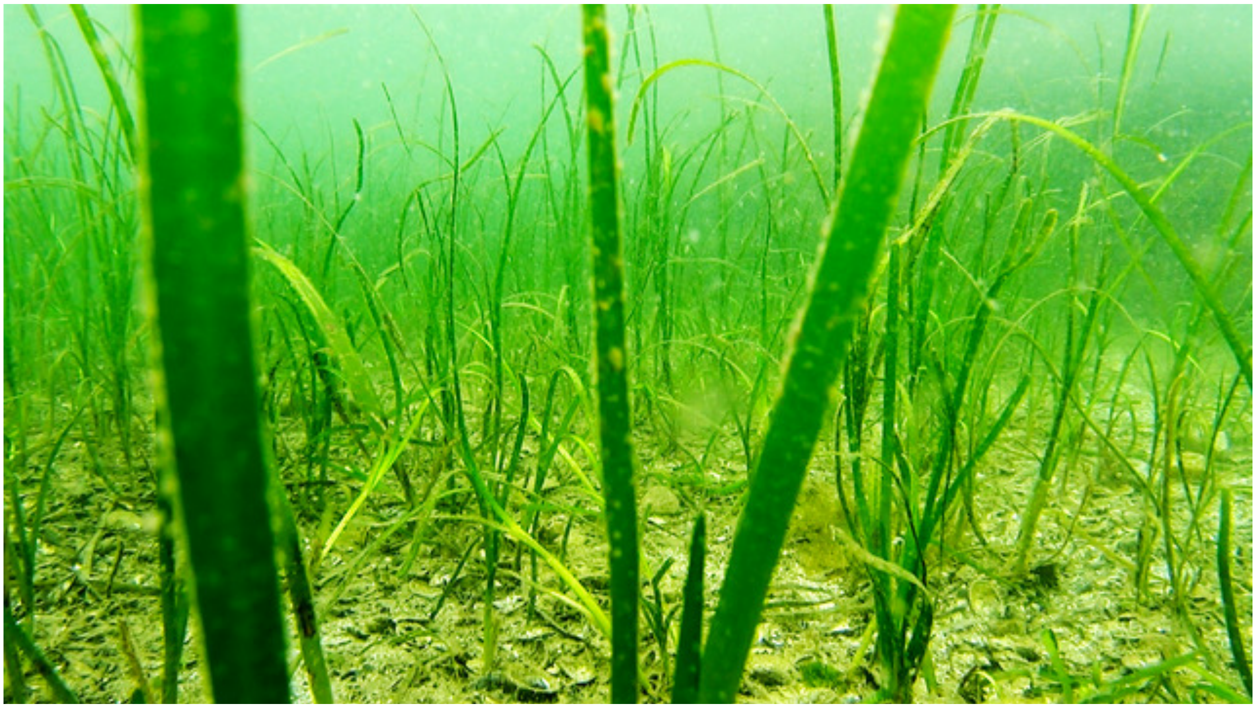
Town of Gibsons and Howe Sound/Atl’ka7tsem Eelgrass Survey Report

September 2019



A healthy eelgrass bed off Worlcombe Island’s shoreline. Photo credit: Bob Turner.

Prepared by:

Howe Sound/Atl’ka7tsem Marine Reference Guide
Fiona Beaty, BASc, PhD Canadidate
778-984-3631
Fiona.L.Beaty@gmail.com
www.howesoundguide.ca

Moonstone Enterprises Interpretation and Consulting
Dianne Sanford, BioTech
1-604-741-1029
diannesanford@gmail.com
www.moonstone.com

a project of Tides Canada SHARED PLATFORM

Background:

The Howe Sound/Atl'ka7tsem Marine Reference Guide ("the Guide") is a collaborative and community-led initiative whose goal is to build capacity to protect the human and natural values associated with Howe Sound/Atl'ka7tsem's marine environment in the face of growing anthropogenic pressures. Atl'ka7tsem is the Squamish Nation place name for this region, which sits within their traditional and unceded territory. The Guide is a project on Tides Canada's shared platform.

To achieve its objective, the Guide is creating decision-support tools that effectively arm local decision-makers and community groups with robust data and holistic information about the region's marine realm. One such tool is an online interactive map and database that will include hundreds of data layers about the Sound's marine ecology, human activities, and vulnerability to anthropogenic pressures (e.g. climate change). This map will visualize areas of multi-use and potential conflict, and provide valuable baseline data at a regional scale.

In July 2019, staff from the Guide co-presented with Moonstone Enterprises to the Town of Gibsons' mayor and council about the status of eelgrass restoration and monitoring in the Sound, and announced that the Guide would survey the Sound's mainland eelgrass in the fall of 2019. Given the interest of the Town of Gibsons ("the Town") in updating their foreshore eelgrass distribution maps (which had previously been surveyed in 2004 and 2013 by Dianne Sanford, sole proprietor of Moonstone Enterprises), councilors requested that the Guide survey the Town's recreational water lease using the same methodology. This involved mapping the full extent of eelgrass beds to enable identifying changes in eelgrass distribution and health that have occurred between 2004-2019. These data will support the Town's capacity to protect critical nearshore ecosystems in the face of growing pressures facing this region.

This report documents the results of the survey, which took place on September 8-9th 2019. The Guide surveyed the remainder of the Sound's mainland coast from September 16th-25th. All data will be made publicly available on the Guide's online map by December 2020.

Regional context:

Moonstone Enteprises mapped eelgrass in the Town's recreational water lease in 2004 and 2013 using a methodology developed by Precision Identification in 2002 (Durance, 2002; www.seagrassconservation.org). In 2012-2013 Seachange Marine Conservation Society mapped eelgrass throughout the Islands Trust's jurisdictional areas using the same methodology. They surveyed the islands within the Sound except Defence Islands (Islands Trust Conservancy, 2019). SeaChange is currently restoring eelgrass habitats throughout the

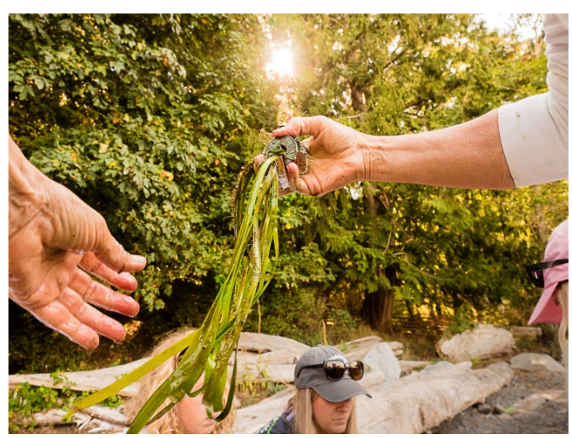


Figure 1. An eelgrass shoot being prepared for transplant at Tunstall Bay. Photo credit Leonard Gilday

Sound as well as in the Sechelt Inlet, Burrard Inlet, and the Gulf Islands from 2017-2021. As a part of this project, Seachange has conducted eelgrass transplants in Plumpers Cove Marine Park, Cotton Bay, Long Bay (Port Graves), Halkett Bay Marine Park, Brigade Bay, and Tunstall Bay (Fig 1).

Eelgrass is relatively scarce in the Sound. Where it does exist, it grows in narrow fringes rather than flat extensive beds as seen elsewhere in the Salish Sea (e.g. Boundary Bay). This is a product of the region's topography and biophysical characteristics: being a fjord, most of the Sound's shorelines are rocky, steep, and exposed. In the places where it is able to grow, eelgrass is vulnerable to nearshore shading and habitat degradation caused by former and present log booming and shoreline development and activity. The cumulative effects of docks, anchoring, and log booms have led to fragmented and low density beds along West Howe Sound and island shorelines. The correlation of habitat loss and degradation with human activity is seen throughout the Salish Sea and the world. For example, eelgrass beds have decreased in area by 45% in the southern Gulf Islands since the 1930s and by 29% globally since the 1880s, largely a product of increased shoreline activity and human density, and industrial impacts (Table 1, Nahirnick et al. 2019).

Table 1. Percent change in total area of eelgrass beds drawn from local and global long-term studies.

