# Lake Windermere
# Aquatic Invasive Plant Species Inventory
# 2021

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goldeneye
ECOLOGICAL SERVICES

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# 1. Introduction/Background

Freshwater aquatic plants are important for a number of ecological benefits and overall lake ecosystem health. They are essential to a healthy freshwater lake ecosystem, similar to how trees are essential for good health of a forest ecosystem. Freshwater aquatic plants are a food source for many animals (e.g., ducks, otter, beaver, invertebrates, fish), they provide nesting materials for birds, provide habitat and cover for some animals (e.g., fish, amphibians, birds, invertebrates), provide erosion control protecting shorelines, they reduce turbidity, and they are a vital part of nutrient cycling in a lake (Liddle & Scorgie, 1980). "Invasive species are alien or exotic plants, animals and other organisms that have been introduced into a natural environment where they are not normally found and where they negatively impact the environment, people or the economy. For example, invasive species can threaten Indigenous species and damage habitats, reduce crop yields and forage for grazing, damage recreational and commercial fisheries, damage infrastructure and pose health risks to people" (Environment Reporting BC, 2015).

There are numerous different 'pathways of invasion' used by invasive species use to enter new habitats. As of 2015, there were 175 known invasive species impacting the Province of BC [Province of British Columbia (BC), 2015]. For instance, transportation corridors (i.e., roads, railways, transmission lines) disperse invasive plant seeds or plant fragments, leading to colonization of species in areas where they were not previously located. Aquatic invasive plants are transported into waterbodies though motorized and non-motorized boat ballast and by boat trailers carrying plant fragments. In the absence of any Indigenous predators to keep these species in ecological balance, the alien invader takes over previously unoccupied habitat and displaces Indigenous species. Regarding the impacts of invasive species introduced by boats, economic costs to U.S. states surrounding the Great Lakes are estimated to cost millions of dollars annually. "It is likely that the overall aggregate level of cost to the Great Lakes region is significantly over $100 million annually" (Rosaen et al., 2012).

Invasive aquatic mussel larvae (veliger) can be introduced into a new waterbody by attaching to watercraft, for example, through retained ballast water in boat tanks (Ministry of Environment, 2011). In the absence of any Indigenous predators to keep these species in ecological balance, the alien invader takes over previously unoccupied habitat and displaces Indigenous species. Within the Columbia Basin, there are several AIS that have been identified, e.g., Eurasian Watermilfoil (*Myriophyllum spicatum*), Curlyleaf Pondweed (*Potomogeton crispus*), Northern Pike (*Esox lucius*), Pumpkinseed Fish (*Lepomis gibbosus*), Largemouth Bass (*Micropterus salmoides*), and American Bullfrog (*Lithobates catesbeianus*). While not yet known to be

present in BC, due to their severe impacts to the economy and environment elsewhere, there is mounting concern about the introduction of invasive mussels [ i.e., Zebra Mussel (*Dreissena polymorph*) and Quagga Mussel (*Dreissena bugensis*)] in the province. There is currently a major effort throughout BC working to prevent new aquatic invasive species (AIS) from entering the freshwater ecosystems of province. In BC, provincial government staff operates watercraft inspection stations that work to decontaminate infected boats at mobile stations spread across the province.

The Lake Windermere AIS Inventory Project has operated annually since 2009, with the exception of the year of 2013. The primary goal of the project is to determine if any aquatic invasive plant species are present in the Lake Windermere ecosystem, leading to a rapid response. However, sampling for Zebra/Quagga Mussel also now takes place by the Province of BC and the East Kootenay Invasive Species Council (EKISC). Since the inception of the Lake Windermere AIS Inventory Project, no aquatic invasive plant or mussel species have been detected. This project remains diligent in its efforts of early detection so that a rapid management response can be implemented if an unwanted invader is located.

## 2. Study Area

Lake Windermere (UTM: 571182; 5590080) is important for a variety of environmental, social and economic purposes including freshwater provisioning, floodwater protection and for recreational activities that help to support the economy. It is well-known for its significant cultural ecosystem services such as recreational boating, cross-country skiing, aesthetic views, fishing and birding. Located within the Regional District of East Kootenay (RDEK), Lake Windermere is found in the Rocky Mountain Trench within southeastern British Columbia. Lake Windermere is part of the Columbia River and is located near the Columbia headwaters. The largest community (Invermere) sits at the northern end of the Lake, which has a population of approximately 4000 permanent residents with that number growing during busy summer months. The village of Windermere (pop: 1,259) is located along the east side (Wikipedia, 2017). The first 180 kilometers of the Columbia River are known as the Columbia Wetlands, a Ramsar site recognized for its international significance. Lake Windermere is considered to be a part of the contiguous Columbia Wetlands ecosystem, a system with Ramar status (Ramsar highlights these wetlands as having of international significance), but the Ramsar designation excludes both Lake Windermere and Columbia Lake. Other designations currently being pursued for the Columbia Wetlands (i.e., Key Biodiversity Area) include both Lake Windermere and Columbia Lake.

