

CONDITION REPORT TO SUPPORT AN ORDINANCE RESTRICTING ARTIFICIALLY ENHANCED WAKES INTHE WATERS OF THE TOWN OF SCHLESWIG, MANITOWOC COUNTY

Introduction

Wisconsin's inland lakes are among the state's most critical natural resources and have incalculable aesthetic, environmental and economic value. In the interest of public health, safety, and/or welfare including the public's interest in preserving natural resources, and protection of the environment and outdoor recreation, it is important to protect lakes and their users from the very large wakes, downward prop wash and other negative impacts of enhanced wake sports.

The Town of Schleswig ("Town") has the authority to enact ordinances covering waters within its jurisdiction, if the ordinances are not contrary to or inconsistent with Chapter 30, Wis. Stats., and they relate to the equipment, use, or operation of boats or to any activity regulated by Wis. Stats. Sections. 30.60 to 30.71 and 30.77 (3)(a).

Purpose of the Ordinance

The purpose of this ordinance is to:

- 1) prevent the environmental degradation caused by artificially enhanced wakes and downward propeller wash generated by boats for enhanced wake sports such as wake surfing;
- 2) prevent the transfer of aquatic invasive species through ballast water intake and discharge between lakes;
- 3) prevent property damage from enhanced wakes hitting privately owned shoreline, docks, shoreline structures and boats;
- 4) prevent enhanced wake activities driving other water sports off lakes; and
- 5) protect public safety.

Specifically, the proposed ordinance would ban the use of ballast tanks, ballast bags or fins to cause a boat to operate in a bow-high manner or which increase or enhance a boat's wake. It also would prohibit operating a boat in an artificially bow-high manner having the effect of increasing the boat's wake; this would include prohibiting wake enhancement using ballast tanks, ballast bags, fins, or continuous operation at transition speed (the speed below planing speed in which a boat is operating in plowing

mode). For the purposes of this provision, “continuous operation” shall mean “operation that is not acceleration for the purpose of achieving a state of planing.”

In no event would any of the following operations be deemed a violation of the ordinance, provided such operations do not use ballast tanks, ballast bags or fins: 1) water skiing, 2) tubing, 3) wakeboarding using a tow rope, 4) brief transition operation to empty a boat of bilge water, or 5) brief transition operation of a boat accelerating into a planing condition.

Moreover, nothing in the proposed ordinance would preclude the use of wake boats, provided the ballast tanks and other features intended to create enhanced wakes or cause the boat to operate in a bow-up stern-down orientation are not deployed. These boats could continue to be used for cruising, water skiing and other activities provided the ballast tanks and other wave-enhancing features are not deployed or the boat is not operated at continuous transition speed.

Various studies and surveys (see Appendix 1) have been conducted that reveal the negative effects of enhanced wakes on inland lakes. The results suggest that these negative effects may largely be avoided if the lake size is more than 1,500 acres; and the distance of the enhanced wake boating activity is at least 700 feet from the shoreline or other lake users and in water depths greater than 25 feet.

By increasing displacement of the boat and equipped with very powerful engines, wake boats impart very large quantities of energy in the form of unusually large waves. The energy of these waves increases with the square of their amplitude, such that a two-fold increase in wave height generates four times more energy and a three-fold increase in wave height generates nine times more energy.¹ Most of this wave energy is conserved until it encounters shallow water, concentrating energy on all materials or objects present, including the shoreline, lake bottom, wildlife habitat, docks, moored boats, swim rafts and other lake recreators.

When wake boats are operating in a bow-up stern-down manner, the propeller wash may scour the lake bottom to depths of more than 25 feet, destroying aquatic vegetation and fish spawning beds, and churning the sediment into the water column, degrading the water quality.

