

Eurasian Milfoil Control Program
Christina Lake, BC
Regional District of the Kootenay
Boundary

2016 Annual Report

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Introduction

Christina Lake is an unincorporated recreational area in the Boundary Country of the West Kootenay region of British Columbia, Canada. . It forms Area C of the Regional District of the Kootenay Boundary (RDKB). Christina Lake is home to approximately 1500 year-round residents (1168 residents from the 2011 Census) with a large population influx during the summer, due to seasonal residents and visitors alike. The warm, clean and clear water attracts people from around the province, country and US. Many businesses in the area depend on this influx of tourists and lake users for their sustainability.

The lake is relatively large with a length of approximately 18.2km (north to south), a maximum width of 1.5km and an average width of 600m (east to west). The average depth of the lake is 36m with a maximum depth of 54m. The majority of the shoreline, with the exception being the most southerly section, contains a fairly steep drop-off translating into a small littoral zone, where aquatic plants receive sufficient light in order to grow. The majority of the residential and resort properties are located towards the south end of the lake, while much of the north end remains crown land with some interspersed boat access residences.

Sometime during the mid-1980s, Christina Lake acquired the invasive species Eurasian watermilfoil, *Myriophyllum Spicatum*, an opportunistic aquatic plant that is not native to North America. It is thought to have been introduced to the eastern United States and eastern Canadian provinces during the 1940's, with it reaching Okanagan Lake in the 1970's (Caswell, 2010). Due to a lack of education and awareness of the plant, it quickly reached many other lakes and streams in British Columbia, including Christina Lake. Eurasian watermilfoil is now found across most of North America, and is recognized as a noxious weed.

It is not known for sure how the plant made it into Christina Lake, however a good prediction is that it came as a plant fragment, attached to a boat, which was transported from an infested lake. At this point, a single viable fragment could have started off the colonization, as Eurasian watermilfoil's reproductive strategy is largely by a vegetative, fragmentation means. A rooted milfoil plant will grow until it reaches a certain maturity, along with favourable conditions, where its stem then breaks off 5-to-10cm long fragments that floats atop the water to new areas. Once a fragment sinks and settles it can then grow its own roots and begin another life cycle.

In optimal temperatures, such as those exhibited in summertime waters, milfoil can grow up to 30cm per week. It is able to grow at a broad range of temperatures and depths, and can root itself in nearly all of Christina Lakes' bottom

compositions, from loose silts, sands and rocks, to hard clay. Plants have been seen to grow at a maximum depth of 10m, with those at 3-5m depth being able to reach the surface. With the combination of surfacing plants and a large influx of lake users during the summer months, the milfoil problem becomes exacerbated as more fragments are produced. This allows the plant to further spread its influence and begin to compete with native aquatic species of the lake for territory, where it usually wins out.

Without the use of control methods, Eurasian watermilfoil has the ability to dominate the littoral zone, creating large, dense homogeneous crops. Large infestations can have detrimental consequences on the biodiversity of the aquatic plant life in the lake as the milfoil chokes out other species, which in turn can disrupt the natural ecology of the organisms that call it home.

As stated above, many lake enthusiasts, both residents and tourists, enjoy Christina Lake during the summer months. If Eurasian watermilfoil is given the time to spread and grow it has the ability to have a large impact on the recreational uses of the lake, making swimming, boating and angling much less appealing. This, in turn, can have a negative effect on the tourism industry. Additionally, dense surfacing milfoil patches can negatively affect waterfront property values as swimming and boating are hindered, aesthetic values are reduced, and decomposing plants in fall season begin to produce foul smelling gasses. All of these factors make control of milfoil a top priority in the lake.

The Regional District of Kootenay Boundary has recognized the threat this plant poses to this important water resource. Beginning in 1987, the RDKB employed a team of SCUBA divers to selectively target and control the Eurasian watermilfoil in Christina Lake. The method of control utilized by the divers is manual hand removal of the plants, with the best efforts to remove all of the roots, just as one does in their garden.

In the 1980's and 1990's, Eurasian watermilfoil control was a priority of the Ministry of Environment on a Provincial level. However, since then funding from the Provincial government for milfoil control programs has vanished, leaving the burden solely on local funding. Since 1999, the Christina Lake Milfoil Program has been paid for by increasing the taxation rate for milfoil control to the taxpayers of Electoral Area C (Caswell, 2010). In 2011, the budget for milfoil control was \$154,017, of which the local taxpayers of Christina Lake paid 100%.

After the 2011 season ended, a requisition was put in by Electoral Area C's director Grace McGregor to increase the funding for the Control Program, with hopes of doubling the crew of divers on the lake, thus raising the level of control over the encroaching plant beds, as ground was being lost with the current program. Also, the implementation of biological control through the use of the American Water Weevil was to be investigated. This funding was granted, and the total budget for the program rose from \$154,017 in 2011, to \$288,655 in 2012. Once

again, the local taxpayers of Christina Lake paid 100% of the annual budget (Gilmore, 2013).

The 2016 budget came in at \$289,454 with an added \$100,000 extra capital for the acquisition of a replacement diving vessel. The budget was designed to sustain two crews of commercial divers to control milfoil seven days a week for a total of nearly five months.

Factors Contributing to the Growth and Spread of Eurasian Watermilfoil

Christina Lake, known as the “warmest tree-lined lake in Canada”, is not only popular to the people that use it for recreational enjoyment; it is also very much enjoyed by the aquatic plants that inhabit it, especially Eurasian watermilfoil. This is due to both natural environmental and human factors that make for a favourable habitat for the reproduction and growth of the species.