Lake Windermere extends for approximately 17.7 kilometers and is 0.7 to 2 kilometers wide. Much of Lake Windermere is classified as a shallow open water wetland, a transition zone between a lake and marsh where the depth of water is often less than 2 meters (Alberta Wetland Policy, 2017). There are some deeper sections, with the greatest depth being approximately 5.5 meters located near the northwest end of the lake. There is a high diversity and abundance of biodiversity found at Lake Windermere and in the Columbia Wetlands, including several species at risk.

The south end of Lake Windermere has been documented as important stopover habitat for large congregations of waterbirds during both spring and fall bird migration (Darvill, 2020). There have been 165 bird species recorded at Lake Windermere, including 17 of those listed as species-at-risk such as the red-listed Western Grebe (*Aechmophorus occidentalis*), red-listed American White Pelican (*Pelecanus erythrorhynchos*), federally Threatened Bank Swallow *(Riparia riparia*) and blue-listed California Gull *(Larus californicus*) (Darvill, 2019a). Lake Windermere was recently designated as proposed Critical Habitat under the proposed Recovery Strategy for the Bank Swallow (Environment and Climate Change Canada, 2021).

# 3. Methods

### 3.1. Shoreline surveys

Shoreline surveys for aquatic invasive plant species were conducted over a seven-hour period on September 6, 2021. Survey methodology adhered to the protocol outlined in the 'Canadian Columbia Basin Regional Framework for an Aquatic Invasive Species Program: 2015 to 2020 [Inter-Ministry Invasive Species Working Group (IMISWG), 2015]. Shoreline sampling occurred at six pre-established survey stations, the same stations that were surveyed in previous years of survey effort. The pre-established surveys stations were chosen (pre-selected in 2015) because those sites posed a higher risk of invasion compared to other shoreline locations. High-risk sites include locations that are known to have higher amounts of trailered boat traffic (boats coming in from other areas that could be affected by aquatic invasive species), public boat launches, or boat marinas with multiple boat docking slips.

A field crew of two people (R. Darvill, volunteer) conducted the aquatic invasive plant sampling at each station. A thatched rake with a 9.7-meter-long rope was use for sampling aquatic plants in the water. The rake was tossed into the water as far as possible and pulled back to the shoreline. This enabled the rake to collect plants below the surface of the water at the specific location where it was thrown. Specific locations were recorded. All aquatic plants collected on the rake were recorded to the family level; where possible the species level was identified and

recorded. Rake pulls occurred at the initial feature (e.g., public boat launch) as well as at three sites (when possible) located 25, 50 and 75 meters upstream of the initial feature, and at three sites located 25, 50 and 75 meters downstream of the initial feature. All upstream and downstream sampling sites were separated by 25 meters. Two rake throws were conducted at each of the seven sites at each station. However, at two of the survey stations (i.e., Fairmont Side Channel, End of Ruault Road), it was not possible to sample at seven sites per survey station due to obstructions such as private property (i.e., Fairmont Side Channel, extensive vegetation, bushy riparian vegetation). The six shoreline survey stations were as follows: Baltac Beach, Fairmont Side Channel, Rushmere Community Docks, end of Ruault Road, Unofficial boat launch near Bayshore Condos and Althalmer/Pete's Marina.

### 3.2. Offshore surveys

Offshore sampling for aquatic invasive plants was completed with the use of an aluminum boat and outboard motor (provided by the District of Invermere), and a crew of two people (R. Darvill, S. McGinty). All offshore sampling occurred on September 22, 2021 at 11 locations/stations considered to be at high-risk for introduction of aquatic invasive plant species. As with shoreline surveys, high-risk locations were considered to be those areas with an increased incidence of trailered boat traffic (boats coming from other waterbodies), public boat launches, and boat marinas. The locations sampled were: Rushmere, Lakeshore Resort, Ruault Road, Indigenous Beach, Tretheway Docks, Akiskinook Resort, end of Coy Road, Baltac Beach, Lakeview Meadows, Althalmer/Pete's Marina, and the 'unofficial boat launch near the Bayshore Condos'.

