Section 1 Doc 1.4

BEAVER DAM LAKE
PLANNING GRANT
LPL 1477-12

Carp Management on Beaver Dam Lake

History and Carp Control Management Experiences

The people of Beaver Dam Lake have battled with the common carp, Cyprinus carpio, for many years. The lake supports an abundance of common carp as well as other rough fish like buffalo carp (genus Ictiobus) and bullhead. Challenges for management not only include common carp overpopulation but also a history of winterkills, low dissolved oxygen, and intensive blue-green algae blooms. These issues have been well documented (WI DNR files) and represent typical problems associated with hyper-eutrophic (highly nourished) shallow lakes in Wisconsin.

Over the years various organized efforts and organizations have pooled to tackle the lake's most critical issues. These partnerships have included multiple management units over the lakes history (WI DNR). In 1983 a kernel of interest for lake rehabilitation was planted by an informal partnership of concerned citizens, property owners, a fishing club, the city of Beaver Dam, a yacht club, and the Lake Property Owners Club Inc. Working with the WI DNR in an appraisal of the lakes quality issues and possible rehabilitation alternatives, this group eventually constructed a rehabilitation plan. This work included winter chemical treatments and intensive water level fluctuations initiated via the dam and gates at the lakes outlet (J.Congdon, 1989). Most recently, the Beaver Dam Lake Improvement Association (BDLIA) has positioned itself on the forefront of organized lake protection and rehabilitation efforts.

Several approaches to the carp problem have been employed over the years, and not surprisingly, with variable results. These tools are discussed below. Some approaches remain to be attempted or are simply not practical for Beaver Dam Lake. Most of the tools used over the years have a long history of use and involve carp capture, spawning area access control, or application of fish toxicants. As discussed further below many tools have been applied, including lake wide rotenone application, spot treatments of rotenone, drawdown (water level fluctuation, WLF), biomanipulation, fish barriers, and commercial harvesting. These tools are best applied with the support of an informed and educated partnership of citizens, municipalities, and lake organizations. The tools used at beaver Dam Lake are as follows;

Rotenone in Combination with Drawdown -This chemical fish toxicant has good efficacy for killing carp (and all fish species). In 1987 this treatment was very effective in carp eradication. The toxicant, combined with lower water volumes in the lake (i.e. drawdowns) was a successful strategy for near elimination of all carp from the lake. While the rotenone application resulted in high fish mortality, other ecological outcomes were also realized. Of special note; the drawdown (i.e. induced water level fluctuation or WLF) exposed many acres of lake bed to desiccation and subsequent sediment consolidation. These effects were obvious and expected. In a typical drawdown scenario these effects can be anticipated:

1) Changes to physical condition of sediment- drying, compaction, and lake depth increase
2) Changes to chemical condition of sediment- oxidation of organic sediment, nitrogen and phosphorus release, sometimes resulting in pulses of phosphorus and nitrogen to water

Fish barriers – Fish barriers were employed at 4 locations: the "Trestle", Bayside Bridge, Long Bridge (also a trap) and Beaver Creek (electrified barrier). These barriers were designed to prevent access to areas as in the shallow warm backwaters or upstream reaches behind the barriers. Three of the barriers are gone or obsolete. The only remaining operating barrier is the electric barrier at Beaver Creek. Barriers can be very effective in the restoration of backwater marshes and bays (C.Marks, Green Lake Sanitary District, 2004). Green Lake installed a barrier to its Silver Creek marsh area with great success for the marsh area. The lake itself (7,300 acres) did benefit from water quality improvements as the inlet marsh filters water entering the lake basin. Barriers also prevent carp from accessing desired spawning areas, the logic being "reduction of spawning success will result in smaller populations of carp in the lake". While this action and it's perceived outcomes seem reasonable, data is not available to determine if the barriers on Beaver Dam Lake have resulted in smaller carp populations or improvements in habitat. Trapping of carp (and subsequent harvest) certainly reduces the number of carp in the lake but ecological impacts would be dependent on the actual number of carp removed (pounds of carp). Respective of future needs, the barrier approach should not be abandoned. Efficacy, costs, and maintenance issues should be examined further and decisions made regarding barrier/traps as a reasonable tool for carp management long term.

On the Lake Winnebago system this advice was provided by State of WI fish managers; "We believe the use of carp barriers as a management tool on the Winnebago pool lakes has proven successful. However, there are limited sites where this application is appropriate and warranted. Ideal sites are those with substantial amounts of protected open water, limited access, and significant summer resident carp populations. Such areas should typically have good potential for Centrarchid (panfish, bass) production, but may not be meeting that potential due to degradation of habitat and water quality by carp. In addition, such areas should not be prime northern pike spawning areas...." (WI DNR, 2006) Considerations regarding height, spacing of vertical bars, materials, and permitting are also required.

Commercial harvest – Beaver Dam has a history of carp harvesting with commercial netting methods. More recently, seining was reinitiated in 1996 and continues to this day. Millions of pounds have been removed over this period. In 2012 total pounds of carp removed was reported to be 370,000 lbs., including buffalo "carp" (WI DNR harvest report, 2012). The effects of this harvest are difficult to evaluate but Beaver Dam Lake is not alone in this challenge. Another area lake, Lake Puckaway, has employed harvesting approaches with similar catches reported year over year. In general, both lakes lack defensible evaluation data regarding the effects of the harvest. Outside of anecdotal evidence based on visual observations, angler reports, and user perceptions, this data gap presents a challenge in answering the question "Did it work?" Due to many variables (% of carp harvested relative to total in lake, annual nutrient load flux, plant community shifts, longer term weather patterns, and lack of evaluation process) these effects can be difficult to quantify without employing comprehensive monitoring methodologies. As a general rule of thumb, a large percentage of carp (up to 70%) are typically required to be harvested (or eliminated) in order to demonstrate substantial ecosystem improvements (Brown and Weber, 2009). The review of literature suggests that removal of large percentages of carp (20 to 70 %) will result in measureable benefits to water quality and habitat but

Generally these tools are available to lake managers for carp control;

A. Toxicants (i.e. rotenone)
B. Water level fluctuations (partial/full drawdowns, seasonal timing, various magnitude, frequency, and duration; see water level discussion on page_____)
C. Electrofishing
D. Trapping with trap nets/gill nets/cages/funnels/seining (potential "FAST" application)
E. Drain and net- Although this is a water level action, the primary objective is to concentrate and net carp rather than effect ecological changes due to sediment compaction, aquatic plant germination etc.
F. Substrate barrier- a physical barrier between the water and sediment in a lake. Prevents carp from access to benthic feeding/uprooting
G. Bio-manipulation- Typically Involves modifying the biological balance to favor zooplankton abundance and predator fish that eat small carp.
H. Barricades- prevents carp from accessing areas of the lake suitable for spawning, life stage support, and sensitive habitat
I. Public Information and Education (I&E) for enabling management actions to be taken

It should be noted here the BDLIA has a history of subsidizing carp harvesting via bow hunting. In 2012, total "bounty" payments of $2,000 were made (estimate) at a per fish bounty of 50 cents and a 4,000 fish harvest. It is not known if this level of harvest is significant to the lake ecology or is a cost effective harvest method.

Biology of Carp and Relevance for Beaver Dam Lake

Carp are a problem for Beaver Dam Lake because of their feeding habits and food processing resulting in nutrient increases of lake water, turbidity, and aquatic plant/habitat destruction. In many lakes carp populations are in balance with other biota. Most lakes in southern Wisconsin support carp in varying degrees and continue to maintain clear water and good habitat. Deep lakes are less susceptible to carp effects when compared to shallow lakes. Because carp prefer shallow warm water with soft substrates, shallow lakes are naturally more sensitive to their influence.

Carp spawning can occur over multiple events and typically begins when water temps in shallow depths reach 17 degrees centigrade (62 degrees Fahrenheit). Fecundity is high with an individual spawning female spreading up to 2,000,000 eggs in suitable substrate, often over aquatic plants (Swee and McCrimmon 1966).This event can occur multiple times in a season, due to precipitation, flooding, and temperature shifts that stimulate spawning behavior. Once spawning is completed and eggs develop, growth in juvenile carp is rapid, with individuals reaching sexual maturity in 2-3 years.

Annual mortality under natural conditions is low, typically less than 10% of population. Weber, 2011 reported annual mortality of 1- 7% in 3 South Dakota lakes along with consistent recruitment resulting in fish of all ages up to age 15. So, low annual mortality, high egg production, and a fast rate of growth

phosphorus per year. 100 lbs. would generate 1.1 pound of phosphorus annually and 100,000 lbs. generate 100 lbs. of P. In the case of Beaver Dam Lake, a standing biomass of carp might be in the millions of pounds, translating into potentially thousands of lbs. of phosphorous regenerated annually. As stated earlier, this P source would be largely unavailable for lake processes were it not for the feeding and digestions habits of carp. Knowing the standing crop of carp is critical for establishing a complete understanding of nutrient sources for the lake.

In Fox Lake, the carp biomass was estimated at 478,000 lbs. (J. Congdon, WI DNR, 1992). On a per acre basis, carp biomass was estimated at 182 lbs. /acre resulting in an annual phosphorous load of 5,260 lb. or 13% of the total annual P load to Fox Lake (M. Sesing, WI DNR, 1993). Similar loads are to be expected at beaver Dam Lake. The biomass of carp at Fox Lake when compared to Beaver Dam Lake (considering the size difference of 2,625 vs. 6,542 acres) is likely much less than Beaver Dams. With several assumptions, it could be extrapolated that Beaver Dam has more than 2x the total biomass of carp compared with Fox. Considering this very rough estimate, the total Lbs. of P generated (regenerated) at Beaver Dam Lake would be greater than 10,000 lbs. /yr. Knowing this relative value enables lake managers to make informed decisions regarding planning and implementation of projects directed at reducing nutrient loads. Beaver Dam Lake managers will benefit from this knowledge in making decisions regarding where limited resources can be most efficiently applied.

Effects of Carp in Beaver Dam Lake

The following changes are to be expected on a large shallow lake with excessive carp;

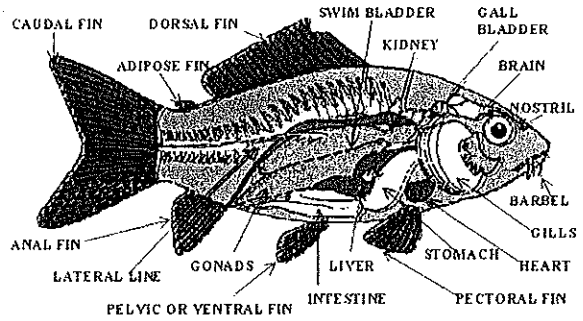
- Aquatic plants decrease
- Green algae decrease while Blue Green algae increase
- Benthic invertebrates decrease
- Water quality decrease
- Phytoplankton and chlorophyll increase
- Small zooplankton increase while large zooplankton decrease
- Game fish decrease
- Lake Use/Local Economy/Property Values decrease

(Brown et al, 2009)

Some of the factors driving the changes are explained below;

Aquatic Plants decrease - As discussed previously, carp will destroy plants through feeding habits and the turbidity generated from resuspension of sediments/nutrient pulses, cuts down the light available for rooted plant growth.

Green algae decrease and Blue Green algae increase – Because of nutrient additions, loss of competition from rooted plants, decrease of predator fish that consume planktivore fish, and changes in zooplankton size (I.e. smaller), the environment for green algae production is negatively impacted, and blue greens favored.



(from Jack Mountain & Jake Chandler)

Management

Understanding the dynamics of the carp population is critical to forming management strategies for carp as well as evaluation of current and future management control strategies. Presently we do not know the standing biomass of carp, their population size, or the potential the population has for further destruction of habitat and degradation of water quality. Presently, in the absence of real appraisal data, the observations at the lake indicate carp as a major negative influence for water quality and habitat. Historical events also support this contention, including a chemical treatment/carp eradication project (1987), water level drawdown, commercial harvest of carp through contract removal, and anecdotal evidence. Quantifying the size of the carp population in Beaver Dam Lake is a critical step to understanding:

1) Water quality and habitat improvement potential
2) Contribution/extent of carp population impact on water quality/ habitat degradation of the lake
3) Development of a dynamic carp management strategy for the lake
4) Evaluation of efficacy for current and future carp management strategies

Recommended Objectives and Strategies for Carp Management

1. Improve Information and Education (I&E) of the public regarding carp issues
2. Determine the community's ecological vision of the lake
3. Complete a carp population appraisal
4. Continue the carp harvesting program and evaluate its efficacy using appropriate tools.
5. Water quality – Establish the "baseline" condition for zooplankton and phytoplankton
6. Continue review of current and potential management alternatives. Special attention should be made regarding review of the existing commercial harvesting approaches.
7. Support, encourage, and lobby for improving research relating to carp management
8. Review the feasibility for reconstructing barriers and traps in suitable areas of the lake
9. Implement Aquatic Invasive Species grants (AIS grant) for carp management

Section 1 Doc 1.5

Beaver Dam Lake Spring Fyke Netting Report – 2010

mprehensive Fisheries Survey - Defined

mprehensive fisheries survey is being conducted on Beaver Dam Lake in Dodge County in 2010. A comprehensive fisheries survey is an assessment of the entire fish community in a lake. Different survey methods and gear types are used to sample all the different fish species that inhabit a lake. These methods include spring fyke netting for northern pike and walleye and late spring and fall electrofishing for panfish, bass, and young-of-the-year (YOY) walleye. An additional spring electrofishing survey is also conducted as part of a walleye population estimate. This report highlights the results of the 2010 spring fyke netting portion of the comprehensive survey with comparisons to similar surveys conducted in 2005 and 1999.

