environmental assessment purposes were noted.

[2] Planned collection at quadrats of sediment samples obtained by a trowel for particle size analysis was not undertaken because these, in the event, were not considered helpful towards distinguishing sediments of sites with or without seagrass. Systematic core sampling would be adopted should such data be required.

[3] This limited sample size (ten) and non-random quadrat locations were due to limited time to access the seagrass beds when uncovered or under shallow water.

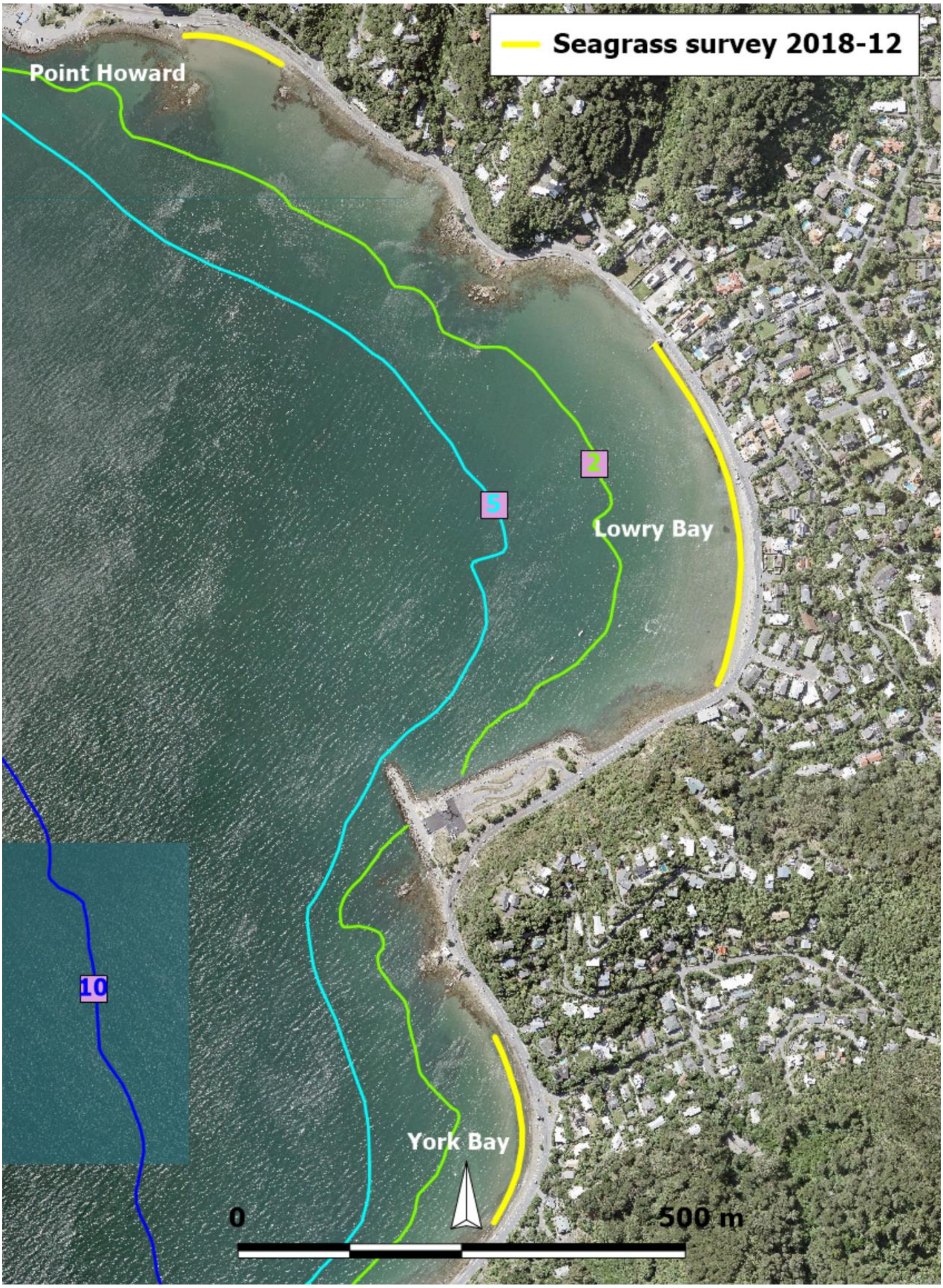

Figure 1: Seagrass survey locations, Point Howard, Lowry Bay and York Bay, December 2018. Aerial photography courtesy of HCC and LINZ and chart data sourced from LINZ (CC BY 4.0).

Figure 2: Seagrass survey location at Hutt River Estuary, 24 December 2018. Aerial photography courtesy of HCC.

3 RESULTS

3.1 Seagrass occurrences

Seagrass was not found at Point Howard or York Bay. At Point Howard, the low intertidal and subtidal substrates were predominantly mobile sand and the wave energy may be too high for seagrass. At York Bay, inshore substrates often comprised pebbles and cobbles vegetated by marine algae, transitioning to mobile sand 10–15 m offshore.

Seagrass was not found at Hutt Estuary. The estuary has an area of tidal flats on its western shore with predominantly soft mud (bed of former Hutt River channel) but there were also extensive gravels, armour rock margins and construction rubble. There was abundant growth of the green macroalgae *Ulva intestinalis* and *Ulva lactuca* (sea lettuce), and the red alga *Gracilaria chilensis* near the estuary mouth (Stevens 2018).

