-3-
LAKE USE

"We can learn far more about the conditions and values of a society by contemplating how it chooses to play, to use its free time, to take its leisure, than by examining how it goes about its work."

-- A. Bartlett Gianatti, Major League Baseball Commissioner

3-1 OVERVIEW

Lake Ripley is a popular and accessible recreational destination frequented by local residents and visitors alike. Its close proximity to the cities of Madison (WI), Milwaukee (WI), Chicago (IL) and Rockford (IL) make it especially attractive for seasonal residents and summer vacationers. The lake supports a diverse range of activities, including boating, swimming, fishing, nature viewing and waterskiing. However, with a total surface area of only 423 acres, this finite resource is confronted with growing and changing lake-use pressures. These pressures can threaten not only the health and condition of the lake, but also the quality of the recreational experience enjoyed by its many users. In recognition of these challenges, the Lake District completed a *Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis* in 2003.[1] The major findings and conclusions resulting from this effort, along with a number of relevant updates, provide the basis of discussion contained in this chapter.

Fishing boats on Lake Ripley, representing a dominant lake use during the slow-no-wake period

As of 2008, there were about 634,000 boats registered in Wisconsin. This figure represents a 109% increase in state boat registrations over the last 40 years. In Jefferson County alone, boat registrations increased 127% over this same 40-year period. Boat size and horsepower have also steadily increased over the years. Over 40% of registered boats in Wisconsin were between 16 and 39 feet long in 1997-98, compared to just 18% in 1968-69.[2] While average horsepower was a mere 3.6 in 1941, it jumped to 43.3 by 1982, and is currently approaching 100 horsepower today.[3] There has also been an explosion in recent years in new types of watercraft, especially personal watercraft (e.g. Jet Skis). Personal watercraft registered in Wisconsin has risen from 6,500 in 1991 to 35,385 in 2008, representing a 544% increase over this 17-year period.[4] These

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[1] Lake Ripley Management District. 2003. Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis.

[2] Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.

[3] Wisconsin Department of Natural Resources Website (http://www.dnr.state.wi.us/org/water/fhp/lakes/onceupon.htm)

[4] Wisconsin Department of Natural Resources. 2008. 2008 Wisconsin Boating Program Report. Wisconsin DNR Bureau of Law Enforcement. PUB-LE-314-2008.

types of watercraft present unique challenges due to their maneuverability and accessibility to shallow and remote lake areas.

Increased lakeshore development is another factor that leads to more people and more demands on the resource. Clearly, the issue of lake access and overcrowding is relevant now more than ever, especially in light of the growing number, power, speed and diversity of today's watercraft. According to a recent Lake District opinion survey, most respondents felt that adequate public access was already provided on Lake Ripley, especially with respect to boating.[5] The survey also revealed that respondents felt at least moderately crowded while using the lake on summer weekends. In descending order, the top four preferred lake-use activities included the enjoyment of peace and tranquility, swimming, observing wildlife, and walking or biking around the lake. This marks a change from earlier opinion surveys that showed higher preferences for motor boating and fishing over the latter two activities.

3-2 USER CONFLICT AND CARRYING CAPACITY

As the number of watercraft and level of congestion increases on a given lake, so does the probability of conflict due to competition for limited space. "The ability of a lake to accommodate a given number of users and mixed recreational uses depends on the compatibility of those uses."[6] The potential for conflict among various recreational activities competing for similar space is illustrated in the compatibility matrix shown as Figure 22. The figure depicts higher intensity activities such as waterskiing and motor boating as being most interfering to other uses.[7] Klessig (2001) noted that the focus of most user conflict involves motorized watercraft and centers on either speed or on noise and maneuverability as in the case of personal watercraft. He argued that users who cannot afford a big boat and motor or who prefer more passive recreation are in fact denied the very access in which they are supposedly entitled under Wisconsin's Public Trust Doctrine.[8]

Under crowded conditions, competing user groups may be 1) forced to tolerate greater levels of intrusion or interference, 2) tempted to engage in riskier and more aggressive behavior, 3) displaced to less optimal locations on the lake, or 4) driven off the lake entirely. "While each water body may have special suitability for particular uses, the water body can accommodate only a limited number of such uses. Beyond this point, the overload of a single use, as well as interactively between several uses, causes conflict and perhaps damage to the water resource."[9]

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[5] Lake Ripley Management District. 2009. Lake Ripley Property Owner Opinion Survey.
[6] Jones, William J. 1996. Balancing Recreational User Demands and Conflicts on Multiple Use Public Waters. American Fisheries Society Symposium 16:179-185.
[7] Ibid
[8] Klessig, Lowell L. 2001. Load Limits for Lakes. Article, University of Wisconsin – Extension.
[9] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.

A

25% capacity

B

65% capacity

C

81% capacity

D

106% capacity

E

155% capacity

	Activity suffering impact							
Recreational Use	Fishing	Motor boating	Waterskiing	Sailing	Canoeing	Swimming	Sunbathing	Aesthetic enjoyment
Fishing	--	◐	◐	○	○	○	○	○
Motor boating	●	--	◐	◐	◐	●	◐	●
Waterskiing	●	◐	--	◐	◐	●	◐	●
Sailing	○	◐	◐	--	○	◐	○	○
Canoeing	○	◐	◐	○	--	○	○	○
Swimming	◐	◐	◐	○	○	--	○	◐
Sunbathing	○	○	○	○	○	○	--	◐
Aesthetic enjoyment	○	○	○	○	○	○	○	--

● Major effect on impacted activity
◐ Moderate effect on impacted activity
○ Minor or no effect on impacted activity

Figure 1: Recreational Use Compatibility Matrix

Motorized watercraft, and especially at high concentrations, can inflict a variety of damages on aquatic ecosystems. In the 2002 University of Wisconsin-Extension publication titled *How's the Water? - Planning for Recreational Use on Wisconsin Lakes & Rivers*,[10] the authors make three key observations pertaining to the environmental impacts of motorized watercraft. First, aquatic plant disturbance, shoreline erosion, and reduced water clarity from sediment re-suspension are all serious issues that can be exacerbated by boat traffic. These causal relationships are well documented in the existing body of scientific literature, including research conducted on Lake

[10] University of Wisconsin-Extension. 2002. How's the Water? – Planning for Recreational Use on Wisconsin Lakes & Rivers.

Ripley.[11] Second, most boating impacts are felt most directly in shallow waters of less than several feet deep. Third, these effects can have repercussions for other features of the aquatic ecosystem, including fish and wildlife communities.

Increased boat traffic can have far reaching ramifications on safety, environmental health, and the public's ability to use and enjoy the lake. A lake's recreational carrying capacity is the point at which it becomes a problem serious enough to warrant management. According to Jaakson et al. (1989), "carrying capacity should not be perceived as a measure but instead as a range of estimates which also reflect the demands of users and the level of environmental quality that they are willing to accept."[12]

> The ability of a water body to accommodate particular types of uses and a given number of users within defined levels of ecological disturbance and inter-use conflicts may be termed its 'carrying capacity.' Carrying capacity differs for each water body. It depends both upon natural characteristics and acceptable limits of environmental disturbance and activity conflict. Determination of the former requires objective factual studies, definition of the latter a subjective weighing of values…[13]

The need to approximate carrying capacity increases as the demand for water-based recreation intensifies due to population growth, rising affluence, ease of mobility, increased leisure time, and the popularity of lakes as leisure destinations. "Free public resources like water may inevitably be trampled by too many users, by a single, well-organized group, or by inappropriate technology that simply overwhelms other uses and sometimes destroys the natural resource itself."[14] In other words, carrying capacity attempts to answer the question: how much is too much?

Wagner (1991) concluded that the impacts of motorized watercraft appear to be largely density dependent; increased use translates into increased potential for impact.[15] However, while there is an increasing store of research and published opinions on the subject of optimal boating densities, no universal boating density standard will satisfy all lake users under all situations. Carrying capacity will undoubtedly vary depending on a given lake's physical characteristics, its susceptibility to environmental damage, the manner in which it is used, and the demands and perceptions of its users. While the first three variables can be scientifically measured or

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[11] Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.
Asplund, T.R. and C.M. Cook. 1997. Effects of Motor Boats on Submerged Aquatic Macrophytes. Journal of Lake and Reservoir Management, 13(1): 1-12.
[12] Jaakson, R., M.D. Buszynski and D. Botting. 1990. Carrying Capacity and Lake Recreation Planning. The Michigan Riparian, November 1989, pp. 11-12, 14.
[13] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.
[14] Klessig, Lowell L. 2001. Load Limits for Lakes. Article, University of Wisconsin – Extension.
[15] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

estimated, the fourth requires more subjective interpretation, which can be aided by lake-user opinion surveys and applicable research on social carrying capacities.

On the surface, the basic premise of carrying capacity seems simple. There is only so much useable surface area on a particular water body, which, in turn, limits the number of watercraft that can safely use the lake. However, what is considered useable lake surface? How much space does each type of watercraft need to ensure adequate safety? In what manner is the lake currently used, and what are the expectations of its users? Are there environmental impacts associated with existing use patterns that should be addressed? Finally, who (if anyone) should get priority use of the lake if access controls are deemed necessary?