Natural environment factors affecting the growth and spread of Eurasian watermilfoil in the lake include temperature, turbidity, nutrient levels and wind. Temperature is a very substantial contributor to the problem. Milfoil has the ability to grow over a broad range of temperatures (15°C – 35°C); however, its life cycle becomes drastically shorter as the water temperature approaches the higher range. In Christina Lake, this translates into an approximate four month growing season as water temperatures reach 15°C by early June, peak around 26°C in August and drop back below 15°C at the end of September. Additionally, the low turbidity levels (i.e. clear water) in Christina Lake allows for light to penetrate well below the surface, enabling plants to grow in depths up to 10m. The great majority of plants are found shallower than 4m due to a thermocline at this depth, where temperature drops below its ideal range for milfoil growth. This affects the south end of the lake the most since there is less of a drop-off along the shoreline and therefore increased area for plants to spread to and grow. Christina Lake is nutrient rich in many areas, receiving heavy run-off from the surrounding mountains during the spring months, which aids in plant growth. This run-off water enters through dozens of tributaries, with water being pushed through a single outflow at the south end of the lake, allowing silt to settle and accumulate, with the greatest accumulation evident in the most problematic areas. This creates a soft, nutrient rich substrate where aquatic plants can thrive. Also, this natural flow of water tends to bring many buoyant milfoil fragments with it; creating new plants wherever the plants sink and root. Finally, wind also contributes to the spread of Eurasian watermilfoil as it produces large waves at times that will carry fragments in whichever direction it blows. These waves, if forceful enough, can be a cause of fragmentation of viable plants that are near the surface. These favourable environmental factors along with human activity leads to increased potential for growth and spread of milfoil.

Human activity also largely contributes to the spread and growth of milfoil in Christina Lake. These factors include increased plant fragmentation due to boating

and various water activities, human-made obstructions to the flow of water, and nutrient/sediment loading along the shoreline. Firstly, a major source of fragments, every year, can be attributed to unaware boaters. An engine propeller easily chops surfacing milfoil stems into many fragments, which are then free to float and eventually sink to a new location somewhere on the lake floor. Secondly, obstructions (such as docks, boat lifts, rock walls, buoys etc.) to the surface flow of water prevent fragments from having the chance to wash up on the beaches, where their life would end. Instead, they get trapped, sink and re-root into the ground where their life cycle continues. The control crew routinely finds new and recurrent Eurasian watermilfoil infestations forming beside or directly beneath these obstructions. Thirdly, the spread and growth can be enhanced due to nutrient/sediment loading caused by new construction, outdated septic systems, and fertilizers/detergents. New roadways, construction and excavation can lead to soil erosion, which has the potential to bring more sediments down to the lake by changing run-off patterns. However, it is unknown how large of a factor this actually is. Outdated septic systems can also raise biological nutrients in the water if they are able to leach out. At the 2008 Christina Lake Watershed Management Plan Annual Review meeting, it was revealed that over 30% of the phosphorus in Christina Lake could be attributed to septic seepage, but again this is not a definite sole cause (Caswell, 2010). Phosphates can also come from fertilizers and detergents leading to production of algae blooms in addition to increased aquatic plant growth. Of note, a few of the resorts have signage insisting on the use of Phosphate-free detergents on their property. Time will tell of the effects of declining phosphate use on the lakes' composition.

Many aspects of Christina Lake contribute to the ongoing issue of Eurasian Milfoil. The human contributions could be reduced through conscious efforts, while those contributed by nature are out of our control.

Summary of the 2016 Christina Lake Milfoil Control Program

2016 marked the 30th consecutive year of Eurasian Watermilfoil control in Christina Lake via manual removal by SCUBA divers hired by the Regional District of the Kootenay Boundary. Since 2012, the budget remained nearly the same with the exclusion of the \$100,000 Capital Fund, however, the Salaries and Benefits were decreased to allow repayment of said Capital, thus allowing two crews of 3 divers to be hired for the majority of the season. This led to the fifth consecutive year of efficient and productive milfoil control, with diving occurring 7 days/week, with few exceptions over long weekends as well as the first month and final weeks of the control season.

The work season began on May 9, 2016 with all 6 divers forming the two crews, as a minimum of three commercially certified divers is required under

WorkSafeBC regulations for diving operations. All six crew members hired were veteran milfoil control divers returning from previous work seasons, thus allowing the crews to perform the daily tasks right from the onset of the dive season. One crew was assigned the early-week shift from Sunday through Wednesday, while the late-week crew worked the Wednesday through Saturday. Both crews worked four days per week at 9hrs/day. On selected Wednesdays, Bob Freeman's barge, the *Tintanic*, was used alongside the RDKB dive vessel, *Haberstock*, in order to accommodate all the divers and their gear. On these days, resorts and other large areas with high plant densities were tackled. The full complement of divers remained until the beginning of September, where a single member pursued continuing educational endeavors, leaving five divers to work the remainder of the season. A modified schedule, having crews of four divers working 5 days/week was created to maintain productivity and be compliant with WorkSafeBC diving regulations (3 crew minimum). The final day of diving operations was Friday October 7 2016, thus completing the 30th Milfoil Control Season.

The 2016 work plan was similar to 2015 work plan. We were to begin at the south end of the lake, where in previous years the highest plant densities (# of plants/area) were found. The crews were to work the highly populated East and West shores in the Southern half of Christina Lake prior to summer, in order to get ahead of the upcoming warm growing season. After sufficient picking in the south end, the boat would then cover the remainder of the shoreline of the lake, before returning for a second inspection/removal of plants at these sites. Depending on speed at which the crews could cover the shoreline, we had decided at the end of the 2014 season to push our picking into new untouched (in years) areas, hoping to put some time into the North End Lagoon, and hopefully the Sutherland Creek Nature Park and down Christina Creek.

Site Locations Christina Lake (Attached PDF) summarizes the plant data collected from each of the 575 sites plus Christina Creek and Sutherland Creek Nature Park (with 2015 year data as reference) and compares previous plant level categories (LOW, MED, HIGH) per site, established during the 2011 control season. Site numbers found in the table can be observed on the five attached maps, pg 16-20 (originals courtesy of sharphooks.com). As 2016 was the fifth consecutive year with crews removing milfoil daily, plant counts were on par this season compared to 2015 season, with the 2016 season removing approximately 80% of the previous seasons plant count, while running at 75% of 2015's staffing capacity. The ground gained in the fight against milfoil from the implementation of the two crew program back in 2012, allowed for an excellent 2016 work season. This was evident as the boat was able to reach each of the sites twice with some sites even receiving a third treatment. The crews were also able to push further into the new areas first identified and brought into control in the 2015 season. The first is a large swath of Eurasian watermilfoil along the south-west properties from the Public Beach to Silver Birch campground. This area is well away from shore, in and around a grouping of moorage buoys, whereas the previous control treatments were from shore to just past the end of the docks. The other area that the crews had pushed

into, in hopes of limiting the spread of milfoil along the north end of the lake, was the North Bay Lagoon protected area. Many tens of thousands of plants were again removed in this area, but many plants still remain, as the Lagoon is vast. It is worthy of noting that the zones within the Lagoon that were picked in the 2015 season had far fewer milfoil plant regrowth, thus allowing the crews to further penetrate deeper into the centre of the Lagoon. A considerable North-South channel was carved into the middle of the Lagoon, and upon each subsequent day of picking, the crews enlarged the width of said channel, opening up a sizable area for new native plants to establish. Our third area of control was along Christina Creek, as many properties have boats and docks along the shore of the creek, and as the creek is the sole outflow for Christina Lake, many milfoil fragments can be captured and transported to new areas of the lake from boating activities. There were hopes of regaining a level of control in the Sutherland Nature Park protected area, however, the crews were at full capacity with maintaining the remainder of the lake.