Region		Time period	Percent change	Study
Salish Sea	Southern Gulf Islands	1932-2016	-45.1%	Nahirnick et al. 2019
	Roberts Bank	1969 – 1984	-30%	Harrison 1990
	Bellingham	Pre 1900 – 1980s	-30%	Thom and Hallum, 1991
	Snohomish River Delta	Pre 1900 – 1980s	-15%	Thom and Hallum, 1991
Global	Historic	1879-2006	-29%	Waycott et al. 2009
	Projected future	Annual loss	-1.4%	Short et al. 2011

Socio-ecological value:

Seagrasses are marine plants found throughout the world in shallow nearshore and estuarine waters with calm wave energy and fine to semi-coarse sediments. Having evolved from terrestrial plants, seagrasses are rooted, perennial, and flowering – all characteristics that set them apart from seaweeds. They can reproduce asexually through their rhizome network, or sexually through flowering shoots and seeds.

The Pacific Northwest's native eelgrass species, *Zostera marina*, provides multiple ecosystem services to marine food-webs and coastal communities. When conditions are right, *Z. marina* will form dense underwater meadows that provide critical habitat to hundreds of ecologically, socially, and culturally important fish, bird, and invertebrate species, including juvenile salmon, Pacific herring, and Dungeness crabs (Fig 2, Nahirnick et al. 2019). Seagrasses are culturally important to coastal First Nations, as they have been used to collect herring eggs and for food storage and preparation. The Hesquiaht Nation is named after the 'hesh-hesh-hesh' sound made when pulling herring eggs off of seagrass blades with your teeth (Turner 2001).

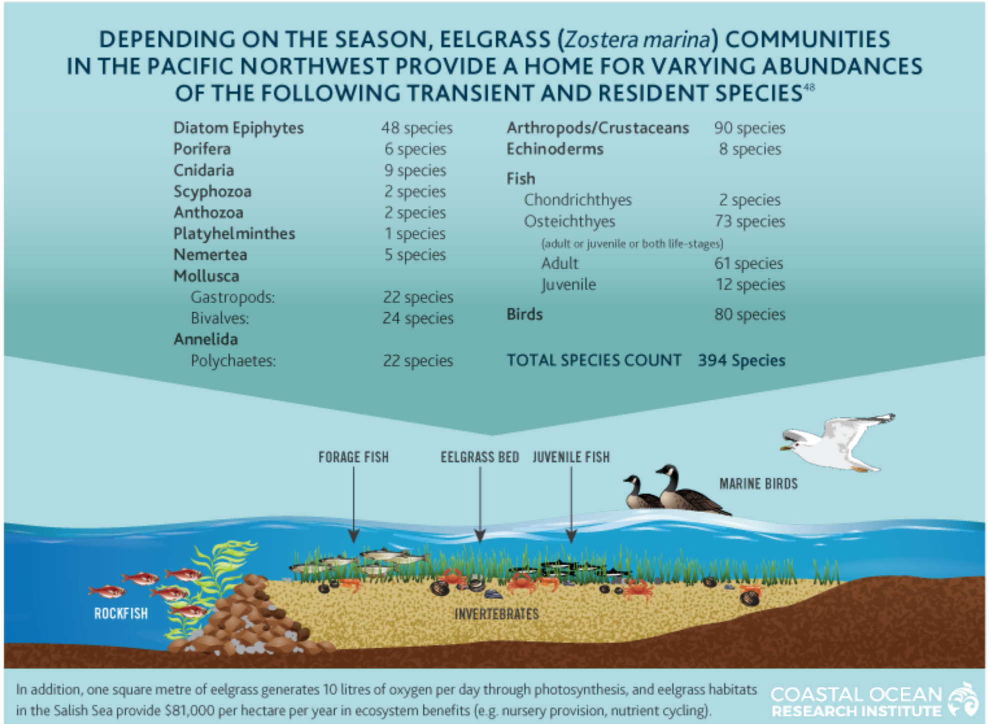


Figure 2. Over 394 species take shelter and feed in eelgrass beds within the Salish Sea. These beds also provide multitude ecosystem services. Graphic provided with permission by Ocean Wise's Coastal Ocean Research Institute: www.habitatprotection.ca.

Eelgrass blades act like trees in a forest: they provide substrate for algae and epiphytes to grow on, create refuge, protection, and migration corridors for invertebrates and juvenile fish, and sequester carbon in the sediments below their root network. In fact, seagrass meadows are among the most productive ecosystems in the world and account for 10-18% of all the carbon sequestered in the global oceans (blue carbon), despite only occupying 0.2% of the seafloor (48-112 Tg of carbon per year) (Greiner et al. 2013; Environment 2019). They also significantly outperform forests when it comes to carbon sequestration: seagrasses capture carbon 35% faster than tropical forests, and B.C.'s roughly 400 km^2 of eelgrass sequesters the same amount of carbon as the province's entire stretch of boreal forest (Campbell, 2010; Environment 2019). In addition to sequestering carbon, eelgrass can buffer nearshore ecosystems from ocean acidification by converting carbon dioxide into oxygen through photosynthesis. This helps maintain seawater acidity at levels low enough to allow the persistence of small grazing invertebrates that are sensitive to changes in seawater acidity (Hughes et al. 2017).

Finally, eelgrass improves water quality and mitigates erosion. The dense canopies filter wave energy, while the root networks stabilize sediments and prevent particulate resuspension (Greiner et al. 2013). Collectively, these characteristics and functions of healthy eelgrass beds contribute to their provision of approximately $87,000 per hectare per year in ecosystem benefits within the Salish Sea (Fig 2, Molnar, 2015). These services and functions underscore the importance of maintaining and protecting eelgrass beds throughout Atl'ka7tsem and the Salish Sea in order to support the health and resilience of British Columbia's nearshore ecosystems and coastal communities.

Survey methods:

Figure 3. Underwater camera used to map subtidal eelgrass.

a.) Town of Gibsons Recreational Water Lease Survey, Sept 2019

We mapped subtidal eelgrass according to the level two methods outlined in Durance 2002. This involved delineating the boundaries of eelgrass meadows using an underwater camera and depth sounder (Fig 3). When eelgrass was present, we recorded GPS waypoints using a Trimble Pathfinder ProXR (accuracy +/- 2.4 metres) every 10 metres. Alongside each waypoint we recorded the following habitat characteristics: fringing or flat bed, percent cover (semi-quantitative metric, <25%, 26-75%, >75%), sediment type, and presence of other plant species (e.g. macroalgae or *Z. japonica*). We also recorded observations of subtidal anthropogenic debris and habitat degradation through scouring, mooring buoys, anchors, or docks. Moonstone Enterprise provided their boat and skipper.

In November 2019, staff from the Nicholas Sonntag Marine Education Centre conducted a subtidal dive survey of the eelgrass in Gibsons Harbour. They quantified shoot density, anthropogenic debris, and species diversity along transects set in front of the harbour breakwater. Results from this survey will be shared in a subsequent report.

b.) Howe Sound Mainland Survey, Sept 2019

The regional survey methods differed in three ways. First, we only recorded presence and absence rather than the full bed extent (i.e. GIS lines versus polygons). Second, we used a Garmin GPSMAP 78 (accuracy +/- 3.6 metres) rather than the Trimble due to software processing incompatibilities. Finally, Ocean Wise rather than Moonstone Enterprises provided the boat and skippers.

Results

a.) Town of Gibsons Recreational Water Lease Survey

From September 8-9th 2019, we surveyed the linear shoreline extent from Gibsons creek to Atlee's beach. We found that the total eelgrass habitat area (3.17 hectares) has declined by approximately 1 hectare compared to the 2013 distribution (4.08 hectares), and observed an overall reduction in eelgrass density compared to prior years (see Appendix 1 for maps). In particular, the eelgrass in front of Armours beach was short, thin, and averaged around 26-75 percent cover, compared to the consistent >75 percent cover recorded in 2013. The total bed area decreased from 1.69 hectares in 2013 to 1.10 hectares in 2019, mostly due to a constriction of the deep and shallow edges. No docks or mooring buoys other than the Armours Beach swim area containment were observed within the eelgrass depth.