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Gamefish Summary

Walleye	2010	2005	1999
Spring Fyke Net Total Catch:	2569	1562	1243
Spring Fyke Net Catch Rate (fish per net night):	29	33	19
Spring Fyke Net Length Range (inches):	6.1-27.3	7.3-26.3	11.8-27.2
Spring Fyke Net Average Length (inches):	14.5	14.5	14.8

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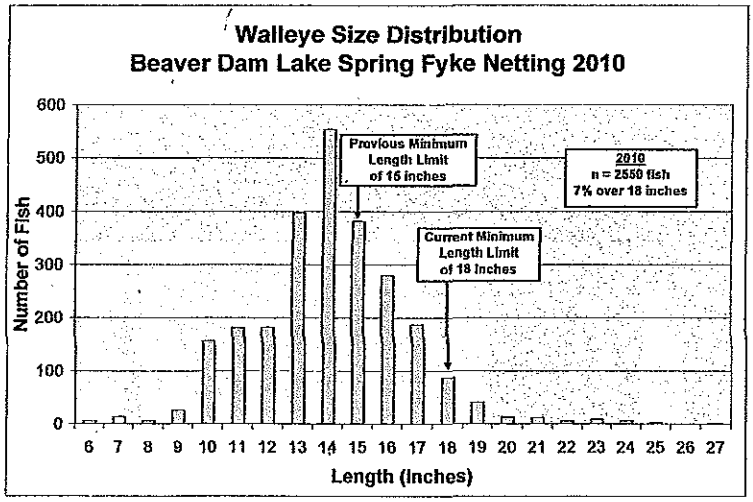
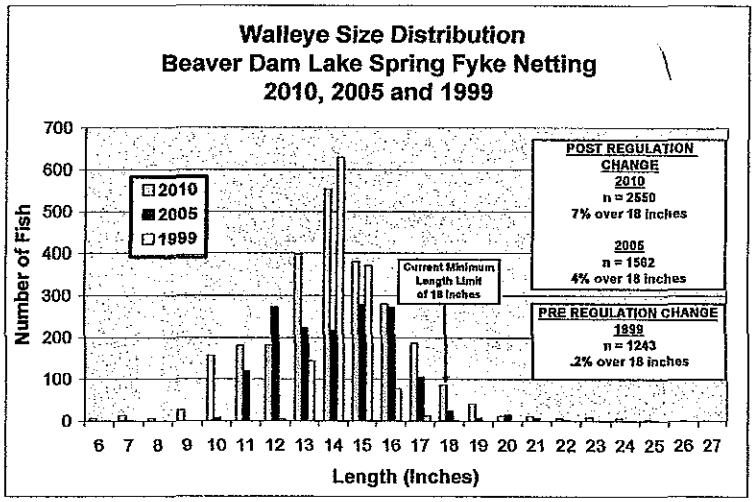
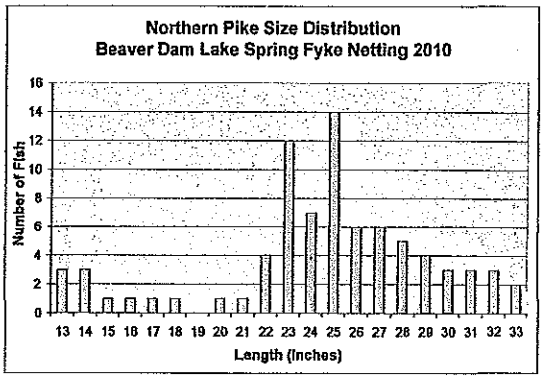
Catch rates for walleye in 2010 were 29 fish per net night, compared to 33 fish per net night in 2005 and 19 fish per net night in 1999. The largest walleye sampled in 2010 was a 27.3 inch female. The 18-inch minimum length limit/3 fish daily bag regulation has been in effect on BDL since 2002 (eight growing seasons prior to the 2010 spring fyke net survey). The 2010 data indicates that the size distribution of walleye has shifted with several additional year classes present that were absent under the previous 15-inch minimum length limit regulation. The regulation appears to be maintaining and increasing the density of moderate and large adult walleye, with the majority of walleye shifting closer to 18 inches over time. Post regulation change data indicates that the percent of walleye over 18-inches was 7% in 2010 and 4% in 2005 compared to pre regulation change data collected in 1999 where 0.2% were over 18-inches. Spine samples were taken for aging purposes but have not yet been processed. A walleye population estimate was attempted by marking walleye sampled during 2010 spring yke netting and recapturing marked fish during electrofishing surveys conducted in May 2010. Due to the low number of recaptured fish, best estimate was obtained using the Schumacher-Eschmeyer method and resulted in an estimated population size of 4043 to 6566 fish % confidence limits) or .6 to 1.0 walleye per acre. In spring 2010, WDNR stocked 114,889 small fingerling (2-inch) walleye into Beaver Dam Lake.





Northern pike	2010	2005	1999
Spring Fyke Net Total Catch:	96	2	4
Spring Fyke Net Catch Rate (fish per net night):	0.5	0.4	.06
Spring Fyke Net Length Range (inches):	10.0-33.5	29.4-32.2	18.5-26
Spring Fyke Net Average Length (inches):	24.9	30.8	22.4

thern pike have not been specifically targeted during the three years of spring fyke netting included in this comparison. Northern pike have been present in all fyke net surveys, but in very low numbers. In 2010, WDNR stocked 17,798 small fingerling (2-inch) northern pike into Beaver Dam Lake. The Beaver Dam Lake Improvement Association (BDLIA) stocked 420 (10-inch) northern pike in 2009.

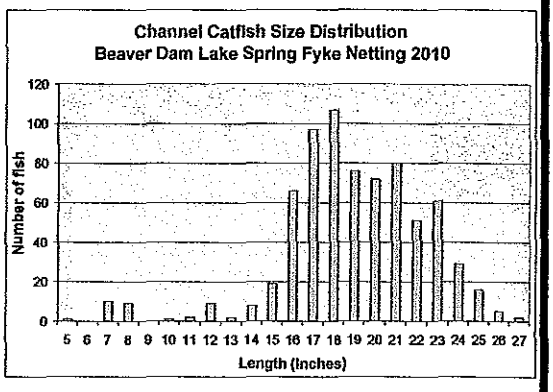


Muskellunge	2010	2005	1999
Spring Fyke Net Total Catch:	28	0	0
Spring Fyke Net Catch Rate (fish per net night):	.14	0	0
Spring Fyke Net Length Range (inches):	32.5-44.5	N/A	N/A
Spring Fyke Net Average Length (inches):	39	N/A	N/A

A total of 28 muskellunge were sampled during 2010 spring fyke netting, representing a catch rate of .14 fish per net night. All muskellunge sampled were larger adults from fyke nets set on the north end of the lake and are most likely fish originating from Fox Lake. Muskellunge are not stocked into Beaver Dam Lake by the WDNR or BDLIA.

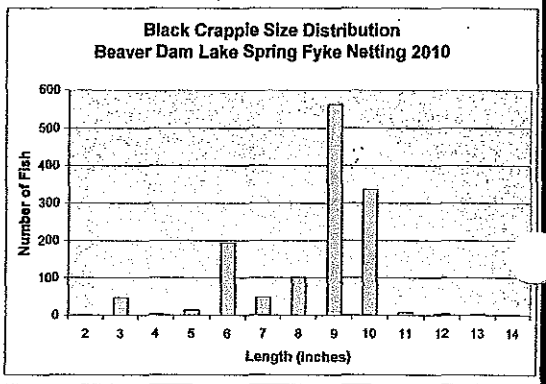
Channel catfish	2010	2005	1999
Spring Fyke Net Total Catch:	746	13	1
Spring Fyke Net Catch Rate (fish per net night):	7	.3	.02
Spring Fyke Net Length Range (inches):	5.4-27.0	7.8-27.5	N\A
Spring Fyke Net Average Length (inches):	19.4	20.1	26.2

In 2010, fyke nets were set in feeder creeks and shallow bays to specifically target channel catfish during spring movement and were located on the north end of the lake. Channel catfish were not specifically targeted in 2005 and 1999 spring fyke netting.



Largemouth bass	2010	2005	1999
Spring Fyke Net Total Catch:	74	0	5
Spring Fyke Net Catch Rate (fish per net night):	.4	0	.1
Spring Fyke Net Length Range (inches):	6.1-20.2	N/A	10.2-18.0
Spring Fyke Net Average Length (inches):	14.4	N/A	13.7

Largemouth bass are not successfully caught in fyke nets, making fyke net catch rate data of limited use. The data above is included for informational purposes only.

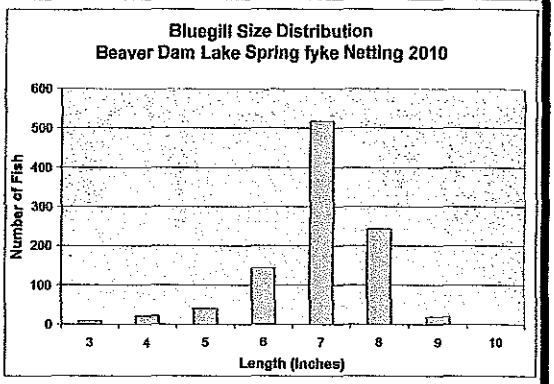


Panfish Summary

The current panfish community in Beaver Dam Lake is composed primarily of black crappie, bluegill, yellow perch and yellow bass. Smaller populations of white crappie, pumpkinseed, green sunfish, yellow bass and white bass are also present.

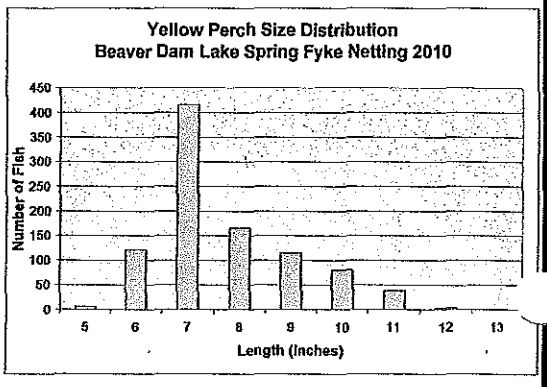
Black crappie	2010	2005	1999
Spring Fyke Net Total Catch:	4,338	457	734
Spring Fyke Net Catch Rate (fish per net night):	22	10	11
Spring Fyke Net Length Range (inches):	2.5-14.3	3.0-12.2	3.4-11.5
Spring Fyke Net Average Length (inches):	8.9	8.8	9.5

Black crappie remains the dominant panfish species in Beaver Dam Lake. The majority of black crappie measured (68%) were between 9.0 and 10.9 inches in length, with the largest measuring 14.3 inches and weighing 2 pounds.



Bluegill	2010	2005	1999
Spring Fyke Net Total Catch:	1,153	62	64
Spring Fyke Net Catch Rate (fish per net night):	107	1	1
Spring Fyke Net Length Range (inches):	3.0-10.1	4.7-9.2	3.2-9.1
Spring Fyke Net Average Length (inches):	7.5	7.4	6.4

The majority of bluegill measured (52%) were between 7 and 7.9 inches in length.



Yellow perch	2010	2005	1999
Spring Fyke Net Total Catch:	1,577	297	1,028
Spring Fyke Net Catch Rate (fish per net night):	7	6	16
Spring Fyke Net Length Range (inches):	5.5-13.0	5.7-12.9	4.5-13.5
Spring Fyke Net Average Length (inches):	8.1	8.8	7.2

The majority of yellow perch measured (44%) were between 7 and 7.9 inches in length. In 2009, the BDLIA stocked 34,725 (4-inch) yellow perch into Beaver Dam Lake.

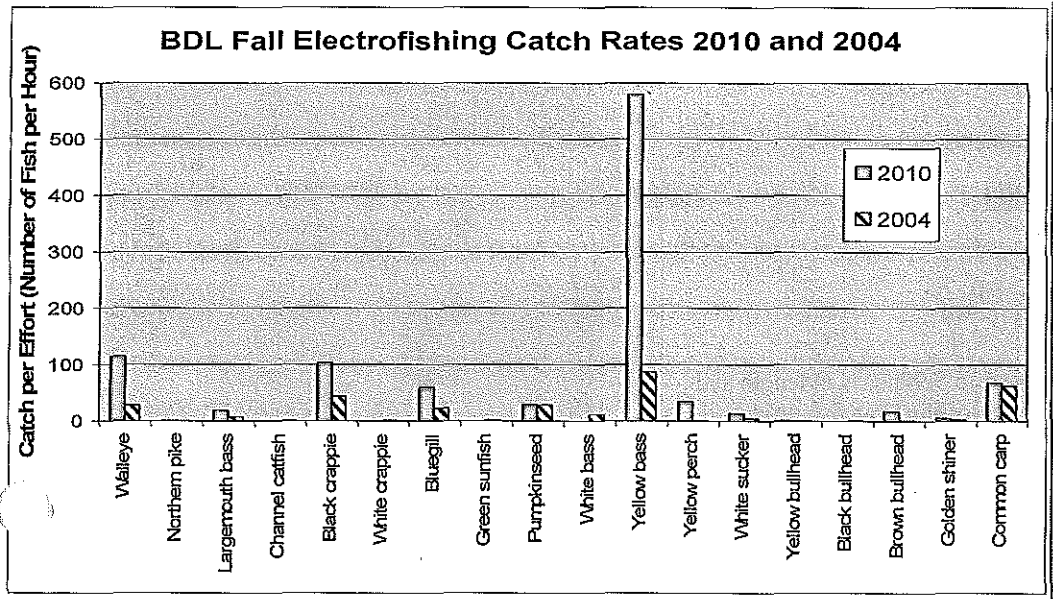
Other Species

Other species sampled during 2010 spring fyke netting included: yellow bass, white bass, white crappie, green sunfish, golden shiner, common carp, white sucker, bigmouth buffalo, bowfin and yellow, black and brown bullhead. 2010 carp catch rates were 4 per net night compared to 11 per net night in 2005 and .1 per net night in 1999.