With multiple passes through each of the 575 sites identified on the lake, plant densities have been maintained at a greatly reduced number from the 2012 control season, and as such, the root systems of the plants that did re-grow are now much smaller and more easily removed from the lake floor. This means that with more treatments, there is potential to knock plant densities back further in years to come. There is hope in 2017 and onward seasons that the crew will reestablish milfoil control in the Sutherland Creek Nature Park, as this extensive area is a veritable breeding ground for Eurasian watermilfoil.

The start of the 2016 control season was at site #87, Little Colville Cove, and continued south along the east shore past La Valley Point and on to Schulli's Resort North (#155) in four days, which had historically taken at least an entire week. With a combination of spring-time cold waters and effective milfoil control from previous seasons, the crews were able to cover both east and west shores of the south bulb of Christina Lake prior to the onset of the busy boating and tourist season. The vast majority of sites #87 through to site #262 along the south bulb of the lake were, in the past, classified as having Moderate to High plant densities, with few sites having Low densities. This season, many of these sites have been reclassified to a Low to Moderate Milfoil density. The exception is of course, the resorts (#155-160) and properties along the deep south end of the lake, control sites #168-181 and #186-190. This again shows the progress of control that has been made in the last few years. The work days were set up so there were four days per week dedicated to controlling the south end properties from sites #200 through #161 plus Christina Creek, two days per week controlling the more northerly sections of the lake, including all the Provincial Park Campgrounds and North Bay Lagoon, and on selective Wednesdays, where both crews would work to control the resorts and other high density areas. These "supercrew" Wednesdays utilized a support vessel, the pontoon barge "*Tintanic*" alongside the RDKB dive boat "*Haberstock*" to accommodate all 6 divers, their gear and help deal with the large quantities of Eurasian watermilfoil removed from the lake. Within two months, on July 10, the entire foreshore of Christina Lake, including a day in Christina Creek,

had been treated, with exception of the resorts and other densely populated areas which were continued to be worked on Wednesdays for the duration of the season.

Notable areas of shoreline along the mid to north section of the lake were the provincial campsites; Troy Creek, Ole Johnson, Treadmill Creek, Parsons Creek and Axel Johnson. In these sites, decreased plant densities were once again observed, with all of the sites being reclassified from High densities to Moderate, and in particular Treadmill and Parsons Creek sites becoming areas of Low densities. This is important to the rest of the lake, as these can be a source of plant fragmentation and spread due to the fact that these campgrounds are boat access only. Many lake users are still uneducated or unaware of Christina Lake's milfoil issue and don't understand the consequences of dragging their engine leg/propeller through the milfoil patches.

For the second lap of the lake, the crews revisited the new areas of previously uncontrolled patches of milfoil that were discovered in the 2015, as well as completing the regular pattern of control. Therefore the second lap of the lake took the remainder of the season. The general trend showed a decrease in the number of milfoil plants per site, however, there were some areas where plants were found in which there hadn't been as many found in the first pass through. For example, sites #169 to 173 and #186 to 189 found on the southern shore of the lake, east and west of the Public Beach, respectively, initially were reported to have lower but significant milfoil plant counts. Further out from the shoreline, large swaths of milfoil discovered in 2015 had regrown. Due to safety reasons during peak summer lake boating, these large areas were mostly left alone on the first and second passes of the season, however, once boat traffic had lessened to a more reasonable level, the crews were able to tackle these large areas more effectively. With that being said, this gave the patches of milfoil nearly a full summer's worth of warm, sunny weather to grow and mature. Mostly all of the plants that were found in these areas had completely developed root systems, which is suggestive of established and mature plants. It should be noted that the water temperature for the 2016 summer was lower than the previous few summers, in which I speculate were due to more average melt-water volumes, as well as a slightly cooler summer maximum temperatures. A series of storms in late May and throughout June, delivering high winds and large swells, churned up the upper warm 3m/10' of the lake and effectively dropping the surface lake temperatures. By the middle of July, the water temperature was closer to the average summer water temperature of around 23°C up to a depth of 3m. This allowed for mid-season regrowth through to late August/early September. At this time, the lake temperature started to decrease below 20°C due to seasonal changes and a late summer windstorm, yet again churning up the water and bringing cold deeper waters to the surface.

As with the first lap of the lake, the focus of control was the south end, with four to five days per week spent there, and the remaining days spent completing the second lap. This marks the third consecutive season that some areas received a third treatment in a season. Therefore, these areas should benefit largely from a

triple treatment and hopefully see a substantial reduction in milfoil plant densities in future years. However, this will depend on continual maintenance to keep them at a high level of control. In early September, a crew member left the program for the season, leaving five divers to complete the 2016 Milfoil Control season which ended on October 7, 2016. .

Overall, the 2016 season should be regarded as successful in Christina Lake's fight against Eurasian watermilfoil. In this season, as with the 2015 season, low plant densities were again recorded in comparison with those of the previous decade. Large areas were able to be worked/controlled as the ground gained in the program since 2012 allowed for this. Also, the program was able to continue control in the new areas discovered in 2015, with the hopes of impacting and lessening its spread throughout both sensitive and populated areas alike. Some areas that had once been large homogenous patches of milfoil, have now been colonized by native species restoring them to pre-milfoil states, as observed during the 2014 survey. Although some would prefer no weeds of any kind, this is actually a huge step forward because the native plants compete for this ground; in other words, they help to keep the milfoil from re-growing there and forming another milfoil patch. As of the end of the 2016 control season, it is my assessment that the lake is well under control in terms of milfoil, with the exception of the south end. In future years, the program is planning on bringing the massive Sutherland Creek Nature Park area under a level of control.