There is a moderately healthy and flat eelgrass bed in front of the Gibsons marina breakwater with a total bed area of 1.85 hectares. This total area is less than both previous sampling years (2.13 ha in 2004 and 2.07 in 2013); however, it is difficult to make an exact comparison in total area for this region across the sampling years due to varying methods of mapping the marker buoy. Shoot densities were also lower here compared to the 2013 records (26-75% rather than >75% cover) (Appendix 1). We observed subtidal debris, including anchor blocks, tires, and scrap metal that is fragmenting the habitat and several large barges that may shade and prevent eelgrass growth throughout the bay (Fig 4). The sub-tidal surveys conducted by the Marine Education Centre confirmed scouring and damage to the eelgrass below one of the three barges in Gibsons harbour. The second barge is on the edge of the eelgrass and may shade the beds, while the third is outside of the eelgrass bed depth. More information on these impacts, location of the barges and debris, condition of the eelgrass, and species present in these eelgrass beds will be included in their upcoming report.

Figure 4. Barges (left) and floats (right) that shade eelgrass bed in front of Gibsons harbour.

The eelgrass beds around the Gap and in front of Georgia, Franklin, and Atlee's beaches had a slightly constricted distribution compared to 2013 (Appendix 1). Eelgrass loss seems to be greatest at Atlee's and Georgia beaches, and around the bluff. Shoot density was lower on average here than in 2013. No subtidal debris was observed here, but several buoys and docks are anchored in the suitable eelgrass habitat at Franklin and Atlee's beaches and contribute to bed fragmentation.

b.) Howe Sound Mainland Survey

From September 16th-25th staff from the Guide and Ocean Wise surveyed the Sound's mainland shoreline from Horseshoe Bay to Squamish to West Howe Sound, ending at Gibson's creek. We found almost no eelgrass along the Sound's eastern shoreline except two small patches on the eastern edge of Brunswick beach (around Lions Bay), two small patches in Mamquam channel (one in front of Stawamus reserve and one in front of Nexen beach) (Appendix 2). We found a small patch along the eastern edge of McNab estuary next to a residential dock.

From McNab estuary to Twin Creeks there is substantial industrial activity, including a pulp and paper mill, log sorts, and log storage facilities. Past and present log booming prevents eelgrass growth along most of this region's shoreline. Log booms shed woody debris that converts the seafloor into an anoxic, or low-oxygen, environment. The booms themselves shade the seafloor, preventing eelgrass from accessing light required for photosynthesis. One small patch of eelgrass was recorded at Witherby point (Appendix 2).

Just north of Williamson's landing healthy, dense, and continuous eelgrass beds were observed that stretched until Gibsons' creek, with the exception of large gaps where rocky shorelines and ferry infrastructure prohibit growth. Occasional docks and anchors also broke up the otherwise continuous beds (Appendix 2). A removable dock is used seasonally by the YMCA camp, which reduces impacts on the eelgrass bed at Williamson's Landing. Kayaks are stacked on the dock during the summer, which also helps reduce stress on the beds.

Discussion:

Eelgrass is extremely rare along the Sound's mainland shoreline, with the exception of West Howe Sound from Williamson's landing down to Atlee's beach (Appendix 2). Unlike the rest of the Sound, this region fosters relatively dense and healthy eelgrass meadows. The distribution and total area of eelgrass within the Town of Gibsons' recreational water lease has declined since 2013, dropping from 4.08 to 3.17 hectares. Shoot density in all eelgrass beds is consistently lower than that recorded in 2013. This change in eelgrass density is likely due to the cumulative effects of coastal development and climate change. When bed connectivity and shoot density decrease, the ability for eelgrass beds to withstand increasing stress and continue providing ecosystem services diminishes.

Coastal development impacts eelgrass by degrading water quality and fragmenting habitat. Water quality can decline when residential, urban, and industrial runoff and effluent (e.g. pesticides, fertilizers, pollutants, sewage) lead to sedimentation and eutrophication (Nahirnick et al. 2019). This can reduce the light available for photosynthesis and alter nutrient levels, leading to nutrient loading. Habitat fragmentation is caused by the construction of docks, mooring buoys, floats, and anchors that shade eelgrass and scour the seafloor with the movement of the anchor and chain (Fig 5). Finally, hard shoreline armouring (e.g. seawalls) can negatively impact eelgrass by altering nearshore hydrology and water clarity. Impacts from hard armouring include increased wave energy, interrupted sediment and nutrient flow from terrestrial to marine systems, and disrupted natural beach formation processes (e.g. changing sandy beaches to coarse cobble shores).

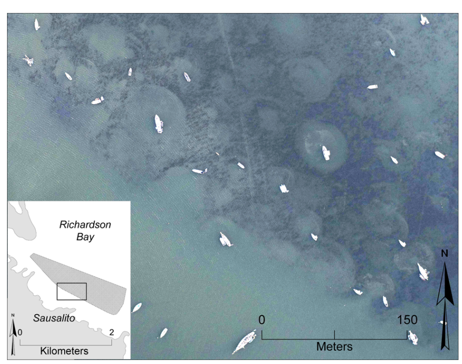
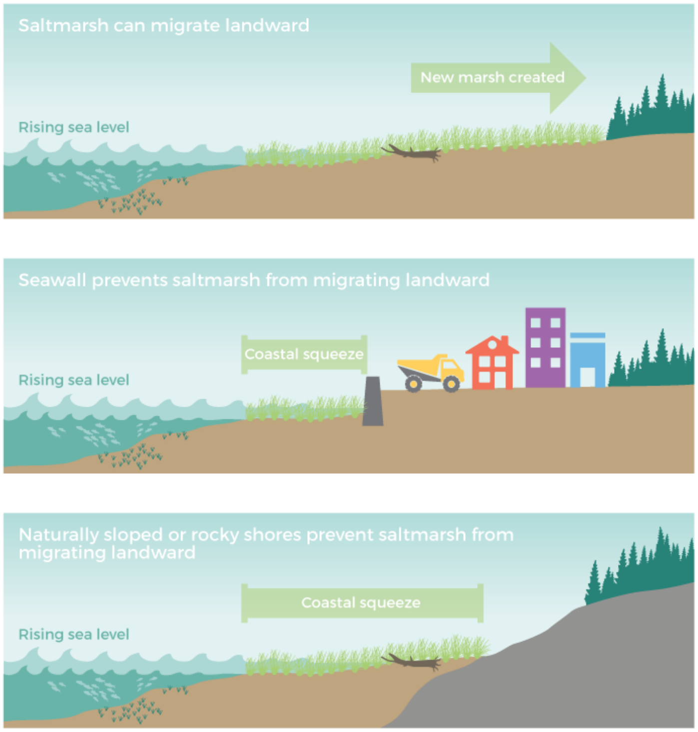


Figure 5. Anchor scars in aerial imagery north of San Fransisco, California. The dark areas in the image are eelgrass and the anchor scars are roughly circular. Image from Kelly et al. 2019.

Coastal squeeze



COASTAL OCEAN RESEARCH INSTITUTE OCEANWATCH

Figure 6. A diagram illustrating the combined effects of sea-level rise and hard armouring on reducing nearshore habitat (i.e. coastal squeeze). Graphic from Ocean Wise's Ocean Watch Howe Sound edition report.

Climate change impacts eelgrass through ocean warming, more intense and frequent winter storms, and sea level rise. Warming seawater temperatures enable the growth of plankton and macro-algae, which compete with eelgrass for light and habitat. This effect is amplified in sheltered bays and estuaries where high nutrient inputs and low water circulation further encourage macroalgal growth. Ocean warming can also cause physiological stree to eelgrass, and interact with low salinity patterns caused by droughts to increase the prevalence and intensity of seagrass wasting disease (*Labyrinthula zostera*) (Kaldy 2014).

The increasing frequency and intensity of winter storms create extreme wind and wave energy in the nearshore, which can carry woody debris into eelgrass beds, uproot plants, and reduce eelgrass density during their slowest growing season. From Dec 2018 – April 2019, several high intensity winter storms affected much of the Sound's shoreline, including those around Gibsons.

Coastal development and climate change can interactively affect eelgrass through coastal squeeze, which is the loss of nearshore habitat due to the combined effect of sea-level rise and hard shoreline armouring (Fig 6).