The Lake District was fortunate to be able to answer many of these questions using information obtained from a variety of past studies and management-planning exercises. These efforts consisted of aquatic plant and biological inventories, water quality and pollutant-identification investigations, resource assessments, lake-user opinion surveys, a motor boat impact study, and watercraft census reports. This wealth of lake-specific information proved critical in making informed value judgments about Lake Ripley's estimated carrying capacity. Finally, existing research and published opinions on optimum boating densities were evaluated. These expert opinions, whenever applicable, were used as a basis for establishing a range of carrying capacity estimates for Lake Ripley.

3-3 LAKE ACCESS

Lake Ripley offers both private and public forms of recreational access. Dense residential development is concentrated mostly within a half-mile band around much of the lake's shoreline, and includes about 160 lakefront homes. There are also several "keyhole" subdivisions where a single lakefront lot serves as a shared access point for a larger, off-lake development. Of those who own lakefront property, over half are part-time, seasonal residents.

Boats parked along a community pier on Lake Ripley.

Individuals without lakefront property or deeded lake-access rights have the option of using a public boat launch located at the north end of the Island Lane peninsula. The boat landing is owned and managed by the Town of Oakland. It provides for 16 parking spaces that can accommodate vehicles with trailers, as well as a pier, port-a-potty, garbage dumpster and self-registration kiosk. A daily permit fee of $7.00 is charged for the use of the landing between May 1 and September 30. Yearly permit fees are $20.00 for Oakland property owners/residents and senior citizens, and $30.00 for all other users.

In addition, the Town of Oakland owns and manages a public fishing and swimming pier on the northeast shore. There is also a privately owned marina with a boat launch at the south end of the lake, and a community beach (Lake Ripley Park) on the west shore that offers walk-in access. The marina and park are both privately owned and require nominal user fees. Access locations are depicted in Figure 23 below.

Left: A view of the public boat landing owned and maintained by the Town of Oakland. **Middle**: Public fishing and swimming pier on 65 feet of shoreline owned by the Town of Oakland. **Right**: Lake Ripley Marina

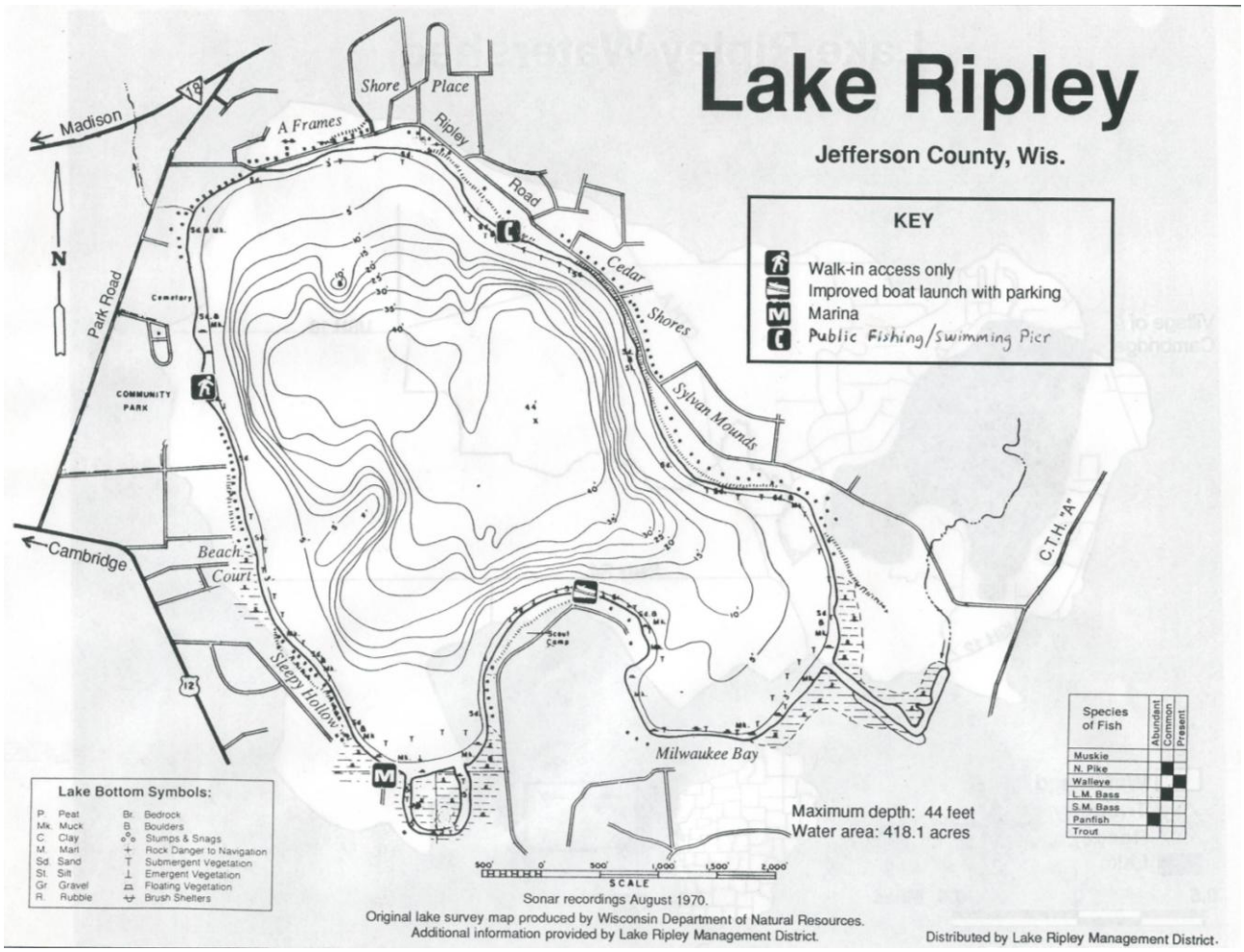

Figure 2: Lake Ripley Access Locations

3-4 LOCAL BOATING ORDINANCES

Protected, shoreline "sensitive areas" were established through a Town of Oakland pier ordinance in 1995.[16] These ecologically-valuable shoreland areas were previously found to harbor high-quality aquatic and wetland plant communities. The ordinance restricted the ability to expand or develop new piers, wharves and swim rafts within mapped areas without a Wisconsin DNR permit review. While it did not directly regulate boat traffic, the ordinance indirectly limited boating-related activities by controlling the expansion of docking areas.

Slow-no-wake buoys found in Lake Ripley's South Bay.

Slow-no-wake and no-motor zones were also adopted to protect these sensitive habitat features. Slow-no-wake zones established by Town ordinance include buoyed portions of both bays, and within 200 feet of any shoreline (marked by several reference buoys). A no-motor zone, where the use of all gas and electric motors is prohibited, is located in Vasby's Channel. No-motor buoys are positioned at both entrances of the horseshoe-shaped channel. There is also a no-wake time period in effect from 7:30 p.m. to 11:00 a.m. daily.[17] A compilation of lake-related ordinances and boating rules can be found in Appendix D.

3-5 ON-LAKE BOATING PATTERNS

A watercraft census and recreational carrying capacity analysis was completed for Lake Ripley in 2003.[18] Based on extensive monitoring during the 2003 boating study, it was found that there was an average of 10.5 boats operating on the lake at any given time, or one boat per 39.8 acres of total lake surface. These boats were represented as follows: fishing boats (53.5%), speed boats (20.8%), pontoon boats (17.5%), personal watercraft (4.6%), paddle craft (2.6%) and sailboats (1.4%). The distribution of watercraft is shown graphically in Figure 24. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was almost 4:1.

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[16] Town of Oakland. 1995. Ordinance #42: An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley.
[17] Town of Oakland. 2006. Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.
[18] Lake Ripley Management District. 2003. Lake Ripley Watercraft Census and Recreational Carrying Capacity Analysis.

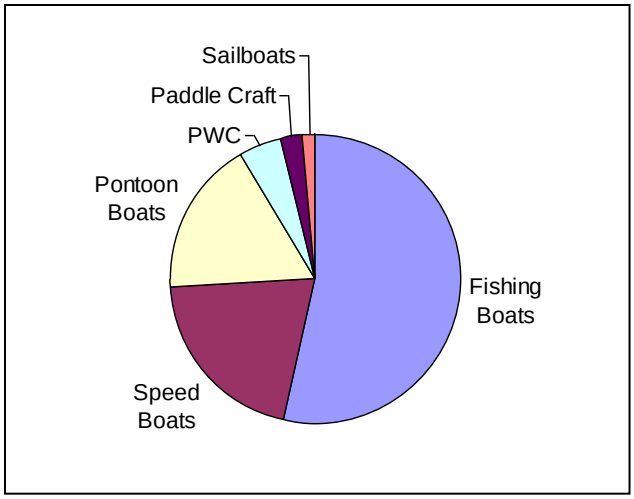

Figure 3: Watercraft Observed During All Hours of Study Period (2003)

During no-wake hours on mid-summer weekends and holidays, there was an average of 9.2 boats operating on the lake at one time, or one boat per 45.4 acres of total lake surface. These boats were represented as follows: fishing boats (84.2%), pontoon boats (8.4%), speed boats (3.4%), paddle craft (2.2%), personal watercraft (1.0%) and sailboats (0.8%). The distribution of watercraft is shown graphically in Figure 25. Because observations were made during the enforceable slow-no-wake period, all watercraft were slow-moving or stationary.