Local Conditions Necessitating a Local Ordinance

¹ Formulas for Boat Wakes, webpage <http://boatwakes.homestead.com/files/form.htm>

In recent years, there has been an increase in boats equipped to generate artificially enhanced wakes on Wisconsin lakes. This also is the case on the Town's lakes. More lake residents and recreators are expressing concern about the effects of enhanced wakes on their environment and on public safety. The Wisconsin DNR's Spring 2023 Survey and Spring 2024 Survey results indicate that both Manitowoc County residents and those who recreate in Manitowoc County are overwhelmingly in favor of legislation that would prohibit the operation of boats in a manner that creates artificially enhanced wakes.²

- The Town of Schleswig includes two lakes greater than 50 acres³ wholly within the town (see table in Appendix 2).
- These are both small, shallow inland lakes.
- The consensus among most researchers is that to dissipate wave height and intensity from enhanced wakes requires a wake boat in wake surf mode be at least 600 to 700 feet from shore.⁴ To prevent lake bottom disturbance from boats in wake surf mode requires depths of more than 25 feet.⁵
- Artificially enhanced wakes can cause irreversible damage to shorelines, lake beds, moored boats, and shoreline structures. Enhanced wakes and the associated propeller wash can uproot aquatic plants and resuspend the lake sediment. This churning action can increase phosphorus levels in the water column that lead to algae blooms. Any toxic substances that may be present in the sediment reenter the water column, degrading water quality and posing additional risks to aquatic wildlife and plants.⁶

² Wisconsin DNR Spring Surveys, 2023 and 2024, https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2023/SpringHearing/2023_CountyResults.pdf and

https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2024/SpringHearing/2024_StatewideResultsByCounty.pdf

³ Per 30.635, Wis. Statutes, on lakes 50 acres or less having public access, motorboats may not be operated more than slow-no-wake speed, except when such lakes serve as thoroughfares between two or more navigable lakes

⁴ Wisconsin's Green Fire "The Effects of Wake Boats on Lake Ecosystem Health," May 2024 https://wiGreenFire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

⁵ Terra Vigilis "Lake Waramaug Impact Analysis," Dec. 2024, https://www.warrenct.gov/sites/g/files/vyhlf3991f/uploads/lake_waramaug_final_report.pdf

⁶ Wisconsin's Green Fire "The Effects of Wake Boats on Lake Ecosystem Health," May 2024 https://wiGreenFire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

- The Town's lakes are shallow and highly susceptible to these outcomes.

Effect on wildlife: Birds, particularly waterfowl such as loons, nest close to shorelines and are especially vulnerable to shoreline disturbances. Studies have shown that when boaters pass too close to shorelines inhabited by birds and wildlife creating large wakes, the following impacts can occur: relocation of nesting sites, abandonment of nests and loss of young. There can also be long term impacts as many species of birds that normally would return year after year to the same nesting area are forced elsewhere. In many cases, this may be to less desirable bodies of water.⁷

Effect on shoreline and water quality: Maintaining water quality is in the best interest of all property owners and the public at large relative to the use of the lakes. Increased sedimentation which can reduce light penetration and inhibit primary production, abrade, and clog fish gills, and prevent feeding by sight feeders, will negatively alter fish populations. While shoreline erosion can be reversed with much cost and effort within years, changes to water quality by disturbance of the lake beds can be even more difficult to remedy. Disturbances of the lake bed can release nutrients such as phosphorus that took decades to accumulate.⁸ Once released and resuspended, it can take decades for a lake to return to its former status. Phosphorus is the limiting nutrient for enhanced growth of algae and its associated detrimental impacts, including killing fish and making the lake unsafe for swimming. Furthermore, without adequate protections, erosion and sedimentation will accelerate lake eutrophication with a negative impact on all who use these water resources.⁹

- The Town of Schleswig Sanitary District #1 Cedar Lake, Manitowoc County (Sanitary District) has been proactively managing phosphorous concerns for more than two decades. In 2005, the Sanitary District presented an ordinance to the Town Board to ban fertilizer containing phosphorous in the district. This was a year before the State enacted such a statewide ban, unless an individual brought a soil sample indicating a lack of populous was present to the presiding county. The impact of enhanced wake activity jeopardizes phosphorous management efforts.