Conclusion:

The Town of Gibsons and West Howe Sound's shorelines contain significant eelgrass habitat compared to the rest of Howe Sound/Atl'ka7tsem's mainland coast. Eelgrass in the Town's recreational water lease is in a stable but declining state of health relative to previous surveys in 2013 and 2004. Accordingly, the staff of the Guide and Moonstone Enterprises recommend the following actions and resources to protect eelgrass and nearshore ecosystems in this region from the ongoing and cumulative negative effects of coastal development and climate change. These actions will enable this critical marine species to continue providing the multiple ecosystem services that are fundamental to building Atl'ka7tsem's resilience and adaptive capacity to change in the Anthropocene.

Local government actions to reduce the impact of coastal development on nearshore ecosystems:

- Encourage boaters, waterfront property owners, and mooring buoy installers to use environmentally friendly designs when installing their docks and mooring buoys (e.g. mid-line floats), and to anchor outside of eelgrass depth (deeper than -7 m below chart datum, pers comms Nikki Wright and Cynthia Durance).
- Incorporate eelgrass protection requirements into policy, management and development plans.
- Install signage and marker buoys to increase public awareness of where eelgrass is and its value to marine food-webs and coastal communities.
- Incorporate soft shore approaches to shoreline development (e.g. Green Shores) into management and development plans, by-laws, and policy.

Local government actions to reduce the impact of climate change on nearshore ecosystems:

- Create formal inventories of critical and/or ecologically sensitive nearshore habitat.
- Develop bylaws that prevent the destruction of or damage to nearshore areas (i.e. no net loss of critical nearshore habitat including seagrasses, salt marshes, and estuaries). Emphasize the importance of first conserving existing habitats (i.e. preventing loss), and then restoring what has historically been lost.
- Incorporate soft shore approaches to shoreline development (e.g. Green Shores) into management and development plans, by-laws, and policies.
- Support nearshore restoration, including eelgrass transplants, marine riparian restoration, and salt marsh and estuary restoration. Restored habitat helps buffer coasts from sea-level rise and storm intensity as well as increases carbon sequestration.
- Develop climate action plans that reduce emissions and build adaptive capacity.

Acknowledgements:

The Guide wishes to thank the many partnering organizations whose collaboration and support made this work possible. SeaChange Marine Conservation Society provided the equipment and training required to conduct these surveys, and Moonstone Enterprises and Ocean Wise donated their boats, skippers, and assistance. We are very grateful to the Galiano Conservancy Association and David Suzuki Foundation for their in-kind GIS and mapping contributions, and to the Nicholas Sonntag Marine Education Centre for their research and community-education support. We are also grateful to those who provided funding for these surveys, including the Town of Gibsons, National Geographic, the Sitka Foundation, and the North Growth Foundation. Finally, we wish to thank the Town of Gibsons and all other local governments in the Sound, as well as the region's residents, communities, and First Nations for demonstrating the effective and proactive leadership and stewardship that is required to protect Atl'ka7tsem's critical and vulnerable marine species, such as eelgrass. Together we look forward to continuing to build our region's resilience to changes that it experiences in the Anthropocene.

Resources:

Environmentally friendly mooring buoys and marker buoys:

- https://washingtondnr.wordpress.com/2011/06/06/how-to-moor-your-boat-on-state-owned-aquatic-lands/
- https://www.dnr.wa.gov/Publications/aqr_mooring_buoy_brochure.pdf
- http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.173.4721&rep=rep1&type=pdf
- https://ncbs.ifas.ufl.edu/marker-buoys-sandy-hook-help-boaters-seagrass/

Soft shoreline development

- http://stewardshipcentrebc.ca/Green_shores/
- http://www.islandstrust.bc.ca/media/282417/Landowners-Guide-September-draft-revised.pdf
- https://fortress.wa.gov/ecy/publications/publications/1406009.pdf
- https://coast.noaa.gov/data/digitalcoast/pdf/living-shoreline.pdf

Climate change adaptation and actions

- https://council.vancouver.ca/20190424/documents/cfsc1.pdf (See Big Move #6)
- http://live-oceanpanel.pantheonsite.io/sites/default/files/2019-10/19_4PAGER_HLP_web.pdf
- http://www.oceanpanel.org/climate (main emphasis on seagrass conservation over restoration)

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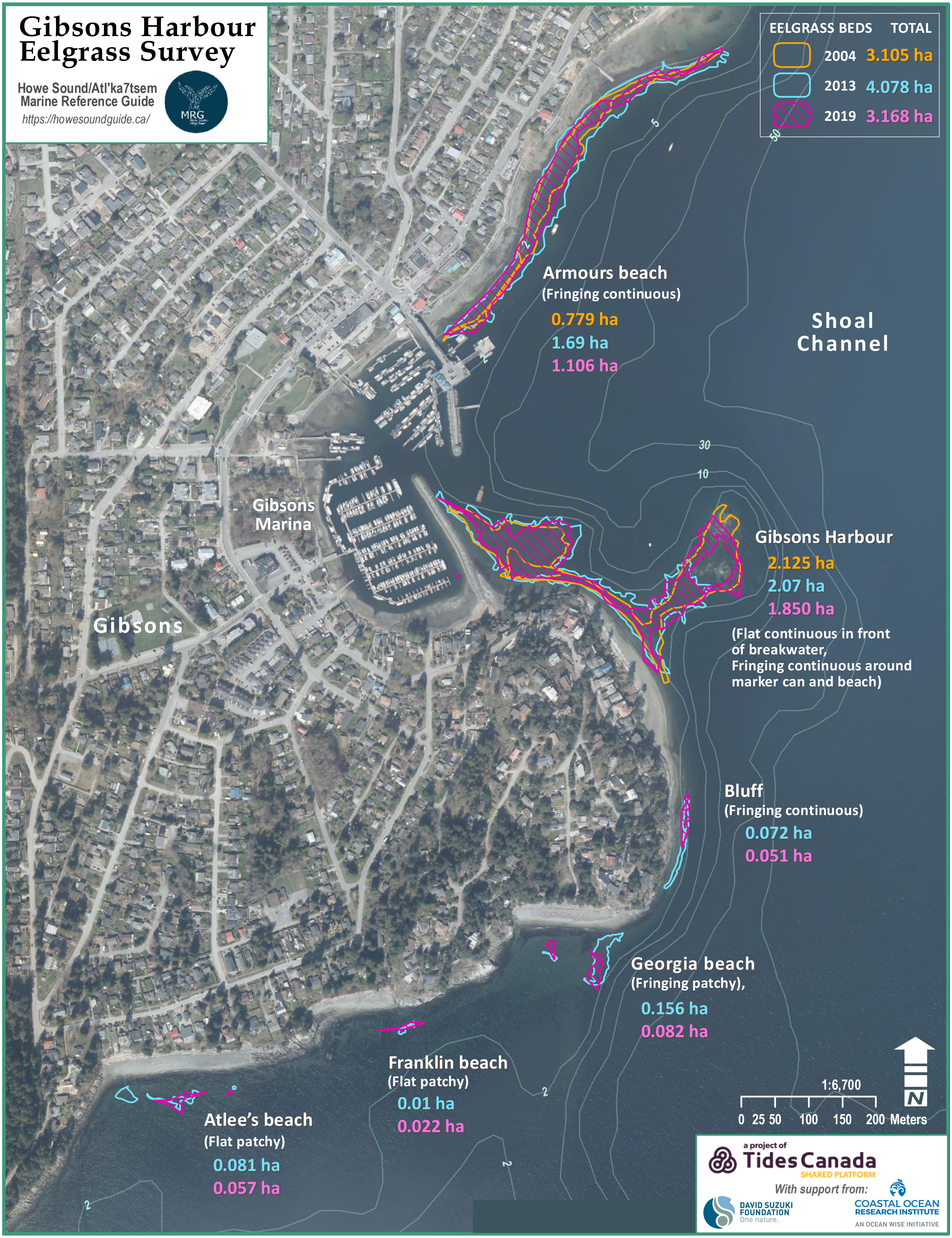
Appendix 1