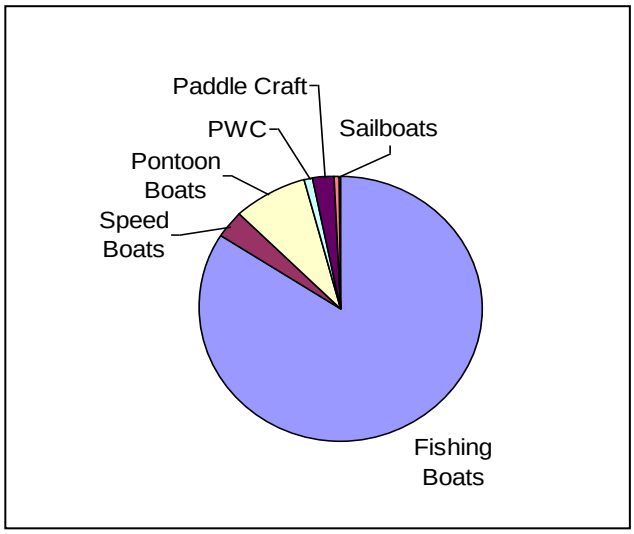

Figure 4: Watercraft Observed During No-Wake Hours (July-August Weekends/Holidays)

During wake hours on mid-summer weekends and holidays, there was an average of 23.6 boats operating on the lake at one time, or one boat per 17.7 acres of total lake surface. This represented the peak-use boating period for Lake Ripley. Observed boats were represented as follows: speed boats (38.7%), pontoon boats (26.4%), fishing boats (20.1%), personal watercraft (11.1%), paddle craft (2.3%) and sailboats (1.5%). The distribution of watercraft is shown

graphically in Figure 26. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was 1.5:1. It was found that average boating densities and distributions by watercraft type were consistent with findings from a 1995 census, which evaluated similar time periods.

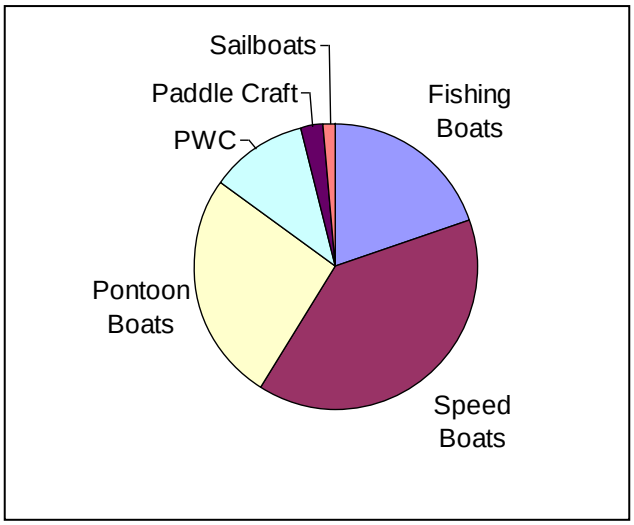

Figure 5: Watercraft Observed During Wake Hours (July-August Weekends/Holidays)

Boating densities occasionally reached highs of one boat per 8.5-10.5 acres of total lake surface, or 40-50 watercraft using the lake at one time. For the 2003 study period, maximum counts by boat type were as follows: speed boats (30), pontoon boats (22), fishing boats (20), sailboats (13), personal watercraft (8), and paddle craft (4). The maximum number of boats observed pulling a skier or tuber was 15.

Peak boating densities were typically reached between the late-afternoon hours of 3:00 and 5:00 p.m. on mid- to late-summer weekends and holidays. Fishing boats were generally the most dominant watercraft during the morning no-wake hours. After 11:00 a.m., the number of fishing boats usually decreased precipitously while the number of speed boats, pontoon boats and personal watercraft increased. Total boat counts typically declined by the early evening hours, although the number of fishing boats and pontoon boats occasionally spiked again during this timeframe. There did not appear to be any correlation between time of day and the number of paddle craft or sailboats using the lake.

3-6 PARKED/MOORED WATERCRAFT

During the 2003 boating study, a mid-summer count was taken of watercraft parked around the lake. Information was also gathered on numbers of swimming rafts, piers and boatlifts. This type of census was repeated on an annual basis during subsequent boating seasons. Several years of results are presented in Table 6 below. Numbers represent totals for each type of parked watercraft observed along the shoreline during the given year. Percentages represent each watercraft's relative contribution to the total for that year. The information is also presented graphically in Figures 27 and 28.

Table 1: Annual counts of piers, boat lifts, rafts and parked boats on Lake Ripley (2003-2009)

Moored Watercraft	Summer 2003	Summer 2004	Summer 2005	Summer 2006	Summer 2007	Summer 2008	Summer 2009
Pontoons	147 (31%)	155 (35%)	162 (35%)	169 (33%)	182 (38%)	170 (34%)	166 (34%)
Runabouts	121 (25%)	109 (25%)	128 (27%)	131 (26%)	123 (26%)	122 (25%)	118 (24%)
Motorized Fishing	75 (16%)	36 (8%)	27 (6%)	33 (6%)	29 (6%)	36 (7%)	35 (7%)
Non-motorized	87 (18%)	92 (21%)	104 (22%)	118 (23%)	93 (19%)	119 (24%)	107 (22%)
Sailboats	15 (3%)	10 (2%)	10 (2%)	17 (3%)	12 (3%)	6 (1%)	13 (3%)
Jet Skis	30 (6%)	38 (9%)	35 (8%)	42 (8%)	41 (9%)	41 (8%)	43 (9%)
Total:	475	440	466	510	480	494	482
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Rafts	19	12	15	29	22	18	20
Piers	167	No data	168	166	180	182	167
Boatlifts	179	No data	212	198	240	210	248
Avg. # of Boats per Pier*	2.8	No data	2.8	3.1	2.7	2.7	2.9

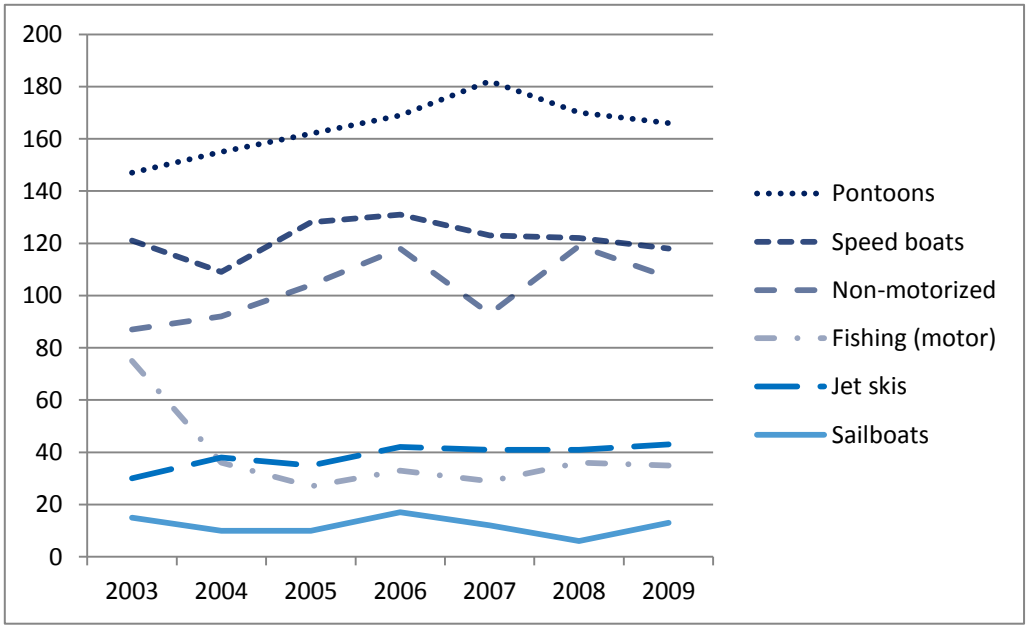

Figure 6: Parked Watercraft Counts (2003-2009)

