

# **Executive Summary**

## **Yahara Lakes Advisory Group Final Report**

**By Mindy Habecker**

### **Introduction**

Dane County Lakes have been regulated in one form or another for over one hundred and fifty years. Lake Mendota was originally raised 4.5 feet in 1847 by the Tenney Dam, which operated as a gristmill for most of the 19<sup>th</sup> century. The higher water flooded out some tamarack/black ash swamps and deep water marshes around Lake Mendota as well as upstream along the Yahara River. The Babcock Lock and Dam controls the water levels for Lakes Monona and Waubesa. LaFollette dam controls Lake Kegonsa's water level. During low flow conditions, this dam has a significant effect on lake levels, habitat and the flow of the Yahara River. During high water conditions, all the dams in the Yahara Lakes system below Lake Mendota are in free flow.

Construction and regulation of these dams was originally in the jurisdiction of the Railroad Commission and the Public Service Commission. They set operating orders for these dams as early as 1917. Operating orders have been reissued through the years for these dams, but they have remained largely unaltered.

The State of Wisconsin's statutory mandate is to regulate operation of these dams in the public interest. Predecessors to the Wisconsin Department of Natural Resources (DNR) established a series of orders to address the state's "public interest" in 1979. Compromises among competing lake interests determined the present operating rules for the Yahara Lakes.

Since 1959 the Yahara Lakes area has experienced major droughts (1988) and historic flood events (1959, 1993, 1996, 2000). Additionally, since 1959 there has been considerable development in nearly all areas that surround this chain of lakes. This development has led to an increased amount of impervious surfaces which in turn has led to a higher inflow of stormwater and heightened lake level responses. Thus, it has become timely to explore the following questions:

- Are these orders serving the lakes well?
- Can fish spawning be enhanced by a different approach?
- Are we protecting flood-prone areas?
- Are we encouraging the recharge of our groundwater?
- Are we doing a good job managing our recreational opportunities?
- Can we improve the water quality of the lakes?
- Are there physical changes to the system that need to be pursued?
- Are we still serving the "public's interest"?

In September of 2001 Ken Johnson, Wisconsin Department of Natural Resources (DNR) Lower Rock River Water Leader, contacted key stakeholders responsible for the management of the Yahara Lakes system to see if there was interest in convening a work group. A work group was subsequently formed to assess the effectiveness of the more than twenty-year-old lake level orders to see if they were still an effective tool for the management of the water levels and flow. The group met over a period of ten months studying the complex issues connected with the lake level orders and the Yahara Lakes System. This included bringing in 22 presenters on various topics and two field trips. The group then generated recommendations that had at least a two-thirds positive vote from the group. A tiered scale of support

ranging from strongly agree to strongly disagree was utilized as part of the voting process. Items receiving less than a two-thirds positive vote were listed as options generated by the group. The major findings are listed in this executive summary, but details can be found in the final report and its appendixes.

Cami Peterson, Sue Joseff and Mike Halsted of the Wisconsin Department of Natural Resources took minutes for the meetings. Mindy Habecker, Dane County UW-Extension facilitated the process and wrote the final report. Ken Weisner, WDNR also assisted in facilitating the process. Dane County Public Works Department hosted the meetings. The total stakeholder group gave generously of their time and expertise to discuss and develop recommendations for these complex issues surrounding the Yahara Lakes System and helped edit the final report.