Town of Gibsons Eelgrass survey maps
September 2019



Gibsons Harbour Eelgrass Survey
Howe Sound/Atl'ka7tsem Marine Reference Guide
https://howesoundguide.ca/
MRG
EELGRASS BEDS TOTAL
2004 3.105 ha
2013 4.078 ha
2019 3.168 ha
Armours beach
(Fringing continuous)
0.779 ha
1.69 ha
1.106 ha
Shoal Channel
Gibsons Marina
Gibsons
Gibsons Harbour
2.125 ha
2.07 ha
1.850 ha
(Flat continuous in front of breakwater, Fringing continuous around marker can and beach)
Bluff
(Fringing continuous)
0.072 ha
0.051 ha
Georgia beach
(Fringing patchy),
0.156 ha
0.082 ha
Franklin beach
(Flat patchy)
0.01 ha
0.022 ha
Atlee's beach
(Flat patchy)
0.081 ha
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- Eelgrass field work 201909 (Trimble)
- Recreation anchorage
- Recreation moorage
- Dock

Eelgrass beds
- 2019
- 2013
- 2004

Bathymetry contour (m)

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Eelgrass field work 201909 (Trimble)

Recreation anchorage

Recreation moorage

Dock

Eelgrass beds

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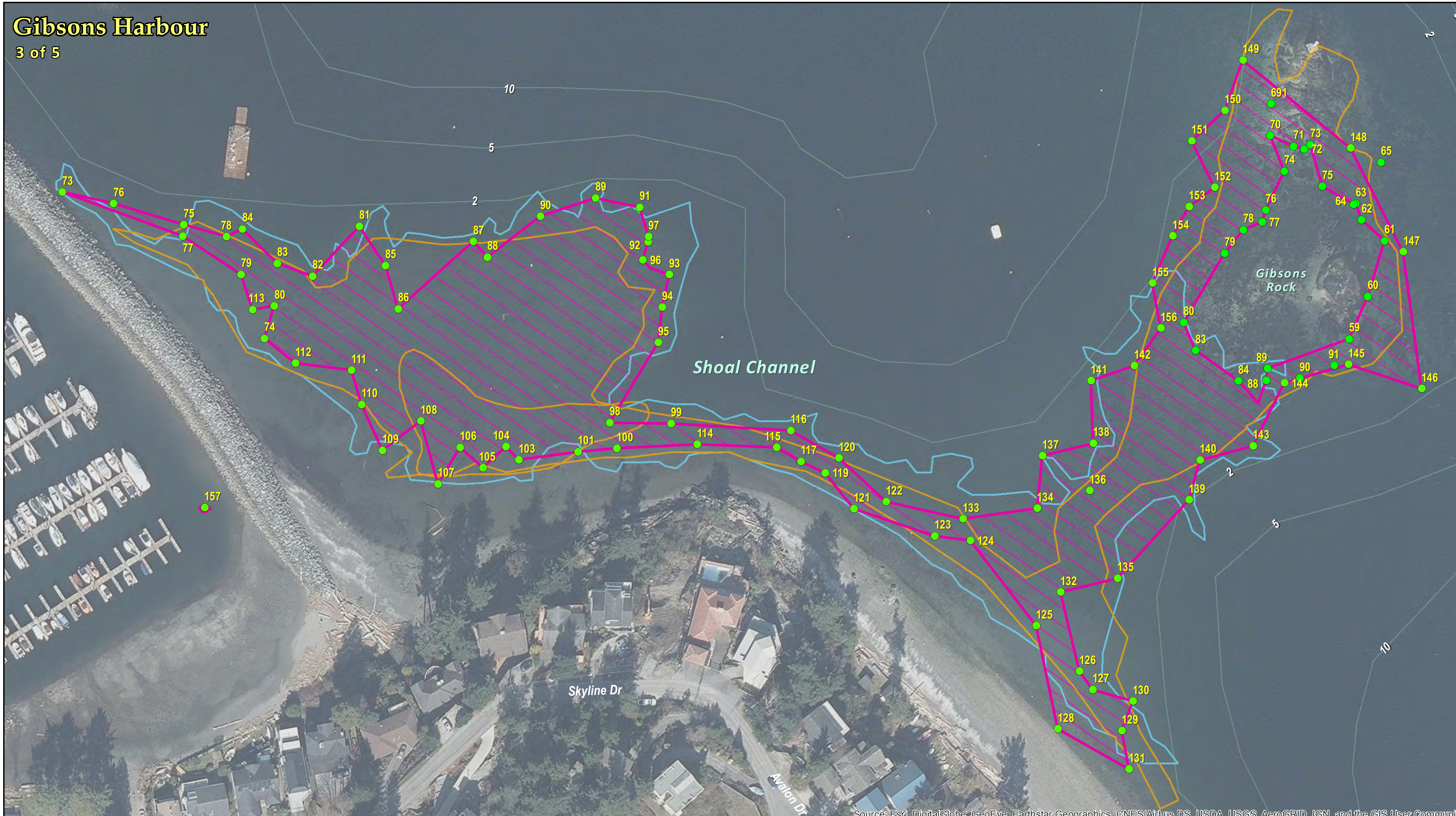

Gibsons Harbour Eelgrass Survey

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Eelgrass field work 201909 (Trimble)

Recreation anchorage

Recreation moorage

Dock

Eelgrass beds

2019

2013

2004

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0 25 50 100 Meters

Eelgrass field work 201909 (Trimble)
Recreation anchorage
Recreation moorage
Dock

Eelgrass beds
2019
2013
2004

Bathymetry contour (m)

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0 25 50 100 Meters

Eelgrass field work 201909 (Trimble)
Recreation anchorage
Recreation moorage
Dock

Eelgrass beds
2019
2013
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Bathymetry contour (m)

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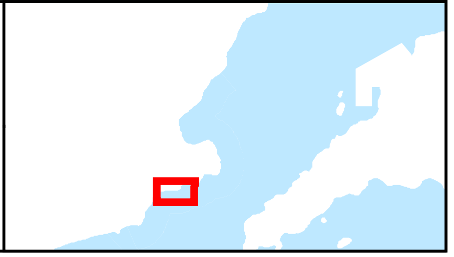
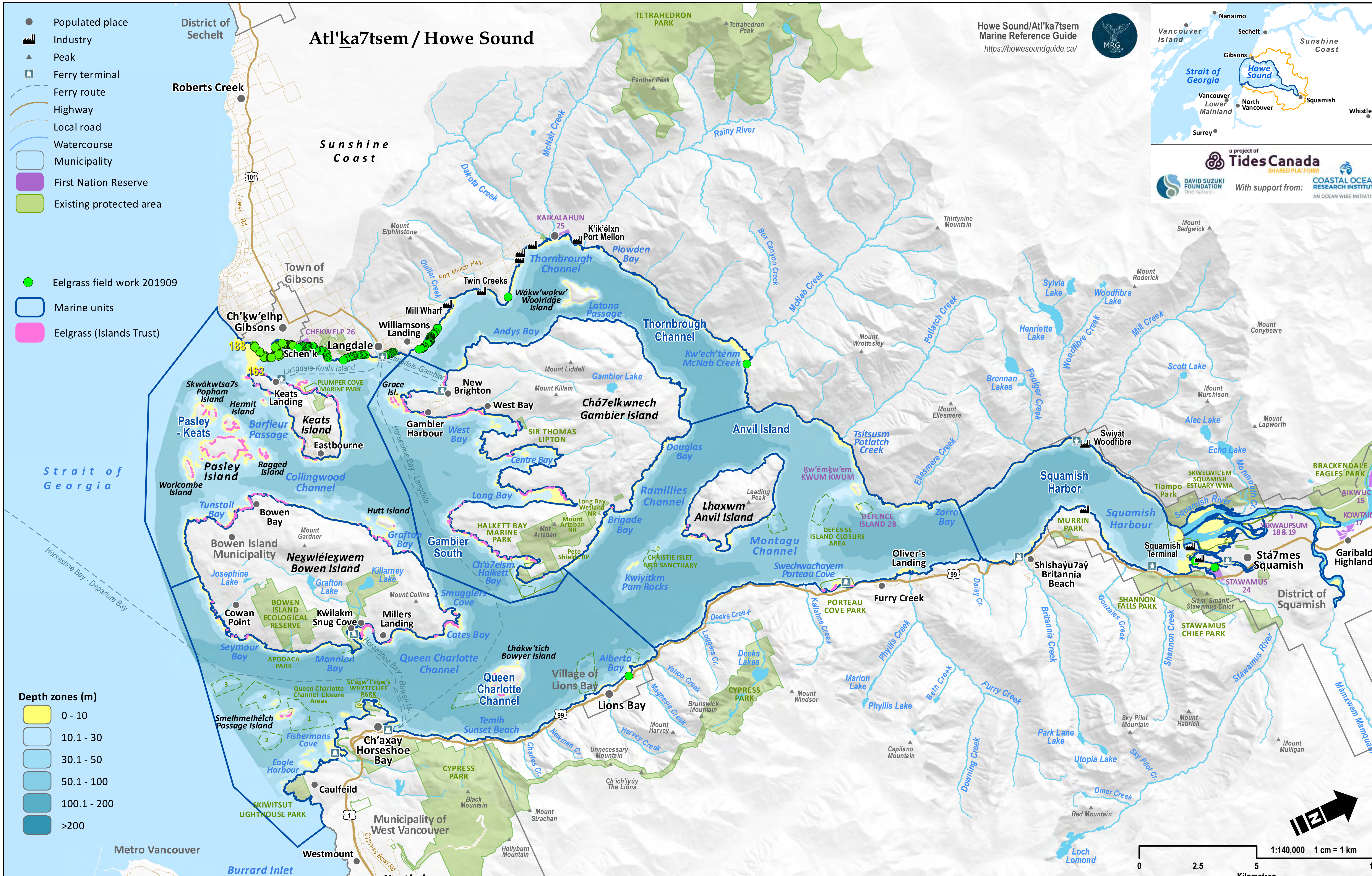


