

A Recommendation by the Beaver Dam Lake Citizen's Alliance for Developing a Comprehensive Management Plan for Beaver Dam Lake

(Adopted 3/04/04)



BOATING ON BEAVER DAM LAKE, C. 1906. It is ironic that the man-made lake created for the purpose of working the industries of the city would, nearly a quarter of a century later, become its main focus of recreation. The lake continues to be the center of leisure to this very day.

Photo and caption from Images of America, Beaver Dam, 1841-1941 by Roger Noll and the Dodge County Historical Society, Inc.

The mission of the Beaver Dam Lake Citizen's Alliance, a volunteer citizen stakeholder organization, is to involve all stakeholders in an open public process, which will result in the development of a management plan for Beaver Dam Lake. The management plan developed through this process will seek to achieve and maintain the maximum recreational, wildlife and aesthetic potential of Beaver Dam Lake for the mutual benefit of those who live and recreate on the lake, its associated wetlands, and its watershed.

The Beaver Dam Lake Citizen's Alliance, a volunteer citizen stakeholder group, developed the following lake management objectives and management actions as a recommendation to the Wisconsin Department of Natural Resources, the City of Beaver Dam, lake stakeholder organizations and lake users. The recommendations contained in this report were developed in response to petitions concerning water level management on Beaver Dam Lake. These recommendations are the conclusion of over two years of public discussion and meetings by a group of dedicated citizens concerned about the future of this valuable recreational and economic resource.

A mission statement was developed by the Alliance to define the purpose of their efforts:

The mission of the Beaver Dam Lake Citizen's Alliance is to involve all stakeholders in an open public process, which will result in the development of a management plan for Beaver Dam Lake. A management plan developed through this process will seek to achieve and maintain the maximum recreational, wildlife and aesthetic potential of Beaver Dam Lake for the mutual benefit of those who live and recreate on the lake, its associated wetlands, and its watershed.

The desired outcome of this process will be a guideline for a management plan which will:

- 1) Develop and maintain Beaver Dam Lake as a quality resource for fishing, hunting and boating and other recreational uses;
- 2) Develop and maintain Beaver Dam Lake as an economic asset to the community for tourism, recreation, property value and quality of life;
- 3) Develop a lake management plan that is economically feasible, can be implemented with minimum management intervention and has public support;
- 4) Maintain biological diversity of the lake ecosystem.

This recommendation is not intended to be a final plan, but rather a flexible, evolving guide that identifies the key issues and needs to be addressed in order to develop and maintain Beaver Dam Lake as a valuable recreational resource. Each element of the proposed management plan would require additional study and development. A continuing open public participation process would be utilized to involve stakeholders in all aspects of the implementation of elements of the proposed plan. After further study some suggested elements of the plan may be determined to be not feasible from either cost, technical insufficiency or lack of public acceptance. It is likely that new elements may be added after further study.

Successful management of Beaver Dam Lake can not be accomplished without broad lake community support and participation. It is the sincere hope of the Beaver Dam Lake Citizen's Alliance, that this recommendation will be received, studied and endorsed by the many stakeholders on Beaver Dam Lake as a foundation for continuing discussion, study and implementation of management strategies and projects to maintain and improve the recreational, biological and aesthetic quality of Beaver Dam Lake.

Background for Management Plan Proposal

On April 26, 2001 a petition by three lake property owners was submitted to the Department of Natural Resources (DNR) requesting a modification of the water level order for Beaver Dam Lake to lower the water level for purposes of restoring the lake to a condition more typical of that which existed in approximately 1930—40 era.

The petition recommended implementation of one of two alternative approaches:

1. lower the maximum water level to 86.00 from the current 88.50 and leave the minimum flow at 3 cubic feet per second,
2. lower the maximum level to 87.67 and have a two year drawdown every five years.

The goals of the proposed change in water level, as listed in the petition, are:

1. Reestablish the wetlands of Beaver Dam Lake thus reestablishing the marsh ecology and species diversity.
2. Enhance the water and air quality
3. Enhance the growth of aquatic plants
4. Stop the erosion of farmland, rip rap, shorelines and what marsh is left.
5. Make the enforcement of the order as simplistic as possible to govern by and enforce.
6. To insure the dam safety to human life and property
7. To compel the Department to regulate the new order.

The petition alleges that the City of Beaver Dam has failed to operate the dam according to the 1958 Public Service Commission order that establishes water level and dam operation procedures for the lake. The petition states that excessively high water levels as a result of improper operation of the dam has caused significant shoreline erosion, loss of shoreline wetlands, and degradation of water quality.