The 2021 offshore surveys utilized the IMISWG (2015) methods for AIS sampling on a lake with a boat. This ensured that surveys can be repeatable over time to maintain consistency with previous years of survey effort. However, given the relatively large spatial scale of Lake Windermere and given limited resources, as in previous years of survey effort, a modification was made to the IMISWG protocol. The IMISWG protocol recommends that continuous surveys be conducted every 100 meters. However, this project's scaled-down survey effort focused on 11 high-risk locations. The scaled-down effort was also done during all years of and between 2015 and 2021.

At each survey location, two rake pulls were conducted (one off the right side and one off of the left side of boat). The rake was tossed into the water as far as possible and pulled back to the boat, enabling the rake to collect plants present on the lake bottom. All aquatic plants collected on the rake were recorded to the family level; where possible the species level was identified and recorded. A 100 meter transect was conducted between the two rake toss sites

at each station. For all transects, the boat travelled 100 meters northward of the initial site, parallel to the shoreline. If the water was calm and shallow enough to see the benthic surface, a single observer would observe all of the additional plant species seen on the lake bottom within this 100 meter transect, with the naked eye from the boat. An additional two rake toss/pulls were conducted at the end of a 100 meter transect, one off the right and one off the left-hand side of boat. All observations were recorded in the field and later transcribed into an excel file.

# 4. Results

### 4.1. Shoreline surveys

No aquatic invasive plant species were detected during shoreline surveys. A list of Indigenous aquatic plant species that were observed at each station are listed in Appendix 1. All watermilfoil species (*Myriophyllum sp.)* detected during surveys had nine (or less) leaflet pairs per leaf. Indigenous watermilfoil species have 5-10 leaflet pairs, whereas invasive Eurasian Watermilfoil (*Myriophyllum spicatum*) has leaves with 12-21 leaflet pairs (Minnesota Sea Grant, 2016). Therefore, all watermilfoil species detected in 2021 were assumed to be Indigenous aquatic plant species. The Potamogeton species identified in the excel table (Appendix 1 and 2) with parenthesis stating 'short/narrow leaves', could be either *P. gramineus* or *P. obtusifolious,* or possibly another related to Potamogeton species. Potamogeton species can be hard to identify, depending on condition/stage of the plant and they hybridize fairly frequently to produce plants with hybrid characteristics (Thomas Wolf, personal communication, 2017). Since the purpose of these surveys is to detect invasive plants, species level determination for Indigenous aquatic plants is not required. It is important to note that freshwater sponges were seen more often on rake toss's than in previous years (Appendix 1 and 2).

It was also observed that at Baltac Beach, three private docks needed to be crossed over along the foreshore, a foreshore area that has been reported by the Lake Windermere Anbassadors to be open for public access. There were also a number of private docks observed at Rushmere Community docks (Figures 1 and 2), but it is unclear whether those are authorised docks or not.

### 4.2. Offshore surveys

No aquatic invasive plant species were detected during offshore surveys. As with previous years of survey effort, dense areas or beds of Indigenous aquatic plants were observed in specific locations such as Ruault Road and Althalmer/Pete's Marina. There were some survey stations that had a lack of abundant and diverse aquatic plant communities, such as Lakeshore Resort,

Baltac Beach, ‘unofficial boat launch near Bayshore Condos’ and Tretheway Docks. While not a part of this study, during an aerial survey conducted on April 8, 2019 (during an annual bird survey by the principal consultant), photographs of Lake Windermere were taken indicating that motor boats could be having an influence on the Indigenous plant communities of Lake Windermere (Figures 2 and 3). There was a lack of freshwater mussels seen on the lake bottom and on the rake, when compared to previous years of survey effort. We pulled up more freshwater sponges with the rake when compared to previous years. Informally, we also observed that there were more buoys on the water when compared to previous years of survey effort.

**Figure 1.** Boats and docks at Rushmere Community area.

**Figure 2.** Additional boats and docks at Rushmere Community area.

Figure 3. Aerial photograph taken on April 8, 2019 showing effects on aquatic vegetation at Lake Windermere.

Figure 4. Second aerial photograph taken on April 8, 2019 showing effects of motorboats on aquatic vegetation on benthic surface at Lake Windermere.

## 5. Discussion/Recommendations

To date, no aquatic invasive plants have been found in Lake Windermere, although the distribution and abundance of plants in the lake may be changing as seen in aforementioned aerial photographs (e.g., see Figures 3 and 4). Several abiotic factors affect aquatic plants, including substrate anoxia, temperature, and the availability of inorganic carbon (Bornette & Puijalon, 2011). The different type of nutrients in Lake Windermere may also have an effect on the growth and species type of aquatic plants that grow (Tootoonchi & Gettys, 2019). Hussner et al. (2009) suggests that the main factors related to an increase in the abundance of invasive aquatic plant (macrophyte) species seen in Germany is significantly correlated with the population size and area. It is recommended to determine how and where aquatic plant species abundance and diversity is changing over time in Lake Windermere.