The south end of the lake from Schulli's Resort #155 around to Silver Birch Resort #190 (about 3km of shoreline) will remain a problematic area. This section of shoreline contains the majority of the milfoil plants in the lake for many reasons including the highest levels of boat traffic, large docking and mooring structures able to trap milfoil fragments, an enlarged littoral zone (plant growing zone) due to shallower depths at given distances from shore, the lake bottom composition and the fact that the flow of water is directed towards Christina Creek (the only outflow of the lake). All of these make the south end an optimal habitat for the propagation and growth of Eurasian watermilfoil. This stretch includes the Sutherland Nature Park area (buoyed off area), which hasn't been controlled by the RDKB Milfoil Program since the early 90's due to its sheer size and difficulty due to the mass of water lilies/various other species of plants. This section of the lake may produce a significant source of plant fragments, which spread and regenerate after windstorms. With the progress in control from the 2016 season, it is hoped that at some point in the 2017 season, an attempt will be made to establish the viability of conventional SCUBA control methods in this area. Also, this area would greatly benefit from a form of biological control, such as the Milfoil Weevil. It would be a suitable habitat for the weevil and it would allow for the selective destruction of Eurasian watermilfoil, while sparing the other delicate species that reside here.

In conclusion, the Eurasian watermilfoil concern in Christina Lake, BC, can be regarded as "under control" for the great majority of the shoreline, with the exceptions noted above. Goals of the 2017 season will be to survey and remove

milfoil plants at each of the sites, multiple times. With time permitting, the Sutherland Creek Nature Park area will also receive some attention, in hopes of reducing the plant density and therefore preventing its spread out of the buoyed off area. Maintaining a two-crew milfoil control dive program will allow for further advancements to be made, restoring most of the shoreline to a near pre-milfoil state.

2017 Milfoil Control Program Work Plan

With the budget for the Christina Lake Eurasian Milfoil Control Program set to remain the same as the previous four seasons, the RDKB will look to hire 6-8 divers to carry out the milfoil removal for the 2017 season. This will again allow control to occur everyday of the week for over 20 weeks. The enlarged crew size has allowed for advancements to be made in the past few years against milfoil spread and growth. With the upcoming replacement of the venerable "*Haberstock*" diving vessel with a larger and more appropriate pontoon barge, more time will be able to be allotted to bringing the south end of Christina Lake to greater control. This, with dual crews, should bring about the 2017 season with increased capacity to fight the plant and will again be a huge benefit to the program. It is expected that fewer milfoil plants will be present in the lake and that some of the problematic areas will be in a much more manageable state. This is projected due to the fact that every year since the implementation of a second crew we have seen these kinds of improvements. With the possibility of the addition of biological control methods in the future, Christina Lake could one day again be controlled with a single crew; however, at present state it is highly recommended that a second crew remains to keep the plant well under control.

The work timeline for 2017, will be similar to that carried out in the previous season, beginning as early as possible in May and terminating around the middle of October. It is my understanding that most, if not all, of the 2016 divers will be returning, making for an efficient start to the season.

The 2017 control program is planned to start at the south end of the lake while the boat traffic is minimal. This will hopefully allow us to remove the majority of the plants before they near the surface and risk being fragmented by boat propellers and other means. Additionally, starting here will hopefully translate into a more efficient and faster removal in the cold, early season water temperatures where the plant is not growing quickly, and cannot spread by fragmentation as easily. Early-season control of the southern sites will also allow the crew to return here around early summer for additional treatments, further pushing back the encroaching plant beds, and halting future growth of the invasive species. As the season progresses, the crew will begin moving systematically north along the east and west shorelines of Christina Lake. Operations are expected to move along the

shoreline quickly reaching the north end of the lake within a couple weeks. At this time, one day a week will be spent in the north bay area, removing as much milfoil biomass as possible before continuing down the remainder of the shoreline. By the middle of July the crew will likely have covered every site, including control procedures on all provincial campgrounds and crown land. Then the crew will begin it's second round of control methods in the south, concentrating efforts predominantly in the heavily populated resort communities. A concerted effort to push back deep rooted plant beds in the southern sites will translate into thinner and fewer dense plant beds in future years, and will also decrease the spread from fragmentation to other areas. Refer to the attached 2017 Work Plan for details and maps.

2016 Christina Lake Eurasian Milfoil Budget Summary

The 2016 annual budget for the Christina Lake Eurasian Milfoil Control Program was set at \$389,454.00, with revenue of \$100,000 brought in from the General Capital Fund. It is of note the extra Capital acquired will require no additions to the current tax requisition for residents of Christina Lake.

As stated previously in the report, the local taxpayers of Christina Lake provide 100 percent of this funding, with the exception of the Capital, as provincial funding was completely discontinued in 1999. Again, this year's budget increase was funded by the local tax base, through a small addition to personal property taxes.

The 2016 year-to-date (November 7) expenditure breakdown is as follows:

Salaries and Benefits-----	\$173,817.77
Travel and Training-----	\$809.26
Communication Equipment-----	\$589.72
Board Fee-----	\$1,390.00
Diver Medicals-----	\$766.75
Dive Equipment Repairs-----	\$681.27
Boat Operating Costs-----	\$7,989.97
Scuba Tank Refills-----	\$0.00 (so far)
Capital-----	\$13,579.76
Vehicle Operating-----	\$6,280.01
Dive Equipment Rental-----	\$4,615.00
Contribution to Reserve-----	\$0.00 (Not yet allocated)
Contingencies-----	\$2,664.28

Total Expenditures:-----\$213,183.79

Total Surplus: \$78,486.95

At the time this report was completed, (November 2016) there was a surplus of \$78,486.95 in the 2016 budget. There will be additional expenses for the remainder of the year and the financial statement will be available in January 2017. Once the remaining line items have been allocated, and at the time of 2017 control operations' start-up, the budget should be at a balance.