### **Members of the Advisory Group**

Margaret Andreasen, Village of Shorewood Hills, Trustee  
Eileen Bruskewitz, Dane County Supervisor  
John P Dunn, Dane County Public Works  
Bill Fitzpatrick, Yahara Lakes Association  
Rick Gullickson, City of Stoughton Street Department  
Don Hammes, Madison Fishing Expo, Yahara Fishing Club, Dane County Conservation League  
Brett Hulseley, Dane County Supervisor  
Ken Johnson, DNR Lower Rock River Water Leader  
Sue Jones, Dane County Lakes and Watershed Commission  
Mike Kakuska, Dane County Regional Planning Commission  
Dick Lathrop, UW Limnology/DNR  
Larry Nelson, City of Madison Engineer  
Don Peterson, Village of McFarland  
Mike Pinnow, Skipper Bud's Marina  
Ray Potempa, Friends of Lake Kegonsa  
Ken Potter, UW Department of Civil and Environmental Engineering  
Dave Ritter, Dane County Sheriff's Department  
Aicardo Roa, Dane County Land Conservation Department  
Jon Schellpfeffer, Madison Metropolitan Sewerage District  
Carl Sinderbrand, Dane County Lakes & Watershed Commission  
Dave Taylor, Madison Metropolitan Sewerage District  
John VanDinter, Town of Westport Supervisor, Lakes & Watershed Commission  
Gary Weinert, City of Monona Public Works  
Kurt Welke, DNR Fisheries Biologist, Dane County  
Jan Zimmerman, Lake Waubesa Conservation Association  
Dave Zugenbuehlen, 4-Lakes Bassmasters

## **Major Findings from Presentations**

### **Flow Restrictions – Aquatic Plants**

- Chemical treatments to control aquatic plants in flowing water have been ineffective and ineffective treatments are prohibited in NR 107.
- Unlike a typical lake application where treatments are isolated along relatively small littoral areas, a river treatment will expose the entire channel to chemical(s) and the potential for negative impacts are greater. Decomposing aquatic vegetation in a long channel stretch could create a significant BOD (biological oxygen demand) and dissolved oxygen depletion. Any potential chemical treatment that results in a direct or indirect fish kill will be denied.
- Vallisneria also known as wild celery, eelgrass or tapegrass is the predominant plant growing in the Yahara River. This plant is considered a high quality aquatic plant for waterfowl and fish. It is not a plant that you would want to completely remove. The chemical registered for use in Wisconsin that will kill Vallisneria, is Hydrothol 191, the amine form of endothol. The label states "the minimum contact time with plants for optimum results should be two hours". This contact would be difficult if not impossible to achieve in a flowing water situation such as a river. Hydrothol 191 is toxic to fish at dosages well below the concentration required to effectively kill plants. Use of this chemical, therefore, would be in violation of the laws cited above it would be ineffective, and it would cause adverse side effects on fish, which are a non-target organism.

### **Flow Restrictions – Channels and Dams**

- The most constrictive points are probably the channel downstream of Lake Waubesa to Lake Kegonsa, which is affected by the levels held by the Kegonsa dam and the outflow from Lake Kegonsa because the Stoughton Dam keeps water up to limit outflow from Kegonsa. This is based on regulatory pool levels, not dam capacity. The channel between Kegonsa Dam and the Stoughton Dam is also a factor limiting outflow from Lake Kegonsa
- Each of the five dam's ability to pass flow on the Yahara Lakes system does not appear to be the problem in flow constriction. It appears that the problem is that Stoughton Dam operated in its regulatory range backs up water and appears to limit the outflow from Kegonsa Dam. If Stoughton Dam was able to operate outside its current legal range, with the dam gates open, the reservoir could be drawn down and the Lake Kegonsa Dam could have a greater outflow capacity to pass flood flows, which could lower Lake Kegonsa. Similarly, Lake Kegonsa Dam backs up water and appears to limit the outflow from Lake Waubesa Dam. If Kegonsa Dam was able to operate outside its legal range, the dam gates could be opened and reservoir could be drawn down. Then the Lake Waubesa Dam could have a greater outflow capacity to pass flood flows and lower Lakes Waubesa and Monona.

### **Watershed Development and Lake Level Responses**

- Since 1835 the Yahara Lakes have lost significant portions of the wetland associated with them. (The wetland losses are, by lake: Mendota – 5088 acres or 50% of the 1835 total, Monona – 4520 acres or 92%, Waubesa 4520 acres or 73% and Kegonsa – 4075 acres or 70%). We continue to lose sedge meadows during flood events as they “float up” at this time to create what people call floating bogs. These are “lost” when they break away and have to be removed because they become navigational hazards.
- The total lost flood storage with this loss of wetland area is 18-90,000 acre-feet of water or 5.4-27 billion gallons.