In response to the petition the City of Beaver Dam and Beaver Dam Lake Improvement Association circulated a counter-petition which requested that the Department of Natural Resources dismiss the petition on the basis that the periodic drawdown and/or lowering of the water level of Beaver Dam Lake would destroy the present recreational use of the lake and depreciate property values. On June 18, 2001 Mayor Thomas Olson, City of Beaver Dam, delivered the petition with an estimated 4,000+ signatures to Department Secretary Darrell Bazzell.

Department of Natural Resources Statutory Authority and Responsibility

All dams in Wisconsin are regulated under statutory authority assigned to the Department of Natural Resources. Under s. 31.02(1), Wis. Stats., the Department may regulate and control the level and flow of water in all navigable waters. Specifically, the Department may erect benchmarks or require the owner of a dam to erect benchmarks in relation to which the impoundment water levels can be determined. The department can establish the maximum level of water to be impounded and the minimum level of water to be maintained by the dam.

The standards for action under this statute are:

“The department, in the interest of public rights in navigable waters . . . may regulate and control the level and flow of water in all navigable waters. . .”. The department is responsible for preserving and protecting public rights in navigable waters.

Generally, it is in the interest of public rights to:

- Maintain natural scenic beauty.
- Protect natural resources such as fish and game habitat.
- Preserve acceptable conditions for navigation and its incidents.
- Allow controlled fluctuations in level for resource management.
- Insure that stream flow is relatively undiminished in quantity or quality.
- Maintain water quality standards by ordering flow release amounts or scheduling flow releases from dams. Minimum flows (elevations) may also be established on flowing streams to preserve water quality.
- Allow dam maintenance or inspection;
- Minimize the possibility of exposing potentially contaminated or unsightly bottom materials or creating stagnant water areas or undesirable odors associated with decaying bottom material;
- Insure that stream flow is relatively undiminished in quantity or quality.

Any person may petition or request the Department to investigate and establish water level or flow requirements. Often these requests are in the form of a complaint. There are no application forms so this is generally accomplished by letter. The request should include specifically what is desired in the way of level or flow to enable that the Department to properly evaluate the request. A comprehensive field investigation is conducted to establish acceptable minimum flows or minimum and maximum elevations.

To protect public rights, evaluations will consider:

- Navigation and its incidents;
- Scenic beauty;
- Fish spawning grounds and wildlife habitat; and
- Wetland areas.

To protect life, health and property, evaluations will consider:

- Existing sewage systems;
- Pollution sources;
- Ice and water erosion potential;
- Flooding potential and easement requirements;
- Flow requirements to maintain water quality;
- Off-shore slopes;
- Dam structural and hydraulic adequacy if levels are raised; and
- Agricultural or irrigation diversions and other downstream beneficial users of water.

After investigation, the recommendation regarding levels or flow are incorporated into an order by the Department. All Department decisions on levels or flow are issued in the form of an order. Changes to an existing order will be issued in the form of an amendment to the initial permit and order authorizing the dam or as an amendment of previous water level orders. Public notice for proceedings to establish levels or flow is not required. If the Department wishes to solicit input from the public, it may issue a notice and hold an informational (legislative) hearing.

Formation of the Beaver Dam Lake Citizen's Alliance

The Department held the first public meeting to discuss the petitions on June 28, 2001. Given the controversial nature of the two petitions the Department recommended that a public participation process with an advisory committee be formed to develop a recommendation to the Department on how this issue should be resolved. In addition, the Department recommended that this process also develop a proposal for a long-range management plan to comprehensively deal with the other issues that are intimately interrelated with the water level issue. At the October 9, 2001 meeting, those in attendance agreed with this recommendation and identified the stakeholder groups that should be invited to participate in the process. On October 29, 2001 the advisory committee held its first meeting. The advisory committee, which named itself the Beaver Dam Lake Citizen's Alliance, has met twice monthly to the present time. All Alliance meetings have been open to the public. Meeting minutes have been kept and distributed to advisory committee members, public wishing to receive the minutes and the media.

Stakeholder groups regularly participating at the Alliance meetings include: City of Beaver Dam; Representatives from townships around the lake; Beaver Dam Lake Improvement Association; Dodge County Conservation Congress; Beaver Dam Yacht Club; Beaver Dam Development Corporation; Lake Businesses; Breezy Point Property Owners; Must-Ski Water Ski Club; Farming Community; Watershed management; Beaver Dam Chamber of Commerce; Environmental Interest Groups; Ducks Unlimited/Wisconsin Waterfowl Association. The University of Wisconsin Extension provided facilitation support and publication of information on the Dodge County University of Wisconsin Extension website. DNR has participated in the discussion as facilitator and advisors to the committee.