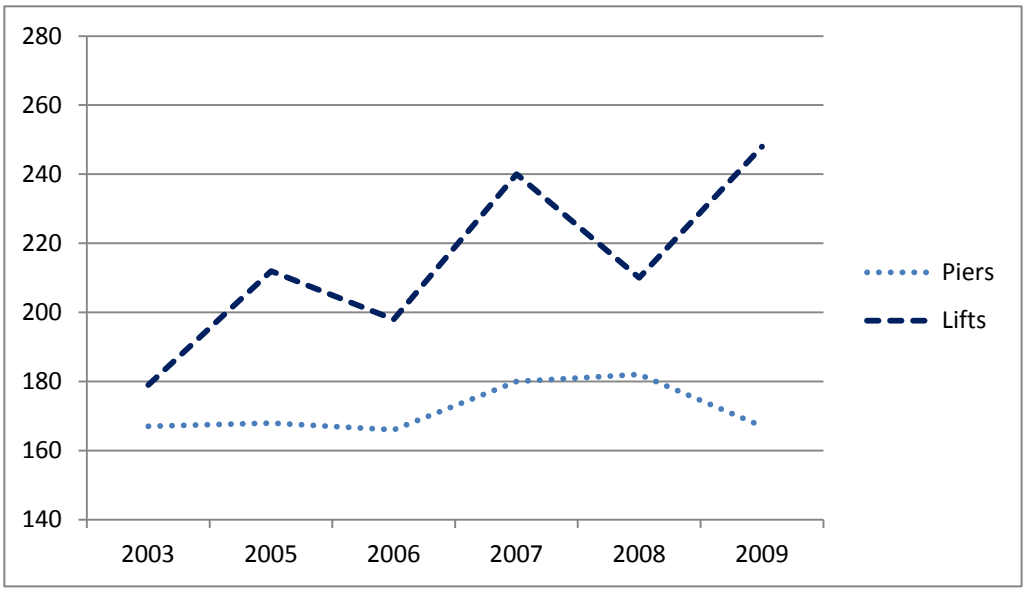

Figure 7: Pier and Boat Lift Counts (2003-2009)

3-7 USE OF PUBLIC BOAT LANDING

During mid-summer weekends and holidays, there was an average of 13.8 parked vehicles observed at the landing. This equates to 86.5% of capacity based on a maximum of 16 legal parking spaces, and assuming vehicles were equipped with boat trailers. In actuality, the number of parked vehicles routinely exceeded the number of available parking spaces, and most but not all vehicles had trailers. The maximum number of parked vehicles observed at one time was 27.

Town of Oakland's public boat landing off Island Lane.

According to launch-registration records obtained from the Town of Oakland, there were 1,743 daily launches during the four-month study period (May 1–September 1). This figure does not include boat launches that may have been made by any of the nearly 200 seasonal pass holders. It also does not account for daily launches that may have occurred without subsequently needing to park a vehicle at the facility. Only 3.8% of publicly-launched boats were registered out of state. The average number of daily pass users on weekdays was 9.4, while on weekends/holidays it was 22.5. A maximum of 36 daily pass users occurred on a Sunday in early June.

Given the average number of boats actively using the lake during wake hours on mid-summer weekends/holidays (23.6), it was estimated that an average of 53.4% gained access through the public landing. This percentage was generated from observation events that included both a trailer count and an on-lake watercraft count occurring within less than one-half hour of each other. The estimate is based on the assumption that each vehicle parked at the landing was associated with one publicly launched boat during the time of observation. It does not account

for boat launches that may have taken place without a vehicle subsequently being parked at the public landing. This distribution suggests that an average of only 2.3% of the 475 moored or beached watercraft surveyed in 2003 were actively using the lake at any given time during wake hours on mid-summer weekends/holidays.

3-8 CARRYING CAPACITY FORMULA

Lake Ripley's recreational carrying capacity was defined as the number of watercraft that can simultaneously operate on the lake without 1) compromising user safety; 2) causing significant user displacement or dissatisfaction; and 3) causing environmental harm to the resource. This number will vary depending on the actual mix of lake uses and watercraft speeds present on the lake at any given moment.

The formula used to evaluate Lake Ripley's carrying capacity was partially based on methods developed by the U.S. Army Corps of Engineers,[19] and modeled after a carrying capacity procedure used to evaluate several lakes in Southwestern Michigan.[20] It consisted of:

1) calculating a useable lake area that could support a range of boating activities/speeds safely and without significant environmental impact;

2) establishing minimum spatial requirements for various boating activities/speeds;

3) determining the number of watercraft that use the lake during periods of peak use, and the relative proportions of those watercraft engaged in different activities/speeds;

4) choosing optimum boating densities for the range of lake-use activities/speeds; and

5) comparing actual use to the lake's estimated carrying capacity.

USEABLE LAKE AREA

In estimating Lake Ripley's recreational carrying capacity, the first step was to determine the useable surface area that could accommodate a mix of lake uses. This area was first calculated by subtracting portions of the lake that are already user restricted (for safety and environmental reasons) from the lake's total surface area. These areas included slow-no-wake zones within 200 feet of the shoreline, buoyed no-wake sections within both major bays, and the 100-foot no-wake zone around the buoyed restricted swim area at the Lake Ripley Park beach. The restricted zones described above were subtracted from the total lake surface to arrive at a "useable" area in which mixed recreational activities could comingle. This calculation—referred to as Scenario #1—removed 120 of the 423 total surface acres, leaving a 303-acre useable lake area (Figure 29).

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[19] U.S. Army Corps of Engineers. 1994. Cumulative impacts of recreational boating on the Fox River-Chain O'Lakes area in Lake and McHenry Counties, Illinois: Final Environmental Impact Statement.

[20] Progressive Architecture Engineering. 2001. Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake. Project #51830106.

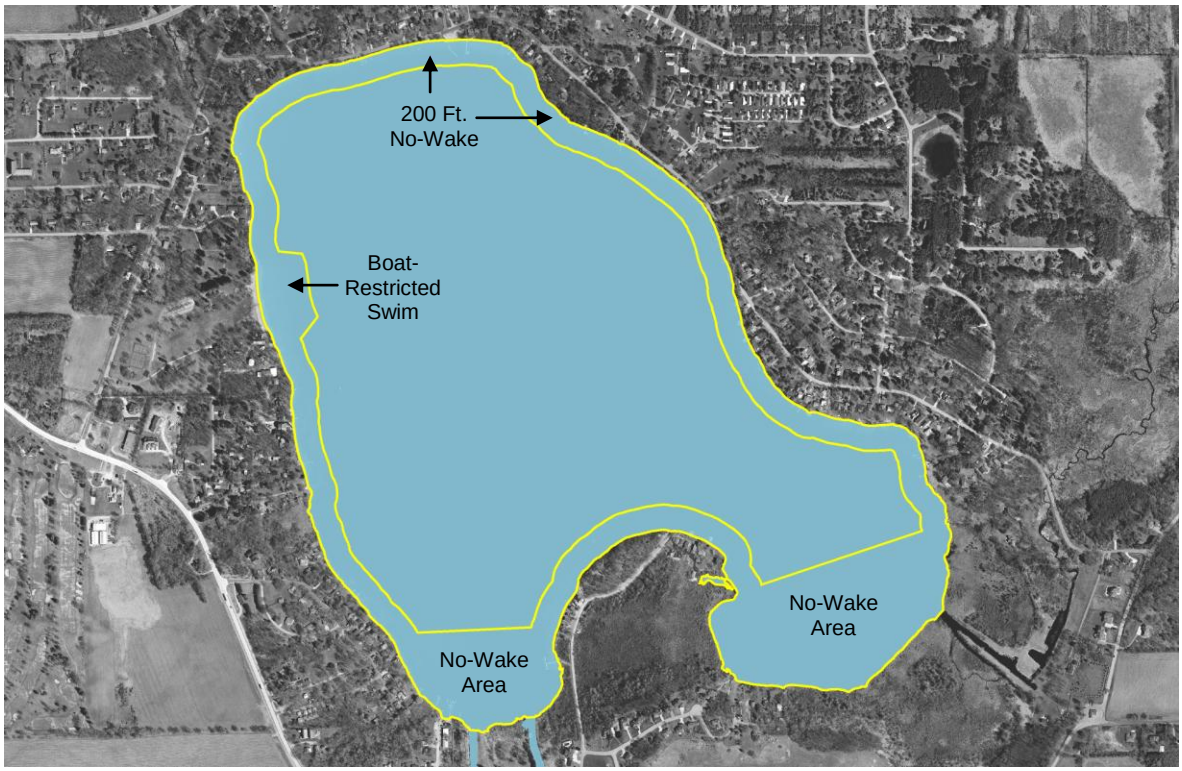

Figure 8: Scenario #1 Useable Lake Area

In this case, useable area describes the portion of the lake surface that is equally available and unrestricted for all competing uses. No attempt was made to expand this area by trying to assign user location preferences, as they can vary widely among and within the different user groups. Expansion of the useable area is considered appropriate only when an *overwhelming* predominance of passive lake uses (i.e. those involving stationary or slow-moving watercraft) are attempting to share the same recreational space. This is the only situation reasonably guaranteeing that user encroachment into the restricted zones is done legally and voluntarily across the board, rather than as a result of forced displacement. In this situation, the useable area may be extended to the 3-foot depth contour. Three feet was chosen to represent the minimum depth necessary to support a range of watercraft types, assuming they maintain idle speed.