Beaver Dam Lake Fall Electrofishing Summary Report-2010

Fall Electrofishing - Defined

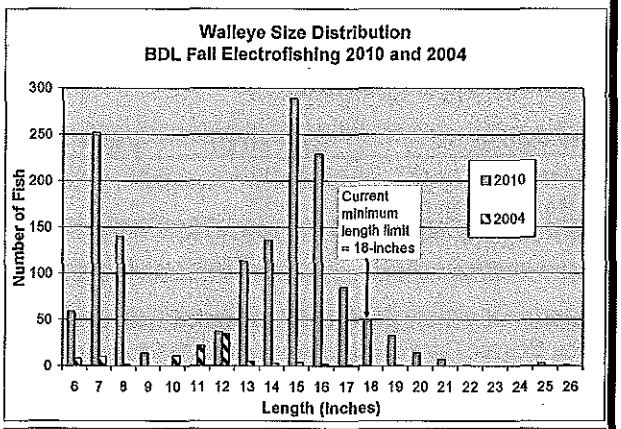
ll electrofishing was conducted on Beaver Dam Lake (BDL) in Dodge County on October 4-7, 2010. Fall electrofishing is conducted ..ng a large boomshocker boat allowing for the collection of young-of-the-year (YOY) and adult bass and walleye that are often under sampled by other gear types. In order to standardize fisheries data, total effort in the form of time spent shocking and/or miles of shoreline shocked is recorded and presented as catch rates or catch-per-unit effort (CPUE). Fall electrofishing sampling provides an indication of the health of the fishery through estimates of gamefish and panfish relative abundance (catch rate or catch per effort), gamefish population size-structure (size distributions), an index of growth and gamefish recruitment (young-of-year catch per effort). Twelve gamefish stations, each 1.5 miles long (18 miles and 9.42 hours total effort) were sampled where only gamefish were collected and included stations 1B-12B (see map). Twelve additional stations, each .5 miles long (6 miles and 3.32 hours total effort) were established where all fish species were collected and included stations 1A-12A. Lengths were taken from a subset of fish and all fish were returned to the lake. This report highlights the results of 2010 fall electrofishing with comparisons to 2004 fall electrofishing. Compiled by: Laura Stremick-Thompson, WDNR Fisheries Biologist, N7725 Hwy 28, Horicon WI 53032, 920.387.7876 or Laura.StremickThompson@wisconsin.gov



Gamefish Summary

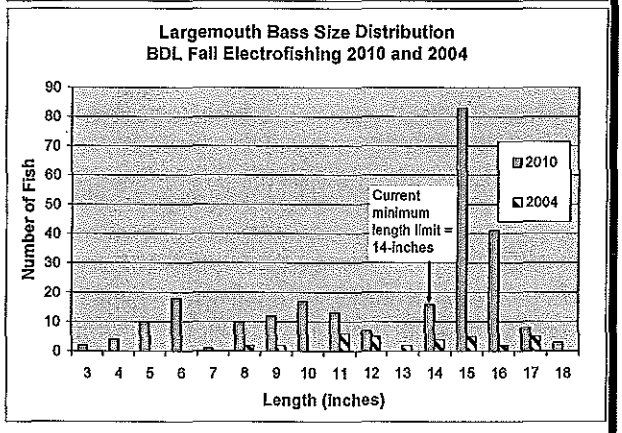
Walleye	2010	2004
Total Catch:	1463	104
Catch Rate (fish per hour):	115	28
Length Range (inches):	6.0-26.3	6.0-19.0
Average Length (inches):	13.2	11.4

Walleye catch rates for 2010 were 115/hour, compared to 28/hour in 2004. The majority of walleye sampled in 2010 (35%) were 15- to 16.9-inches in length and 7.5% were over 18-inches (current legal minimum size). Catch rates for young-of-the-year (YOY) walleye under 10-inches was 36/hour, compared to 5/hour in 2004. In 2010 YOY walleye comprised 32% of the sample, compared to 19% in 2004. In 2010, WDNR stocked 114,889 small fingerling walleye and the Beaver Dam Lake Improvement Association stocked 2.3 million walleye fry into BDL.



Largemouth bass	2010	2004
Total Catch:	245	33
Catch Rate (fish per hour):	19	9
Length Range (inches):	3.5-18.4	8.2-17.5
Average Length (inches):	13.1	13.6

2010 largemouth bass catch rates were 19/hour, up from 9/hour in 2004. The ..jority of bass sampled (51%) were 15- to 16.9-inches in length and 62% of the ..emouth bass sampled were over 14-inches (current legal minimum size).



Channel catfish	2010	2004
Total Catch:	11	1
Catch Rate (fish per hour):	.9	.3
Length Range (inches):	6.0-22.5	N/A
Average Length (inches):	18.1	10.5

Northern pike	2010	2004
Total Catch:	5	2
Catch Rate (fish per hour):	.4	.5
Length Range (inches):	12.0-26.6	16.5-22.4
Average Length (inches):	20.3	19.5

Muskellunge	2010	2004
Total Catch:	1	0
Catch Rate (fish per hour):	.08	0
Length Range (inches):	N/A	N/A
Average Length (inches):	37.0	N/A

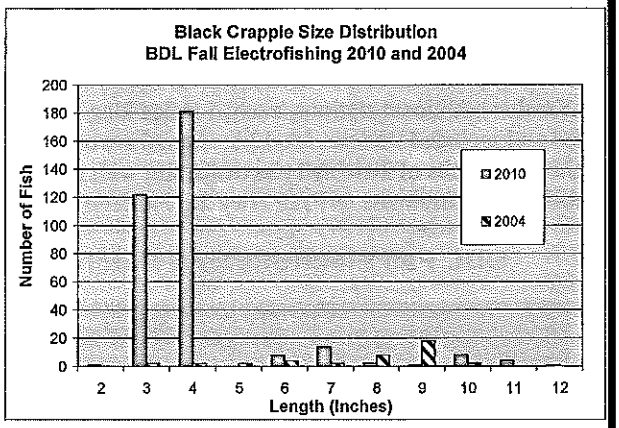
Electrofishing is not an effective method for sampling northern pike or muskellunge, as population data is best obtained using fyke nets set during spring spawning. In 2010, WDNR stocked 17,798 small fingerling northern pike, the Beaver Dam Lake Improvement Association stocked 450 (12-inch) pike and Gollon Bait and Fish Farm, Dodgeville WI donated 450 (13-inch) pike to BDL.

Panfish Summary

The panfish community of Beaver Dam Lake is comprised of black crappie, bluegill, yellow bass, yellow perch and pumpkinseed. Small populations of white crappie, white bass and green sunfish are also present.

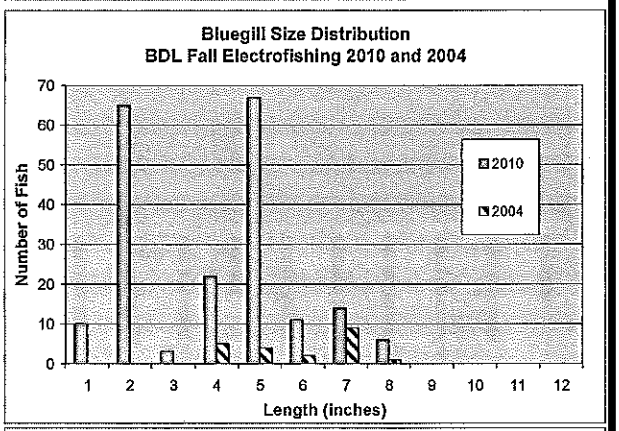
Black crappie	2010	2004
Total Catch:	343	40
Catch Rate (fish per hour):	103	43
Length Range (inches):	2.9-12.0	3.2-10.3
Average Length (inches):	4.5	8.1

The majority of black crappie (89%) were 3- to 4.9-inches in length.



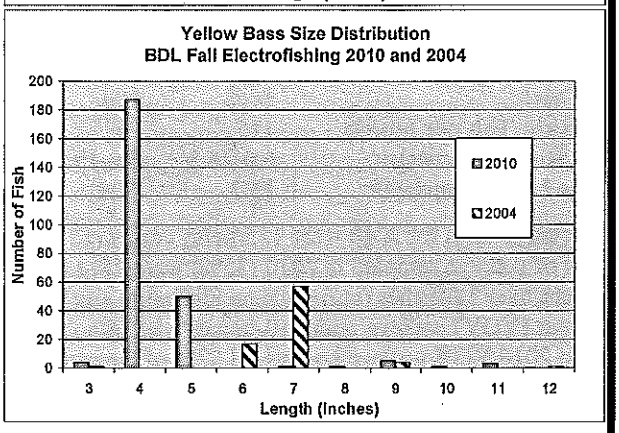
Bluegill	2010	2004
Total Catch:	198	21
Catch Rate (fish per hour):	60	23
Length Range (inches):	1.5-8.5	4.0-8.0
Average Length (inches):	4.4	6.3

The majority of adult bluegill sampled in 2010 were 5-to 5.9 inches in length and 16% of the sample were greater than 6-inches. Young-of-the-year fish produced in 2010 were also present.



Yellow bass	2010	2004
Total Catch:	1925	80
Catch Rate (fish per hour):	580	87
Length Range (inches):	3.5-11.6	3.8-12.0
Average Length (inches):	4.9	7.2

An extremely large year class of 4-inch yellow bass was produced in 2010. These fish will serve as excellent forage for many species of fish present in the lake, which may make angling more difficult.

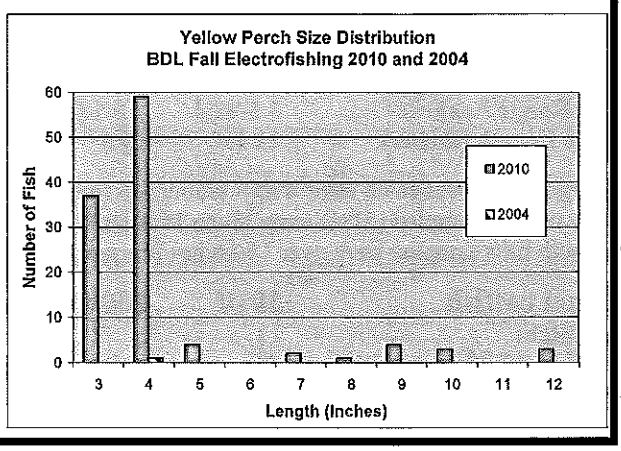


Yellow perch	2010	2004
Total Catch:	113	1
Catch Rate (fish per hour):	34	1
Length Range (inches):	3.2-12.5	N/A
Average Length (inches):	4.8	4.5

The majority of yellow perch (85%) sampled were 3- to 4.9-inches in length. In 2010, the Beaver Dam Lake Improvement Association stocked 25,375 large fingerling yellow perch into BDL.

Pumpkinseed	2010	2004
Total Catch:	96	26
Catch Rate (fish per hour):	29	28
Length Range (inches):	2.0-7.6	2.5-8.9
Average Length (inches):	4.4	5.9

The majority of pumpkinseed (60%) were 3- to 4.9 inches in length.



Other Species

Other species collected during 2010 fall electrofishing included golden shiner, common carp, bigmouth buffalo, white sucker, bowfin and yellow and brown bullhead. Bullhead catch rates in 2010 were 19/hour compared to 4/hour in 2004. In 2010, bullheads ranged in size from 4.6-14.5 inches. Adult carp catch rates were 62/hour in 2010, consistent with 62/hour in 2004.

Section 2 Doc 2.3

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

The Science of Water Level Fluctuations (WLF)

All lakes experience fluctuating water levels. Natural lakes without manipulation have a predictable seasonal level pattern with two important flow pulses (spring and fall) with annual lows occurring in late summer and annual highs occurring in spring. Manipulated lakes (w/dams) create their own fluctuation patterns and are typically disassociated with natural WLF patterns. The quality of this fluctuation is defined by the amplitude, timing, duration and frequency of the target level chosen by the lake management authority. These 4 management variables can determine the ecological condition of an artificially managed lake.

Deciding how the 4 variables are managed can be a source of great controversy. This difficult and complex decision process can lead to divisions within the lake community as well as drawn out political confrontations. In years gone by, stories of trappers versus farmers ring a nostalgic tone, but the reality was stark. Trappers desired wetlands for good muskrat habitat while the farmer wanted high and dry farmland. Night time sabotage of dam operations were common and the boards holding back water vanished into thin air only to reappear the next day. Today's conflicts are more complex and are typically related to boating and recreational demands that are in conflict with fish and wildlife habitat.

The adopted objectives at Beaver Dam Lake, as indicated in the "order" are primarily navigation, flood control, and safety related with secondary considerations for habitat and water quality.

The 4 variables

1) Timing – When does the target level take place? Is it in summer, winter, or? Timing is extremely important and is dependent on your WLF objectives. For instance, a winter action will have a much different outcome than a summer action. The WLF objectives for a lake will dictate the timing of a water level action (up, down, or same). At Beaver Dam lake timing is written into the official dam operation order (see below WDNR Order, Hunt D. May, 2004) as specific target levels must be reached for the winter, spring, summer and fall periods. Important timing periods occur in March, April and May of the year.

2) Duration – How long will the target level be applied? Again, your recreational, safety, flood control or habitat objectives will dictate the length of time an action is taken. The duration of a specific target level at beaver Dam Lake can last from 2 weeks, 1month, or 10 months (88.30 operating level). As an example; if you wish to desiccate sediments and restore bulrush beds, the duration of the drawdown action could be a full year, or as short as one summer. Some actions could be a short length of time, i.e. 2 week duration

3) Amplitude – How many inches or feet (up or down) will it take to reach the target level? A high amplitude action would be a 1 foot change on a 3 ft. deep lake. A small magnitude might be 1 inch change of level. In the case of Beaver Dam Lake the targeted amplitude of level change is 0.6 feet or 7.2 inches (i.e. Change from pre-spring to summer operating level). This is the "target" level; however deviation due to natural circumstances like flooding or drought is common and largely uncontrollable.

4) Frequency – How often will the action be repeated? Most level actions are seasonally based and might occur once or twice a year. For instance, the level on Beaver Dam Lake is adjusted to 88.30 feet once every summer period. Although attention must be paid to maintain this level, the target of 88.30 ft.is set once a year and maintained at that level when possible. In some cases, a water level action might occur 1x every 10 years, such as a major drawdown to repair a dam or to restore habitat.

These 4 variables are critical to reaching a specific objective, be it habitat, water quality, recreational, safety or power generation related. One variable, if not sufficiently addressed, can make or break success in reaching the objectives adopted for the lake. These objectives can be represented within the lake plan, assuming state and local consensus is reached.

(((Water Level Graphic goes here and is included as a separate attachment)))

The WLF charts show the approximate pattern of natural WLF and the pattern of the 2004 WLF order (the existing target levels). Although in real time there will be more variability in both patterns, the levels indicated by the lines in the chart represent the approximate patterns of water level fluctuations (WLF) for natural and for Beaver Dam Lake, a manipulated system with dam.

Both WLF patterns will support various uses and neither pattern is intended for promotion within the context of this discussion. The purpose for this comparative examination is to show how the 2 very different patterns of WLF relate to the ecological and recreational events occurring at Beaver Dam Lake in a typical year.

Fluctuations are moderated in the "ordered levels" now employed at the lake when compared to natural lakes fluctuation, i.e. the amplitude of level change is less in a typical year. This condition is often considered a "stable" water level condition which is viewed as positive by

many users. However, from a biological perspective, stable levels, outside the natural condition, are usually negative for the biological health of the lake. The target amplitude change in Beaver Dam Lake is less than 8 inches annually while natural systems can fluctuate a few feet or more. From an ecological perspective, these low amplitude/high duration level changes affect the quality of the lake plants, water quality, shoreline conditions, flooding, and fishery. These effects can be positive (in the case of flood control) or negative (when plants, water quality, and fish habitat suffer) for the lake.

Referring to the water level graph, it can be seen summer levels on Beaver Dam Lake do not "dip" like levels do in natural lake hydrology. Although this has positive effects for boating and pier access, the lake plants are out of "sync" respective of favorable plant growth conditions. As previously noted, lake plants evolved over thousands of years in parallel with lower water during the warm summer period. This reality, however, can be difficult to accommodate as summer is the peak boating season for the lake.