2016 Champion Lakes Milfoil Control Summary

The RDKB Eurasian Milfoil Control Program was once again contracted for two days of SCUBA control procedures at Champion Lakes during the summer and fall of 2016. These control operations took place on July 13th, and on September 29th. This marked the 35rd consecutive year that Eurasian watermilfoil had been surveyed and removed from the lake.

In 2011, less than 40 plants were located and removed from the lake, continuing a downward trend in plant counts from previous years. In 2012, the crew had hoped this trend would continue to persist, but they were out of luck. 57 plants were extracted from Champion Lake in 2012, and unfortunately, this number increased once again during the 2013 day of control procedures. The crew was surprised to locate and remove a total of 244 plants at that time, by far the largest number reported in over a decade. Luckily, in 2014 the number of plants collected had decreased to 119, which was an improvement over the prior year. With the large increase in plants in 2013, BC Parks had hoped the dive crew could do two control treatments during the 2014 season; however, it didn't end up working out. For 2015, the dive crew was able to implement two control days; the June treatment had removed a total of 370 milfoil plants and the September treatment had removed 617 plants.

The 2016 plant count tallies are as follows: July treatment had 488 plants on the west beach and 365 plants on the east beach, giving a total of 853 plants removed. There were no milfoil plants growing outside of the beachfront areas. The September treatment had 437 plants on the west beach and 531 plants on the east beach. Total plants removed were 968 plants, with a lone weed growing outside of the beachfront areas. See attached July and September Champion Lakes Maps for plant distribution.

The plants collected in the July treatment were moderate in stature with minimal stems and root systems. These plant properties suggest that they had survived the winter freeze and had minimal time to grow before control operations took place. The majority of the plants found in Champion Lake in both July and September, as in previous years, were all clustered around the swim beaches, which is the most frequented by the public. Plants here were found in ten feet of water or less, suggesting that they may be spreading and fragmenting due to human disturbance in the shallow water. Most of the plants found at the east beach location

were located at a sharp drop-off in water depth. In previous years, this drop-off was marked with series of floating swim area buoys, where it was suspected that the milfoil fragments would be blocked from washing up on shore and subsequently sank, rooted and began another life cycle. It is possible that these demarcation tubes were removed as a result of previous years' milfoil control recommendations. Along the west beach, plants were again clustered in a line extending from just beyond the east end of the beach to the lakes inflow/outflow. It is of note that nearly every plant had rooted itself in a type of geotextile matting, which was put in place many years ago in order to mitigate the growth of milfoil. The divers reported that removing the entire root system was nearly impossible, due to the root anchors having penetrated through the mat webbing, thus leaving viable root fragments for regrowth.

The plants collected in the late September treatment were fully matured plants, with well developed root systems with multiple stems growing from each root. The plants were mature enough that any disturbance to the plant caused the top portion to fragment, and float to the surface. Care and due diligence was taken by the boat crew to ensure no fragments were left to start a new life cycle. As with the July treatment, nearly all plants were once again located around the swim beaches. Again, divers commented on the difficulty in removing the entire root systems where the geotextile matting had been laid. With 968 plants removed in September, being an increase in numbers from previous treatments, it should be noted that every plant removed was located in and around the same areas as every treatment since 2012. Only time will tell if the increase in plant numbers is indicative of an overall increase in plants, if it's a seasonal effect of having a late-season milfoil treatment, or some other possible long-term cyclical population ebb and flow. Should BC Parks request treatments in 2017, we will have a greater understanding of the effects of winter weather and freeze have on the growth of milfoil in Champion Lakes.

Ten-plus years of data show that plant counts in the 3rd Champion Lake have decreased steadily, from over 1000 plants in 1998, to less than fifty plants annually since 2003. The upward trend in plant levels over the last two years does not discount the effectiveness of diver survey and hand removal techniques; rather, it could be due to better reporting of the number of plants removed, as the 3rd Champion Lake is still well within the ability for a single small dive crew to control its milfoil population. Since 2015 was the first year in which the dive crew was able to treat the lake twice, it is possible that future years, with dual treatments, Milfoil plant counts in the 3rd Champion Lake could be contained to less than one hundred plants or less each treatment. It is hoped that from this year onward, funding for bi-annual control would largely benefit the lake. Two rounds of control on the lake will greatly reduce the chance of this invasive species from regaining its previous foothold throughout the littoral zone of Champion Lake. Also, a survey of the upper lakes wouldn't hurt to ensure that no plants exist there, as they will quickly spread and fragment downstream.