After subtracting those portions of the lake that are already restricted according to State law and Town ordinance, the "useable" surface area may be further adjusted to better protect shallow, environmentally-sensitive portions of the lake. Studies have shown that shallow areas are most susceptible to adverse impacts associated with motor boat activities.[21] Impacts include sediment re-suspension, reduced water clarity, and damage to fish and wildlife habitat, among others. Wagner (1991) observed that the shallowness ratio, which compares the area of the lake less than 5 feet deep to the total area, is more indicative of the lake bottom area likely to be directly

[21] Asplund, Timothy R. 1996. Impacts of Motor Boats on Water Quality in Wisconsin Lakes. Monona, WI: Wisconsin Department of Natural Resources, Bureau of Research.
Asplund, Timothy R. 1997. Effects of Motor Boats on Submerged Aquatic Macrophytes. Journal of Lake and Reservoir Management, 13(1): 1-12.

affected by motorized watercraft.[22] Shallowness ratios range from a low of <0.10 for lakes unlikely to be impacted to a high of >0.50 for lakes with a high potential for impact. For Lake Ripley, 143 of its 423 total acres are characterized by less than five-foot water depths, producing a shallowness ratio of 0.34. Under Scenario #2, an additional 38 acres would be removed, leaving a 265-acre useable surface area beyond the five-foot depth contour (Figure 30). Both scenarios and their corresponding useable area calculations are summarized in Table 7.

OPTIMUM BOATING DENSITY

The next step was to determine a range of optimum boating densities for Lake Ripley based on published spatial requirements estimated for various types of watercraft and their associated uses (see Table 8). Most of these published spatial requirements were determined after evaluating user-satisfaction levels under varying boating conditions. Unfortunately, no single boating density standard satisfies all lake users in all situations, especially since each lake is unique and users will have different perspectives on what constitutes congestion.

A number of different methods, each with its own set of analytical variables and assumptions, were used to arrive at the figures published in Table 8. For example, some researchers evaluated the spatial requirements of only a single user group in isolation, while others looked at how optimal boating densities change depending on the interplay among multiple uses. User surveys were commonly employed to gauge feelings of crowdedness under a variety of boating conditions. These opinions will at least partially reflect the conditions and expectations specific to that particular lake or region.

[22] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

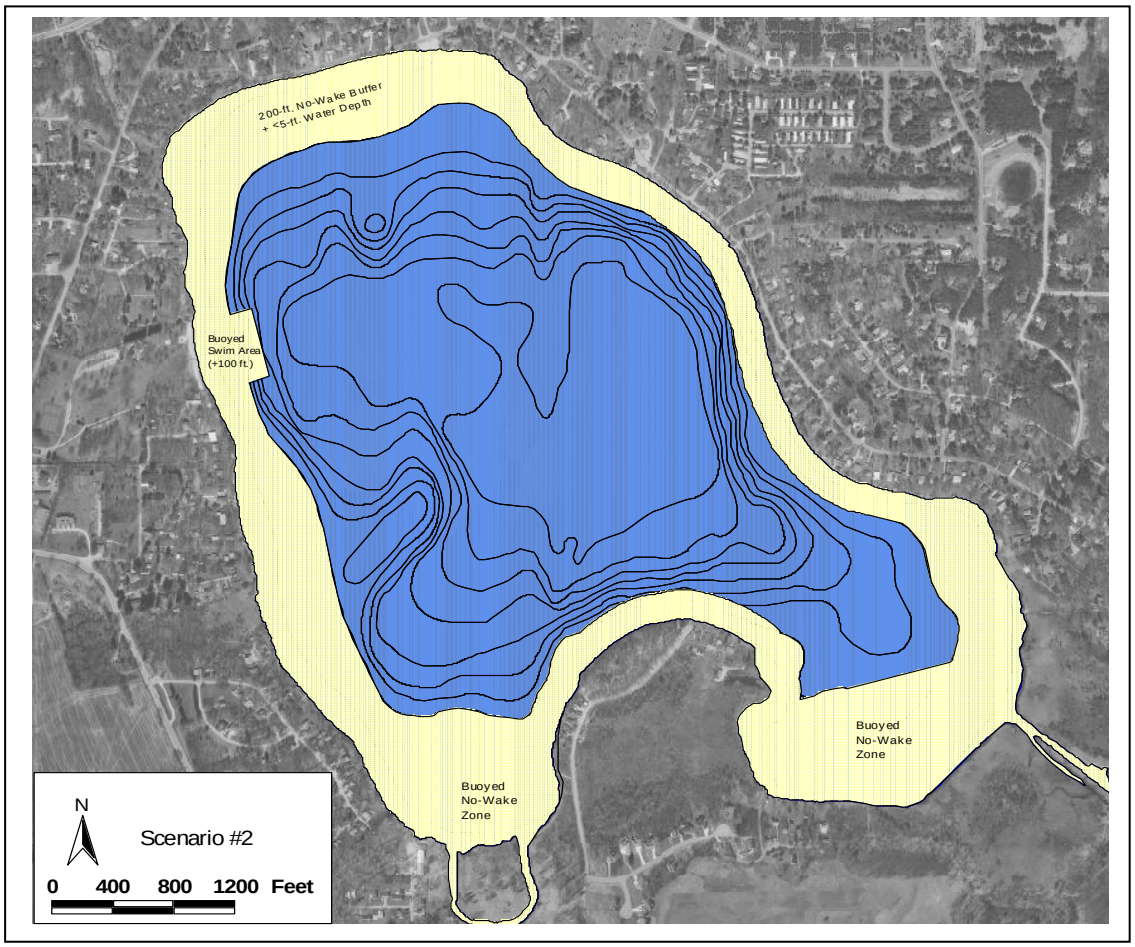

Figure 9: Scenario #2 Useable Lake Area

Table 2: Scenario #1 and #2 useable lake areas

	Total Lake Area (Acres)	General Restricted Area (Acres)*	Useable Lake Area for All Uses (Acres)
Scenario #1	423	120	303
Scenario #2	423	158	265

***** Figures are based on a mix of competing boating activities/speeds attempting to share the same recreational space. They do not reflect user location preferences, as they may vary considerably among and within the different user groups.

Table 3: Summary of published optimum boating densities[23]

Source	Boating Uses	Suggested Density
Ashton (1971)[24]	All uses combined in Cass Lake	5 to 9 acres/boat
	All uses combined in Orchard Lake	4 to 9 acres/boat
	All uses combined in Union Lake	6 to 11 acres/boat
Kusler (1972)[25]	Waterskiing combined with all other uses	40 acres/boat
	Waterskiing only	20 acres/boat
	Coordinated waterskiing	15 acres/boat
Jaakson *et al.* (1989)[26]	Waterskiing and motorboat cruising	20 acres/boat
	Fishing	10 acres/boat
	Canoeing, kayaking, sailing	8 acres/boat
	All uses combined	10 acres/boat
Wagner (1991)[27]	All boating activities	25 acres/boat
Warbach *et al.* (1994)[28]	All motorized (>5 HP) uses	30 acres/boat

[23] Progressive Architecture Engineering. 2001. Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake. Project #51830106.
[24] Ashton, P.G. 1971. Recreational Boating Carrying Capacity: A preliminary study of three heavily used lakes in southeastern Michigan. Doctoral Thesis, Department of Resource Development, Michigan State University.
[25] Kusler, Jon A. 1972. Carrying Capacity Controls for Recreation Water Uses. Upper Great Lakes Regional Commission.
[26] Jaakson, R., M.D. Buszynski and D. Botting. 1990. Carrying Capacity and Lake Recreation Planning. The Michigan Riparian, November 1989, pp. 11-12, 14.
[27] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

Each researcher's methodology and set of assumptions had to be carefully evaluated to determine the degree of applicability to Lake Ripley. Reported density figures for each lake use, or combination of lake uses, were also compared to identify accepted value ranges. Ultimately, the greatest weight was given to those figures that 1) were generated from the most relevant and replicable research methods, and 2) showed the highest correlation across studies.

Next, a sliding scale of optimal boating densities was formulated. A sliding scale was chosen as a means of capturing the range of lake uses and watercraft speeds that may be observed at any given time. Threinen's (1964) theory that a boat's space requirements are directly proportional to the speed at which the boat is traveling provided the basis for this scale.[29] Activities involving more passive boating behavior (i.e., fishing and canoeing) would translate into lower values on the scale, while more aggressive activities (i.e., waterskiing and high-speed boating) would translate into higher values.

The above procedure yielded an optimal density range of 10-30 acres per boat for Lake Ripley. The range of spatial requirements was believed to reflect the best research available at the time, and should be fine tuned whenever new and better information is forthcoming. Following this guidance, a low 10-acre-per-boat spatial requirement would be selected when the lake is dominated by stationary and slow-moving watercraft (passive boating activities). Alternatively, a high 30-acre-per-boat spatial requirement would be selected when the lake is dominated by fast-moving watercraft (aggressive boating activities). A mean optimum density of 20 acres per boat assumes a relatively equal mix of stationary, slow- and fast-moving boats engaged in a full spectrum of activities. The optimum density would consequently vary along this scale, and would depend on the proportion of slow-moving and stationary to fast-moving watercraft in relation to the useable lake area calculation (see Tables 9 and 10).

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[28] Warbach, J.D., M.A. Wyckoff, G.E. Fisher, P. Johnson and G. Gruenwald. 1994. Regulating Keyhole Development: Carrying capacity analysis and ordinances providing lake access regulations. Planning and Zoning Center, Inc.