⁷ Wisconsin's Green Fire "The Effects of Wake Boats on Lake Ecosystem Health," May 2024
https://wiGreenFire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

⁸ Wisconsin's Green Fire "The Effects of Wake Boats on Lake Ecosystem Health," May 2024
https://wiGreenFire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

⁹ Wisconsin's Green Fire "The Effects of Wake Boats on Lake Ecosystem Health," May 2024
https://wigreenfire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf

- The Town's lakes are popular with anglers. On Cedar Lake this includes: northern pike, black crappie, and bluegill common; and yellow perch, walleye and largemouth bass present. On Wilke Lake this includes: abundant bluegill; and largemouth bass, northern pike, perch and stocked walleye present.
- Citizens are very concerned that if enhanced wake boating is not regulated that wake sports creating enhanced wakes will become more popular, too late to regulate and ultimately cause permanent damage to the Town's lakes. Common concerns heard from residents include the long-term effects on the lakes from wake-surfing, especially related to damage to the shoreline, damage to the lake bed, damage to fishery and increased sediment with phosphorous being stirred up by the downward prop wash.

Ballast system threats to AIS spread. Ballast systems are impossible to empty completely, thereby increasing the risk of carrying aquatic invasive species from one lake to another. Ballast tanks contain an average of 8 and up to nearly 23 gallons of residual water, according to a University of Wisconsin study.¹⁰ Further, the likelihood of transporting zebra mussel veligers through ballast systems is known to be high, with a 97% chance of a ballast tank containing at least 1 veliger and a 71% chance of it containing 100 veligers, according to a University of Minnesota report, studying this on Minnesota lakes with zebra mussel infestations.¹¹

- Cedar Lake has zebra mussels and Wilke, while not currently known to be infected, is suitable for zebra mussels according the DNR AIS Smart Prevention Tool.¹² Zebra mussels can upset the entire lake ecosystem and kill the food sources need for a healthy fishing habitat as well as significantly damage property and equipment and impact the value of shoreline property and the safety of lake users. Boats using ballasts in Cedar Lake are a threat to spreading zebra mussels to other lakes through water the that does not drain.
- Cedar Lake and Wilke Lake also have Eurasian water milfoil (EWM), which reproduces via fragmentation, meaning a single stem fragment can take root

¹⁰ University of Wisconsin Study,
https://www.reabic.net/journals/mbi/2016/3/MBI_2016_Campbell_etal.pdf

¹¹ University of Minnesota Study,
<https://conservancy.umn.edu/server/api/core/bitstreams/da582b1c-7880-4adb-af31-5303491ed1a6/content>

¹² Center for Limnology, University of Wisconsin, AIS Smart Prevention Tool,
<https://uwlimnology.shinyapps.io/AISSmartPrevention2/>

and establish a new population. Once a lake is infected, it's never eradicated and can cost thousands of dollars annually to manage. It displaces native plants, impacts food and habitat for fish and aquatic animals; reduces oxygen levels which can cause fish die off and hinders water recreation. Wake boats in wake sport mode (bow-high, stern down) pose an added threat in uprooting and cutting the plant, encouraging it to spread.