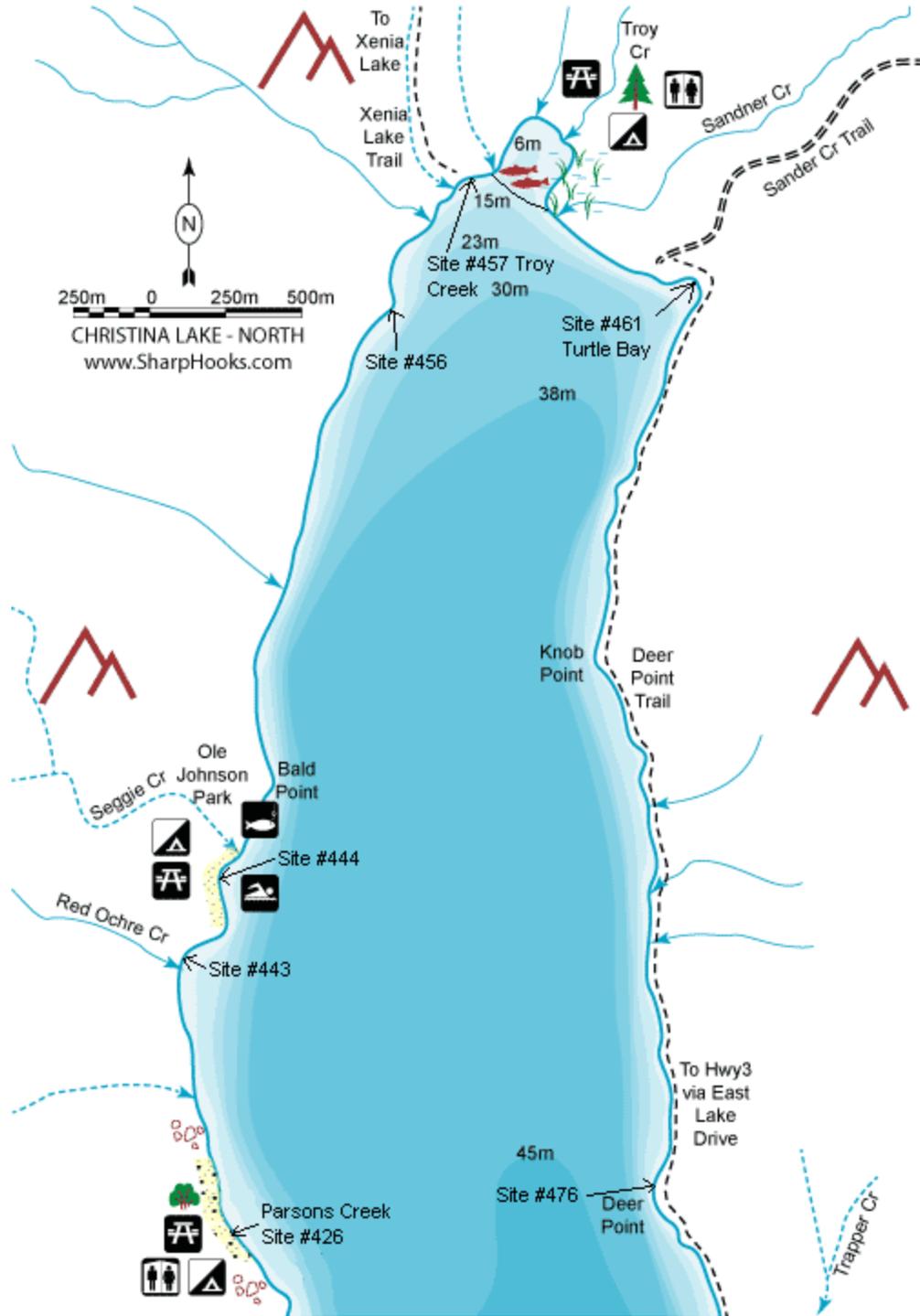
Acknowledgments

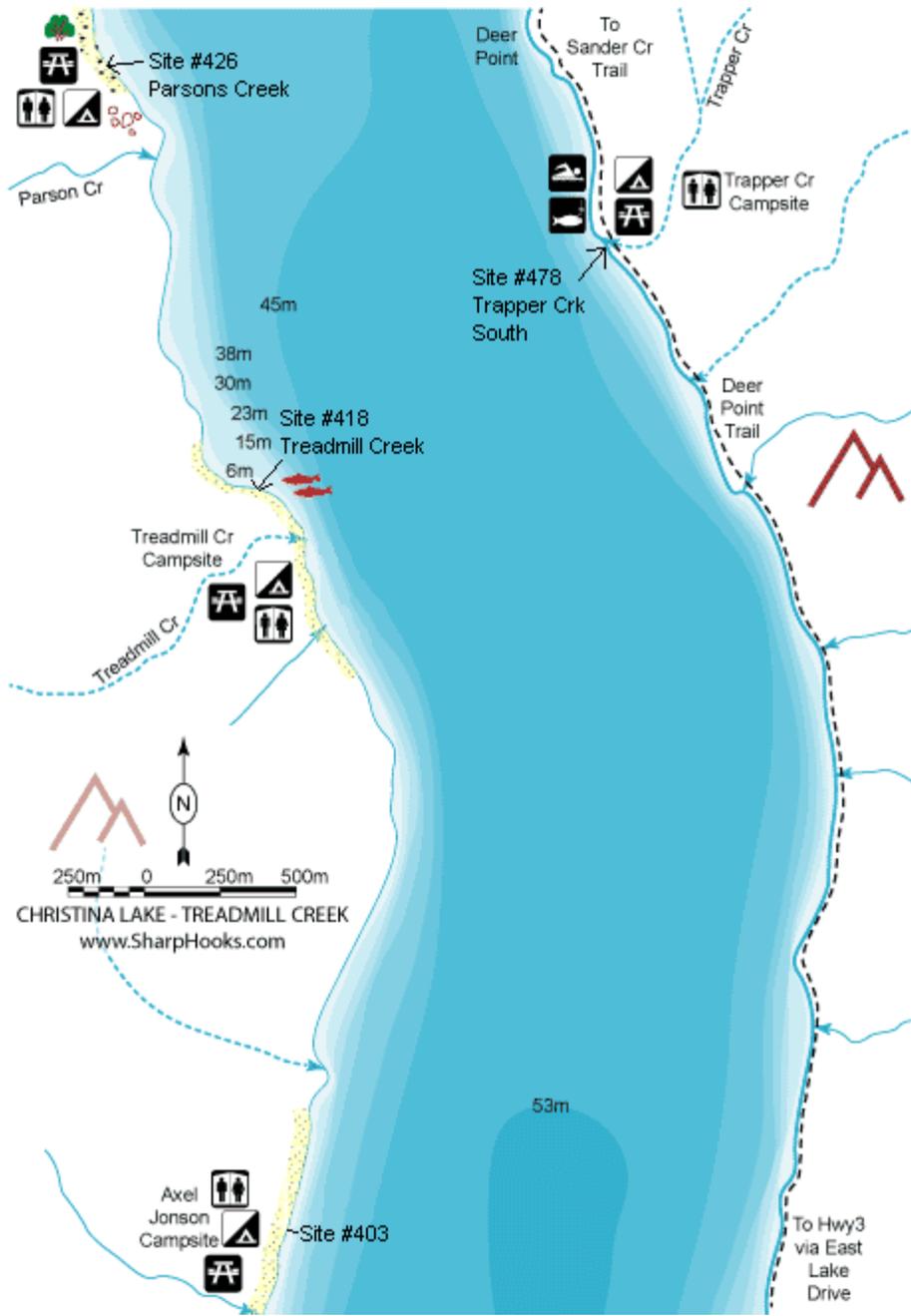
The Christina Lake Eurasian Milfoil Control Program could not continue to exist without the continued support of the local community, and for this, it is grateful. Following a town hall meeting in 2011 at which the public agreed that the program needed expansion and as a result, the budget was increased. The program is grateful for the support of the public, and strives on a daily basis to work its hardest and live up to the expectations of the local community. The program would also like to extend its gratitude to Grace McGregor, Area C Director. Grace has been a staunch supporter of the Milfoil Control Program for many years, and was instrumental in helping the program gain the additional funding necessary for increasing the size of the crew. The Control Program is very thankful to have the support of such a passionate leader of the community behind it.