A decline in the amount of aquatic vegetation can lead to a cascade of negative environmental impacts, since plant decreases affect the aforementioned ecological functions that aquatic plants provide (see Introduction section) (Sagerman et al., 2020). It was beyond the scope of this study to determine how the abundance of freshwater aquatic vegetation may have changed in Lake Windermere. The physical forces from boats (i.e., wash, turbulence, propeller action with cutting effects, sight and sound disturbance) have been shown to negatively affect lake ecosystems elsewhere and can have a negative impact on the health of Indigenous aquatic plants in a freshwater ecosystem (Liddle & Scorgie, 1980). Motorboats and the wash (or wake) they create have caused considerable erosion of plant roots in other lake ecosystems (Liddle & Scorgie, 1980), and studies have shown that motorboats have dramatically reduced plant biomass primarily through direct cutting (propellor) and scouring of the substrate (Asplund, 2000). Mooring can also have a significant impact on the abundance of freshwater aquatic vegetation (Sagerman et al., 2020). If changes in aquatic plant abundance and distribution can be determined, it may also be useful to have additional information that may be contributing to these changes (e.g., conduct annual counts on the number of boats, anchoring buoys and moorage slips on Lake Windermere). It is recommended that more education be created and distributed to both landowners and tourists regarding the importance of Indigenous aquatic plants to the health of a freshwater ecosystem and its inhabitants. It is also important to educate people on the negative impacts to aquatic plants that are associated with boating activities.

A lack of freshwater mussels was noted throughout the survey in 2021. In previous years of survey effort, freshwater mussels were often observed and pulled up on rake tosses designed for plants. Freshwater mussels are amongst the most imperilled group of organisms in the world (Lydeard et al., 2004; Metcalfe-Smith & Cudmore-Vokey, 2004; Strayer et al., 2004), with

only four to seven species known to occur in BC (Gelling, 2008; Nedeau, 2009). Fifty-five percent of North America's mussels have gone extinct or are imperiled, compared to only 7% of the continent's bird and mammal species (Master, 1990). This significant decline is strongly associated with habitat destruction and the additional degradation associated with anthropogenic influences such as dams, sedimentation (that can come from motor boats), and introduction of nonindigenous aquatic bivalve mollusks and pollution (Williams et al., 1993). The Freshwater Mussels Guidance document developed by the Mistry of Forests, Lands, Natural Resources and Rural Development (MFLNRORD) for the Okanagan region recommends that "complete avoidance of adverse effects is the most preferred mitigation option for mussels (MFLNRORD, 2018). In order to help protect the abundant freshwater mussel population in Lake Windermere (that very little is known about), it is suggested to adhere to the MFLNRORD recommendation for development applications on Lake Windermere as well. It is also recommended that a freshwater mussel inventory be conducted on Lake Windermere to gather baseline information on their abundance and diversity and to learn what specific areas may be more important than others in terms of their habitat value for freshwater mussels.

During the aquatic plant surveys several rake pull samples revealed green freshwater sponge, an animal species likely known as *Spongilla lacustris.* These animal species are very interesting and deserve more attention. "Sponges are important for maintaining ecosystem function and integrity of marine and freshwater benthic communities worldwide" (Bell et al., 2015). "[L]ittle information is available for most species [of freshwater sponge] and more data is needed on the impacts of anthropogenic-related pressures" (Bell et al., 2015). Freshwater sponges can be a sign of overall higher water quality. Some recent research out of Alberta has shown that freshwater sponges provide insight into human health and evolution (Kenny at al., 2020). Some research has highlighted the importance of sponges in benthic communities including important relationships with other organisms (Webster & Taylor, 2012; Wulff, 2012). It is recommended that an investigation be done regarding the abundance and distribution of freshwater sponges at Lake Windermere and assess how this species may be effected by anthropogenic-related activities.

It was observed that there are several hard-stemmed bulrush Deep Marsh communities on the edges of Lake Windermere, e.g., the sites of Rushmere Community Docks and the End of Ruault Road. This ecological community is blue-listed in BC, meaning that it is at-risk in the province. It appears that none of the hard-stemmed bulrush Deep Marsh communities in Lake Windermere have been recorded into BC's Conservation Data Centre database. It is recommended that these locations be identified and entered into the provincial database and into the regional Official Community Plan for Lake Windermere.