Spring levels, as presently managed under the 2004 WLF order, are less likely to accommodate fish spawning behavior, especially Northern pike and walleye. The level reduction scheduled to start in March (88.3 to 87.6 ft.) occurs within the same time period where N pike and walleye seek out flooded wetland plants for spawning. Again, it can be generally concluded this is a positive for flood management but a negative for fish production.

In summary, WLF has a highly significant influence on the lake, its inhabitants and its users. As a tool for lake management WLF can have powerful outcomes.

Management

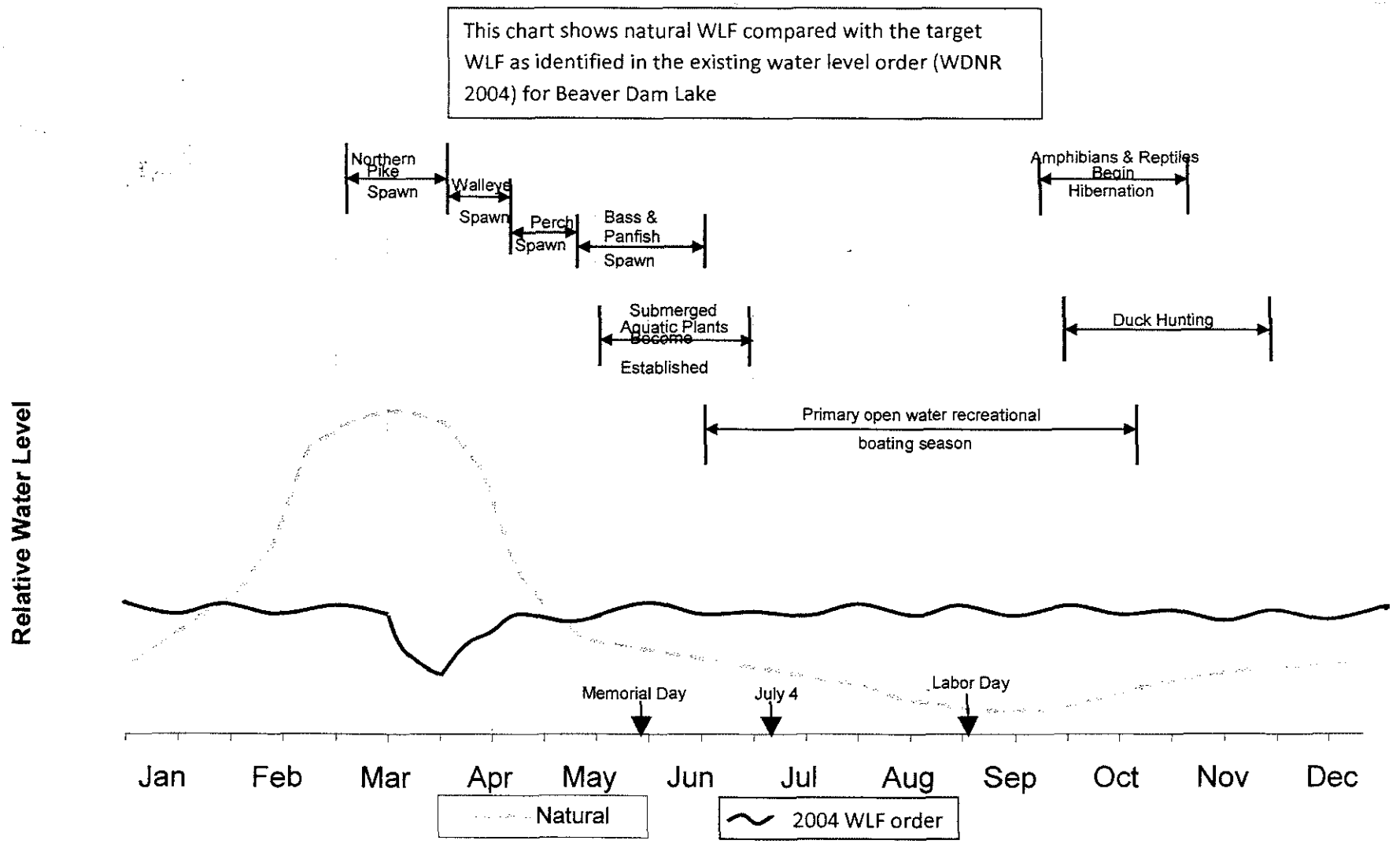
Understanding the dynamics of water level fluctuation (WLF) is critical to forming balanced and informed management strategies for Beaver Dam Lake. One course of action is to maintain the status quo following the existing water level order from 2004. A more difficult course, but potentially more biologically healthy, would be to review the existing level schedule and explore opportunities to enhance water clarity and habitat through modification of some or all of the water level management variables; timing, duration, amplitude or frequency. The question of "what to do" can only be answered through further definition of management objectives for the lake.

Recommended Objectives for WLF

1. Improve WLF management for a balanced set of recreational and ecological benefit

Recommended Strategies for WLF

1. Establish the community's vision for the future condition of the lake
2. Form an advisory team with the mission to explore WLF alternatives
3. Improve Information and Education (I&E) of the public regarding WLF



Water levels affect the fish, wildlife, water quality, and recreation uses. (UW-Ext/WI DNR modified MFS 6/2013))

Wisconsin Department of Natural Resources

BEAVER DAM LAKE PLANNING GRANT # LPL 14477-12

Lake Water Quality 2013 Annual Report

Beaver Dam Lake
Dodge County
Waterbody Number: 835100

Lake Type: DRAINAGE
DNR Region: SC
GEO Region:SE

Site Name	Storet #
Beaver Dam Lake - Breezy Point	143311

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
05/28/2013	2.5	0.8	NO		114	64		65	HIGH	CLEAR	BROWN	2-Very minor aesthetic problems
06/26/2013				28.5	201		60	69				
07/30/2013				150	206		73	69				
08/27/2013	.75	0.2	NO	169	335	81	74	73	LOW	MURKY	GREEN	3-Enjoyment somewhat impaired (algae)

05/28/2013		
Depth FEET	Temp. DEGREES F	D.O. MG/L
1	65	7.3
3	64	7.3
6	63	7.4

08/27/2013		
Depth FEET	Temp. DEGREES F	D.O. MG/L
1	79.1	6
3	78.9	6
6	78.6	5.7

Date	Collector Comments
05/28/2013	75- Sunny- light south breeze- only a few fishermen- 100-s of pelicans but only a few cormorants.
08/27/2013	Samples taken with Rachel Sabre- Sunny- wind 8-10 mph

Date	Data Collectors	Project
05/28/2013	Bob Roell	Citizen Lake Monitoring - Water Quality - Beaver Dam Lake; Breezy Point
06/26/2013	Bob Roell	Citizen Lake Monitoring - Water Quality - Beaver Dam Lake; Breezy Point
07/30/2013	Bob Roell	BEAVER DAM LAKE IMPROVEMENT ASSOCIATION: Beaver Dam Lake Mgmt Plan Development
07/30/2013	Bob Roell	Citizen Lake Monitoring - Water Quality - Beaver Dam Lake; Breezy Point
08/27/2013	Bob Roell	BEAVER DAM LAKE IMPROVEMENT ASSOCIATION: Beaver Dam Lake Mgmt Plan Development
08/27/2013	Bob Roell	Citizen Lake Monitoring - Water Quality - Beaver Dam Lake; Breezy Point
09/25/2013	Data Collectors Unknown or Specified in Comments	BEAVER DAM LAKE IMPROVEMENT ASSOCIATION: Beaver Dam Lake Mgmt Plan Development

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet.

Wisconsin Department of Natural Resources **Wisconsin Lakes Partnership**

Report Generated: 12/03/2013

Section 2 Doc 2.5

Wisconsin Department of Natural Resources
Laboratory Report

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:	**143122**	*Sample #:*	**100643001**
Collection Start:	**09/25/2013 11:00 am**	*Collection End:*	**09/25/2013 11:00 am**
Collected by:	**BEAVER DAM LAKE ASSN**	*Waterbody/Outfall Id:*	**835100**
ID #:	**143122**	*ID Point #:*	**61743757**
County:	**Dodge**	*Account #:*	**LM020**
Sample Location:	**BEAVER DAM LAKE - DEEP HOLE (DENNING POINT)**		
Sample Description:	**INTEGRATED SAMPLER**		
Sample Source:	**Surface Water**	*Sample Depth:*	**3F**
Date Reported:	**12/02/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL-1477-12**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/31/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/18/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**3.34**	MG/L	0.140		0.400

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

Wisconsin Department of Natural Resources
Laboratory Report

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Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:	**143311**	*Sample #:*	**100643002**
Collection Start:	**09/25/2013 11:30 am**	*Collection End:*	**09/25/2013 11:30 am**
Collected by:	**BOB ROELL**	*Waterbody/Outfall Id:*	**835100**
ID #:	**143311**	*ID Point #:*	**61743637**
County:	**Dodge**	*Account #:*	**LM020**
Sample Location:	**BEAVER DAM LAKE - BREEZY POINT**		
Sample Description:	**INTEGRATED SAMPLER**		
Sample Source:	**Surface Water**	*Sample Depth:*	**3F**
Date Reported:	**12/02/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL-1477-12**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/31/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/18/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**3.78**	MG/L	0.140		0.400

Wisconsin Department of Natural Resources
Laboratory Report

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Madison **WI** **53718**
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Sample:

Field #:	**HS**	*Sample #:*	**93607001**
Collection Start:	**08/22/2013 11:30 am**	*Collection End:*	**08/22/2013 11:30 am**
Collected by:	**DAVID MARSHALL**	*Waterbody/Outfall Id:*	**1286100**
ID #:	**10037189**	*ID Point #:*	**61743478**
County:	**Sauk**	*Account #:*	**LM020**
Sample Location:	**HEMLOCK SLOUGH-SOUTH END**		
Sample Description:			
Sample Source:	**Surface Water**	*Sample Depth:*	**1.0F**
Date Reported:	**11/18/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL1462**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 350.1	**10/10/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
608	**NITROGEN NH3-N DISS**	**0.0200**	MG/L	0.0150		0.0480

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 445	**09/04/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99717	**CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)**	**10.4**	ug/L	0.520		1.74

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 365.1	**09/05/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
665	**PHOSPHORUS TOTAL**	**0.0222**	MG/L	0.00500		0.0160

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/10/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/05/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**0.592**	MG/L	0.140		0.400

Wisconsin Department of Natural Resources
Laboratory Report

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2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:	**LS**	*Sample #:*	**93607002**
Collection Start:	**08/22/2013 10:30 am**	*Collection End:*	**08/22/2013 10:30 am**
Collected by:	**DAVID MARSHALL**	*Waterbody/Outfall Id:*	**1285800**
ID #:	**10037188**	*ID Point #:*	**61743285**
County:	**Sauk**	*Account #:*	**LM020**
Sample Location:	**LAVALLE MILLPOND-CENTER**		
Sample Description:			
Sample Source:	**Surface Water**	*Sample Depth:*	**1.0F**
Date Reported:	**11/18/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL1462**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 365.1	**09/05/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
665	**PHOSPHORUS TOTAL**	**0.776**	MG/L	0.00500		0.0160

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 445	**09/04/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99717	**CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)**	**1030**	ug/L	10.4		34.8

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/10/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 350.1	**10/10/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
608	**NITROGEN NH3-N DISS**	**0.348**	MG/L	0.0150		0.0480

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/05/2013**	**Analyzed past the 28 days holding time: Method EPA**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**13.7**	MG/L	0.280		0.800

Wisconsin Department of Natural Resources
Laboratory Report

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Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:	**BREEZY POINT**	*Sample #:*	**95292001**
Collection Start:	**08/27/2013 11:00 am**	*Collection End:*	**08/27/2013 11:00 am**
Collected by:	**BOB ROELL**	*Waterbody/Outfall Id:*	**835100**
ID #:	**143311**	*ID Point #:*	**61743634**
County:	**Dodge**	*Account #:*	**LM020**
Sample Location:	**BEAVER DAM LAKE - BREEZY POINT**		
Sample Description:	**BREEZY POINT, INTEGRATED SAMPLER**		
Sample Source:	**Surface Water**	*Sample Depth:*	**3F**
Date Reported:	**11/18/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL1477**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/16/2013**	Analyzed past the 28 days holding time: Method EPA

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/05/2013**	Analyzed past the 28 days holding time: Method EPA

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**4.08**	MG/L	0.140		0.400

Wisconsin Department of Natural Resources
Laboratory Report

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2601 Agriculture Dr
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Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:	**DENNING**	*Sample #:*	**95292002**
Collection Start:	**08/27/2013 12:00 am**	*Collection End:*	**08/27/2013 12:00 am**
Collected by:	**BOB ROELL**	*Waterbody/Outfall Id:*	**835100**
ID #:	**143122**	*ID Point #:*	**61743754**
County:	**Dodge**	*Account #:*	**LM020**
Sample Location:	**BEAVER DAM LAKE - DEEP HOLE (DENNING POINT)**		
Sample Description:	**DEEP HOLE (DENNING POINT), INTEGRATED SAMPLER**		
Sample Source:	**Surface Water**	*Sample Depth:*	**3F**
Date Reported:	**11/18/2013**	*Sample Status:*	**COMPLETE**
Project No:	**LPL1477**	*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 353.2	**10/16/2013**	Analyzed past the 28 days holding time: Method EPA

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
631	**NITROGEN NO3+NO2 DISS (AS N)**	**ND**	MG/L	0.0190		0.0610

Analysis Method	*Analysis Date*	*Lab Comment*
EPA 351.2	**11/05/2013**	Analyzed past the 28 days holding time: Method EPA