- Both Cedar Lake and Wilke Lake have taken significant measures to manage AIS. For example, Cedar Lake Sanitary District has been proactive in its efforts to protect and preserve Cedar Lake and combat AIS. To this end, it has:
 - Implemented the Clean Boats, Clean Waters program for eight years; now done in coordination with lake residents
 - Applied for a grant from the DNR to run a DASH (diver assisted suction harvesting) program the year after hand pulling EWM
 - Regularly completed Aquatic Plant Management Plans as well as chemical and mechanical aquatic plant harvesting
 - Purchased more than \$200,000 worth of harvesting equipment including a harvester, trailer, elevator and dump truck to manage EWM; and invested more than \$45,000 to date treating the lake. The plant harvesting effort requires four individuals cutting five days a week from early summer to early fall
 - Coordinated with the Town Board to place a harvesting station on Town property and with the DNR to dredge where it was too shallow to get the *harvester to the station
 - Purchased land and built a shed to house the equipment with support from the Cedar Lake Improvement Association
- Lake residents are concerned that enhanced wake activity runs counter to the efforts and investments they are making in managing AIS And a threat to transferring infected water to other lakes through ballast systems that do not completely drain.
- Furthermore, while combatting these AIS, lake residents also are fearful of other AIS spreading from other lakes to the Town lakes, including quagga mussels, which the DNR discovered in Geneva Lake in 2024 (just over 100 miles south of the Town's lakes). Described as the "bigger, badder" cousin of the zebra mussel, quagga mussels appear less sensitive to water chemistry and there is no viable option for eradicating them once introduced to a lake, according to the DNR.¹³

¹³'Deeply disturbing news.' Invasive quagga mussels documented in Geneva Lake; first finding in Wisconsin inland lake, Paul Smith, Milwaukee Journal Sentinel,

- Currently, there also is no readily available way in Wisconsin to clean and decontaminate ballast systems, which require flushing with water heated to at least 120 degrees for several minutes.¹⁴

<https://www.jsonline.com/story/sports/outdoors/2024/08/27/quagga-mussels-found-in-geneva-lake-first-in-a-wisconsin-inland-lake/74964798007/>

¹⁴ Ballast Tank Decontamination, Pacific States Marine Fisheries Commission, <https://www.youtube.com/watch?v=aTMHclwwZk>

Impacts on property and lake recreators

- The use of ballast and wake-enhancing fins, vanes, shapers, or other such devices puts the boat in a bow-up stern-down position. This may obstruct the driver's view, increased safety risks for others on the lake: anglers, kayakers, paddleboarders, and swimmers. There have been various reports of close-call encounters between wake boats and other water sport enthusiasts.
- As a result of artificially enhanced wakes, property owners have reported numerous incidents and complaints:
 - Damage to docks, piers, seawalls, and boats as well as moored boats breaking their ties due to enhanced wakes
 - Shoreline damage, severe erosion and high turbidity with clear lakes turning murky as sediment re-enters the water column
 - Fish and habitat damage, including significant amounts of weed floating on the water and washing up on shore
- Lake users also report they are unable to use the lake out of concerns for safety when just one or two boats are out operating in wake-surf mode. For example:
 - Kayakers and paddlers not going out on lake when wake surfing activity is occurring
 - Boats towing skiers or tubers returning to their docks out of safety concerns
 - Anglers having to move to other areas of the lake to ensure they can safely fish; and often having to leave the lake entirely
 - Pontoon boats getting swamped or completely re-routing to avoid entire areas of the lake when a wake boat is generating enhanced wakes.
 - Young children not being able to play in the shallows given the wave energy from a wake boat's enhanced wakes

See Appendix 3 for specific lake resident comments.

How a Town Ordinance Would Solve the Above Issues for the Town of Schleswig

Compliance with a Town ordinance prohibiting boats from generating artificially enhanced wakes would result in the following benefits for the Town:

- The negative environmental impacts and property damage associated with boats generating artificially enhanced wakes, described above, would be prevented.
- The safety risks associated with boats generating artificially enhanced wakes, noted above, would be eliminated. Other lake recreators would not be driven off the lake and everyone enjoying the lakes would be that much safer.

- The likelihood of ballast tanks used by these boats transferring aquatic invasive species from one lake to another would be reduced or eliminated.

Upon adopting the proposed ordinance, appropriate signage would be placed at all public landings, in accordance with Wisconsin law. Based on the experiences of the Town in adopting other boating ordinances as well as the experience of other Wisconsin municipalities that have adopted ordinances regulating the creation of enhanced wakes, such signage and general education regarding the ordinance will help ensure compliance.