Understanding the Biology and Management of Shallow Lakes

Early in the process the stakeholders participating in the Alliance agreed on its mission and the desired outcomes listed above. However, to develop a management plan that can accomplish these outcomes, the Alliance members needed information concerning shallow lake management on which to base their recommendations. We requested presentations from “experts” about the biology and management strategies for shallow lakes. DNR staff from the Horicon and Madison office provided technical information and facilitation support throughout the Alliance’ effort. The difficulty in developing agreement on a management plan for a shallow lake is due to the conflicting desires of the various stakeholders who utilize the lake. The biology and management of shallow lakes is very complex and many interrelated factors are involved. It is not possible to present a thorough discussion of the many issues in this document. The following is a summary of the information presented to the Alliance and a discussion of the inherent conflicts in shallow lake management that must be resolved to implement a management plan that will accomplish the goals of the diverse user groups. This information is presented to assist readers with understanding the reasons for the recommendations contained in this document.

To maintain clear water and a quality sport fishery in shallow, fertile lakes such as Beaver Dam there are three critical elements of a management program:

- Promote and maintain an abundance of aquatic plants;
- Maintain a low carp population;
- Improve water quality by reducing incoming nutrients and sediment from the watershed and lakeshore.

Rooted aquatic plants are necessary to achieve several purposes:

- Abundant plants compete with algae for nutrients thereby reducing the blue-green algae blooms during the summer
- Rooted plants anchor the bottom sediments so that wave action doesn’t muddy the water so easily
- Aquatic plants provide hiding habitat for large zooplankton that feed on algae to help keep the water clear. Without vegetation predators deplete the large zooplankton.
- Aquatic plants provide required habitat for fish and wildlife species
- Aquatic plants provide habitat for food organisms for fish and wildlife

Maintaining a low carp population is critical because:

- Carp muddy the water so sunlight can’t penetrate to allow plants to grow and so sight feeding fish can’t effectively find food
- Carp destroy aquatic plants when feeding. Loss of vegetation reduces habitat and available food for game fish species and wildlife
- Carp compete for food with desired game fish species
- Uncontrolled, carp can become the dominant fish species in the lake causing the water to become very muddy and desirable fish and wildlife to virtually disappear from lake.

Improving water quality by watershed and shoreline management is a necessary long-term management program to reduce fertility available to feed the overabundant algae population and to prevent the water quality from becoming worse in the future.

One of the most critical factors in the successful management of shallow, fertile lakes is water level management. On lakes with a dam that controls water level such as Beaver Dam, water level management is the most easily achieved and least costly management tool that we have. Shallow water depth early in the growth season is desirable as it allows plant growth to become established on a larger area of the lake bottom. To maintain aquatic plant growth through the summer season sunlight must continue to be able to penetrate to the lake bottom so that plant growth can be maintained. When dense algae blooms occur during the summer sunlight may only be able to penetrate a few inches, so water depth becomes a very

important factor in maintaining plant growth. To maintain plant growth throughout the summer season it would be advantageous to have lower water levels during the late summer.

Water level management is also the most controversial aspect of managing shallow lakes. Boaters and many riparian (lake shore) property owners want deeper water to improve navigation in the shallowest areas of the lake. Consequently water level is often maintained at a high level to satisfy this user group. The high water level may discourage or actually destroy aquatic plant growth needed to maintain water quality and fish and wildlife habitat. High water levels also increase shoreline erosion and loss of wetland shorelines. The erosive action of waves, and ice in the winter, cause increased sediment to be deposited in the lake. Valuable wildlife habitat and spawning/nursery areas for fish are lost when the wetlands disappear.

Maintaining the biological needs of the lake and satisfying the desires of the boating and shoreline property owners becomes a delicate balancing act. How does the operator of the dam satisfy all interest groups? If it is agreed that the most important goal is to promote and maintain water quality and a desirable fishery then water level management to provide for the biological needs of the lake must be given the highest priority. However, all lake user needs must be considered in designing a management plan for the lake. Drastic changes in water level will not be acceptable to most lake users. A plan must be designed that achieves the biological needs of the lake without significantly impacting the wants of other lake users.

Water level can significantly impact shoreline vegetation also. As mentioned above high water level can cause erosion and loss of shoreline wetlands. Water level manipulation can be used to maintain or restore emergent shoreline vegetation that provides water quality benefits and wildlife/fishery habitat.

To develop the recommended management plan that follows, the Alliance had to deal with two water level issues: 1) long-term lake level and, 2) short-term reduction levels. They are each different and critical because they maintain the biology of the lake in different ways. Both issues must be addressed to successfully maintain a healthy lake for our enjoyment.