Three seagrass occurrences were found at south Lowry Bay (**Figure 3**). From north to south, these had areas of 150, 1620 and 170 m^2 respectively (total 1940 m^2). Over half of the beach length from north of the Cheviot Road bus stop to the southern end of Lowry Bay had seagrass.

Seagrass at the northern occurrence had abundant algal epiphytic growth, more frequent on the seaward side of the bed (**Figure 4**, **Figure 6**).

Several observations were made of seagrass plants that had been detached from their substrates and floating in the water (**Figure 5**). These fragments are potentially sources of vegetative spread of seagrass.

An area shown in 2017 HCC 1:500 colour aerial photos immediately south of the Cheviot Road bus stop as having dense subtidal vegetation was found to have only sparse marine algal cover, and no seagrass (**Figure 3**). The substrate was mobile sand. This vegetation appears to have been lost since the date of the aerial photography, a period of less than two years.

The only available low tide map definition is Mean Low Water (MLW). By the low tide map definition, the northern occurrence was mostly above MLW, all the mid-beach seagrass occurrence was below MLW, and the southern occurrence spanned the MLW line (**Figure 3**). However, the northern occurrence was observed fully exposed on a spring low tide on 2018-12-28 (**Cover photo**), when the low tide level at Wellington was 0.4 m, close to lowest astronomical low tide of 0.41 m (Land Information New Zealand 2019b, a). Comparison of GPS elevation data (0.1 m vertical precision) indicates the seaward sides of the southern and middle occurrences are 20–30 cm below the northern occurrence, and these beds were not seen fully exposed. Thus, the northern seagrass occurrence at spring low tide is entirely intertidal and the middle and southern occurrences are predominantly intertidal, but their seaward margins are probably subtidal.