[29] Threinen, C.W. 1964. An Analysis of Space Demands for Water and Shore. Wisconsin Conservation Department.

Table 4: Scenario #1 carrying capacities for Lake Ripley

Lake-Use Mix (Prevailing Boat Speeds)	Optimum Boating Density (Acres/Boat)	Scenario #1 Useable Lake Area (Acres)	Carrying Capacity (Total # of Boats)
100% Idle Speed or Stationary	10	378*	38**
75% Idle Speed or Stationary & 25% Fast Moving	15	303	20
50% Idle Speed or Stationary & 50% Fast Moving	20	303	15
25% Idle Speed or Stationary & 75% Fast Moving	25	303	12
100% Fast Moving	30	303	10

* Figure is adjusted to include all portions of the lake that are at least 3 ft. deep, with the exception of boat-restricted swim areas. 3 ft. is chosen as the minimum depth to support a range of boat types at idle speed.

** Figure assumes 100% passive lake uses with equal opportunity to access restricted, no-wake areas (and not as a result of forced displacement). Other figures represent shared, mixed-use situations.

Table 5: Scenario #2 carrying capacities for Lake Ripley

Lake-Use Mix (Boat Speeds)	Optimum Boating Density (Acres/Boat)	Scenario #2 Useable Lake Area (Acres)	Carrying Capacity (Total # of Boats)
100% Idle Speed or Stationary	10	378*	38**
75% Idle Speed or Stationary & 25% Fast Moving	15	265	17
50% Idle Speed or Stationary & 50% Fast Moving	20	265	13
25% Idle Speed or Stationary & 75% Fast Moving	25	265	10
100% Fast Moving	30	265	9

* Figure is adjusted to include all portions of the lake that are at least 3 feet deep, with the exception of boat-restricted swim areas. 3 ft. is chosen as the minimum depth to support a range of boat types at idle speed.

** Figure assumes 100% passive lake uses with equal opportunity to access restricted areas (and not as a result of forced displacement). Other figures represent shared, mixed-use situations.

3-9 CARRYING CAPACITY RESULTS

According to 2003 lake-use data, there was an *average* of 24 boats operating on Lake Ripley *during wake hours on mid-summer weekends and holidays*. This particular timeframe was chosen to represent the peak, mixed-use recreational period for the lake. The average ratio of slow-moving and stationary to fast-moving watercraft during this period was 1.5:1 (60% vs. 40%, respectively), resulting in an optimum boating density of 18 acres per boat on the sliding scale. Using this applied density standard, recreational carrying capacity would be 17 boats under Scenario #1 and 14 boats under Scenario #2 for these average boating conditions.

The above findings indicate that average boating densities in 2003 were between 141% and 171% of Lake Ripley's carrying capacity, depending on which of the two useable-lake-area calculations is used. Carrying capacity was ultimately exceeded 16 out of the 17 observed days that fell within this peak, mixed-use timeframe. Even in the hypothetical but impractical absence of any restricted areas on the lake, average boating densities would still represent 104% of estimated carrying capacity. Alternatively, observed boating densities during no-wake hours never exceeded carrying capacity.

From 1998-2008, random boat counts were taken by Lake Watch volunteers during the defined peak-use periods. These census data show an average of 20 boats using the lake at any given time. While slightly less than the average 24 boats documented during the 2003 study, the 10-year data record suggest that estimated carrying capacity is regularly and consistently exceeded during peak use. This analysis suggests a high probability of user conflict and potential environmental degradation on Lake Ripley due to overcrowding on busy, mid-summer weekends and holidays.

In 2009, the Lake District solicited volunteers who boat on Lake Ripley to serve on a focus group, namely for the purpose of evaluating factors that influence boating behaviors. A total of 10 local property owners and frequent boaters agreed to participate by maintaining detailed boating logs. Volunteers included both on-lake and off-lake property owners, and they used a variety of different (but mostly motorized) watercraft on the lake. A follow-up questionnaire revealed positively that all but one of the focus group participants either "never" or "rarely" encountered unfavorable lake conditions (irrespective of weather) that inhibited their preferred boating activities. Even so, the top reason for deciding *not* to boat on the lake was "too much general boat traffic," which was also cited as the least appealing factor about Lake Ripley as it applied to their preferred activities. In the future, it may prove useful to expand the sample population targeted by this type of survey, particularly for the purpose of producing statistically relevant information that is more representative of the larger boating community.

3-10 MANAGEMENT OPTIONS AND RECOMMENDATIONS

Evidence suggests that boating conditions on Lake Ripley regularly exceed the lake's estimated carrying capacity during periods of peak use. As a result, recreational safety and environmental quality are likely to be jeopardized absent measures to reduce overcrowding or control boat traffic. If future problems are to be averted, it is incumbent upon local policy makers to devise boating ordinances that balance the physical limitations of the resource with the demands of its users.

Common measures used to manage the causes and impacts of overcrowding include land-use controls, public access limitations, pier ordinances, and any number of watercraft-related restrictions (i.e. speed limits, lake-use zoning, outright bans, etc.). When considering such measures, care must be taken to strike a fair balance between the interests of the private riparian and the general public. To exclude either local riparians or the public in any given situation would raise serious policy as well as legal questions. Town of Oakland ordinances related to access and lake use are listed in Table 11 below. Summary information pertaining to some of these ordinances and other rules are contained in Appendix D.

Table 6: Scenario #2 carrying capacities for Lake Ripley

Ordinance Number	Adoption or (Amendment) Date	Title	Description
2	07/18/06	An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document	Sets forth public boat launch fees; slow-no-wake times; slow-no-wake zones; and emergency no-wake rules during flood events
3	04/18/89 (03/18/96)	An Ordinance to Prohibit the Use of Boats Being Propelled by Motors in the Man-Made Channel Area of Lake Ripley…	Prohibits the use of motors of any kind (including electric) trolling motors in Vasby's Channel located in South Bay
4	05/16/89 (09/30/08)	Regulation of Fishing and Hunting	Adopts provisions of Ch. 29, Wis. Stats. relating to the harvesting of fish and game
13	12/17/74	Adoption by resolution of Jefferson County Zoning Ordinance No. 11	County shoreland zoning provisions for unincorporated areas dealing with building setbacks, shoreline vegetation

			removal, land disturbance, etc.
30	04/20/99	An Amendment to Ordinance No. 30 to Regulate the Burning of Yard Waste Near Lake Ripley	Prohibits burning yard waste within 25 feet of Lake Ripley or any of its continuously flowing streams and drainage channels.
42	03/21/95	An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley	Prohibits new or expanded piers, wharves and swimming rafts without a DNR permit along shorelines mapped as "sensitive"
51	05/15/01	An Ordinance to Prohibit the Intentional Feeding of Geese and other Waterfowl on or Adjacent to Lake Ripley	Prohibits the hand-feeding of waterfowl or the use of feeding stations that can attract nuisance populations
55	02/21/06	An Ordinance to Prohibit Keyhole Developments on Lake Ripley	Prohibits new subdivision developers from granting lake access to off-lake lots through a commonly-owned shoreline area
58	11/18/08	Adoption of Town of Oakland Comprehensive Growth Plan	Goals include prohibiting development within floodplains and wetlands; protecting unique environmental areas; promoting good soil conservation practices; and protecting surface and ground water quality.

A brief overview of some available management strategies and their potential relevance to Lake Ripley is presented below. This list of strategies and subsequent discussion is not intended to be exhaustive, nor is it intended to advance any particular policy agenda. Rather, it is meant as a starting point and framework for future discussion and decision making.

SELF-REGULATION

A lake's capacity for safe and enjoyable use is finite. It is a function of user types, preferences and perceptions, as well as the actual physical limitations of the resource. Regardless of the lake, user satisfaction and perceptions of safety will typically decline in response to increased levels of boating congestion. Therefore, recreational use on lakes becomes partially self-regulating. Riparian users can self-regulate by basing lake-use decisions on a minute-by-minute assessment of weather and boating conditions. On the other hand, non-riparian users will generally self-regulate on a less frequent basis. These users must travel greater distances and expend greater effort to access the lake, and may be less inclined to abort their plans once they have arrived—even when less than optimal conditions are encountered. However, a negative boating experience may encourage these users to cut their time on the lake short. It may also dissuade them from returning unless conditions are known to have changed for the better.

Relying on self-regulation as a recreational management strategy is not recommended for Lake Ripley. In the University of Wisconsin-Extension publication titled *How's the Water: Planning*

for Recreational Use on Wisconsin's Lakes and Rivers, the authors point out that "People often continue (or learn) to be satisfied even when conditions become more crowded, often to the detriment of the resource. This phenomenon results in more bodies of water being managed for higher densities. The acceptance of crowded conditions results in fewer opportunities to manage for lower use levels."[30] It also favors users and activities that are more tolerant of these conditions.