Appendix 2

Howe Sound/Atl'ka7tsem mainland
eelgrass survey maps
September 2019



Atl'ka7tsem / Howe Sound
Howe Sound/Atl'ka7tsem Marine Reference Guide
https://howesoundguide.ca/
MRG
Populated place
Industry
Peak
Ferry terminal
Ferry route
Highway
Local road
Watercourse
Municipality
First Nation Reserve
Existing protected area
Eelgrass field work 201909
Marine units
Eelgrass (Islands Trust)
Depth zones (m)
0 - 10
10.1 - 30
30.1 - 50
50.1 - 100
100.1 - 200
>200
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David Suzuki Foundation
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Coastal Ocean Research Institute
Nanaimo
Sechelt
Vancouver Island
Sunshine Coast
Gibsons
Strait of Georgia
Howe Sound
Vancouver
Lower Mainland
North Vancouver
Squamish
Whistler
Surrey
District of Sechelt
Roberts Creek
Sunshine Coast
Town of Gibsons
Ch'kw'elhp Gibsons
Chekwelp 26
Langdale
Schen'k
Williamsons Landing
Mill Wharf
Twin Creeks
Port Mellon Hwy.
Mount Elphinstone
Kaikalahun 25
K'ik'élxn Port Mellon
Plowden Bay
Thornbrough Channel
Wákw'wakw' Woolridge Island
Latona Passage
Andys Bay
Tetrahedron Park
Tetrahedron Peak
Panther Peak
McNair Creek
Rainy River
Dakota Creek
Box Canyon Creek
McNab Creek
Potlatch Creek
Kw'ech'ténm McNab Creek
Thornbrough Channel
Gambier Lake
Mount Liddell
Mount Killam
Chá7elkwnech Gambier Island
New Brighton
West Bay
Gambier Harbour
Grace Isl.
Sir Thomas Lipton
Centre Bay
Long Bay
Halkett Bay Marine Park
Mount Artaban
Pete Shields NR
Long Bay Wetland NR
Ch'á7elsm Halkett Bay
Gambier South
Langdale-Keats Island
Langdale-Gambier
Horseshoe Bay - Langdale
Plumper Cove Marine Park
Keats Landing
Keats Island
Eastbourne
Skwákwtsa7s Popham Island
Hermit Island
Pasley - Keats
Barfleur Passage
Pasley Island
Ragged Island
Worlcombe Island
Collingwood Channel
Strait of Georgia
Tunstall Bay
Bowen Bay
Hutt Island
Grafton Bay
Mount Gardner
Bowen Island Municipality
Nexwlélexwem Bowen Island
Killarney Lake
Grafton Lake
Josephine Lake
Bowen Island Ecological Reserve
Cowan Point
Kwílakm Snug Cove
Millers Landing
Mount Collins
Smugglers Cove
Cates Bay
Seymour Bay
Apodaca Park
Mannion Bay
Queen Charlotte Channel
Lháḱw'tich Bowyer Island
Queen Charlotte Channel
St'éxw't'ekw's Whytecliff Park
Queen Charlotte Channel Closure Areas
Smelhmelhélch Passage Island
Fishermans Cove
Eagle Harbour
Ch'axay Horseshoe Bay
Caulfeild
Skiwitsut Lighthouse Park
Municipality of West Vancouver
Westmount
Metro Vancouver
Burrard Inlet
Northshore
Cypress Park
Black Mountain
Mount Strachan
Hollyburn Mountain
Cypress Bowl Rd
Horseshoe Bay - Departure Bay
Temlh Sunset Beach
Village of Lions Bay
Alberta Bay
Lions Bay
Ch'ich'iyúy The Lions
Unnecessary Mountain
Mount Harvey
Harvey Creek
Magnesia Creek
Brunswick Mountain
Deeks Lakes
Deeks Creek
Loggers Cr.
Yahoo Creek
Cypress Park
Anvil Island
Douglas Bay
Ramillies Channel
Brigade Bay
Lhaxwm Anvil Island
Leading Peak
Christie Islet Bird Sanctuary
Kwiyitkm Pam Rocks
Montagu Channel
Swechwachayem Porteau Cove
Porteau Cove Park
Kw'émkw'em Kwum Kwum
Defence Island 28
Defence Island Closure Area
Tsítsusm Potlatch Creek
Ellesmere Creek
Mount Ellesmere
Mount Wrottesley
Furry Creek
Oliver's Landing
Zorro Bay
Daisy Cr.
Kallahne Creek
Phyllis Creek
Marion Lake
Phyllis Lake
Beth Creek
Furry Creek
Mount Windsor
Capilano Mountain
Downing Creek
Squamish Harbor
Swiyát Woodfibre
Shishayu7ay Britannia Beach
Murrin Park
Britannia Creek
Gonzales Creek
Shannon Falls Park
Shannon Creek
Squamish Harbour
Squamish Terminal
Stá7mes Squamish
Stawamus 24
Siam' Smánit Stawamus Chief
Stawamus Chief Park
Stawamus River
District of Squamish
Garibaldi Highlands
Skwelwil'em Squamish Estuary WMA
Tiampo Park
Squamish River
Mamquam River
Brackendale Eagles Park
Aikwucks 15
Kowtain 17
Skwaupsum 18 & 19
Mámxwem Mamquam
Mount Habrich
Sky Pilot Mountain
Sky Pilot Cr.
Park Lane Lake
Utopia Lake
Omer Creek
Red Mountain
Loch Lomond
Mount Mulligan
Sylvia Lake
Woodfibre Lake
Woodfibre Creek
Henriette Lake
Brennan Lakes
Foulger Creek
Mill Creek
Scott Lake
Alec Lake
Echo Lake
Mount Murchison
Mount Lapworth
Mount Roderick
Mount Sedgwick
Mount Conybeare
Thirtynine Mountain
Mamquam River
1:140,000
1 cm = 1 km
0
2.5
5
10
Kilometres
N

Howe Sound mainland Eelgrass Survey

Howe Sound/Atl'ka7tsem Marine Reference Guide
https://howesoundguide.ca/

Ferry terminal	Youth camp	Recreation anchorage	Eelgrass coordinates
Ferry terminal (inactive)	Bathymetry contour (m)	Recreation moorage	Eelgrass restoration potential
Marina	First Nation Reserve	Private dock	Eelgrass interpolation
Public dock	Protected area		

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Stawamus reserve

Howe Sound mainland Eelgrass Survey

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- Private dock
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Nexen beach