It is important to educate adjacent communities (e.g., Invermere, Windermere, Fairmont) and also tourists about the ecological benefits provided by Lake Windemere's Indigenous aquatic plants. It's also advantageous (for humans and the wildlife that relies on Lake Windermere) to maintain the ecological values of aquatic plant communities in Lake Windermere, while at the same time find a way to balance the economic needs of the community.

## 6. Acknowledgements

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8. Appendices

Appendix 1. Results from the Lake Windermere shoreline surveys for aquatic invasive plants on September 6, 2021.

| Site | AIS sampling location | Aquatic Plants Identified (ranked in order of % in the pull) | Observations/Notes |
|---|---|---|---|
| **1. Baltac Beach** | Launch (Public Boat Launch) UTM: 0570748; 5593608 | **Pull 1:** *Chara sp.* **Pull 2:** No plants. | One small *Chara sp*. fragment. |
| | South 1 (25m) UTM: 0570750; 5593583 | **Pull 1**: No plants. **Pull 2:** No plants. | |
| | South 2 (50m) UTM: 0570760; 5593559 | **Pull 1**: No plants. **Pull 2:** No plants | |
| | South 3 (75m) UTM: 0570779; 5593544 | **Pull 1:** No plants **Pull 2**: No plants | Rocky/cobble substrate at Baltac. |
| | North 1 (25m) UTM: 0570739; 5593631 | **Pull 1**: *Chara sp*. **Pull 2:** No plants. | Small fragment of Chara. |
| | North 2 (50m) UTM: 0570728; 5593656 | **Pull 1:** *Chara sp.* **Pull 2**: *Myriophyllum sp., Chara sp.* | |
| | North 3 (75m) UTM: 0570714; 5593672 | **Pull 1:** *Chara sp.* **Pull 2:** *Myriophyllum sp., Chara sp.* | |
| **2. Rushmere Community Docks** | Launch ( centre of private docks) UTM: 0574650; 5585352 | **Pull 1:** No plants **Pull 2**: *Myriophyllum sp., Potamogeton sp.* (short/narrow leaves). | Motorboat seen in Columbia Wetlands Wildlife Management Area, south end of Lake Windermere. Rocky substrate. |
| | South 1 (25m) UTM: 0574659; 5585334 | **Pull 1:** *Chara sp., Utricucularia sp., Elodea canadensis., Potamogeton robbinsii.* **Pull 2:** *Chara sp., Utricularia sp.*, freshwater moss*, Najas sp.* | Freshwater sponge on rake. |
| | South 2 (50m) UTM: 0574666; 5585311 | **Pull 1:** *Chara sp., Utricucularia sp.* **Pull 2:** *Chara sp., Najas sp.,* aqautic moss. | Beds of bulrush at this site. |
| | South 3 (75m) UTM: 0574674; 5585287 | **Pull 1:** *Chara sp., Utricucularia sp*. **Pull 2:** *Chara sp., Potamogeton robbinsii,* freshwater moss. | Rake toss conducted about 10 meters north of bullrush community. Freshwater sponge on rake. |
| | North 1 (25m) UTM: 0574637; 5585375 | **Pull 1**: *Najas sp., Potamogeton sp. (short/narrow leaves).* **Pull 2**: A*quatic moss, Chara sp., Najas sp.* | Saw six different men seen making modifications to a buoy in the water at Rushmere. |
| | North 2 (50m) UTM: 0574623; 5585394 | **Pull 1:** *Chara sp., Najas sp.* **Pull 2:** *Chara sp.* | |