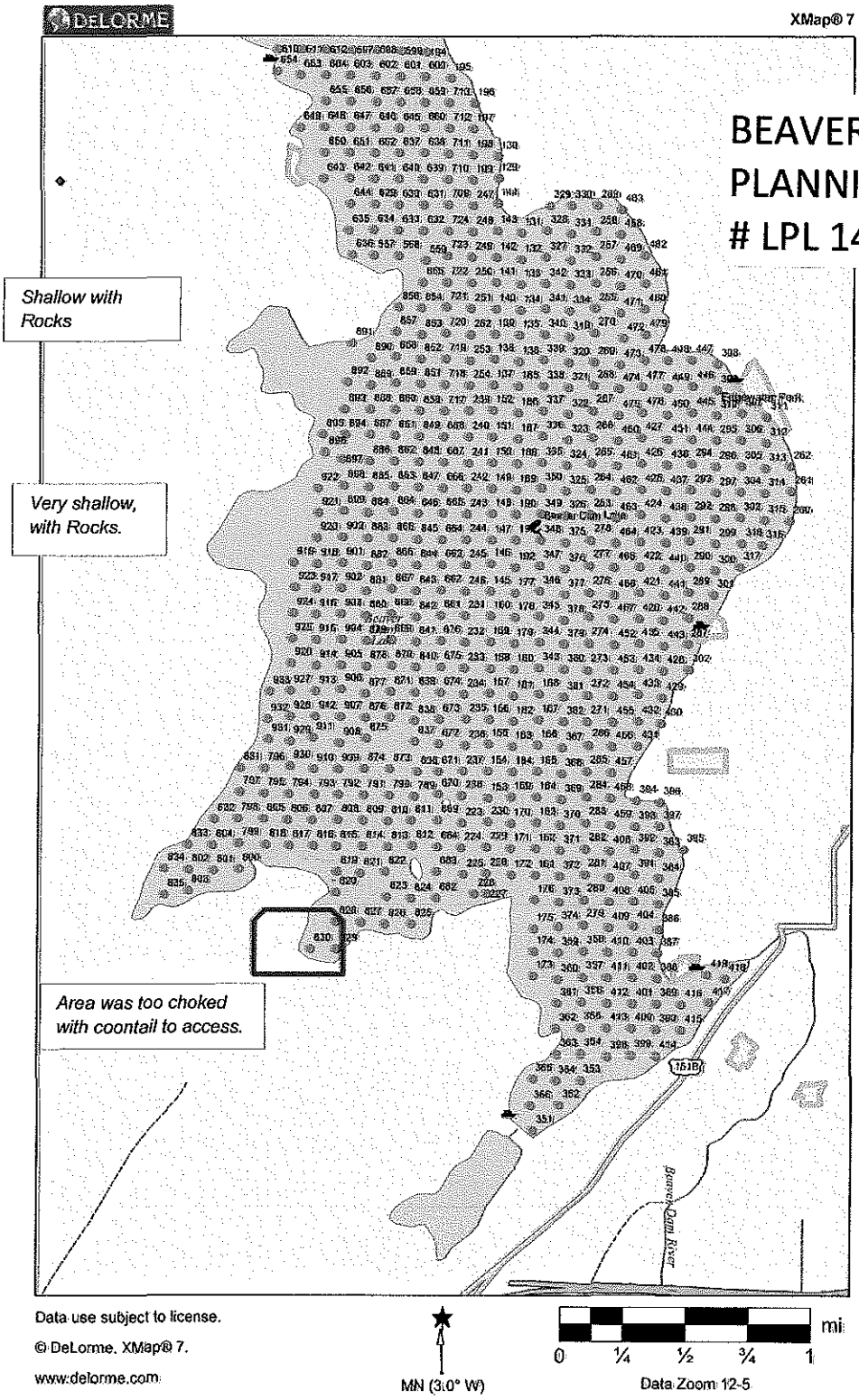
Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
625	**NITROGEN KJELDAHL TOTAL**	**4.11**	MG/L	0.140		0.400

Sample/Labslip	ıple Status	Sample Collected (Start) Date	Id #	Id Point #	Field #	Program Code	Region	County	Sample Collector	DNR Parameter Code	DNR Parameter Description	Result Type	Result	Units	LOD	LOQ	Lower Reporting Limit	Upper Reporting Limit	Comments/Analysis	Analysis ID
10064300	OMPLETE	9/25/2013	143311	61743637	143311	FH	1	Dodge	BOB ROELL	625	NITROGEN KJELDAHL TOTAL	1	3.78	MG/L	0.14	0.4			COMMENTS	8608096
100643002	COMPLETE	9/25/2013	143311	61743637	143311	FH	1	Dodge	BOB ROELL	631	NITROGEN NO3+NO2 DISS (AS N)	2	ND	MG/L	0.019	0.061			COMMENTS	8608095
100643001	COMPLETE	9/25/2013	143122	61743757	143122	FH	1	Dodge	BEAVER DAM LAKE ASSN	625	NITROGEN KJELDAHL TOTAL	1	3.34	MG/L	0.14	0.4			COMMENTS	8608094
100643001	COMPLETE	9/25/2013	143122	61743757	143122	FH	1	Dodge	BEAVER DAM LAKE ASSN	631	NITROGEN NO3+NO2 DISS (AS N)	2	ND	MG/L	0.019	0.061			COMMENTS	8608093

Sample/Labslip	ıple Status	Sample Collected (Start) Date	ld #	Id Point #	Field #	Program Code	Region	/ Name	Sample Collector	DNR Parameter Code	DNR Parameter Description	Result Type	Result		Units	LOD	LOQ	Lower Reporting Limit	Upper Reporting Limit	Comments/Analysis	Analysis ID
9529200	MPLETE	8/27/2013	143311	61743634	BREEZY POINT	FH	1	Dodge	BOB ROELL	631	NITROGEN NO3+NO2 DISS (AS N)	2	ND		MG/L	0.019	0.061			COMMENTS	8597058
95292001	COMPLETE	8/27/2013	143311	61743634	BREEZY POINT	FH	1	Dodge	BOB ROELL	625	NITROGEN KJELDAHL TOTAL	1		4.08	MG/L	0.14	0.4			COMMENTS	8597059
95292002	COMPLETE	8/27/2013	143122	61743754	DENNING	FH	1	Dodge	BOB ROELL	631	NITROGEN NO3+NO2 DISS (AS N)	2	ND		MG/L	0.019	0.061			COMMENTS	8597060
95292002	COMPLETE	8/27/2013	143122	61743754	DENNING	FH	1	Dodge	BOB ROELL	625	NITROGEN KJELDAHL TOTAL	1		4.11	MG/L	0.14	0.4			COMMENTS	8597061

Section 3 Doc 3.1 (2 sheets)

Map X – Beaver Dam Lake – Survey Point South Half

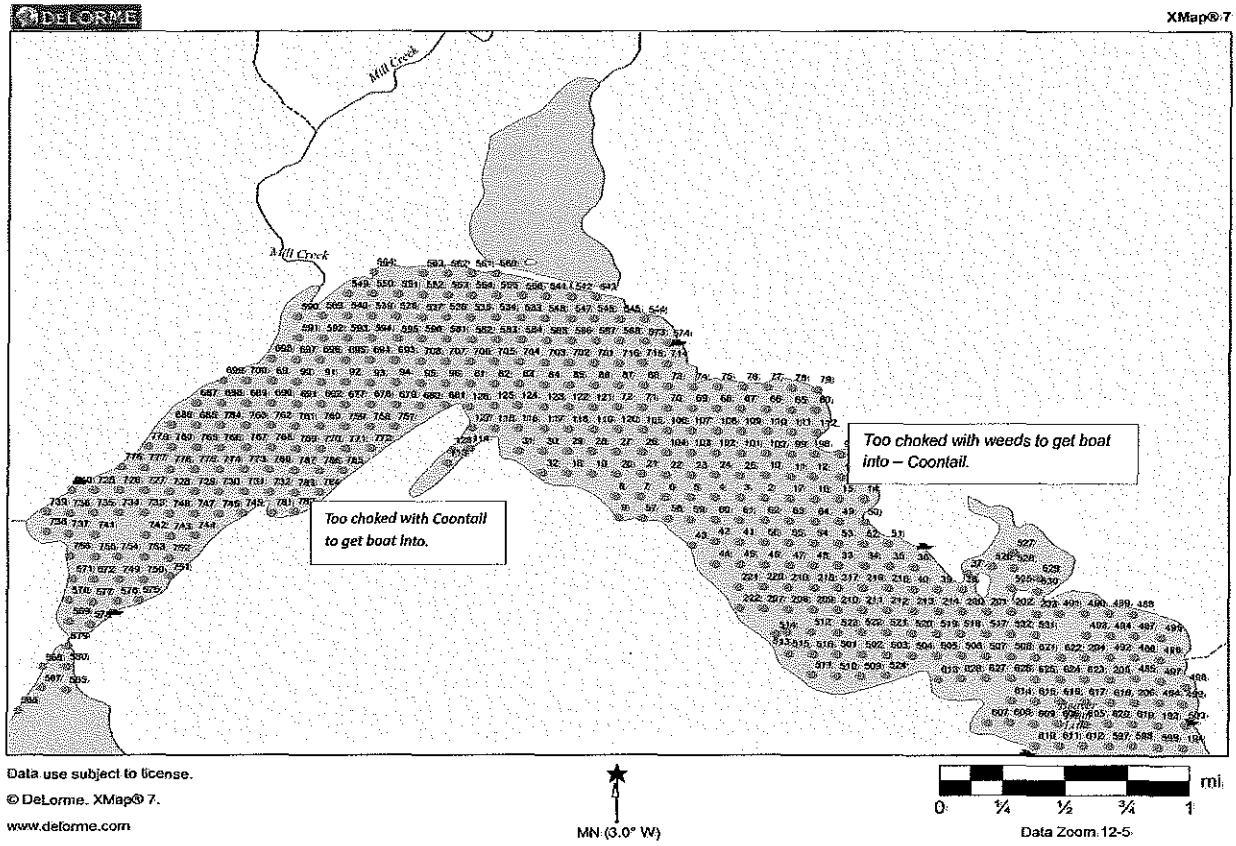


Source: Environmental Horizons, Inc. and DeLorme.

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

Map X Beaver Dam Lake – Survey Points North Half

Source: Environmental Horizons.



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Section 3
Item 3.2
3 page sample
of 48 page report

BEAVER DAM LAKE
PLANNING GRANT
 # LPL 14477-12

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Section 4 Doc 4.1 + 4.2
Lake use + Boat Inventory

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

ENVIRONMENTAL HORIZONS, INCORPORATED

"Providing Innovative Solutions for Land and Water Resource Management"

PUBLIC OPINION OF LAKE USE AND WATER QUALITY OF BEAVER DAM LAKE

I. METHODOLOGY

A. Questionnaire survey using a mail-back survey method with one follow-up postcard reminder was conducted during summer 2012.

B. Analysis based upon 394 responses out of 1,595 possible. This correlates to a 25 percent return of questionnaire surveys by the Beaver Dam Lake residents.

II. RESPONDENT PROFILE

A. Beaver Dam Lake was the primary residence of the majority of respondents (71 percent).

B. Majority of respondents (52 percent) were year-round residents; 32 percent were resident during an extended summer period; and 10 percent were weekend residents during the summer. Four percent were summer residents only and 2 percent were vacationers.

C. Respondents spent an average of 221 days per year at the Lake.

D. Majority of respondents (72 percent) had resided on Beaver Dam Lake for more than 10 years. Sixteen percent had resided on the Lake between 6 and 10 years, 11 percent for 1 to 5 years, and 1 percent were new residents.

E. Almost all respondents (99 percent) owned their homes.

III. LAKE USE

A. Categories of Use

The most popular passive lake uses included: aesthetic viewing/bird and wildlife watching with a weighted score of 821 (based upon the numbers of people engaging in the activity and the numbers of days in which they participated), walking/jogging with a weighted score of 340, and picnicking/barbecuing with a weighted score of 193.

The most popular active lake uses included: Fishing with a weighted score of 191, powerboating with a weighted score of 142, waterskiing with a weighted score of 140, and operating personal watercraft with a weighted score of 115.

Cross-country skiing was the least popular activity with a weighted score of 21. Ice-fishing had a weighted score of 75; sailing, rowing and hunting had a weighted score of 72, and swimming and snowmobiling had a weighted score of 68.

B. Importance of Use

1. Snowmobiling, powerboating, and hunting were rated as the most important uses, rated as 4.0 or greater on a five-point scale, where 5.0 is the most important use.

2. Sailing and cross country skiing were rated at 3.0 or less, and were reported to be the least important lake uses.

C. Intensity of Use

1. Beaver Dam Lake was described as being lightly used during the week by a majority of respondents (86 percent), with 13 percent of respondents describing the use as moderate.

2. Weekend use was described as moderate by a majority of respondents (60 percent), with 34 percent of respondents describing the weekend use as light.

D. Frequency of Use

1. Bird-watching (18,000 total days with an average of 222 days per respondent), walking/jogging (5,730 total days with an average of 100 days per respondent), and picnicking (2,914 total days with an average of 51 days per respondent) were the most frequently engaged in passive activities.

2. Fishing (5,597 total days with an average of 49 days per respondent), powerboating (5,320 total days with an average of 28 days per respondent), waterskiing (3,058 total days with an average of 28 days per respondent), and operating personal watercraft (1,592 total days with an average of 31 days per respondent) were the most frequently engaged in active recreational activities. Ice-fishing was engaged in on more than 1,330 total days with an average of 21 days per respondent.

3. Overall, lake use during spring and summer was greater than during fall and winter. Boating, angling and swimming activities were engaged in on average on 27 days during the spring and summer months and on 11 days during the fall and winter months (open water activities obviously being curtailed during the ice-bound winter period).

4. Ice bound water activities (snowmobiling, ice-fishing and cross-country skiing) were engaged in on average on 14 days during the fall and winter.

E. Use of Other Lakes

1. Thirty-six percent of respondents reported that they regularly used other lakes throughout south-central and southeastern Wisconsin.

2. Of these, 40 percent reported using Fox Lake.

3. Other lakes used frequently included Lake Emily, (Big and Little) Green Lake, Lake Mendota, Lake Monona, and Lake Winnebago. Numerous respondents also reported using Lake Michigan.

F. Levels of Satisfaction

1. Open-water Angling

One-third (34 percent) of respondents engaged in fishing during the open-water season. Anglers spent 10,881 days fishing, with an average time spent fishing per respondent of 44 days. Of these respondents, 43 percent fished from piers, 19 percent from boats, and 38 from both piers and boats.

Collectively, of the anglers responding, 53 percent of respondents rated the fishing quality of these Lakes as fair and 31 percent as good.

A majority of the anglers responding caught catfish (30 percent), panfish (25 percent), crappie (20 percent) and largemouth bass (14 percent). Seventy-five percent of respondents reported fishing for "other species". Of the other species sought, walleye were caught about 49 percent of the time, and bullhead were caught 25 percent of the time.

Overall, anglers perceived that these populations have remained the same in this system (40 percent of respondents); those indicating a perceived change in the fisheries were evenly divided as to whether it has improved (32 percent of respondents) or declined over time (28 percent of respondents).

Two-thirds of respondents indicated that carp were perceived as a problem, while one-third suggested that carp were a problem that was under control. A majority of respondents (83 percent) indicated that the size of the carp population had remained the same or decreased during their period on the lake.

2. Ice-bound water Angling

Fifteen percent of respondents engaged in fishing during the ice-bound-water season. Ice-anglers spent 2,736 days fishing, with an average time spent fishing per respondent of 20 days.