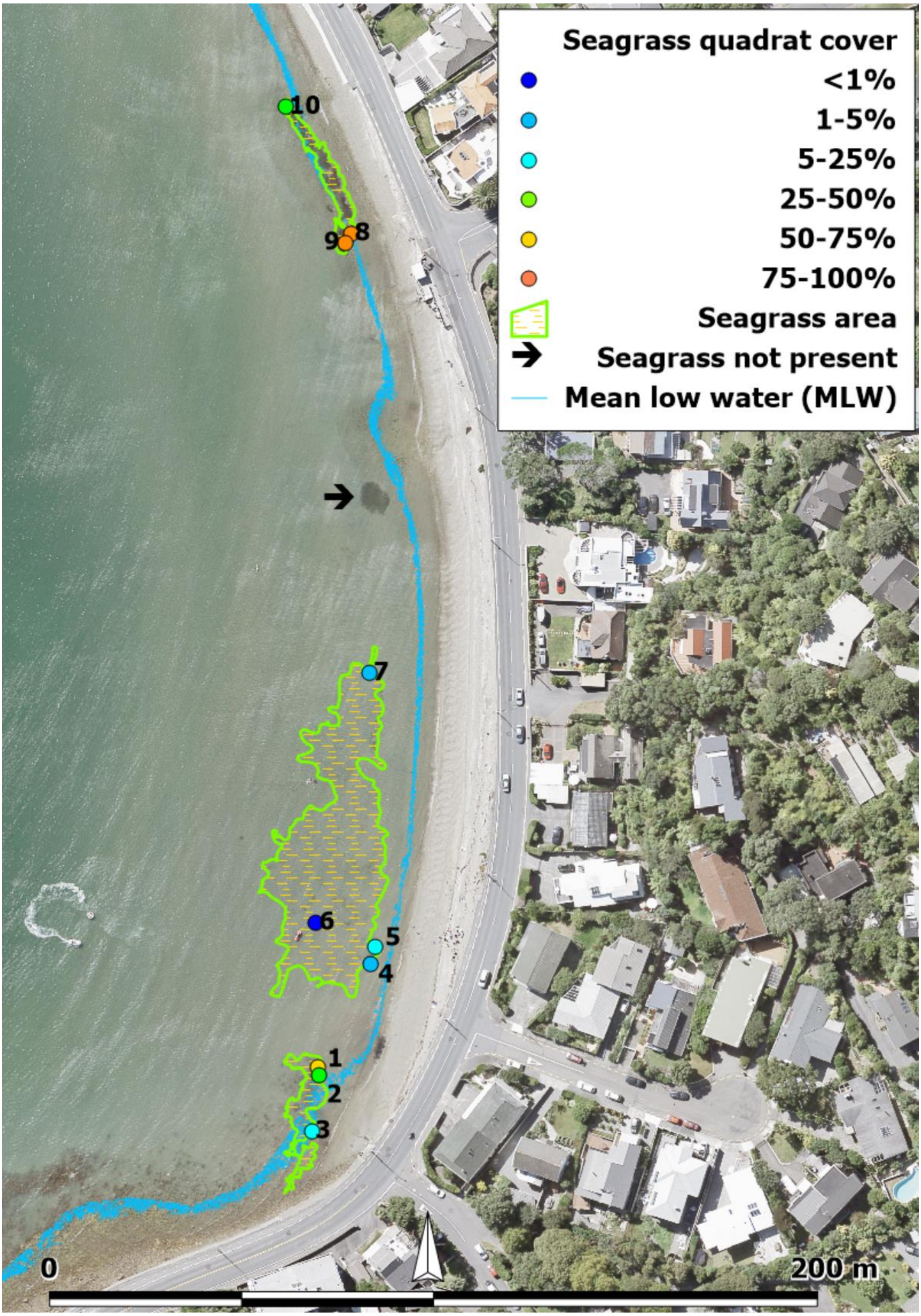

Figure 3: Locations of seagrass quadrats and areas of seagrass found, south Lowy Bay, December 2018. The location of dense subtidal vegetation present in 2017 but not at survey time is also indicated. Aerial photography courtesy of HCC. Mean low water line based on Stantec GIS data.

Figure 4: Algal epiphytic growth on seagrass, south Lowry Bay. Several filamentous roots (from disturbance) are also evident. Photo: PC250661.JPG, 2018-12-25.

Figure 5: Seagrass detached from its substrate and floating in seawater, south Lowry Bay. Its thin rhizomes and fine root structures are evident. Photo: PC280759, 2018-12-28.