Regarding long-term lake levels, the Alliance has sought to reach a compromise to balance the needs of boating and lake access with the need to promote and maintain aquatic plant growth and reduce ongoing shoreline erosion. The primary cause of shoreline erosion in a shallow lake is high water levels during the open water months. In the winter, ice push causes destabilization of the shoreline. When the ice expands during freezing or is moved by the wind it plows into the shore pushing up vegetation or lakebed/shoreline. The destabilized bed/bank is then vulnerable to erosion by waves if the water level is too high. If the water level is controlled the bank will again stabilize with vegetation growth.

Soil erosion affects more than just the landowners who lose their property. It pollutes the water filling in the lake bottom and exacerbating all the problems already inherent in a shallow lake. Soil clouds the water and blocks sunlight from penetrating to the lake floor. Reducing erosion promotes vegetation that is essential for a healthy fishery. We want clearer water and great fishing but we also want high lake levels in the summer for boating and recreation. These two goals are not consistent or compatible. High summer water levels create a turbid (cloudy) lake that eventually will be unable to support even a stocked fishery. In determining a long-term lake level, the Alliance has attempted to balance these competing goals.

The Alliance' plan also includes a proposal for short-term water level reductions on a periodic basis as needed to restore and maintain emergent vegetation on or adjacent to undeveloped shorelines and for fishery management purposes. The goal of such a proactive plan would be to prevent the lake quality from becoming so bad that a full drawdown and eradication such as in 1987 would be necessary to restore the water quality and fishery.

A natural lake has a "natural reduction" or drought on the average of every 10-12 years. A drought in a natural lake (or short-term reduction in an artificial lake) produces a number of essential biological responses that are critical for a healthy lake. A short-term reduction of the water level which exposes the lake bed compacts the soil and allows emergent vegetation (above the water) to germinate and grow, anchoring the soil and using up some phosphorus (which otherwise produces excessive algae in late

summer). In addition, the vegetation provides critical habitat for fish/wildlife and helps produce significantly clearer water upon return to the normal level. Prior short-term water level reductions on Beaver Dam Lake have also allowed the community to do needed improvements to the lake including dam inspection and repair, shoreline repair and carp removal among others. If we must have some type of short-term reduction, how can we balance the needs of the community to use the lake for boating and fishing in the short term? One line of thought the Alliance is discussing is to have less dramatic reductions over shorter periods of time to minimize the interference on boating and recreation and then to monitor the effect that has on the lake's biology. These short-term reductions would be based upon the biology of the lake instead of when it is politically feasible. To implement such a plan a set of biological/water quality indicators would be developed as a guide for when a water level reduction might be considered.

The implementation of some elements of the management plan (such as water level reduction, carp removal) should be guided by objective measurable criteria that are determined and agreed upon prior to the time of need. In the past management has generally been implemented after the lake condition has severely degraded, then requiring drastic management activities, such as complete drawdown and carp eradication. Management could be more effective, less costly and have less negative impact on other lake uses if actions were implemented before the lake reached a severely degraded condition. A monitoring strategy that objectively measures lake quality (such as vegetation density, water clarity, fish population structure) should be established. A set of criteria would be developed to guide when a particular management program would be implemented. When monitoring indicates that lake quality has declined to the level of the established criteria, sometimes called a biological trigger, the appropriate management elements would be put into action. The objective is to maintain a more consistent lake quality rather than manage on a "boom and bust" strategy. These same criteria would also be used to measure success of a management action. Rather than base success on an activity, such as pounds of carp removed, success would be measured by water clarity improvement, vegetation response and a measure of the game fish population.

Recommendations for a Management Plan for Beaver Dam Lake

A search of the historical records shows that Beaver Dam Lake has been a source of controversy since it was first impounded in 1841 (see attached addendum). The dam failed several times until the current structure was completed in 1914. A water level order was first established in 1919 when farmers adjoining the lake complained of cropland being flooded. The Public Service Commission/Department of Natural Resources has since been petitioned to amend the order in 1939, 1946, 1958, 1972 and again now in 2001 as a result of conflicts arising from water level of the lake. Numerous lake studies were conducted and committees formed to look at problems with the lake over the years. Lake drawdowns and carp eradications were conducted in 1967 and 1987. The historical records show that the theme has been much the same, only the names and dates have changed. There has been a cyclic trend to Beaver Dam Lake's history. About every 10 years (+ or - a few years) there has been a citizen movement to take management actions to correct identified or perceived problems with the lake. Each of these efforts resulted in increased knowledge about the lake's management, and accomplished some goals. Overall, the attempts at lake management were less than successful due to lack of cooperation and coordination of stakeholders and the inability to provide funding to follow through and accomplish management objectives. To date the most successful management has resulted from the 1987 carp eradication and follow up management conducted by the DNR, Beaver Dam Lake Improvement Association and Beaver Dam Lake Development Corp..