Collectively, of the anglers responding, 54 percent of respondents rated the ice-fishing quality of these Lakes as fair; 23 percent rated the ice-fishing as good, and 20 percent rated the ice-fishing as poor.

A majority of the anglers responding caught crappie (32 percent), panfish (27 percent), perch (22 percent) and largemouth bass (6 percent). Seventy-five percent of respondents reported fishing for "other species". Of the other species sought, walleye were caught about 73 percent of the time; northern were caught 25 percent of the time.

Overall, anglers perceived that these populations have remained the same in this system (38 percent of respondents) or declined over time (42 percent of respondents). Only 20 percent of ice-bound-waters anglers indicated that fishing had improved.

3. Boating

Respondents reported owning 675 watercraft, the majority of which (30 percent) were pontoon boats. Fishing boats and other (nonmotorized) watercraft accounted for 23 percent each of the remaining watercraft reported, while skiboats and personal watercraft each accounted for 12 percent of the watercraft.

The average horsepower of the motors reported by respondents was 110 horsepower. Skiboats and personal watercraft were the most highly powered vessels (167 horsepower on average), while pontoon boats averaged 60 horsepower and fishing boats averaged 50 horsepower.

G. Concerns

Collectively, the greatest concern among respondents was the general water quality of the Lake. Eighty-six percent of respondents rated water quality in Beaver Dam Lake as poor. This rating was primarily based on water clarity (88 percent of respondents), and aquatic plant growth, specifically algae (55 percent of respondents). Forty percent of respondents also noted aesthetic reasons for their water quality determination.

Respondents were divided as to whether the water quality had deteriorated (29 percent), remained the same (41 percent), or improved (23 percent).

A majority of respondents (72 percent) indicated concerns over excessive aquatic plant growth in the Lakes, primarily due to algal growth.

Other, related concerns included runoff from farmland (ranked at 1.9 on a five-point scale, with 1 being most important and 5 being least important), barnyard and fertilizer runoff (each ranked at 2.5), erosion of shorelines (ranked at 2.8), and rocks and loss of wildlife habitat (each ranked at 3.0). Concern over fishing regulations was the fifth most common concern expressed by respondents (ranked at 3.1).

Eighty percent of respondents noted that water levels were too low, with the inability to launch watercraft being cited as the primary reason for this perception. About one-fifth (18 percent) of respondents indicated that water levels were "about right."

G. Regulations and Law Enforcement Issues

1. Majority of respondents (56 percent) indicated satisfaction with the boating regulations in place on Beaver Dam Lake. Many respondents noted that these were State law.

2. Majority of respondents (57 percent) indicated satisfaction with law enforcement on the Lake.

3. Respondents were split over their levels of satisfaction with development and land use zoning regulations applicable to the Lake watershed; 35 percent indicated satisfaction and 29 percent indicated dissatisfaction with the level of development, and 34 percent indicated satisfaction and 25 percent indicated dissatisfaction with the zoning regulations. A major source of dissatisfaction was the perception that manure and agricultural runoff is entering the lake.

4. Plurality of respondents (32 percent each) indicated satisfaction and dissatisfaction with sanitation regulations in the Lake watershed, with agricultural operations being of concern. A number of respondents suggested extending the public sanitary sewerage system beyond the City of Beaver Dam.

IV. WATER QUANTITY AND QUALITY

A. Perceptions and Trends

1. Based upon water clarity and water testing, the majority of the respondents (86 percent) considered the Lake as having poor water quality.

2. Based upon algal and aquatic plant growth, the majority of respondents (72 percent) did not consider the Lake to have good water quality.

Section 4 Doc 4.3

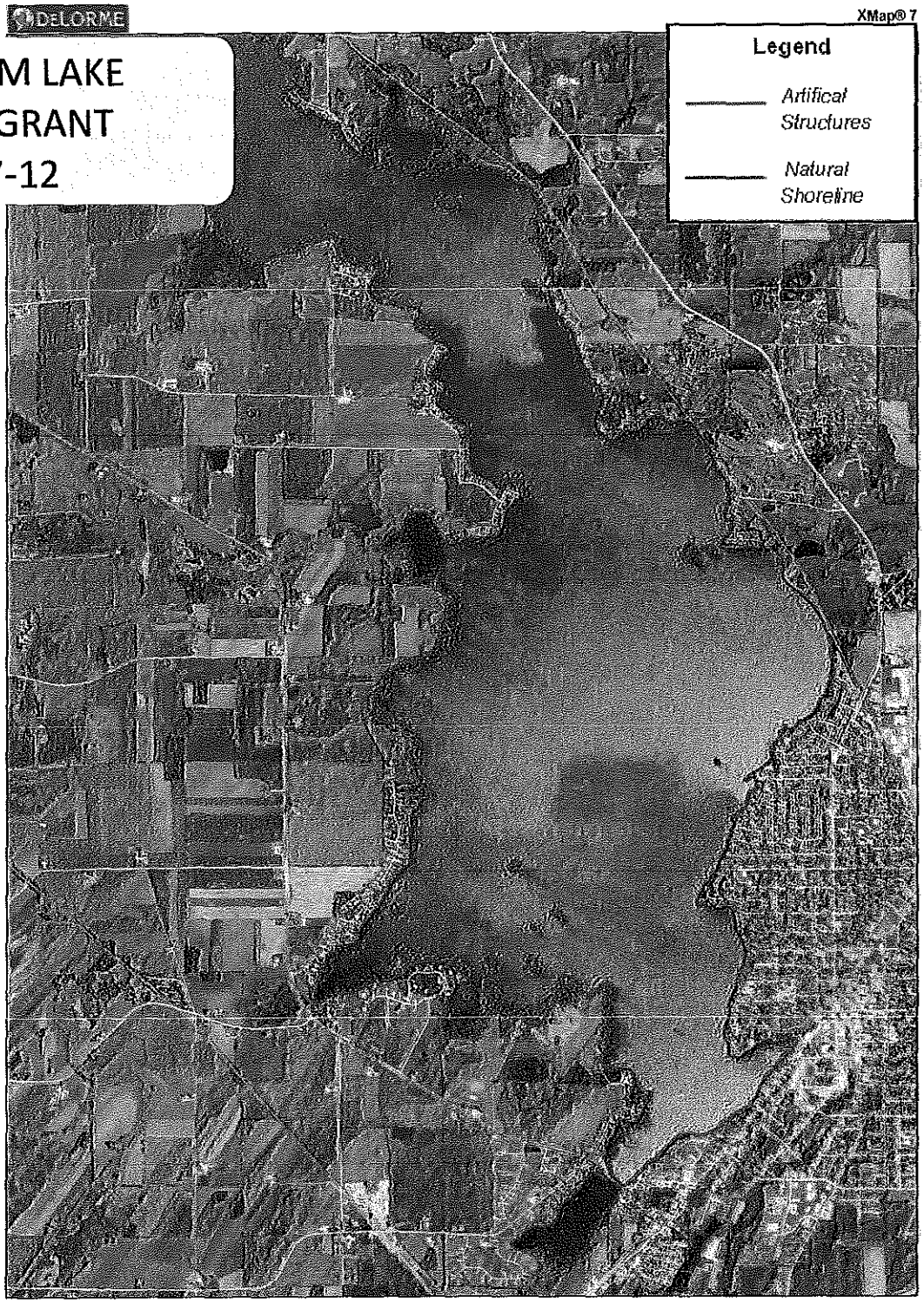
Shore Survey Maps

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

Map X Beaver Dam Lake Shoreline Survey -- North Half

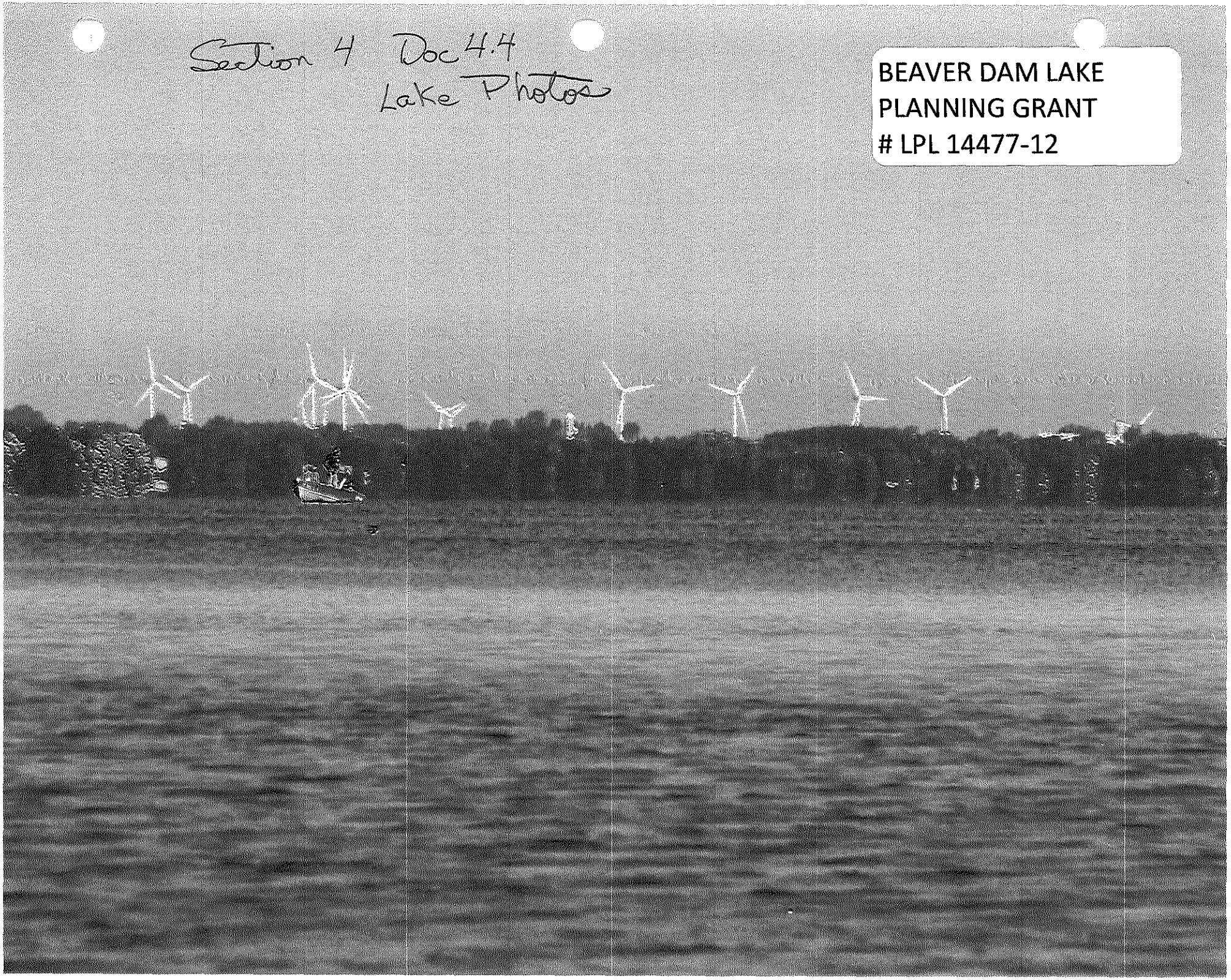
Map X – Beaver Dam Lake Shoreline Survey – South Half

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12



Section 4 Doc 4.4
Lake Photos

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12



BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

Section 5 Doc 5.1
w/ map

Beaver Dam Lake Improvement Association, Inc.

Improvement
Association, Inc.
P.O. Box 33
Beaver Dam, WI 53916

LAKE USE AND WATER QUALITY SURVEY

Dear Friends and Neighbors,

The Beaver Dam Lake Improvement Association, Inc., in cooperation with the Wisconsin Department of Natural Resources and your local municipality, is engaged in developing a lake management plan for Beaver Dam Lake. A brief description of the entire project is given on the next page.

We are conducting this survey to determine your opinions regarding the state of the Lake and surrounding development, to determine how you use the Lake, and to identify those improvements which you would like to see in the Lake. This information will help us to identify the management measures necessary to protect and enhance our Lake and our communities.

This survey is being conducted by our consultants, Environmental Horizons, Inc., to whom your responses will be returned. These responses will be kept confidential, although responses will be tabulated and compiled for use in the development of the comprehensive lake management plan. Your responses will help us to develop an appropriate strategy for protecting our shared water resources. We hope that you will take a few minutes to provide us with your opinions and responses to the following questions.

To return your response to Environmental Horizons, please remove these outer pages, refold the questionnaire so that the Environmental Horizons address is visible, place a piece of tape on the top edge, and drop the survey into the U.S. mail.

If you have any questions regarding this survey, please contact Dr Jeffrey Thornton of Environmental Horizons, Inc., by telephone at 920 627 9925 or by electronic mail at info@environmentalhorizons.com. More general questions regarding the Beaver Dam Lake Improvement Association, Inc., and its activities should be directed to me at the address given above.

Thank you for your participation. Your reply by August 31, 2012, would be appreciated.

Sincerely,

Bob Roell, President
Beaver Dam Lake Improvement Association, Inc.

Enclosure

Beaver Dam Lake Improvement Association
www.bdlia.org

Beaver Dam Lake Management Plan

Funded by WDNR & BDLIA

Development Stage May 2012 to December 2013

PURPOSE

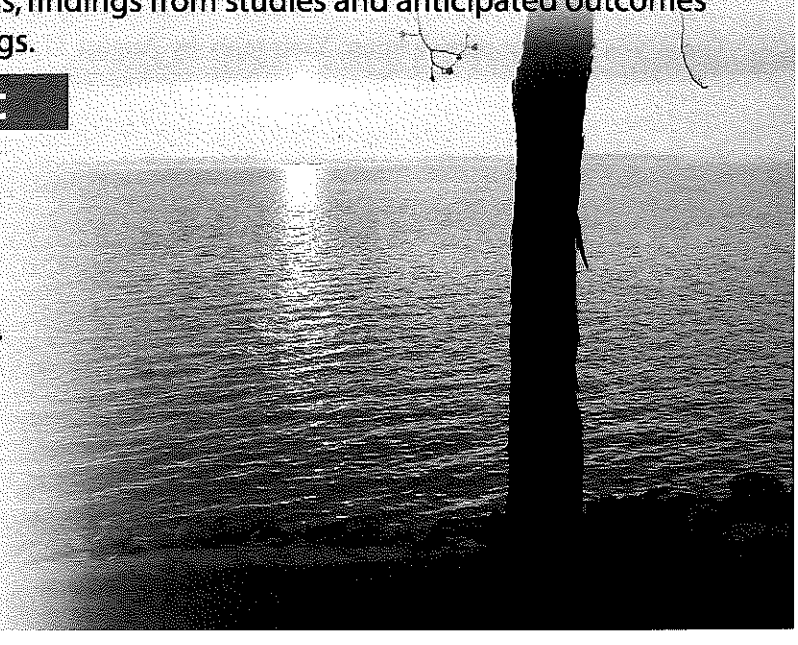
- Develop a comprehensive long range management plan for Beaver Dam Lake and its watershed.
- Set forth the inventory and analysis of findings.
- Identify alternative and recommended management measures.