| | | | |
|---|---|---|---|
| | North 3 (75m) UTM: 0574611; 5585417 | **Pull 1:** *aquatic moss, Myriophyllum sp., Chara sp., Utriculaia sp., Potyamogeton richardsonii.* **Pull 2:** aquatic moss. | *Sagittaria cuneata* leaves in water. |
| | Boat launch UTM: 0580441; 5577289 | **Pull 1:** *Potamogeton sp.*(likely *P. vaginatus), Chara sp.* **Pull 2:** *Potamogeton sp.*(likely *P. vaginatus), Chara sp.* | Outhouse, picnic tables, garbage cans. |
| | South 1 (25m) UTM: 0580421; 5577269 | **Pull 1:** *Chara sp., Potamogeton sp.(likely P. vaginatus), Potamogeton richardsonii.* **Pull 2:** *Chara sp., Potamogeton sp.(likely P. vaginatus), Potamogeton richardsonii.* | Could not go further south to sample; private property. Did not sample here 2015-2021. |
| **3. Fairmont Side Channel** | North 1 (25m) UTM: 0580450; 5577309 | **Pull 1:** *Chara sp., Potamogeton sp. (likely P. vaginatus), Potamogeton richardsonii.* **Pull 2:** *Chara sp., Potamogeton sp. (likely P. vaginatus), Potamogeton richardsonii.* | |
| | North 2 (50m) UTM: 0580451; 5577332 | **Pull 1:** *Potamogeton richardsonii, Potamogeton sp.*(likely *P. vaginatus), Chara sp.* **Pull 2:** *Potamogeton sp.*(likely *P. vaginatus), Chara sp., Potamogeton richardsonii.* | |
| | Additional Notes: It was not possible to sample at more than four locations at Fairmont Side Channel due to private property (same as in previous years of sampling effort). | | |
| | Landing site: UTM: 0572641; 5587665 | **Pull 1:** *Chara sp., Najas sp.,* aqautic moss. **Pull 2:** *Chara sp., Myriophyllum, Potamogeton robbinsi.* | During entire time at Ruault Road site, saw two men dirt biking on other side of lake (east side). |
| | North 1 (25m) UTM: 0572619; 5587674 | **Pull 1:** *Chara sp., Myriophyllum sp., Najas sp., Elodea canadensis.* **Pull 2:** *Chara sp., Myriophyllum sp., Ranunculus aquatilis, Elodea canadensis,* aquatic moss, *Potamogeton praelongus, Megalodonta beckii.* | Bulrushes located north of 25 m did not enable for pulls further north. Did not sample here in 2015-2020. |
| **4. End of Ruault Road** | South 1 (25m) UTM: 0572664; 5587657 | **Pull 1**: *Chara sp., Najas sp.* **Pull 2:** *Chara sp.* | |
| | South 2 (50m) UTM: 0572687; 5587647 | **Pull 1**: *Potamogeton sp.* (short/narrow leaves). **Pull 2:** *Chara sp.* | Few fragments of Chara. |
| | South 3 (75m) UTM: 0572711; 5587639 | **Pull 1**: *Chara sp.* **Pull 2**: *Myriophyllum sp., Chara sp.* | Little fragments of Chara. |
| | **Additional Notes:** Could not sample northwards beyond the 25m north survey station due to extensive bulrush vegetation. | | |
| | Launch UTM: 0569389; 5595010 | **Pull 1:** *Najas sp.* **Pull 2:** No plants. | Gravel/rocky substrate. |
| | North 1 (25m) UTM: 0569390; 5595037 | **Pull 1**: No plants. **Pull 2:** *Myriophyllum sp.* | One fragment on rake of second toss Dead fish on washed up on shore. |
| **5. Calgary Beach** | North 2 (50m) UTM: 0569380; 5595059 | **Pull 1:** *Chara sp.* **Pull 2:** No plants. | One fragment on 1st toss. |
| | North 3 (75m) UTM: 0569363; 5595076 | **Pull 1:** *Megalodonta beckii***,** *Myriophyllum sp., Chara sp., Najas sp., Elodea canadensis.* **Pull 2***: Megalodonta beckii.* | |
| | South 1 (25m) UTM: 0569390; 5594986 | **Pull 1:** No plants. **Pull 2:** No plants. | |