Stevens, Robertson & Robertson (2004) reported two small eelgrass (seagrass) beds at the south end of Lowry Bay and described them as subtidal. The difference in tidal zones reported by the two surveys may be attributable to changes in seagrass location over time: the spatial extent of seagrass has been shown to vary over periods as short as one year (Ismail 2002). Alternatively, the observations of this survey may have been at a lower low water.

3.2 Seagrass quadrats

The northern occurrence had high density seagrass. Two quadrats (numbers 8 & 9) there had seagrass cover densities of 75–100% (**Figure 6**), and the third had 25–50% cover (quadrat 10) (**Figure 3**, **Table 1**). Seagrass density was low and patchy in the central occurrence, with densities ranging from <1% to 5–25% (quadrats 4–7). The three quadrats (1, 2 & 3) in the southern occurrence had a range of cover densities (5–25%, 25–50% and 50–75%).

Sediments at eight of the ten quadrats were predominantly sand. Pebbles (4–64 mm) were dominant at two quadrats in the northern seagrass occurrence. Sediments recorded at the quadrats are typical of the low intertidal zone at south Lowry Bay, the exceptions being some small areas of silts and angular cobbles. Seagrass was observed to be trapping sediments and marginally raising the level of the seabed compared with non-seagrass sites.

Seagrass blade length ranged between 60 and 138 mm. The longest lengths measured were in the northern and southern seagrass areas (136 and 138 mm). A recent study at Te Awarua-o-Porirua Harbour found average seagrass blade lengths between 57–85 mm (Duncan 2017).

Table 1: Data from 10 seagrass quadrats, Lowry Bay, December 2018. Seagrass bed refers to quadrat locations in relation to the three seagrass beds found (**Figure 3**).

Quadrat	Seagrass bed	Cover (%)			Blade length (mm)	Surface sediments	Water depth (at survey, cm)	Seagrass density
		Seagrass	Algae	Sediment				
1	South	50–75	1–5	5–25	138	Sand	20	Dense
2	South	25–50	25–50	25–50	88	Sand	32	Moderately dense
3	South	5–25	1–5	75–100	68	Sand	15	Low density
4	Mid-beach	1–5	75–100	5–25	75	Sand	23	Patchy
5	Mid-beach	5–25	25–50	25–50	110	Sand	29	Patchy
6	Mid-beach	<1	75–100	5–25	71	Sand	55	Patchy
7	Mid-beach	1–5	<1	75–100	115	Sand		Low density
8	North	75–100	Nil	<1	136	Pebbles		Dense
9	North	75–100	<1	Nil	110	Sand	56	Dense
10	North	25–50	Nil	50–75	60	Pebbles	65	Moderately dense