> Perhaps the commonest circumstance under which societies fail to perceive a problem is when it takes the form of a slow trend concealed by wide up-and-down fluctuations…Politicians use the term "creeping normalcy" to refer to such slow trends concealed within noisy fluctuations. If the economy, schools, traffic congestion, or anything else is deteriorating only slowly, it's difficult to recognize that each successive year is on the average slightly worse than the year before, so one's baseline standard for what constitutes "normalcy" shifts gradually and imperceptibly.[31]

The laissez faire policy of self-regulation is also inherently inequitable for two main reasons. First, it establishes a first-come, first-served basis of lake use. Second, it does nothing to prevent more dominant and aggressive activities from displacing more passive uses, such as those that may be most sensitive to noise, boat wakes and congestion. As crowding increases, so does the level of user conflict and frustration. Boaters must then choose whether to accept riskier operating conditions, or alter the timing and nature of their preferred lake-use activity. They may also have little choice but to encroach upon areas of the lake that are environmentally sensitive or less suited for their desired activities. The end result is an overall decrease in environmental quality, equity, and lake-user satisfaction. Consequently, attempting to allow the lake to self regulate may prove to be an ineffective and inequitable control measure.

PUBLIC-ACCESS CONTROLS

Facility Design

Lake Ripley's public boat landing is owned and operated by the Town of Oakland. It currently allows unlimited launches, but provides only a limited number of legal parking spaces (16) that can accommodate vehicles and their attached trailers. Users must purchase a daily or seasonal launch pass in order to leave their vehicle parked at the facility following the launch of a watercraft. While parking availability generally limits the number of public boat launches, it does not prevent users from launching a boat and parking elsewhere when the lot is full. In fact, on busy days, up to a half-dozen vehicles with trailers routinely end up at Ripley Park.[32] Illegal parking on Island Lane has also been observed, thereby effectively increasing the capacity of the landing.

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[30] University of Wisconsin-Extension. 2002. How's the Water? – Planning for Recreational Use on Wisconsin Lakes & Rivers.
[31] Jared M. Diamond, author of Collapse: How Societies Choose to Fail or Succeed
[32] Richard H. Moen, Ripley Park Supervisor, 2003 personal communication

According to the Wisconsin Department of Natural Resources (DNR), a lake has reasonable public boating access and is eligible for natural resource enhancement services when public boating access meets certain standards. For a water body of Lake Ripley's size, the DNR requires one or more access sites which in total provide one car-trailer unit per 30 open water acres.[33] This formula yields a minimum of 14 car-trailer units based on 423 open water acres. Therefore, Lake Ripley currently satisfies the state's minimum public access requirements, making it eligible for funding assistance and resource enhancement services such as fish stocking.

The DNR uses a similar formula to determine whether a lake has too much boating access. If this is found to be the case, the DNR will not pursue public boating access development, nor will it approve permits or provide financial assistance for boating access. For a water body of Lake Ripley's size, the DNR sets a maximum of one car-trailer unit per 15 open water acres.[34] This formula yields a maximum of 28 car-trailer units based on 423 open water acres. The fact that the DNR establishes boating access limits suggests that the state does consider capacity controls at some level.

Providing new public-access facilities or expanding existing facilities that can accommodate increased capacity is not advisable for Lake Ripley. Additional parking capacity would only serve to increase carrying-capacity pressures that already exist on the lake. Furthermore, recent opinion surveys suggest that there are already adequate opportunities for public boating access on Lake Ripley.[35] Currently, watercraft using the public landing represent a significant fraction of the total number of watercraft using the lake at any given time, including during peak-use periods when overcrowding is likely to occur. Expanding the existing facility or constructing new public boating access sites can only exacerbate congestion problems unless special launching restrictions are imposed.

Conversely, reducing available parking may also not prove advisable, especially if such action leads to a loss of state financial assistance and lake-improvement services. Wagner (1991) points out that "Such restrictions may limit density but will not necessarily eliminate impacts by motorized watercraft and may be perceived as unfair by lake users."[36] They may also simply lead to increased use by riparian owners, thereby replacing users turned away by public parking limitations.

Launch Fees

Launching is free at the public landing unless a vehicle is to be parked at the facility. The current fee structure from May 1st to September 30th is set by Town ordinance (2006) as follows:

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[33] NR 1.91(4)(d)
[34] NR 1.91(5)(b)
[35] Lake Ripley Management District. 2007. Lake Ripley Property Owner Opinion Survey.
[36] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

$7.00 for a daily pass; $20.00 for an annual Oakland resident or property owner pass; $30.00 for an annual non-resident/property owner pass; and $20.00 for an annual senior citizen pass.[37]

State law under the Public Trust Doctrine prohibits charging high fees for the purpose of restricting public access. While the Wisconsin DNR encourages free boat launching, it does allow a reasonable launch fee to be charged for the purpose of operating and maintaining a publicly-owned boat access site.[38] According to Section 30.77, Wis. Stats., a reasonable launch fee is one that does not exceed the maximum allowable amount under the following criteria:

(a) *Base fee*. A base is that fee that is charged a state resident vehicle for entrance to the state parks.

(b) *Public boating access surcharges*. Municipalities, lake management districts and other public boating access providers that maintain any of the following services may add to the base fee not more than the following surcharges for vehicles with trailers. No more than the base fee may be charged for non-motorized or non-trailered boats.

1. Attendant when on duty: 0.20 X Base

2. On-site toilet facilities: 0.20 X Base

3. Great Lakes sites: 0.30 X Base

4. Boats 20 ft. in length or more but less than 26 ft.: 0.30 X Base

5. Boats 26 ft. or greater in length: 0.60 X Base

(c) *Daily launch fee*. The total of the base fee and all applicable surcharges, rounded to the nearest quarter of a dollar, shall constitute the daily launch fee. A daily launch fee that is paid shall be valid for all boat access facilities provided by the issuing authority for that day. If different fees are charged by the issuing authority for different access sites, the higher fee shall be allowed for use of all the sites.

(d) *Season pass*. If a launch fee is charged, a season pass at a fee not to exceed 10 times the daily launch fee shall be provided for both residents and non-residents. A mechanism to obtain a season pass shall be provided by the public access provider at the launch site.

(e) *Prior approval required*. Each public boat access provider charging a launch fee in excess of the resident state park daily entrance fee shall provide its fee schedule to the department for approval prior to its adoption. Department approval shall be based solely on demonstration that the provider maintains the facilities or services described in par. (b) that justify charges in excess of the resident state park daily entrance fee and that a season pass is available.

(f) *Existing approved fee structures*. Reasonable fees under pars. (a) to (e) do not apply to access sites which the department has determined in a written decision to have a reasonable fee prior to the effective date of this rule.

(g) *Differential fee based on residency*. Local units of government, including lake management districts, which maintain and operate public boating access sites, may charge differential fees on the basis of residency within the unit of government maintaining or operating the access. If a fee is charged, the fees for a

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[37] Town of Oakland. 2006. Town Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.
[38] s. 30.77, Wis. Stats.

nonresident may not exceed 150% of the fee charged a resident, and nonresident fees may not exceed the maximum allowable amounts except when par. (b) 4 or 5 are applicable.[39]

RIPARIAN-ACCESS CONTROLS

Land-Use Zoning

It is not surprising that high-density shoreland use translates into high-intensity water use. As the number of lakefront lots around a given lake increases, so does the number of potential riparian users, private access points, piers and watercraft. This trend has been evident on Lake Ripley where dense residential development is already concentrated around most of the lake's shoreline.

Keyhole subdivisions are of particular concern since they can greatly exacerbate problems associated with excessive riparian access and lake use. Keyhole or funnel development occurs when a waterfront lot is used to permit access to a larger development located away from the lake. According to Progressive AE (2001), "Funneling allows a large number of individuals to gain access to the lake through a small corridor of lake property, thereby exceeding the natural limitation on access afforded by the existing shoreline."[40] As of 2006, keyhole development is no longer permitted around Lake Ripley.[41]

Marinas can also be a source of controversy when it comes to access and overcrowding. There is presently only one, small marina that operates on Lake Ripley. Because of limited parking at the marina and close proximity of the public landing, this facility is not believed to contribute significantly to boat traffic on the lake. Anecdotal observations by Lake District staff and volunteers in recent years support this opinion. However, expansion of the marina's boat-launching and support capabilities could be cause for concern, as would the addition of other marinas on the lake.

County shoreland zoning and Wisconsin DNR rules governing the placement of piers and other structures in the water are intended to ensure reasonable development while protecting lake quality. Jefferson County's shoreland zoning rules must include minimum standards mandated under Chapter NR 115 of the Wisconsin Administrative Code. They apply to various building activities located within 1,000 feet of a lake and 300 feet from a river or stream in unincorporated areas. These rules include 75-foot building setback requirements from the water's edge, standards for boat ramps, shoreline clear-cutting restrictions, and various other provisions that can help mitigate the environmental impact of structures and surrounding development. A summary of shoreland zoning rules applicable to Lake Ripley can be found in

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[39] NR 1.91(11)

[40] Progressive Architecture Engineering. 2001. Four Township Recreational Carrying Capacity Study – Pine Lake, Upper Crooked Lake, Gull Lake & Sherman Lake. Project #51830106.

[41] Town of Oakland. 2006. Ordinance #55: An Ordinance to Prohibit Keyhole Developments on Lake Ripley in the Town of Oakland.