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| | South 2 (50m) UTM: 0569389; 5594972 | **Pull 1:** *Chara sp., Potamogeton sp.* (short/narrow leaves). **Pull 2:** *Chara sp.*, *Potamogeton sp*. (short/narrow leaves), *Myriophyllum sp.* | Very little fragments on rake. |
| | South 3 (75m) UTM: 0569401; 5594942 | **Pull 1:** No plants. **Pull 2:** *Chara sp.* | 1 fragment of Chara at site, but last year saw high abundance of Chara here. |
| **6. Althalmer/ Pete's Marina** | Boat Launch UTM: 0569527; 5596336 | **Pull 1:** *Chara sp., Elodea canadensis, P. richardsonii,* aquatic moss*, Hippuris vulgaris, Myriophyllum sp., Najas sp*. **Pull 2***: Elodea canadensis, Chara sp, Najas sp., P. richardsonii.* | Most heavily used public boat launch access point on Lake Windermere. |
| | South 1 (25m) UTM: 0569536; 5596313 | **Pull 1:** *Najas sp., Chara sp., Myriophyllum sp., Elodea canadensis.* **Pull 2:** *Chara sp, Najas sp., Myriophyllum sp., Potomogeton richardsonii, Elodea canadensis, Potamogeton sp.* (short/narrow leaves). | Freshwater sponge abundant at this site. Freshwater sponge on rake. |
| | South 2 (50m) UTM: 0569543; 5596290 | **Pull 1:** *Myriophyllum sp., P. richardsonii, Sagittaria cuneata, Hippuris vulgaris, P. natans, Najas sp., Chara sp.* **Pull 2:** *Myriophyllum sp., Hippuris vulgaris, Najas sp., Potamogeton sp.* (short/narrow leaves), *Ranunculus aquatilis.* | |
| | North 1 (25m) UTM: 0569523; 5596361 | **Pull 1***: Potamogeton sp.* (short/narrow leaves), *Potamogeton richardsonii, Chara sp, Elodea canadensis, Myriophyllum sp., Najas sp.* **Pull 2:** *Potamogeton sp. (short/narrow leaves), Potamogeton richardsonii, Najas sp., Chara sp.* | |
| | North 2 (50m) UTM: 0569515; 5596382 | **Pull 1:** *Elodea canadensis, Myriophyllum sp., Potamogeton richardsonii, Najas sp., Potamogeton sp.* (short/narrow leaves)*, Ranunculus aquatilis.* **Pull 2***: Elodea canadensis, Myriophyllum sp., Potamogeton richardsonii.* | High abundance of plants seen on rake. |
| | North 3 (75m) UTM: 0569507; 5596414 | **Pull 1:** *Elodea canadensis, Myriophyllum sp., Najas sp., Chara sp., Potamogeton richardsonii.* **Pull 2***: Elodea canadensis, Myriophyllum sp., Potamogeton richardsonii, Potamogeton sp.* (short/narrow leaves)*, Najas sp., Chara sp., Ranunculus aquatilis.* | High abundance of plants seen on rake. |

Appendix 2. Results from the rake pulls conducted during offshore aquatic invasive plant inventories at 11 survey stations on Lake Windermere, on September 22, 2021.

| Site Name | GPS coordinates (UTM) | Rake Pull # or transect survey | Aquatic Plant Species | Notes/Observations |
|---|---|---|---|---|
| Rushmere | 0574794; 5585464 | 1 | *Chara sp., Potamogeton natans, Myriphyllum sp., Megaladota beckii, Potamogeton amplifolius.* | |
| Rushmere | 0574794; 5585464 | 2 | *Potamogeton natans, Chara sp.,* | |
| Rushmere | N/A | 100 m transect | *Potamogeton praelongus, Potamogeton richardsonii.* | |
| Rushmere | N/A | 1 | *Potamogeton natans, Chara sp., Myriophyllum sp.* | |
| Rushmere | N/A | 2 | *Utricularia sp., Potamogeton natans, Myriophyllum sp., Najas sp., Potamogeton richardsonii, Elodea canadensis* | |
| Lakeshore Resort | 0574787; 5586587 | 1 | *Chara sp., Myriophyllum sp., Potamogeton sp.* (short/narrow leaves). | |
| Lakeshore Resort | 0574787; 5586587 | 2 | *Chara sp., Potamogeton sp.* (short/narrow leaves). | freshwater sponge |
| Lakeshore Resort | N/A | 100m transect | No additional plant species seen; little vegetation on transect. | Mainly *Chara* seen. Sandy substrate. |
| Lakeshore Resort | N/A | 1 | *Potamogen praelongus, Potamogeton robbinsii, Utricularia sp., Elodea canadensis* | |
| Lakeshore Resort | N/A | 2 | *Elodea canadensis, Myriophyllum sp., Megaladota beckii.* | |
| Ruault Road | 0573136; 5587233 | 1 | *Myriophyllum sp., Elodea canadensis, Potamogeton praelongus, Potamogeton richardsonii, Megalodonta beckii.* | freshwater sponge |
| Ruault Road | 0573136; 5587233 | 2 | *Potamogeton richardsonii, Myriophyllum sp., Potamogeton praelongus, Elodea canadensis, Chara sp.* | |
| Ruault Road | N/A | 100m transect | *Potamogeton natans*. Diverse and abundant beds of aquatic vegetation. | Diverse and abundant beds of aquatic vegetation, campared to other sites. |
| Ruault Road | N/A | 1 | *Myriophyllum sp., Elodea canadensis.* | |
| Ruault Road | N/A | 2 | *Myriophyllum sp., Chara sp.* | |
| Indigenous Beach | 0572514; 5589031 | 1 | No aquatic plants. | sandy bottom. |
| Indigenous Beach | 0572514; 5589031 | 2 | *Chara sp.* | Small amount of *Chara sp.* |
| Indigenous Beach | N/A | 100m transect | No additional plants. | Primarily bare ground. Sparse *Chara sp.* (muskgrass). |
| Indigenous Beach | N/A | 1 | *Chara sp.* | Small amount of Chara sp. |
| Indigenous Beach | N/A | 2 | *Chara sp., Potamogeton natans, Najas sp., Potamogeton sp.* (short/narrow leaves). | Freshwater sponge. |
| Tretheway Docks | 0571732; 5589724 | 1 | *Chara sp.* | Primarily bare ground. Sparse *Chara sp.* (muskgrass). Sandy bottom. |
| Tretheway Docks | 0571732; 5589724 | 2 | *Chara sp.* | |
| Tretheway Docks | N/A | 100m transect | No additional plant species seen. Sandy substrate with little plant life detected; mainly bare ground. | 1 fragment of *Chara sp.* on rake. |
| Tretheway Docks | N/A | 1 | *Chara sp.* | |
| Tretheway Docks | N/A | 2 | No aquatic plants. | |
| Akisknook Docks | 0571280; 5591436 | 1 | *Myriophyllum sp., Chara sp.* | May have been a change here from last year, when Myriophyllum was recorded. |