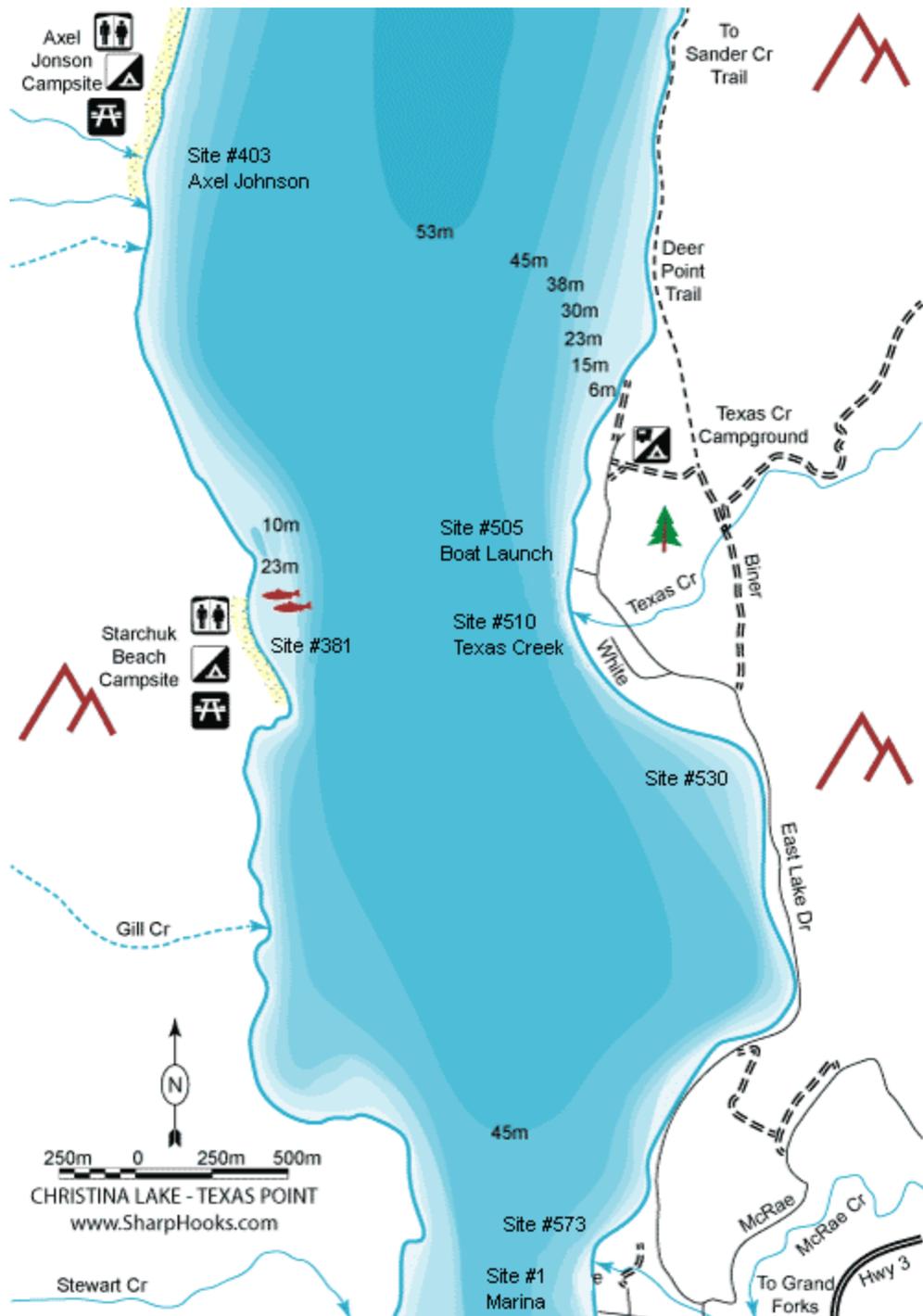
The Milfoil Program would also like to thank the Christina Lake Stewardship Society, who has been a continued supporter of the Program throughout these many years. We appreciate the many positive impacts that your members make around the lake every year, and look forward to continuing our partnership with you for many years to come.