Appendix D. This summary was adapted from Jefferson County's *Management Plan for Rock Lake, Lake Mills*.[42]

Pier and Boat Ramp Ordinances

In addition to the public boat landing and the marina, there are several private boat ramps on Lake Ripley. At least two of these private ramps serve residents of keyhole subdivisions. These types of access structures could potentially become more prevalent over time. Their construction is currently regulated under county shoreland zoning, but only if they disturb a certain amount of soil or are built on a fairly steep slope. This situation is considered problematic as each new ramp represents another largely uncontrolled access point to the lake. Other problems include a host of environmental and scenic impacts to the shoreline. Many of these impacts are considered to be both cumulative and permanent. It may therefore become necessary to explore local ordinances that can better regulate these structures.

The Town of Oakland already has a pier ordinance in effect on Lake Ripley.[43] This ordinance requires a Wisconsin DNR permit for any new piers in areas designated as sensitive shoreline. These areas are generally associated with riparian wetlands, and include significant portions of both bays and about a 300-foot stretch of shoreline on the lake's west side. Elsewhere on the lake, piers have historically been loosely regulated, and have often evolved into extensive boat-docking facilities. The Wisconsin DNR sets reasonableness standards for piers, requiring a permit only if such standards are exceeded. A summary of the State rules relating to the placement of piers in public waterways can be found in Appendix D.

WATERCRAFT-BASED REGULATION

Bans

Wagner (1991) concluded that the prohibition of all or certain types of watercraft is justified when safety considerations are paramount or when the minimum anticipated level of impact on the lake ecosystem is inconsistent with management objectives.[44] Even so, across the board regulation by boat size or type has been considered an unwarranted restriction of public rights in previous court rulings.[45] These rulings were based chiefly on the Equal Protection clause of the U.S. Constitution and Wisconsin's Public Trust Doctrine. However, the Courts have found laws to violate the Equal Protection clause only when based on an irrational or arbitrary classification.

> While a local boating regulation need not solve all of the watercraft-related problems facing a lake community, a regulation must reflect a thoughtful effort to address an actual threat to public health, safety, welfare or the environment. Although the Courts will generally defer to the policy decisions of elected officials, they may not

[42] Jefferson County Land and Water Conservation Department, Rock Lake Improvement Association, and Joint Rock Lake Committee. 2006. Management Plan for Rock Lake, Lake Mills. p. 108-111.
[43] Town of Oakland. 1995. Ordinance #42: An Ordinance to Regulate the Location of Piers, Wharves and Swimming Rafts on Lake Ripley.
[44] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.
[45] Engfer, William G. 1992. Guidelines for Ordinance Writing & Buoy Placement in Wisconsin Waters. Wisconsin Department of Natural Resources, Bureau of Law Enforcement.

> sustain regulations on the free use of public waters which impose unnecessary restrictions on one type of watercraft, if other watercraft types present similar threats to public health and safety and environmental resources (O'Connor, 1998).[46]

Therefore, unless it can be reasonably established that a certain watercraft type by nature of its design is the cause of a particular problem, an outright ban may not be legally feasible.

Horsepower and Speed Limits

> Horsepower limits represent a modified form of prohibition, which addresses engine size but not watercraft design or operational features. Speed limits address the operational features in a general way but do not consider engine size or watercraft design. Horsepower limits are easier to implement and enforce than speed limits, while the latter are more likely to minimize disruptive ecological effects than horsepower limits. Either may be construed as unfair or arbitrary by some user groups for logical reasons. If either horsepower or speed limits are to be employed, it is advisable to base the established limit on a scientifically-defensible rationale and the specific characteristics of the lake in question. Blanket coverage of a region by these limits is apt to be inappropriate (Wagner, 1991).[47]

As with bans by boat size or type, across-the-board regulation by horsepower has been considered an unwarranted restriction of public rights in previous court rulings.[48] The Wisconsin Department of Natural Resources takes the position that ordinances regulating horsepower are overly restrictive and cannot be justified because they do not account for the fact that larger horsepower motors can be operated within established speed limit.[49] Other control measures, such as time and space zoning, are likely to be more effective and will be perceived as being more equitable. As for speed limits, the small size of Lake Ripley may act as a natural deterrent to racing and high-speed boating. Existing state regulations also already prohibit watercraft from generating dangerous wakes and speeding in close proximity to shore or other boats, swimmers, piers and rafts. Finally, studies have shown that speed limits are not very effective at minimizing environmental impacts such as sediment re-suspension and shore erosion. Most of these disturbances are caused during initial acceleration in shallow water depths, and may therefore be better addressed through slow-no-wake zoning.[50]

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[46] O'Connor, William P. 1998. Local Boating Regulation in Wisconsin: A Guide for Lake Management Organizations. Wisconsin Association of Lakes, Inc.

[47] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

[48] Engfer, William G. 1992. Guidelines for Ordinance Writing & Buoy Placement in Wisconsin Waters. Wisconsin Department of Natural Resources, Bureau of Law Enforcement.

[49] O'Connor, William P. 1998. Local Boating Regulation in Wisconsin: A Guide for Lake Management Organizations. Wisconsin Association of Lakes, Inc.

[50] Hill, David and Michele Beachler. 2001. The Hydrodynamic Impacts of Recreational Watercraft on Shallow Lakes. Penn State University, Civil & Environmental Engineering.

Asplund, Timothy R. 2000. The Effects of Motorized Watercraft on Aquatic Ecosystems. Wisconsin Department of Natural Resources' Bureau of Integrated Science Services, and University of Wisconsin-Madison's Water Chemistry Program.

Time and Space Zoning

One of the most flexible approaches to regulating watercraft and separating conflicting lake uses involves the use of time and space zoning. Time zoning involves setting specific hours aside for different activities. For instance, quiet hours may be reserved for more passive activities that would otherwise be displaced by high-speed, motorized boat traffic. Lake Ripley currently has a mandatory slow-no-wake period every day from 7:30 p.m. to 11:00 a.m. In the past, Tuesdays were also set aside as slow-no-wake "quiet" days by Lake District proclamation, but only on a voluntary, non-enforceable basis. Other lakes have established quiet hours prohibiting motor use entirely, or have devised a schedule of rotating days for specific uses. According to Wagner (1991), the key is in reaching a consensus among user groups that satisfies the greatest number of users for the greatest amount of time while preserving desirable lake qualities.[51]

Space zoning involves setting aside portions of the lake for specific uses, and is commonly employed on water bodies where adequate space is available for each use. This strategy can be used to set aside safe swimming areas, protect sensitive aquatic habitats, and direct fast-moving motorized watercraft to areas of least potential impact. Within more crowded, higher-intensity user zones, traffic can be further managed by instituting waterskiing and high-speed boating routes. For example, such traffic can be restricted to a particular directional pattern around the lake (i.e. clockwise or counterclockwise). An advantage of space zoning is that it facilitates the selection of appropriate lake management techniques for each area of the lake. Management techniques can then be better targeted, leading to added cost savings and increased effectiveness. Space zoning can even be applied to the entire lake surface as an emergency measure during periods of high water. This type of ordinance is currently in effect on Lake Ripley.[52]

Buoys are often used to demarcate different user zones. On Lake Ripley, there is a buoyed swimming area adjacent to Ripley Park where all watercraft are strictly prohibited. There is also a slow-no-wake buoyed restricted area in each of the lake's two bays and within 200 feet of any shoreline as established through Town ordinance.[53] While motor boats are allowed in these particular areas, they are required to operate at idle speed. Lake Ripley's existing time and space zoning appears to be meeting its intended objectives. These policies also appear to be widely understood and accepted by lake users. No further ordinance modifications or actions are recommended at this time.

EDUCATION AND ENFORCEMENT

Passing an ordinance or adopting a new boating law does not always change boater behavior. Education and enforcement are necessary to make even the most carefully-crafted boating rules work. Therefore, aside from regulatory approaches, the continued dissemination of information

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[51] Wagner, Kenneth J. 1991. Assessing Impacts of Motorized Watercraft on Lakes: Issues and Perceptions. Proceedings of a National Conference on Enhancing States' Lake Management Programs. Northeastern Illinois Planning Commission.

[52] Town of Oakland. 2006. Town Ordinance #2: An Ordinance to Confirm the Current Status of the Ordinance Regulating Traffic, Boating and Water Sports upon the Waters of Lake Ripley, and Prescribing Penalties for Violations Thereof by Combining All Amendments to Date in One Document.

[53] Ibid

[53] Section 30.77, Wisconsin Statutes

about existing lake rules combined with aggressive law enforcement may help alleviate many of the problems associated with overcrowding. The Lake District and Town of Oakland should continue to educate lake users about the current rules and regulations that are in effect on Lake Ripley. Each should also work to ensure that an adequate and visible police presence is maintained on the lake to stem flagrant safety violations, particularly during peak-use periods. According to Town Police Chief Bruce Gondert, an average of one citation is issued for every seven hours an officer is on the lake. Most of these citations are related to or prompted by slow-no-wake violations.[54] Appendix D includes a summary of state and local rules affecting Lake Ripley.

[54] 2009 personal communication with Bruce Gondert, Town of Oakland Police Chief