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| Akisknook Docks | 0571280; 5591436 | 2 | *Chara sp., Myriophyllum sp.* | May have been a change here from last year, when Myriophyllum was recorded. |
| Akisknook Docks | N/A | 100m transect | Deep water, could not see lake bottom during transect. | |
| Akisknook Docks | N/A | 1 | *Myriophyllum sp.* | |
| Akisknook Docks | N/A | 2 | *Elodea canadensis, Potamogeton praelongus, Myriophyllum sp.* | |
| End of Coy Road | 0570197; 5590742 | 1 | *Chara sp., Elodea canadensis, Megalodonta beckii, Myriophyllum sp., Potamogeton sp.* (short/narrow leaves), *Najas sp.* | Large bullrush commmunity here. |
| End of Coy Road | 0570197; 5590742 | 2 | *Najas sp., Chara sp., Elodea canadensis.* | |
| End of Coy Road | N/A | 100m transect | *Potamogeton natans, Potamogeton richardsonii.* | |
| End of Coy Road | N/A | 1 | *Chara sp.* | Small amount of *Chara sp.* |
| End of Coy Road | N/A | 2 | *Chara sp., Potamogeton sp.* (short/narrow leaves), *Potamogeton natans.* | |
| Baltac Beach | 0571105; 5593384 | 1 | *Chara sp.* | |
| Baltac Beach | 0571105; 5593384 | 2 | *Chara sp.* | |
| Baltac Beach | N/A | 100m transect | No additional plant species seen. Too deep to see lake bottom. | |
| Baltac Beach | N/A | 1 | *Chara sp.* | Small amount of *Chara sp.* |
| Baltac Beach | N/A | 2 | *Chara sp.* | Small amount of *Chara sp.* |
| Lakeview Meadows | 0570202; 5594093 | 1 | *Myriophyllum sp., Chara sp., Potamogeton richardsonii, Potamogeton sp.* | |
| Lakeview Meadows | | 2 | *Myriophyllum sp., Potamogeton sp., Potamogeton richardsonii, Chara sp.* | |
| Lakeview Meadows | 0570202; 5594093 | 100m transect | *Chara sp.* | |
| Lakeview Meadows | N/A | 1 | *Chara sp.* | |
| Lakeview Meadows | N/A | 2 | *Chara sp.* | |
| Unofficial boat launch near Bayshore Condos | 0569426; 5595305 | 1 | *Myriophyllum sp., Chara sp.* | |
| Unofficial boat launch near Bayshore Condos | 0569426; 5595305 | 2 | *Elodea canadensis, Myriophyllum sp., Potamogeton praelongus.* | |
| Unofficial boat launch near Bayshore Condos | N/A | 100m transect | Deep water, could not see lake bottom during transect. | |
| Unofficial boat launch near Bayshore Condos | N/A | 1 | *Myrioplyllum sp.* | 1 fragment on rake. |
| Unofficial boat launch near Bayshore Condos | N/A | 2 | No plants. | |
| Althalmer/Pete's Marina | 0569564; 5596291 | 1 | No plants. | Many plants seen on rake near here last year. |
| Althalmer/Pete's Marina | 0569564; 5596291 | 2 | *Najas sp., Chara sp., Potamogeton gramineus, Stuckenia pectinata.* | |
| Althalmer/Pete's Marina | N/A | 100m transect | No additional plants seen. | |
| Althalmer/Pete's Marina | N/A | 1 | *Chara sp.* | Rocky substrate. Little *Chara sp.* on rake. |

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| Althalmer/Pete's Marina | N/A | 2 | *Chara sp.* | |