Summary of the Arguments of Those Opposed to Regulation

Certain individuals may be opposed to any or all forms of regulation and a limited number may feel the ordinance is infringing on their rights to lake usage. However, when one or two people can operate boats that intentionally generate artificially enhanced wakes on small or mid-size lakes, many others can't navigate safely or enjoy their activities and the scenic beauty, water quality and aquatic habitat will be damaged or destroyed.

The boating industry claims they can self-regulate. However, this has not proven to be the case given the mounting damage and concerns raised by other lake users.

Some opponents have claimed that any regulation of enhanced wakes would be a violation of the Public Trust Doctrine. However, this issue has been addressed by the Wisconsin Legislative Council (the nonpartisan state agency charged with responsibility for providing legal advice to the Legislature). The Wisconsin Legislative Council issued a Dec 6, 2023 legal memo addressing this very point, concluding that any challenge under the public trust doctrine would be unlikely to succeed.

Other opponents claim that existing state laws are enough, but they clearly are not:

- NR 19.055 requires all boats that take in water from a lake to drain that water before leaving the boat launch, and NR 40 makes it illegal to possess, transport, transfer or introduce certain invasive species. Some opponents to regulation claim that ballast tanks of wake surf boats are no more likely to transfer invasives than live wells and bait buckets. But live wells and bait buckets can be fully emptied and are easily inspected. Ballast tanks cannot be fully emptied and cannot be inspected, as they are sealed within the hull of the boat. The significant amount of water the ballast tanks transport even when "empty" is made very clear by the wake surf boat industry itself. For example, the MasterCraft owner's manual instructs the owner to add multiple gallons of anti-freeze to the ballast system, this shows that considerable water is transferred as the wake surf boats move between lakes. The discharge of the antifreeze in the spring presents an additional hazard if done so in the lake, with that being the expressed directions provided (see Appendix 4).

- Wis. Stats. 30.66(3)(a) requires slow no-wake for all motorboats within 100 feet of any shoreline, dock, pier or buoyed restricted area. Even the wake boat industry acknowledges this is insufficient (see wave height discussion in below bullet).

Likewise, other existing state laws regarding hazardous wakes are inadequate because they are limited:

- Wis. Stats 30.68(4)(a) states no person shall operate a motorboat so as to “approach or pass” another boat in such a way to create a hazardous wake or wash. However, this is limited as it requires the boats be well under 100 feet apart. But wake surf boats can make waves 20 inches high a full 100 feet from the track of the wake boat and 13 inches high a full 300 feet from a wake boat, as detailed in the wake boat industry’s own “Goudey Study”.¹⁵
- Wis. Stats. 30.68(4)(b) provides an apparent remedy for injury to people and damage to property (e.g., docks and shoreline), but this requires a civil lawsuit. Not only is this expensive, stressful and takes years to resolve, but often property damage, for example, occurs when the owner is not there to identify what surf boat caused the damage.

Impact on Public Health, Safety or Welfare if the Ordinance Is Not Adopted

If the ordinance is not adopted, additional impacts will continue and increase as the numbers of wake surf boats used on Town lakes continue to increase. This will result in more environmental damage, more safety issues from the very large wakes and bow-up orientation of these boats while in wake surf mode and greater numbers of other boat owners not able to use the lakes because of worry about the large waves and bow-up condition of wake surfers.

Possible Negative Effects of Adopting the Ordinance

Certain individuals who enjoy wake surfing may not come to the Town’s lakes and others now on these lakes may choose not to buy wake surf boats. Those that own wake surf boats may choose to sell them, to continue to use them in accordance with the proposed ordinance, or use them on other lakes better suited for wake surfing.

¹⁵ Water Sports Industry Association, “Characterization of Wake-Sport Wakes,” Nov. 2015, https://www.wsia.net/wp-content/uploads/2020/03/WSIA_draft_report_Rev_II.pdf

Appendix 1

Relevant Research Studies and Surveys

Several studies contributing to the facts in this condition report were completed a few years ago. Since that time, boats generating enhanced wakes have gotten more powerful, added more ballast, and are capable of generating bigger wakes and more powerful downward prop wash. Therefore, the figures cited in this report are likely conservative. More studies are underway and in review.