Goals & Objectives

- Review and detail existing and anticipated future water quality conditions.
- Inventory aquatic plants.
- Shoreline condition survey.
- Identify current and future lake usage.
- Identify sources of pollution, nutrient and contaminant inputs.
- Computation and estimation of nutrient limitation.
- Determination of alternative water quality management actions.
- Determination of carp population estimates.
- Utilize WDNR 2010 fisheries survey, which provided an assessment of the entire fish community in the lake.
- Development of lake management options that meet use goals set by the lake community.
- Communicate planning process, findings from studies and anticipated outcomes at public informational meetings.

Citizen Involvement

- Be involved, volunteer to help.
- Stay informed regarding the development of the plan.
- Support the process and plan through membership in BDLIA.



WISCONSIN DEPT. OF NATURAL RESOURCES

BEAVER DAM LAKE

RECREATIONAL WATER USE AND WATER QUALITY SURVEY

Please color the block next to the appropriate answer completely: ■

PART I. Residency
(select one residency type, then answer questions below):

A. 1. Primary residence?

◯ ***YES***

◯ **NO**

2. If NO, please select the one description that best describes your time spent at Beaver Dam Lake.

◯ Summer season [June-August]

◯ Extended summer [spring to fall]

◯ Summer weekends

◯ Vacations only

◯ Weekends year-round

3. Do you:

◯ ***RENT***

◯ **OWN**

B. How many days per year do you spend at Beaver Dam Lake? _____ days

C. How many years have you lived in this area?

◯ Less than one year

◯ One year to five years

◯ Six years to 10 years

◯ More than 10 years

PART II. Lake Use

A. **Open Water Fishing** (*If you do not fish skip to C*)

1. Days fished per year _____ days

   Usually fish from:

◯ pier
◯ boat
◯ both equally

2. Which species of fish did you catch last year?

◯ Largemouth Bass
◯ Catfish
◯ Panfish (Blue Gill, Green Sunfish, etc.)
◯ Yellow Perch
◯ Crappie
◯ Other (please specify) _____

3. Do you think the number of CARP in Beaver Dam Lake have increased, decreased, or remained the same, within the last ten years?

◯ Increased
◯ Decreased
◯ Stayed the Same

4. Do you consider CARP to be:

◯ A major problem in Beaver Dam Lake
◯ A problem that is under control in Beaver Dam Lake
◯ Not a problem in Beaver Dam Lake

5. How do you rate the fishing quality?

◯ Excellent
◯ Good
◯ Fair
◯ Poor

6. Do you think the fishing in Beaver Dam Lake has increased, decreased, or remained the same, within the last ten years?

◯ Increased
◯ Decreased
◯ Stayed the Same

B. **Ice-fishing** (*If you do not ice fish skip to C*)

1. How many days did you ice fish over the past year? _____ days

2. Which species of fish did you catch last year?

◯ Largemouth Bass
◯ Catfish
◯ Panfish (Blue Gill, Green Sunfish, etc.)
◯ Yellow Perch
◯ Crappie
◯ Other (please specify) _____

3. How do you rate the ice fishing quality?

◯ Excellent
◯ Good
◯ Fair
◯ Poor

4. Do you think the fishing in Beaver Dam Lake has increased, decreased, or remained the same, within the last ten years?

◯ Increased
◯ Decreased
◯ Stayed the Same

C. **Other Recreational Uses**

1. Manner in which you pursue these activities.

   a. On WEEKDAYS, do you consider the Lake to be:

◯ lightly used
◯ moderately used
◯ heavily used
◯ over used

   b. On WEEKENDS, do you consider the Lake to be:

◯ lightly used
◯ moderately used
◯ heavily used
◯ over used

Why do you feel this way? _____

_____

2. Do you use other Southeastern Wisconsin Lakes for recreation (fishing, swimming, skiing, picnicking, camping, etc.)? If **YES**, please list them.

◯ ***YES,*** _____

◯ ***NO***

3. The following list contains a number of popular water based activities. If you engage in any of these activities, please indicate the approximate number of days per year you spend on the activity in the space provided. In the last column, please indicate the relative importance of that activity to you by ranking the activities from 1 through 5, with 1 being least important and 5 being most important.

	Year Round (number of days)	Spring/Summer Only (number of days)	Fall/Winter Only (number of days)	Relative Importance (1-5)
*Power Boat	- -			
*PWC/Jet Ski	- -			
Water ski/Wakeboard/Tube	- -			
*Sail/Boardsail	- -			
*Row/Canoe/Kayak/Paddle	- -			
Swim/SCUBA Dive	- -			
Snowmobile	- -	- -		
Cross-Country Ski	- -	- -		
Bird Watching				
Picnic/Barbecue				
Walk/Jog				
Fishing				
Ice-fishing				
Other (specify _____)				

****If you indicated boating use of the Lake, please complete the following:***

Type of Boat:	*Ski Boat*	*Pontoon Boat*	*Fishing Boat or Other Motor Boat*	*Personal Watercraft/ Jet Ski*	*Other Boats (Non-motorized boats, sailboats, canoes, etc.*
Horse Power:					
Number Owned:					

PART III. Lake Management

A. Regulations and Law Enforcement Issues:

1. How would you rate your general level of satisfaction with *boating regulations* on the Lake?

◯ Well satisfied
◯ Satisfied
◯ Not satisfied
◯ Very dissatisfied
◯ No strong feeling

Why? _____

2. How would you rate your general level of satisfaction with *law enforcement* on the Lake (e.g., boating, fish and game regulations)?

◯ Well satisfied
◯ Satisfied
◯ Not satisfied
◯ Very dissatisfied
◯ No strong feeling

Why? _____

B. Land and Watershed Issues (The watershed is all of the land that drains to the Lake):

1. How do you rate your general level of satisfaction with the *level of development* (land use **planning**) in the Lake watershed?

◯ Well satisfied
◯ Satisfied
◯ Not satisfied
◯ Very dissatisfied
◯ No strong feeling

Why? _____

2. How do you rate your general level of satisfaction with *stormwater management* (land use **zoning regulations**) in the Lake watershed?

◯ Well satisfied
◯ Satisfied
◯ Not satisfied
◯ Very dissatisfied
◯ No strong feeling

Why? _____

3. How do you rate your general level of satisfaction with *sanitation regulations* (solid waste, sewerage, septage, manure) in the Lake watershed?

◯ Well satisfied
◯ Satisfied
◯ Not satisfied
◯ Very dissatisfied
◯ No strong feeling

Why? _____

C. Water Quality Issues:

1. Do you consider the Lake to have *good water quality*:

◯ ***YES***

◯ ***NO***

2. Is your assessment based on: (check all that apply)

◯ **WATER CLARITY** and/or water tests?
◯ **AQUATIC PLANTS**?
◯ **AESTHETICS** and/or wildlife conditions?

3. How would you describe good water quality?

_____

_____

4. In your opinion, how has the quality of the Lake changed since you first moved to or visited the area?

◯ Improved
◯ Stayed the same
◯ Deteriorated
◯ Don't know

D. Aquatic Plant Management Issues:

1. Do you feel that the Lake has excessive algae and/or aquatic plant growth?

◯ ***YES***
◯ ***NO***
◯ DON'T KNOW

Why? _____

If you answered **NO** or **DON'T KNOW** to the previous question, *skip to Part E, Lake Level Issues.*

If you answered **YES** to the previous question, please answer the following question.

2. How would you like to see the excessive algae and aquatic plants controlled?

◯ Mechanical harvesting of weeds

◯ Use algae/aquatic plant herbicides

◯ Biological control [i.e. weevil]

◯ Place additional development controls on these areas (check all that apply):

- Along the shoreline
- Within 500 feet of the lakeshore
- Within 1,000 feet of the lakeshore
- Within the watershed

◯ Dredging

◯ Other (please specify): _____

E. **Lake Level Issues:**

1. Do you consider the current Lake level to be: (indicate one)

◯ Too High

◯ About Right

◯ Too Low

Why? _____

F. **Other Issues:**

From the list below, please indicate the top five issues affecting Beaver Dam Lake, with number 1 indicating your greatest concern and the number 5 indicating the issue of least concern:

_____ Fertilizer and runoff from residences

_____ Shoreline erosion

_____ Obstructions to boating (rock piles)

_____ Industrial and waste discharges

_____ Too few amenities (restaurants, marinas)

_____ More wildlife habitat

_____ Wetland preservation

_____ Lack of public parks

_____ WDNR fishing regulations

_____ Flood risk

_____ Barnyard and Pasture runoff

_____ Fertilizer and runoff from farm fields

_____ Alternative recreational opportunities

G. Funding Lake Management Actions

1. Would you be prepared to pay for any improvements to the lake or river environment or facilities that you may have indicated above?

◯ *YES*

◯ *NO*

If *NO*, who should pay? _____

how should the funds be raised? _____

ENVIRONMENTAL HORIZONS, INC.
140 CORPORATE DRIVE, SUITE 1
BEAVER DAM, WI 53916-9952

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UNITED STATES

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AVADA
140 CORPORATE DRIVE STE 1
BEAVER DAM WI 53916-9914

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G. Funding Lake Management Actions (continued)

If *YES*, which additional improvements would you be willing to pay for?

_____

_____

2. Are you a member of the Beaver Dam Lake Improvement Association?

◯ ***YES***

◯ ***NO***

If *NO*, would you like more information on the Association? (please provide your address)

_____

3. Are there any other issues that you would like to draw to our attention at this time?

_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION

BEAVER DAM LAKE IMPROVEMENT ASSOCIATION, INC.

Annual Meeting – Saturday, August 25, 2012

Members & Non-members are welcome!

8:30 AM Continental Breakfast – 9:00 AM Meeting

The Beaver Dam Conservation Club

W9554 County Trunk Highway G - Beaver Dam

Meeting will include Election of Board Members

Guest Speaker Jeff Thornton, Environmental Horizons, Inc.
Discussion on developing a lake management plan for Beaver Dam Lake.

RSVP by August 20th to 920-356-1200 or email info@bdlia.org

Beaver Dam Lake Improvement Association

☐ **RENEWAL**
☐ **NEW MEMBER**

Through July 31, 2013
MEMBERSHIP FORM

PERMANENT ADDRESS:

Name(s) _____

Address _____

_____

Phone _____

LOCAL ADDRESS (if applicable):

Address _____

_____

Phone _____

Email _____

MEMBERSHIP CATEGORIES:

☐ Individual - $20.00 – 1 Vote
☐ Family - $30.00 – 2 Votes
☐ Association - $30.00 – 1 Vote
☐ Corporation - $50.00 – 1 Vote

Where would you like BDLIA correspondence and newsletters sent?

☐ Permanent Address
☐ Local Address
☐ Email

Membership supports:
Aeration – Education – Newsletters – Restoration – Stocking ~ Hatchery ~ Etc.

Please make CHECKS PAYABLE and SEND TO:
Beaver Dam Lake Improvement Association, Inc.
PO Box 33 ~ Beaver Dam, WI 53916-0033
920-356-1200 ~ www.bdlia.org ~ info@bdlia.org

Beaver Dam Lake
Improvement
Association, Inc.
P.O. Box 33
Beaver Dam, WI 53916

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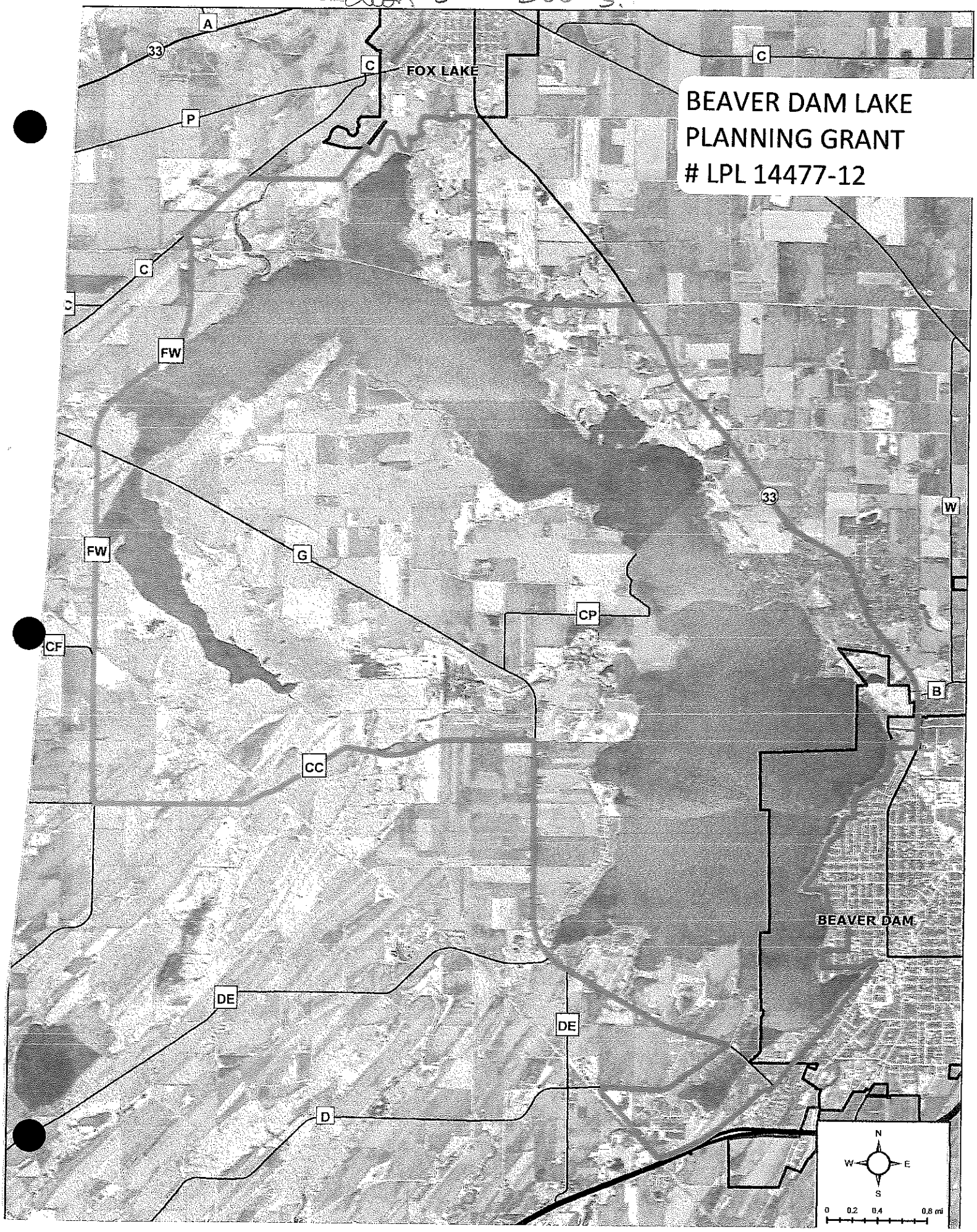
Section 5 Doc 5.1



Section 5 Doc 5.2

BEAVER DAM LAKE
PLANNING GRANT
LPL 14477-12

ENVIRONMENTAL HORIZONS, INCORPORATED

"Providing Innovative Solutions for Land and Water Resource Management"

PUBLIC OPINION OF LAKE USE AND WATER QUALITY OF BEAVER DAM LAKE

I. METHODOLOGY

A. Questionnaire survey using a mail-back survey method with one follow-up postcard reminder was conducted during summer 2012.