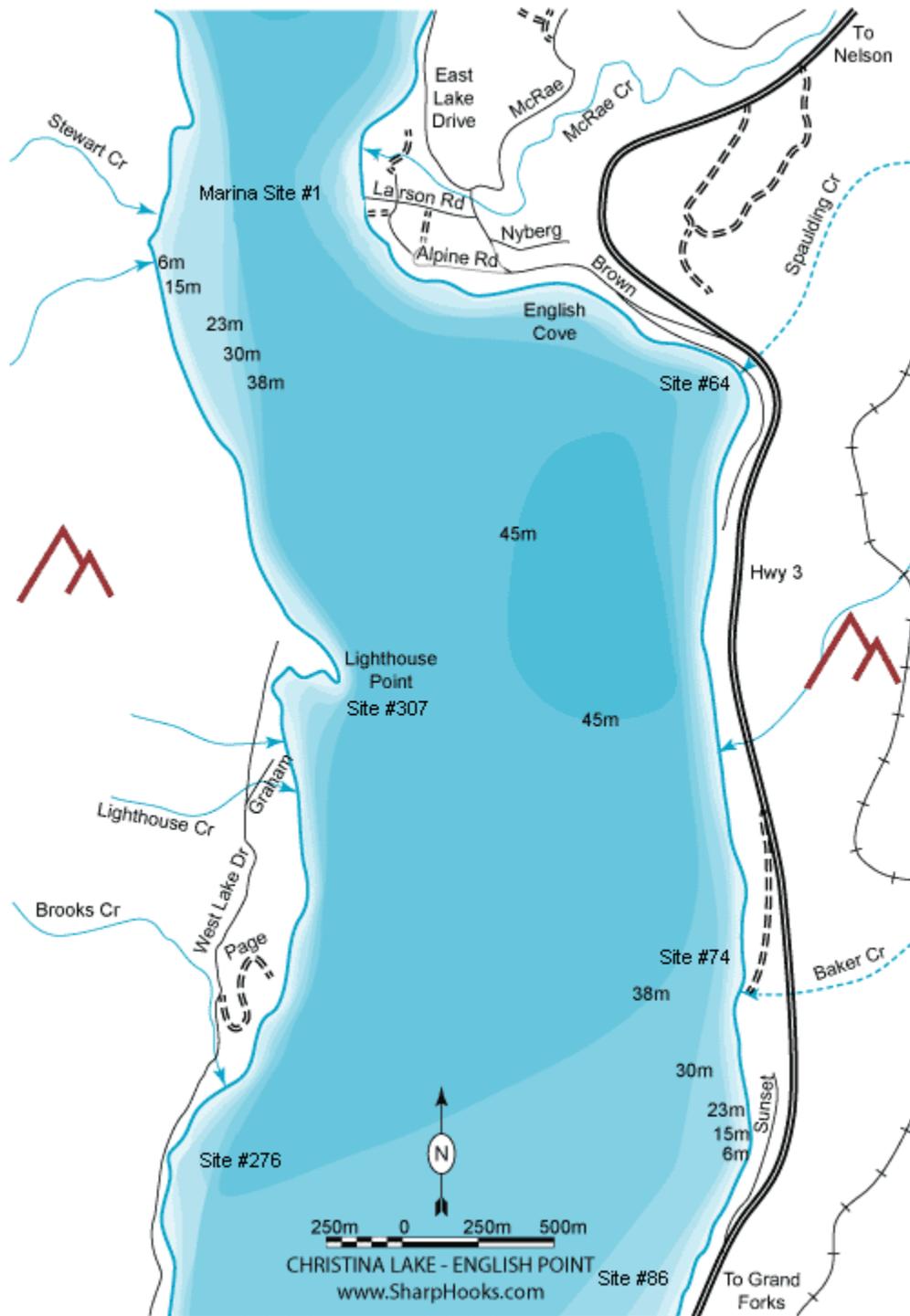
Over the past couple seasons Bob Freeman has generously allowed the use of his personal pontoon boat in the diving operations, as well as a mooring site for the RDKB "*Haberstock*" dive vessel. This is also greatly appreciated by the Eurasian Milfoil Control Program.

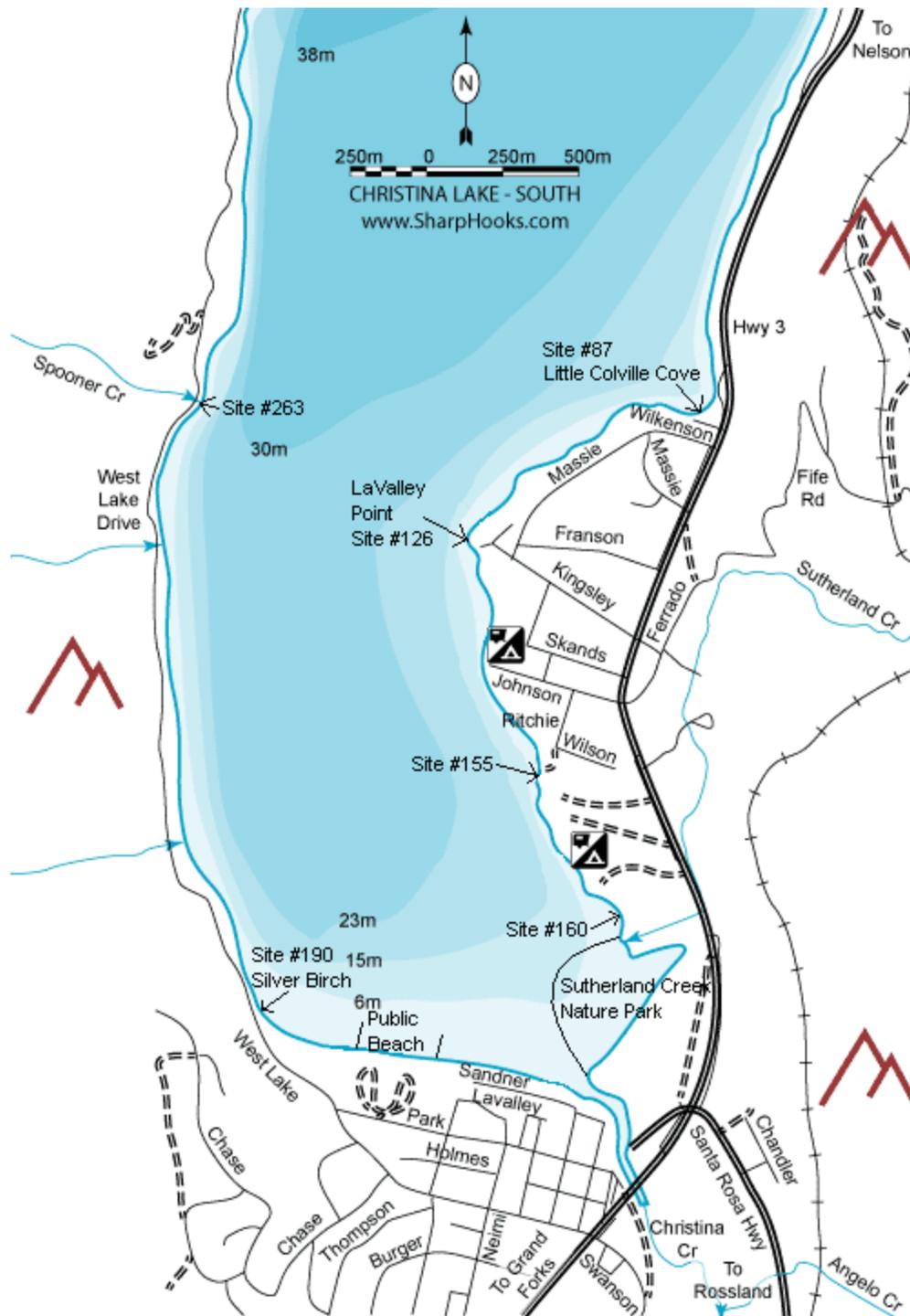
Christina Lake Site Map











Champion Lakes July Treatment



Champion Lakes September Treatment