Ballast tank water retention and invasive species: “Volume and contents of residual water in recreational watercraft ballast systems,” *Management of Biological Invasions* (2016) Volume 7, Issue 3: 281-286, first published online 04/18/2016, https://www.reabic.net/journals/mbi/2016/3/MBI_2016_Campbell_etal.pdf; and “Occurrence and Survival of Zebra Mussel (*Dreissena polymorpha*) Veliger Larvae in Residual Water Transported by Recreational Watercraft,” University of Minnesota thesis, Adam Doll, Dec. 2018, <https://conservancy.umn.edu/handle/11299/202094>.

Wave height, power, and energy: “A field study of maximum wave height, total wave energy, and maximum wave power produced by four recreational boats on a freshwater lake,” St. Anthony Falls Laboratory, College of Science & Engineering, University of Minnesota, SAFL Project Report No. 600, 02/02/2022, <https://conservancy.umn.edu/handle/11299/226190>.

Wave energy and “Wakesurfing, Wakeboarding, and Waterskiing: A Comparison of Wake Characteristics,” Gregor Macfarlane, Australian Maritime College, University of Tasmania, Australia, First published 3/18/2025, <https://onlinelibrary.wiley.com/doi/10.1002/rra.4438?af=R>

Wave energy, propeller downwash and sediment disturbance: “Lake Waramaug Wave Impact Study Final Report,” Prepared for the Lake Waramaug Inter-Local Commission, Terra Vigilis Environmental Services Group, 11/15/2024, https://www.warrenct.gov/sites/g/files/vyhlif3991/f/uploads/lake_waramaug_final_report.pdf.

Wave size, power, and turbidity: “A phased study of the water quality and wave propagation dynamics currently impacting a small southeast Wisconsin freshwater lake: Waukesha,” Terra Vigilis Group, as contained in Responsible Wakes for Vermont Lakes (see pp 16-37 of linked presentation where study is embedded), <https://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Additional%20supporting%20Information%20submitted%2007292022.pdf>.

Public support for restricting enhanced wakes to lakes greater than 1500 acres and 700 feet from shore, Manitowoc County: “2023 Spring Hearing Statewide Results by

County,” Wisconsin Conservation Congress and Department of Natural Resources, 4/20/23,

<https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2023/SpringHearing/2023CountyResults.pdf>

Public support for restricting enhanced wakes to lakes greater than 1,500 acres, 700+ feet from shore, 20+ feet of depth; and prohibiting use of ballast systems on Wisconsin lakes and rivers, Manitowoc County: “2024 Spring Hearing and Statewide Results by County,” Wisconsin Conservation Congress and Department of Natural Resources, 4/26/2024,

<https://dnr.wisconsin.gov/sites/default/files/topic/About/WCC/2024/SpringHearing/2024StatewideResultsByCounty.pdf>.

Extensive review of literature: Wisconsin Green Fire—“The Effect of Wake Boats on Lake Ecosystem Health,” May 2024, https://wigreenfire.org/2019/wp-content/uploads/2024/05/WakeBoatsLakeEcosystemHealth_WGF-May2024_Final.pdf.

The Industry’s own study showing that a surf boat operating in 20’ water depths makes a wave 20” high at 100’ from the boat, 16” high at 200’ from the boat and a wave 13” high a full 300’ from the boat: “Characterization of Wake-Sport Wakes and their Potential impact on Shorelines,” commissioned and paid for by the Water Sports Industry Association, November 2015, https://www.wsia.net/wp-content/uploads/2020/03/WSIA_draft_report_Rev_II.pdf.

Appendix 2

Lake Descriptions

The Town of Schleswig has two lakes with shoreline wholly within the town and exceeding 50 acres in size.