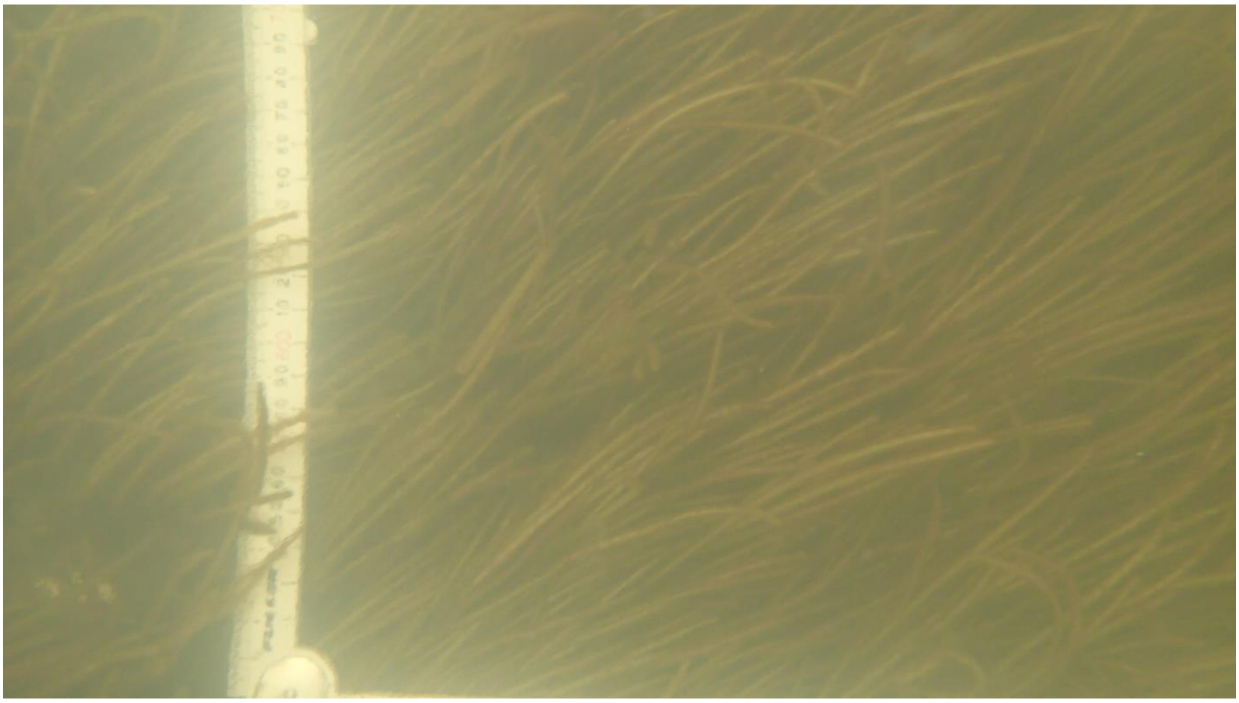

Figure 6: Dense seagrass, quadrat 8, Lowry Bay. The algal epiphytic layer on the seagrass leaves is also evident. Photo: PC220474, 2018-12-22.

3.3 Seagrass flowering

Three flowering shoots were found at Lowry Bay, one adjacent to each of the three seagrass occurrences (**Figure 3, Figure 7**). Flowering shoots were a low proportion of the total number of shoots observed (*c.* 80).

Flowering of seagrass in New Zealand was thought to be rare but was recently found to occur annually during spring and summer at a North Island site at mean densities of 1.3 shoots m^{-2} (Dos Santos & Matheson 2017). The finding of flowering is significant because sexual reproduction facilitates dispersal, enhances genetic diversity, and is an indicator of seagrass health because it is correlated with seagrass bed density (Dos Santos & Matheson 2017).

3.4 Status of seagrass in Wellington Harbour

Three records of seagrass in Wellington Harbour were known prior to the survey, the largest at the Hutt River Estuary/Seaview (**Table 2**). Seagrass has not been found at Korokoro and Kaiwharawhara tidal mouths (Robertson & Stevens 2007).

The available evidence indicates two of the known occurrences are no longer extant, and the occurrence in Lowry Bay is now the single known location remaining in Wellington Harbour, making it vulnerable to local loss. Substantial populations remain elsewhere including at nearby Pauatahanui Inlet (Todd et al. 2016).