The Alliance recognizes that the past history of lake management has been one of incomplete or no follow-through on management recommendations. To implement an effective management plan for Beaver Dam Lake there needs to be an appropriate lake management organization established. Such an organization must be recognized by the majority of stakeholders as the lead for implementing a plan. There must be a funding mechanism established to obtain necessary funds to accomplish agreed upon objectives. The committee is emphasizing its intent to promote establishment of an effective lake management organization and develop a process to resolve issues and implement agreed upon management plans.

This management plan is not intended to be a final plan, but rather a flexible, evolving guide that identifies the key issues and needs to be addressed in order to develop and maintain Beaver Dam Lake as a valuable recreational resource. Each element of the proposed management plan would require additional study and development. A continuing open public participation process would be utilized to involve stakeholders in all aspects of the implementation of elements of the proposed plan. After further study some suggested elements of the plan may be determined to be not feasible from either cost, technical insufficiency or lack of public acceptance. It is likely that new elements may be added after further study.

The Alliance developed the following management objectives and recommended management actions. They are categorized into actions recommended for immediate implementation and for long term implementation.

Implementation of Recommended Lake Management Plan

Management Objective—Develop a lake management organization and funding base to implement actions to accomplish goals and objectives established in lake management plan

Management Actions:

1. Investigate need, feasibility and process for formation of a lake protection and rehabilitation district (all parties)**
2. Identify and utilize existing organizations and funding sources to implement agreed upon elements of the management plan
 - A. Existing sources of funding utilized to date
 1. Beaver Dam Lake Improvement Association
 - a. Banquet
 - b. membership fees
 - c. lake planning and implementation grants
 - d. mandatory launch fees
 2. Townships
 - a. contribution to aeration fund through Beaver Dam Lake Development Corporation
 - b. voluntary contributions to management actions
 3. City of Beaver Dam
 - a. Beaver Dam Lake Development Corporation-aeration
 - b. Dam operation and maintenance
 - c. Contribution to carp removal program
 4. Department of Natural Resources
 - a. carp removal
 - b. fish stocking
 - c. fishery surveys
 - d. other management projects funded through budget
 5. Dodge County Land Conservation Department
 - a. Beaver Dam River Priority Watershed Project
 - b. Agriculture land management practices funded through DATCP and WDNR

**Suggested agencies, municipality or organization responsible for implementing or leading the implementation for each action is indicated in parentheses following each action listed

6. Natural Resources Conservation Service
 - a. Wetland Reserve Program
 - b. Conservation Reserve Enhancement Program
 - c. Wildlife Habitat Incentive Program
 - d. Environmental Quality Incentive Program

B. Funding sources not utilized to date

1. Waterways Commission
 - a. Navigation aids
1. Department of Natural Resources
 - a. Lake Implementation Grants
 - b. Knowles-Nelson Habitat Grants
2. U. S. Army Corps of Engineers
3. U. S. Environmental Protection Agency
4. University of Wisconsin Extension
5. Other Organizations(not inclusive list)
 - a. Ducks Unlimited
 - b. Wings Over Wisconsin
 - c. Wisconsin Wetlands Association
 - d. Private Foundations
 - e. Other Townships not contributing to date
 - f. Area conservation clubs and organizations
6. Inland Lake Protection and Rehabilitation District formation

Water Level Management

Management Objective—a) Operate the dam so as to minimize exceedence of the operating level; b) Maintain a water level that is conducive to recreational use, access from shoreline properties and public access points; c) Minimize erosion of wetland shoreline, encourage reestablishment of emergent wetland plants, and encourage growth of submergent plants.

Management Actions:

Immediate:

1. Amend the current order to establish an operating level of 88.3. (DNR)
2. Continue the spring water level reduction to 87.7 starting by March 1 to be completed by March 15. It is recommended to maintain the lake level at 87.7 until the later of April 1 or when the lake is ice free, begin raising slowly to the operating level by May 1, but to not exceed 88.0 before April 15. Ice free is to be defined as the lake being sufficiently free of ice to allow navigation by boat from the dam to Long Bridge. Put language in the order requiring an operating procedure for response to rising/falling water levels and minimum discharge to river. (DNR)
3. Establish reporting requirements to inform DNR and lake users concerning water level management. (DNR, City)
4. Monitoring of the new management plan and conduct an assessment at the end of a five year period. Modify the order if appropriate. (DNR, City, Lake Organization)
5. Develop draft language for the order and hold public informational meeting to present proposed amendment for public review. (DNR)
6. Publish a lake user's handbook that explains water level and biological management issues relating to shallow lakes. (DNR, City, Lake organization)