B. Analysis based upon 394 responses out of 1,595 possible. This correlates to a 25 percent return of questionnaire surveys by the Beaver Dam Lake residents.

II. RESPONDENT PROFILE

A. Beaver Dam Lake was the primary residence of the majority of respondents (71 percent).

B. Majority of respondents (52 percent) were year-round residents; 32 percent were resident during an extended summer period; and 10 percent were weekend residents during the summer. Four percent were summer residents only and 2 percent were vacationers.

C. Respondents spent an average of 221 days per year at the Lake.

D. Majority of respondents (72 percent) had resided on Beaver Dam Lake for more than 10 years. Sixteen percent had resided on the Lake between 6 and 10 years, 11 percent for 1 to 5 years, and 1 percent were new residents.

E. Almost all respondents (99 percent) owned their homes.

III. LAKE USE

A. Categories of Use

The most popular passive lake uses included: aesthetic viewing/bird and wildlife watching with a weighted score of 821 (based upon the numbers of people engaging in the activity and the numbers of days in which they participated), walking/jogging with a weighted score of 340, and picnicking/barbecuing with a weighted score of 193.

The most popular active lake uses included: Fishing with a weighted score of 191, powerboating with a weighted score of 142, waterskiing with a weighted score of 140, and operating personal watercraft with a weighted score of 115.

Cross-country skiing was the least popular activity with a weighted score of 21. Ice-fishing had a weighted score of 75; sailing, rowing and hunting had a weighted score of 72, and swimming and snowmobiling had a weighted score of 68.

B. Importance of Use

1. Snowmobiling, powerboating, and hunting were rated as the most important uses, rated as 4.0 or greater on a five-point scale, where 5.0 is the most important use.

2. Sailing and cross country skiing were rated at 3.0 or less, and were reported to be the least important lake uses.

C. Intensity of Use

1. Beaver Dam Lake was described as being lightly used during the week by a majority of respondents (86 percent), with 13 percent of respondents describing the use as moderate.

2. Weekend use was described as moderate by a majority of respondents (60 percent), with 34 percent of respondents describing the weekend use as light.

D. Frequency of Use

1. Bird-watching (18,000 total days with an average of 222 days per respondent), walking/jogging (5,730 total days with an average of 100 days per respondent), and picnicking (2,914 total days with an average of 51 days per respondent) were the most frequently engaged in passive activities.

2. Fishing (5,597 total days with an average of 49 days per respondent), powerboating (5,320 total days with an average of 28 days per respondent), waterskiing (3,058 total days with an average of 28 days per respondent), and operating personal watercraft (1,592 total days with an average of 31 days per respondent) were the most frequently engaged in active recreational activities. Ice-fishing was engaged in on more than 1,330 total days with an average of 21 days per respondent.

3. Overall, lake use during spring and summer was greater than during fall and winter. Boating, angling and swimming activities were engaged in on average on 27 days during the spring and summer months and on 11 days during the fall and winter months (open water activities obviously being curtailed during the ice-bound winter period).

4. Ice bound water activities (snowmobiling, ice-fishing and cross-country skiing) were engaged in on average on 14 days during the fall and winter.

E. Use of Other Lakes

1. Thirty-six percent of respondents reported that they regularly used other lakes throughout south-central and southeastern Wisconsin.

2. Of these, 40 percent reported using Fox Lake.

3. Other lakes used frequently included Lake Emily, (Big and Little) Green Lake, Lake Mendota, Lake Monona, and Lake Winnebago. Numerous respondents also reported using Lake Michigan.

F. Levels of Satisfaction

1. Open-water Angling

One-third (34 percent) of respondents engaged in fishing during the open-water season. Anglers spent 10,881 days fishing, with an average time spent fishing per respondent of 44 days. Of these respondents, 43 percent fished from piers, 19 percent from boats, and 38 from both piers and boats.

Collectively, of the anglers responding, 53 percent of respondents rated the fishing quality of these Lakes as fair and 31 percent as good.

A majority of the anglers responding caught catfish (30 percent), panfish (25 percent), crappie (20 percent) and largemouth bass (14 percent). Seventy-five percent of respondents reported fishing for "other species". Of the other species sought, walleye were caught about 49 percent of the time, and bullhead were caught 25 percent of the time.

Overall, anglers perceived that these populations have remained the same in this system (40 percent of respondents); those indicating a perceived change in the fisheries were evenly divided as to whether it has improved (32 percent of respondents) or declined over time (28 percent of respondents).

Two-thirds of respondents indicated that carp were perceived as a problem, while one-third suggested that carp were a problem that was under control. A majority of respondents (83 percent) indicated that the size of the carp population had remained the same or decreased during their period on the lake.

2. Ice-bound water Angling

Fifteen percent of respondents engaged in fishing during the ice-bound-water season. Ice-anglers spent 2,736 days fishing, with an average time spent fishing per respondent of 20 days.

Collectively, of the anglers responding, 54 percent of respondents rated the ice-fishing quality of these Lakes as fair; 23 percent rated the ice-fishing as good, and 20 percent rated the ice-fishing as poor.

A majority of the anglers responding caught crappie (32 percent), panfish (27 percent), perch (22 percent) and largemouth bass (6 percent). Seventy-five percent of respondents reported fishing for "other species". Of the other species sought, walleye were caught about 73 percent of the time; northern were caught 25 percent of the time.

Overall, anglers perceived that these populations have remained the same in this system (38 percent of respondents) or declined over time (42 percent of respondents). Only 20 percent of ice-bound-waters anglers indicated that fishing had improved.

3. Boating

Respondents reported owning 675 watercraft, the majority of which (30 percent) were pontoon boats. Fishing boats and other (nonmotorized) watercraft accounted for 23 percent each of the remaining watercraft reported, while skiboats and personal watercraft each accounted for 12 percent of the watercraft.

The average horsepower of the motors reported by respondents was 110 horsepower. Skiboats and personal watercraft were the most highly powered vessels (167 horsepower on average), while pontoon boats averaged 60 horsepower and fishing boats averaged 50 horsepower.

G. Concerns

Collectively, the greatest concern among respondents was the general water quality of the Lake. Eighty-six percent of respondents rated water quality in Beaver Dam Lake as poor. This rating was primarily based on water clarity (88 percent of respondents), and aquatic plant growth, specifically algae (55 percent of respondents). Forty percent of respondents also noted aesthetic reasons for their water quality determination.

Respondents were divided as to whether the water quality had deteriorated (29 percent), remained the same (41 percent), or improved (23 percent).

A majority of respondents (72 percent) indicated concerns over excessive aquatic plant growth in the Lakes, primarily due to algal growth.

Other, related concerns included runoff from farmland (ranked at 1.9 on a five-point scale, with 1 being most important and 5 being least important), barnyard and fertilizer runoff (each ranked at 2.5), erosion of shorelines (ranked at 2.8), and rocks and loss of wildlife habitat (each ranked at 3.0). Concern over fishing regulations was the fifth most common concern expressed by respondents (ranked at 3.1).

Eighty percent of respondents noted that water levels were too low, with the inability to launch watercraft being cited as the primary reason for this perception. About one-fifth (18 percent) of respondents indicated that water levels were "about right."

G. Regulations and Law Enforcement Issues

1. Majority of respondents (56 percent) indicated satisfaction with the boating regulations in place on Beaver Dam Lake. Many respondents noted that these were State law.

2. Majority of respondents (57 percent) indicated satisfaction with law enforcement on the Lake.

3. Respondents were split over their levels of satisfaction with development and land use zoning regulations applicable to the Lake watershed; 35 percent indicated satisfaction and 29 percent indicated dissatisfaction with the level of development, and 34 percent indicated satisfaction and 25 percent indicated dissatisfaction with the zoning regulations. A major source of dissatisfaction was the perception that manure and agricultural runoff is entering the lake.

4. Plurality of respondents (32 percent each) indicated satisfaction and dissatisfaction with sanitation regulations in the Lake watershed, with agricultural operations being of concern. A number of respondents suggested extending the public sanitary sewerage system beyond the City of Beaver Dam.

IV. WATER QUANTITY AND QUALITY

A. Perceptions and Trends

1. Based upon water clarity and water testing, the majority of the respondents (86 percent) considered the Lake as having poor water quality.

2. Based upon algal and aquatic plant growth, the majority of respondents (72 percent) did not consider the Lake to have good water quality.

3. Plurality of respondents (29 percent) perceived the quality of the Lake to have deteriorated since they first moved to or visited the area; 41 percent perceived the water quality to have stayed the same.

4. Majority of respondents (72 percent) felt that the Lake had excessive algal and aquatic plant growth. Watershed-based management measures, collectively, including restricted fertilizer usage and land development controls, were the preferred options for controlling aquatic plants (40 percent of respondents).

5. One-quarter of the respondents suggested dredging the lake; 80 percent of respondents described the water level in the Lake as being too low, although numerous respondents noted the fact that the survey was being conducted during a low rainfall period (drought year).

6. Numerous respondents noted the ongoing drought as a basis for indicating that water levels were too low; some suggested altering the dam operations as a result.

7. Many comments were made regarding rocks and obstructions, and consequent damage to watercraft.

B. Management: Willingness to Pay

1. Majority of respondents (62 percent) was willing to contribute more money for lake-related improvements.

2. Many respondents (38 percent) felt that local, county, and state funds should be allocated for lake-related improvements, and were unwilling to pay more for lake management measures.

3. Thirty percent of respondents specifically identified dredging as a specific management measure for which they would be willing to pay.

4. Plurality of respondents (40 percent) preferred land-based management measures over in-lake measures, although dredging the lake was frequently identified by many respondents (26 percent of respondents). Between 10 percent and 13 percent of respondents each identified in-lake aquatic plant management measures—harvesting, chemical, and biological control measures—for addressing concerns regarding abundant aquatic plant growths, many of which were associated with algal blooms in the Lake.

5. Respondents were relatively evenly split between being members of the Beaver Dam Lake Improvement Association, Inc., (47 percent of respondents), and not being members (53 percent of respondents).

V. GENERAL OBSERVATIONS: SUMMARY AND CONCLUSIONS

In general, respondents indicated a high degree of awareness of the characteristics of shallow lakes, and held expectations that were commensurate with such a waterbody. Given the fairly widespread use of other (deeper) lakes in south-central and southeastern Wisconsin by respondents, the awareness and acceptance of the shallow nature of Beaver Dam Lake was somewhat unexpected. However, as was expected, respondents frequently expressed a desire for deeper water, especially adequate depth for pursuing high speed boating activities, and maintaining a productive and diverse fishery.

That said, angling was a major use of the lake, especially during open water periods. While an array of warmwater sportfish were sought after species, many anglers reported fishing for catfish and carp, while most anglers indicated their preference for northern pike and walleye. The latter species is not generally

considered to be a shallow lake fish, and consequently was not included in the selection of species offered to respondents.

Of the aquatic plant concerns, concerns over algae dominated the responses. There was special concern over blue-green algae, which are not only unsightly and produce a distinctive odor, but some varietals are potentially toxic if ingested in large quantities or there is long term exposure. Visual criteria were overwhelmingly utilized in describing good water quality.

Some respondents suggested a desire for improved "structure" in the lake to be created by a greater population of rooted aquatic plants, or macrophytes. The delicate balance between an algal-dominated shallow lake and a macrophyte-dominate shallow lake is an issue to be examined in greater detail, especially given the active recreational boating use of the Lake.

Respondents were generally satisfied with the levels of law enforcement and boating regulation on the Lake, although there were numerous comments regarding both the lack of (visible) enforcement and selective enforcement, especially of boating regulations. Respondents generally were less well informed about land use, zoning and sanitation regulations, suggesting that these areas would be useful areas for the Beaver Dam Lake Improvement Association to consider in its future informational programming. About one-half of the respondents were Association members.

As was expected, the majority of concern was focused on the agricultural community and specifically on the runoff of agrichemicals and manure into the Lake. Provision of greater vegetated buffers between the shorelands and lake (in both agricultural and residential areas) was frequently suggested as a means of dealing with this runoff and minimizing its entry to the Lake. Observations suggested that residential lands could certainly benefit from application of such buffers. Protection of riparian lands, therefore, is an issue to be examined in greater detail, together with stormwater management and control of nonpoint source pollution.

There was general agreement that investments in creating deeper water with better water quality were required, with respondents being split on whether the funding should come from the local community or other governmental sources. There seemed to be slightly more respondents suggesting that a lake district (a public inland lake protection and rehabilitation district pursuant to Chapter 33 of the *Wisconsin Statutes*) would be helpful than those who were opposed to such a move. Options other than direct funding through a special purpose unit of government included continuation of the voluntary funding opportunities currently provided by the Beaver Dam Lake Improvement Association, solicitation of state (and federal) grants, imposition of a room tax by the City of Beaver Dam, to dedication of local tax revenues to lake improvement activities (in lieu of forming a special purpose unit of government).

In response to these opinions and comments, Environmental Horizons staff will formulate a comprehensive lake management plan for Beaver Dam Lake so as to address the characteristics of shallow lake ecosystems, limitation on lake management actions relating to shallow lake ecosystem in view of the recreational boating activities, management of algae (and aquatic plants in general), and the potential for deepening the lake. In addition, community informational programming and organizational options will be addressed, in view of the need for sustained financial investments in lake rehabilitation.

/JAT/
BDLIA SURVEY RESULTS.DOC
12/04/12