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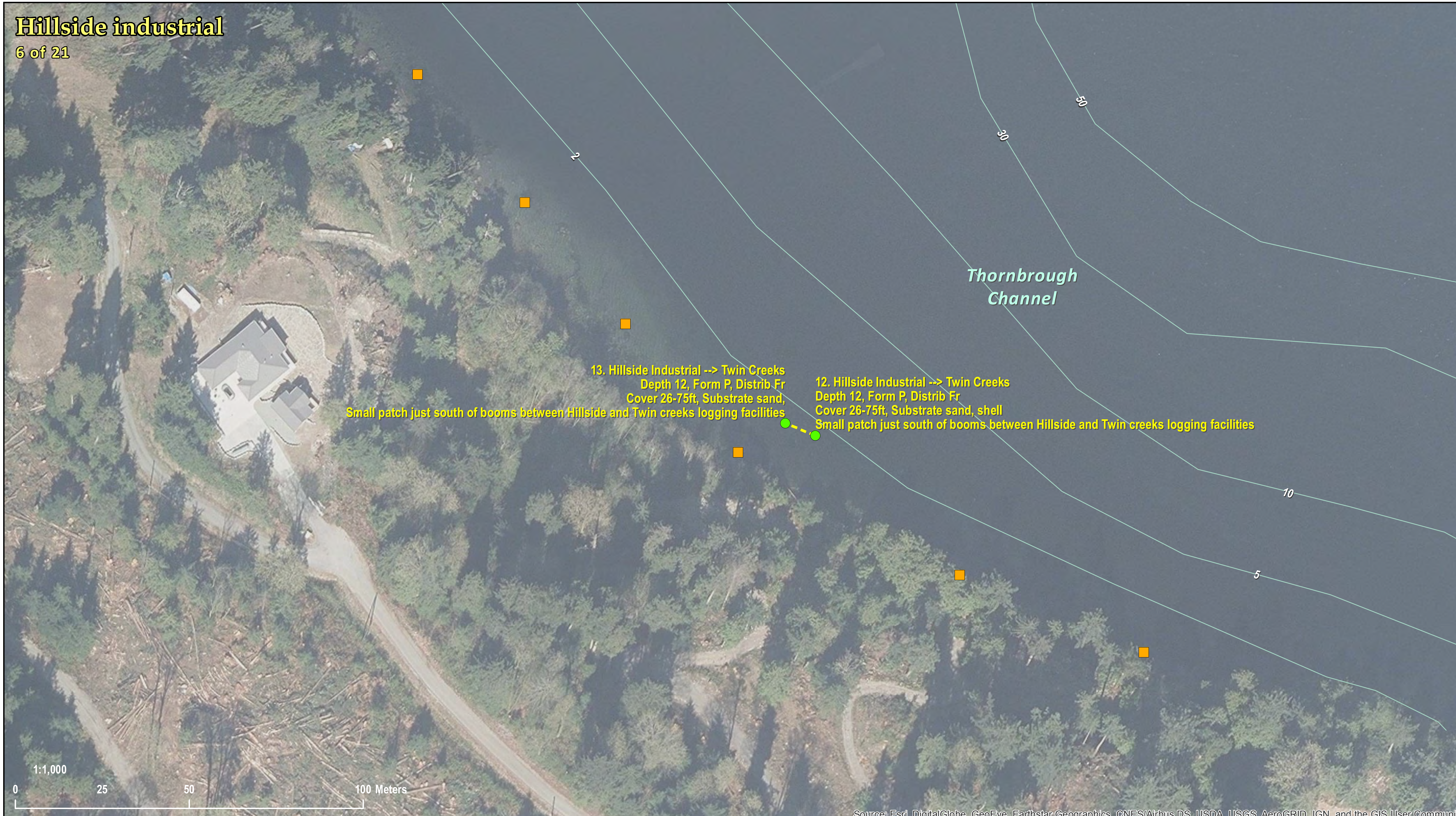

Howe Sound mainland Eelgrass Survey

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Ferry terminal
Ferry terminal (inactive)
Marina
Public dock
Youth camp
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First Nation Reserve
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Eelgrass restoration potential
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Public dock	Protected area		

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Williamsons Landing 2

Howe Sound mainland Eelgrass Survey

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Marina	First Nation Reserve	Private dock	Eelgrass interpolation
Public dock	Protected area		

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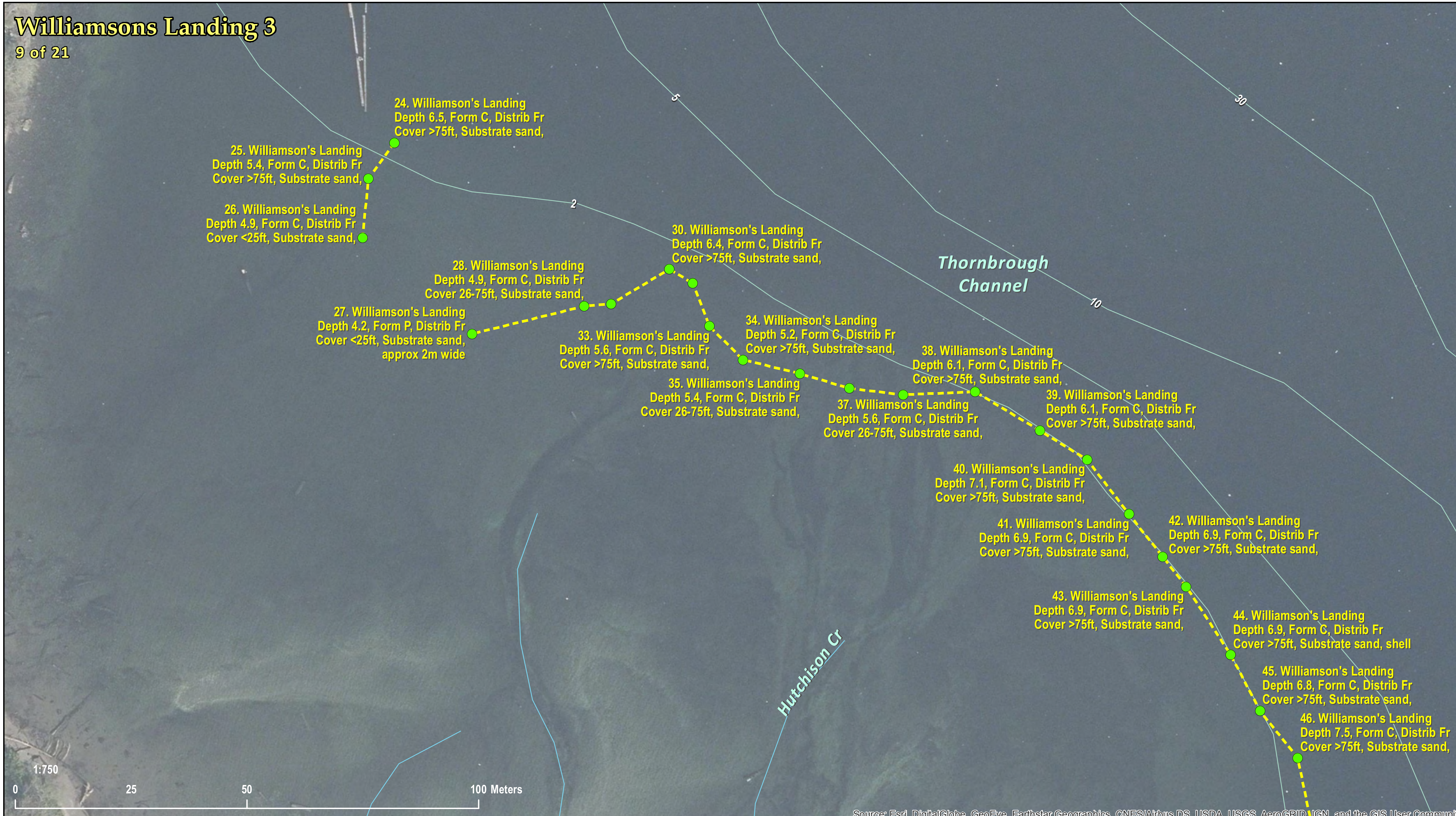
Williamsons Landing 3



Howe Sound mainland Eelgrass Survey

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- Recreation moorage
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- Eelgrass coordinates
- Eelgrass restoration potential
- Eelgrass interpolation