Long Term:

7. Establish an effective communication system with Fox Lake Dam operator and the Village of Lowell to coordinate water level management on the connected water bodies. (City)
8. Install electronic water level gauge/s at locations away from the dam to obtain more accurate measurement of water level. Connect gauge/s to internet to allow easy public access to water level data. (City)

9. Investigate feasibility of installing new larger, motorized, bottom-draw gates to increase dam discharge capacity and ease of operation of the dam. (City)
10. Investigate feasibility and cost of removing obstructions to river flow downstream of the dam to increase the channel capacity so as to improve ability to manage the lake water level. (City)

Rationale for Proposed Water Level Management

The current water level order for Beaver Dam Lake sets a maximum water level of 88.5 and minimum level of 88.17 (referenced to the water level gauge located on the dam face). Most lake users interpret the order to mean that the water level should be at the 88.5 elevation all the time. The intent of the water level order is that the lake level shall not exceed 88.5 except in the event of excessive rainfall or snow melt. In past years the City of Beaver Dam has attempted to manage the lake at the 88.5 level to satisfy the demands of lake users. As a result when rain events occur the lake level has frequently exceeded (violated) the lake level order. Water marks on the shoreline indicate that the average water level elevation in recent years has been approximately 88.7. The water level records show that the level often exceeded 89.0. This high water level may have significantly contributed to shoreline erosion, especially in unprotected wetland shoreline areas.

It is proposed to amend the order to establish an operating level of 88.3 similar to the way that Fox Lake operates their dam. An operating water level is that level that the dam operator uses as a target for managing the lake water level. The water level will fluctuate above and below the operating level depending on weather conditions. By establishing an operating level of 88.3 a margin of safety will be created so that the water level only exceeds 88.5 when excessively heavy rainfall events occur. The City is currently operating the dam using 88.3 as its target water level. This level is 2.4 inches below the 88.5 maximum allowed.

It is also proposed to eliminate the current established minimum level of 88.17 because it does not serve a useful purpose. This number was established when the dam was used to generate power for a mill by drawing water from the lake. The City now operates the dam to maintain the water level as high as legally allowed to accommodate recreational uses. Under the proposed order, the only time the water level will fall below the operating level is during periods of dry weather when there is not adequate rainfall to maintain the water level. The City will continue to be required to discharge a minimum flow of 3 cubic feet per second at all times. This is a statutory requirement to discharge a minimum of 25% of the low flow in the river at all times. This flow must be discharged even though the lake level goes below the operating level to maintain water quality in the river downstream of the dam.

The spring water level reduction serves two purposes: 1) to provide storage for anticipated spring snow melt and rainfall so as not to exceed the established water level; and 2) to encourage and stimulate submergent aquatic plant growth early in the season. It is likely that there will be sufficient rainfall to refill the lake to the operating level by May 1. A search of the water level records showed that historically the lake has refilled to the operating level by the main lake use season. Even in these past two dry years the lake has refilled to the operating level by the lake use season, and in fact exceeded the legal maximum level.

This water level regime will accomplish an approximate six inch reduction in the water level compared to the average water level over the last 10 year period that has often exceeded the legal maximum. This estimate is based on measurements comparing the ordinary high water marks that have been established on the shoreline to the proposed water level. This water level management should help protect wetland shorelines and stimulate aquatic plant growth that is critical for a healthy lake.

Water level management is one of the most critical factors in the successful management of shallow, fertile lakes. It is also the least costly management action that can be done.

The Alliance recommends that the Department of Natural Resources amends the 1958 water level order to read as follows:

ORDER

All elevations are expressed in local datum.