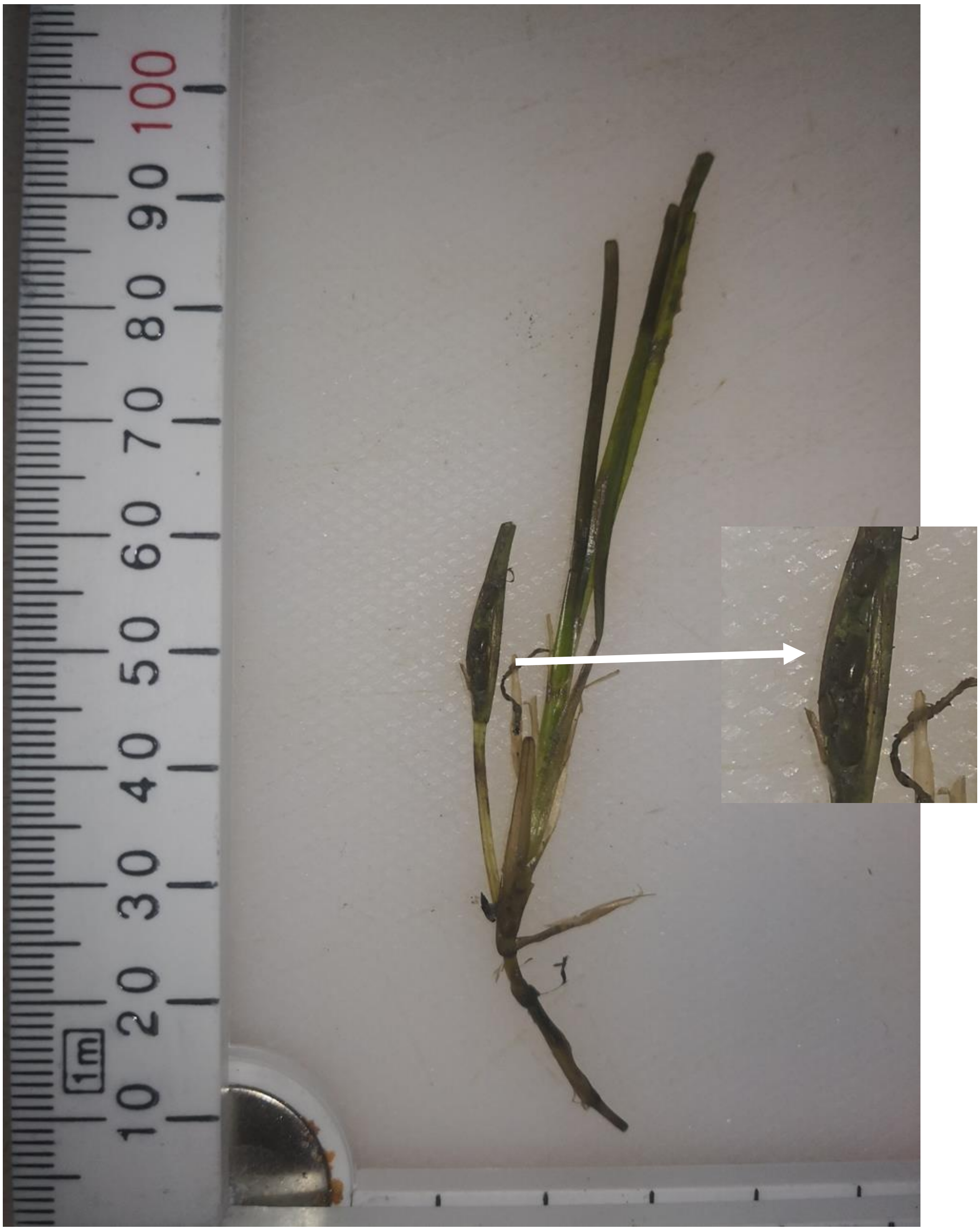

Figure 7: Flowering seagrass plant found at northern seagrass occurrence. Photo: Peter van Kampen.

Table 2: Status of past seagrass records in Wellington Harbour. A further early herbarium record (T. Kirk, pre-1898, Port Nicholson) (Cameron 2019) has insufficient information to determine whether it is from one of the known locations or a different one.