Lake Name	Surface Area (acres)	Max. Depth (ft)	Mean Depth (ft) (where known)	Shoreline Perimeters (miles) (where known)	Public Boat Landings	WBIC (WDNR Water Body Index Code)	Comments
Cedar Lake	136	21	9	3.57	1	45100	Cedar Lake is comprised of two very small, shallow lobes; and contains two small islands as well as submerged islands. Less than 8% of the lake is greater than 20 feet. The size and depth of the lake is unsuitable for wake surfing.
Wilke Lake	93	21	9	1.67	1	58000	Wilke Lake is very small and shallow with most under 10 feet deep. Less than 0.2% of the lake is greater than 20 feet. The size and depth of the lake is unsuitable for wake surfing.

Appendix 3

Statements from Town of Schleswig Sanitary District #1 Members (Riparian Owners)

- Numerous riparian owners have had enormous boulders placed on their shoreline in an effort to protect against erosion. In many places this just can't be done, so the shoreline just disappears.
- Today, the two main issues I see as concerns are invasive species / overall vegetation management and uncontrolled use of the large wake generating boats and their effects on shoreline and creating dangerous boating conditions.
- It is evident that heavy boat traffic and wakes are causing shoreline erosion by the large amount of increased shoreline protection being done in the last couple of years.... I was anchored parallel to the shore. A large wake pushed the boat 10-15 feet sideways! Lucky we were all seated!
- We have a general overall concern about safety on the lake during heavy boat traffic periods.
- It got so bad, as far as I'm concerned, that I barely use the lake anymore.
- Erosion is a big problem. The lake is too small for wake surfing.
- Erosion from boats not staying far enough from shore. Specifically, ballast boats. Lake is too small for wake surfing.
- Wake boats/bow up positions are too dangerous for our small lake. We are considering leaving the lake due to these boats and their excessive wakes.
- When a wave producing boat is on the lake, other recreators leave.
- The lake is not useable or safe during wake hours.
- Since I have been on the lake, we have experienced severe erosion. I feel like the problem has gotten much worse.
- Wake boats are ruining our shoreline!
- Tired of the destruction of wake boats. Constantly reposition rocks on shoreline.

Appendix 4

From Mastercraft Wake Boat Manual¹⁶

Ballast tanks, pumps, hoses and fittings must be properly winterized to prevent freezing damage during winter storage. Because of the complexity of preparing a ballast system for winter storage, as well as the possibility of extreme damage to the ballast system if a preparation error is made, MasterCraft recommends scheduling an appointment with an authorized dealer's service department to have a certified technician to perform all winterization procedures, including ballast winterization.

MasterCraft uses a -50 F RV type, nontoxic, propylene glycol-based antifreeze to winterize every boat built at the factory. Any antifreeze meeting these requirements is acceptable for MasterCraft engine, ballast, and freshwater system winterization. Be aware that colder climates may require antifreeze with a -100 F temperature rating.

To winterize NXT boats:

1. Completely empty all ballast tanks and bags of any water that may be in the ballast system.
2. Remove all ballast bags (if applicable) and re-attach the bridge connector (pictured to the left) to the ballast thru hull vent hose and the hose leading to the ballast hard tanks. Completely drain and store the bags in a dry place.
3. With the rear ballast bags removed and the bridge connector in place, identify the three ballast thru-hull vents on the hull sides of NXT boats.
4. Add one gallon of -50 F RV type nontoxic propylene glycol based antifreeze to each of the three thru-hull vents. Colder climates may require this same type of antifreeze with a -100 F temperature rating.
5. Because the NXT uses a different style ballast system than X and XT models, the antifreeze will stay in the ballast system during storage rather than being immediately pumped out.

Upon reactivating the boat the first time after storage, run the ballast system to pump out the antifreeze (the engine must be on and the boat must be in the water).

¹⁶ (As of 3/22/24) <https://mastercraft-wake.com/knowledge-center/ballast-system-winterization/#:~:text=Ballast%20tanks%2C%20pumps%2C%20hoses%20and,bags%20in%20a%20dry%20place.>