1. The staff gauge located on the upstream retaining wall of the dam is the official gauge. The gauge must be periodically cleaned. The gauge shall be checked each spring after ice out to assure that it is properly reading the correct water level. The staff gauge shall be replaced when the face becomes damaged and is difficult to read.
2. The owner shall operate the dam when necessary to prevent excessive fluctuation of water level. Dam operation may be necessary seven-days a week depending on the precipitation and the runoff into the lake.
3. The dam owner shall operate the dam to maintain a normal operating level of 88.30 feet as close as possible. The dam shall be operated to closely match the outflow from the lake to the inflow to the lake to maintain the lake elevation at 88.30. As the flow into the lake increases, the discharge from the dam shall be increased to not only reflect the inflow to the lake but to reduce the lake level to 88.30 as quickly as possible.
4. During high runoff events when inflow exceeds the discharge capacity of the river channel downstream of the dam, if the lake level rises to approximately the 10 year flood elevation of 89.00, the dam shall be operated to pass a minimum outflow of 450 cfs.
5. When operating the dam to decrease outflow from the lake, the owner shall operate the dam to maintain sufficient flow in the river to prevent the river from dropping more than 6 inches (measured at the USGS gage) in a 24-hour period. The river's water surface elevation and flow relationship at the gage is shown in the attached graph.
6. The dam owner shall begin lowering the water level to 87.70 feet by March 1st to be completed by March 15th of each year.
7. A water level of 87.70 shall be maintained until the later of 1) April 1, or 2) until the lake is ice free, of each year for the purpose of providing storage for high runoff events due to snowmelt runoff or spring floods. Ice free, for purpose of this order, is defined as the lake being sufficiently free of ice that a boat can be navigated from the dam to the westerly end of the lake locally known as Long Bridge.
8. On April 1, if the lake is ice free, the dam owner may start raising the water level but the water level shall not exceed 88.00 before April 15 of each year. This level shall be maintained as close as possible until April 15.
9. Beginning April 15th, the owner shall raise the water level from 87.70 feet to 88.30 feet.
10. The owner shall maintain a minimum discharge of 3 cubic feet per second passed through the dam at all times. At times of low inflow into the lake the lake level may drop below 88.30.
11. The owner shall maintain a log of dates, times, water level readings as well as gate manipulations. Gate manipulations must be recorded in enough detail to determine the flow passing the dam as well as appropriateness and adequacy of the actions taken. The operation logs shall be available to Department of Natural Resources for inspection.

Fishery Management:

Management Objective - Maintain a quality sport fishery by managing for gamefish and predator species while actively controlling rough fish populations. Working within the limitations of an impounded ecosystem, utilize cost-effective, low maintenance management actions that enhance fish habitat and facilitate fish production.

Management Actions:

Immediate

1. Continue commercial fishing contracts and investigate methods to encourage the harvest of carp and buffalo (DNR and Lake organization)
2. Maintain or increase predator fish populations
 - A. Establish and enforce appropriate fishing regulations to maintain spawning stock (DNR)
 - B. Continue cooperative fish stocking program with the Beaver Dam Lake Improvement Association (DNR and Lake organization)
 - C. Evaluate stocking program and continue stocking species and sizes found to be successful (DNR)
 - D. Install woody shoreline structure (Christmas trees or other artificial structure) in shallow water to provide nursery and shallow water habitat for game fish species (Lake organization)
 - E. Investigate areas for habitat enhancement on tributary streams and construct managed northern pike rearing marshes where feasible (DNR and Lake organization)
 - F. Conduct education on importance of all predator species to maintain fish population balance (DNR and Lake Association)
3. Maintain adequate winter oxygen levels by operating aeration systems as necessary to minimize winter mortality of game fish species (Lake Dev. Corp and Lake organization)
4. Promote fishing contests to harvest carp (Lake organization)

Long Term

5. Investigate feasibility of installing structures on selected bays to allow management of water level to establish vegetation and manipulate water level to increase natural reproduction of northern pike (DNR and Lake organization)
6. Utilize electrical or mechanical barriers or traps to prevent carp movement or remove carp where feasible (DNR)
7. Investigate additional methods of controlling carp population such as selective biological controls, poison bait, chemical spot treatment or additional predator species (DNR)
8. If carp become dominant species in the lake conduct whole lake eradication to reestablish desirable fish population (DNR)

Shoreline Stabilization, Wetland Protection/Restoration:

Management Objective—Prevent loss of wetland shorelines, restore wetland shoreline vegetation and prevent erosion of upland shorelines which result in sediment deposition.

Management Actions:

Immediate

1. Document existing wetland shorelines to serve as a measure of future shoreline loss or success of restoration efforts (DNR)
2. Place emphasis on water level management to prevent extended periods of high water levels that cause wetland shoreline erosion (City)

Long Term

3. Investigate management practices to stabilize or restore wetland and upland shorelines (DNR, Lake organization, private landowners)
4. Investigate feasibility of structural methods to protect/restore wetland shorelines that maintain connectivity of wetland with the lake (DNR, Lake organization, private landowners)

5. Encourage bioengineering for erosion control in appropriate areas to protect/establish and maintain habitat (DNR, Lake organization)

Vegetation Management:

Management Objective—Promote/maintain submergent plant growth in protected areas with four feet or less depth and maintain/reestablish growth of emergent wetland plants on undeveloped shorelines and other shorelines where such plant community is not objectionable to property owners.