Location	Source	Notes
Hutt Estuary / Seaview / Seaview Marina	Auckland Museum herbarium record AK 185673, collector R. Mason, 19 Jan 1950	Seagrass not found by this survey, nor by other surveys at Hutt Estuary (Stevens, Robertson & Robertson 2016). The Estuary has the most extensive reclamation around Wellington Harbour (cf. Bell 1909), much of it occurring between the 1940s and 1960s (Crown historical aerial photos 128_G_2 1939, 847_2391_21 1954, 3185_4232_21 1969). These photos are suggestive of formerly extensive seagrass in the now reclaimed areas. Mason's herbarium collection record cites Seaview as the locality (Cameron 2019), and it likely was from this locality. Mikoz (2003) noted that 'the (Seaview) marina was built over a major shellfish and eel grass habitat'. The marina (built 1989–1991) appears to have covered the remaining seagrass beds at Seaview.
Evans Bay	Auckland Museum herbarium record AK 30710, collector T. Kirk, pre-1898	Almost certainly lost to extensive reclamation of upper part of the Bay at Kilbirnie (cf. Bell 1909). Also reported by a Lowry Bay resident (2018-12-31).
Lowry Bay	East Harbour Environmental Association (1998), Stevens, Robertson & Robertson (2004)	The eelgrass beds also supported a diverse range of species including juvenile fish and appeared to be healthy populations (Stevens, Robertson & Robertson 2004). Confirmed by this survey.

3.5 Other observations

There are five stormwater outlets in south Lowry Bay. Three outlets adjoin the northern seagrass occurrence while two outlets adjoin the southern seagrass occurrences. The impact of terrestrial sediment from these outlets on seagrass at south Lowry Bay is unknown. The immediate catchment is well vegetated with low density residential cover. However, Lowry Bay is likely to be impacted by other influences in Wellington Harbour (e.g. sedimentation from the Hutt River).

Intertidal habitats at Lowry Bay are generally in a healthy condition and sediment quality is high (Oliver & Milne 2012). The presence of *Ulva* spp. at most stormwater outlets indicated some level of nutrient enrichment. However, eutrophication may not be a factor in the algal epiphytic growth on seagrass at the northern occurrence (**Section 3.1**). Epiphyte biomass was not consistently affected by nutrient addition at nearby Porirua Harbour (Duncan 2017). Algal epiphytes are a common and natural occurrence on seagrass blades, part of an often-complex system of direct and indirect interactions between invertebrates, epiphytes and the seagrass itself (Duncan 2017).

Cockles (tuangi, *Austrovenus stutchburyi*) and cat's eye snail (*Lunella smaragda*) were frequently present at seagrass quadrats. While cockles were found in pockets outside of the seagrass beds, cat's eye were only found within seagrass (and mussel) beds. Sprats (*Sprattus muelleri*) were also observed.

Several people were observed collecting cockles within the northern seagrass bed. About 10 people were observed collecting shellfish at the southern end of Lowry Bay on 24 December and 28 December, in shallow soft sediments beyond the seagrass. One person collected half of a large bucket of larger-sized cockles (*Austrovenus stutchburyi*, tuangi); he reported they were not abundant but small cockles were. Abundance of small cockles was supported by our own observations. The siphon-feeding *Cyclomactra ovata* and wedge shell (*Macomona liliana*) were also observed. The collection of cockles and cat's eye from within the seagrass beds could disturb and damage the beds, reducing density and range.

Free-diving by several parties for kina (*Evechinus chloroticus)* around the offshore rocks was observed at Point Howard, and a large collection of kina shells was observed by the boat ramp at the north end of Whiorau reserve.

4 CONCLUSION

This survey has confirmed the presence of seagrass in south Lowry Bay. Current seagrass extent has been mapped, seagrass densities sampled and preliminary environmental information has been gathered. Limitations of the survey include a limited characterisation of the seagrass ecosystem at one point in time. Seagrass was not found at Point Howard or York Bay, and Sorrento Bay (between Point Howard and Lowry Bay) was not surveyed.

The available evidence indicates two of three known occurrences of seagrass in Wellington Harbour are no longer extant, and the occurrence in Lowry Bay is now the only known one remaining.

5 ACKNOWLEDGEMENTS

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