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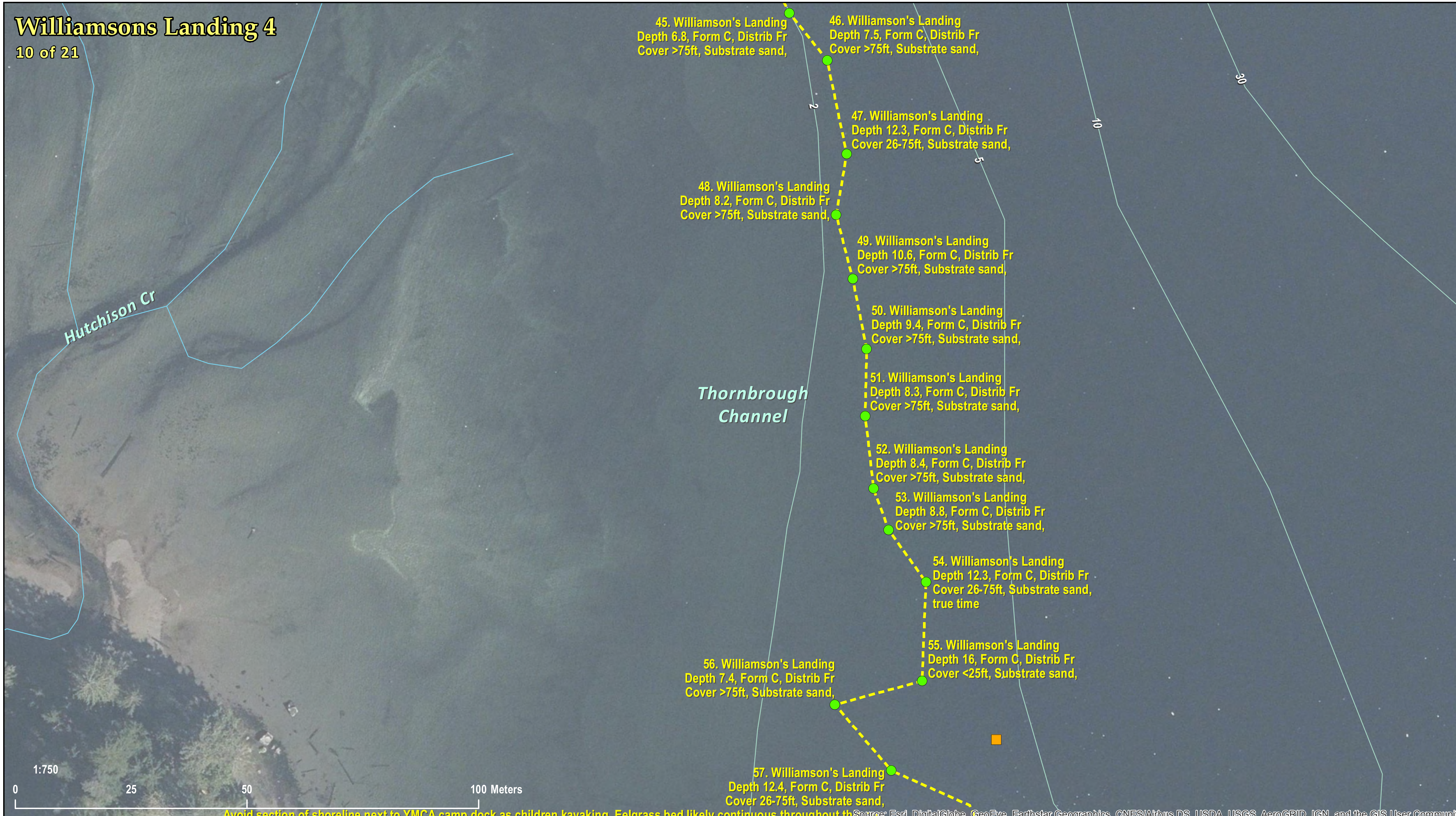
Williamsons Landing 4



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Williamsons Landing 5

Howe Sound mainland Eelgrass Survey

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Ferry terminal (inactive)	Bathymetry contour (m)	Recreation moorage	Eelgrass restoration potential
Marina	First Nation Reserve	Private dock	Eelgrass interpolation
Public dock	Protected area		

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Williamsons Landing 6

Howe Sound mainland Eelgrass Survey

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Marina	First Nation Reserve	Private dock	Eelgrass interpolation
Public dock	Protected area		

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- First Nation Reserve
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- Recreation moorage
- Private dock
- Eelgrass coordinates
- Eelgrass restoration potential
- Eelgrass interpolation

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Hopkins Landing 2

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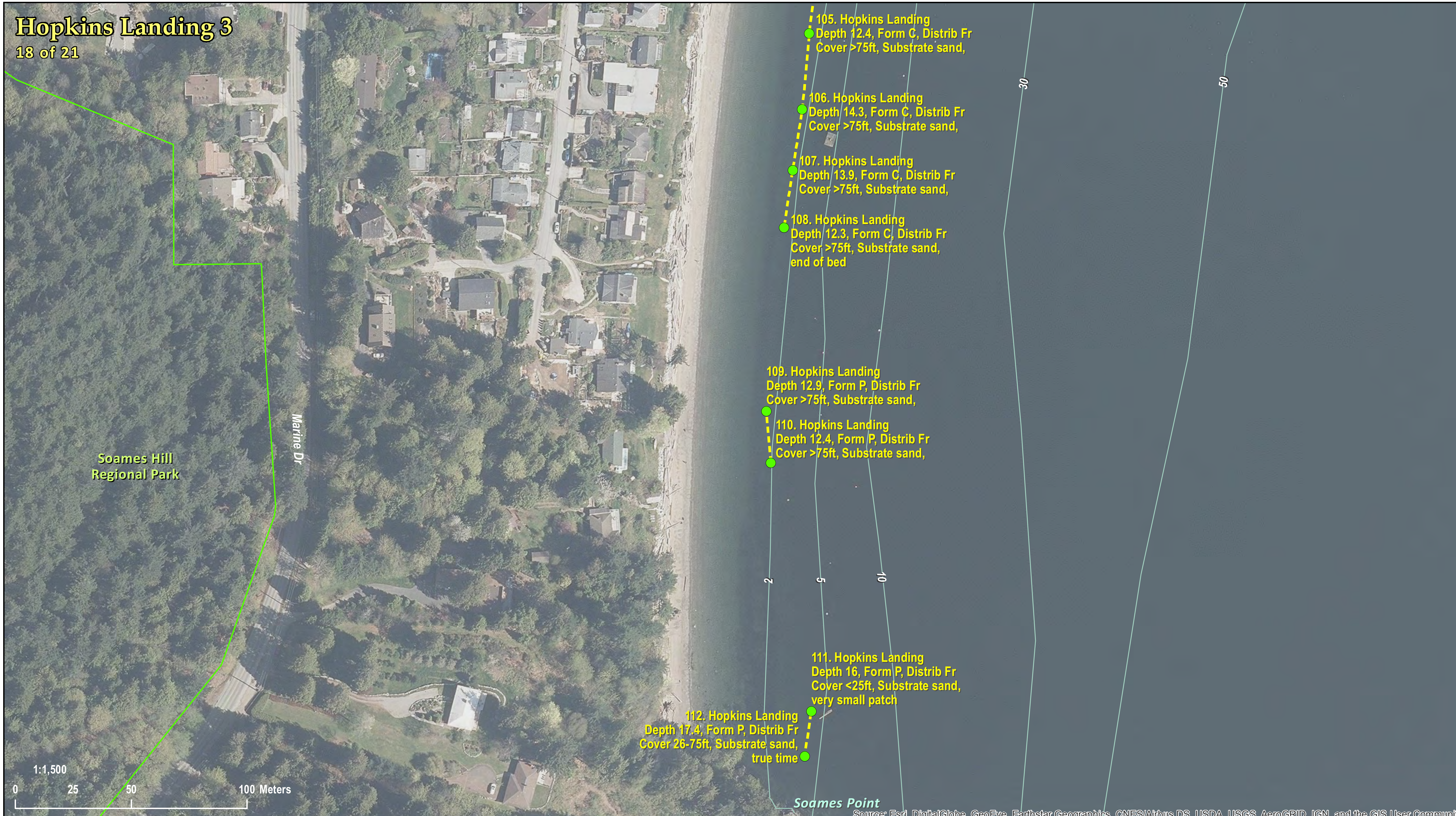

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Youth camp
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First Nation Reserve
Protected area
Recreation anchorage
Recreation moorage
Private dock
Eelgrass coordinates
Eelgrass restoration potential
Eelgrass interpolation

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Grantham's Landing 1

Howe Sound mainland Eelgrass Survey

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