Management Actions:

Immediate

1. Manage winter water level to prevent rising level which will uproot emergent plant growth and minimize ice damage to wetland shorelines (City)
2. Conduct aquatic plant survey to document present plant abundance and location (Lake organization)

Long Term

3. Identify and delineate sensitive areas where aquatic plant growth will be protected/promoted. (DNR, Lake organization)
4. Establish no wake zones to protect designated sensitive areas (Lake organization, Townships, City)
5. Establish no-motor travel zone to protect emergent/submergent plant growth in designated sensitive areas (Lake organization, Townships, City)
6. Develop pier regulations to restrict pier installation in designated sensitive areas (Townships, City)
7. Investigate feasibility of constructing wave barriers or creation of islands to promote vegetation growth in designated sensitive areas (Lake organization)
8. Investigate feasibility of techniques to protect and reestablish wetland shoreline vegetation such as offshore structures, using dredge spoil to recreate historic wetlands, planting to reestablish desired species (Lake organization)
9. Conduct periodic water level management to reestablish emergent wetland species on shallow shorelines (DNR, Lake organization, City)
10. Protect and enhance shoreline vegetation and aesthetic quality of lake (DNR, Lake organization, private landowners)
 - A. Use the most natural appearing shoreline stabilization methods available which are structurally suitable for the specific site
 - B. Promote natural vegetation plantings to naturalize shorelines, provide wildlife habitat and filter runoff from adjacent land
 - C. Promote maintaining woody shoreline habitat where compatible with shoreline use and development
11. Establish no-wake zones marked with buoys (Townships, City)

Hunting, trapping and wildlife observation management

Management objective—Promote and establish shallow water and open water wildlife habitat

Management Actions:

1. Protect existing shallow bays with no entry/no wake/no motor areas during the nesting season (Lake organization, townships, city)
2. Establish “new” artificial islands for habitat development and wave attenuation (Lake organization)
3. Identify local bird/wildlife watching groups for possible assistance (monetary and other)
4. Manage shallow bays for wildlife habitat (Lake organization, DNR)
5. Reestablish lost shoreline wetlands through water level management and shoreline protection (Lake organization, City)

6. Promote planting and protection of vegetation as wildlife food source (Lake organization, DNR)
7. Establish submergent and emergent vegetation through water level management to promote aquatic plant growth in the lake (Lake organization, City)
8. Restore wetlands on tributary streams to lake for wildlife habitat and water quality improvement (DNR, NRCS, LCD, other organizations)

Watershed Management

Management Objective—Improve water quality in Beaver Dam Lake by reducing sediment and nutrient delivery to the lake from the lake watershed

Management Actions:

Immediate

1. Implement water quality and vegetation monitoring in Beaver Dam Lake to document existing conditions and future trends to enable evaluation of lake management projects (Lake organization)

Long Term

2. Implement stream monitoring project to document existing water quality, identify problem areas in the watershed, and provide baseline data to evaluate future improvements achieved through watershed management (Lake organization)
3. Encourage the development and implementation of stormwater management plans for the City of Fox Lake, Village of Randolph and the part of the City of Beaver Dam that drains to Beaver Dam Lake (DNR, Lake organization)
4. Develop and publish a lake property owners guide for proper management of lake shore property to reduce sediment and nutrient runoff, and for protecting and restoring lake shore habitat for fish and wildlife (Lake organization)
5. Encourage full implementation of the Beaver Dam Priority Watershed Project. Work with the Dodge County Land Conservation Department to develop a follow-up project for when priority watershed project ends (Lake organization)
6. Develop programs to promote use of best management practices to reduce sediment and nutrient runoff from agricultural land in the watershed. Work with the Natural Resources Conservation Service to promote restoration of wetlands in the watershed (WRP) and installation of stream bank buffers on tributary streams (CREP). (Lake organization)
7. Reduce nutrient pollution to the lake from residential septic systems by promoting sanitary districts for existing housing and new subdivisions (Lake organization, Townships)

Boating, Navigation and other Recreation Management

Management Objective—Maintain safe navigation on open lake areas for recreational boating, maintain/improve navigational access to shallow bays with existing residential development and maintain safe winter recreational use of the lake

Management Actions:

Immediate

1. Produce new base lake maps showing lake depth contours and hazardous navigation areas (Lake organization)
2. Mark winter aeration areas when aerators are in operation and place warning signs at public access points on the lake. Distribute information concerning winter navigation hazards to lake properties (Lake Dev. Corp.)

Long Term

3. Locate and mark major navigational hazards located in high speed navigation areas (Lake organization, Townships, City)
4. Place informational signs at boat launches with warnings about navigation hazards. Distribute navigational information to residential properties on lake shore. (Lake organization)
5. Establish marked navigational channels in shallow bays with residential development. Dredge and maintain navigational channels as necessary to provide boating access to properties in these areas.
6. Mark ice skating areas to warn snowmobilers of these use areas. (City)
7. Create and mark designated swimming areas (City, County)