- Analysis of precipitation and lake response indicates that this increase in lake levels is due at least in part to development in the watershed.
- USGS modeling of Pheasant Branch indicates that if low-density residential development occurs in the undeveloped portion of the Lake Mendota watershed, runoff amounts from medium to large storms will increase by about 20%. More aggressive development would increase runoff by greater amounts.
- Water balance analysis of Lake Mendota indicates that a 20% increase in the runoff occurring in 1993 would have increased the peak level of Lake Mendota by over 1.5 feet, assuming releases to Lake Mendota remained unchanged. A 50% increase in runoff would have increased the peak level by over 4 feet.
- Exploration of various alternatives for preventing catastrophic increases in Lake Mendota levels requires a much-improved modeling capability, including a continuous rainfall-runoff model of the Yahara Lakes watershed and a sophisticated hydraulic model of the connecting channels. The cost of the modeling would be about \$200,000 or more depending on the questions the model is asked to answer and would take approximately two years work according to USGS. The cost of a gage can be \$10,000-\$20,000 for installation and \$10,000-\$15,000 per year for maintenance and data management.
- A statistical analysis representing the trend of Yahara River runoff over the years 1931 to 2001 (for the same amount of rainfall) indicated that there was a statistically significant increase in the amount of runoff over that period of time if the diverted Madison Metropolitan Sewerage District water is factored into the analysis. This trend also existed when compared to adjacent basins.

### **Stormwater Management**

- Standard methods of stormwater management do not sufficiently address increases in high lake levels due to urban and suburban development. Detention, by far the most common storm water management practice, reduces the rate of storm water runoff, but not the volume.
- An effective stormwater management strategy must be predicated on infiltration of runoff from impervious surfaces.
- Potential methods to reduce the volume of storm water include large-scale infiltration basins (which have been used effectively in Long Island, New York for over 65 years) and small-scale practices such as rain gardens, avoidance of compaction of soils, enhancement of the infiltration capacity of pervious surfaces, installation of grassed swales and infiltration trenches. Some of these practices require further research and testing of their effectiveness.
- Infiltration practices have primarily been used to maintain groundwater levels and base flow, rather than to control flooding.
- Large-scale infiltration practices can be difficult to site and design. Thus for this region, small-scale infiltration practices may offer more promise than large-scale practices.
- Based on theoretical calculations, it is feasible to use small-scale infiltration practices to control the 100-year storm event, except where the water table is high or the subsoils are impermeable.
- The need for a more restrictive stormwater/infiltration ordinance needs to be weighed against the ability to comply. Dane County soils are high in clay/silt content. The ability to incorporate infiltration into a stormwater management plan is limited by the soil type and an understanding of long-term maintenance requirements.
- The county has identified a concern with the current version of the proposed NR 151, Wis. Adm. Code. This code establishes prohibitions and restrictions on infiltration according to the

depth of groundwater and bedrock among other concerns. This proposed code may jeopardize the county's ability to adequately use infiltration as a stormwater management technique. Approximately 60% of Dane County's land area would be prohibited to incorporate infiltration with the current version of NR 151.

### **Potential Water Level Changes – Fishery Effects**

- For successful fish spawn you need to emulate the natural hydrograph as fish cue on rising water and rising temperature. To do this winter lows should be held on the high end as ice break up occurs, but specific elevations need to be established at representative points within critical habitats to determine required water levels. In the Yahara River below McFarland, any stage below 844'+ is too low to allow access into the marshes of Lower Mud Lake.
- Any discharge below 150 cfs is too little water to maintain high quality habitats for fish.
- The specific habitat needs for fish include: 1) adequate water level for access into and out of spawning marshes 2) maintenance of water through period of incubation 3) preservation of correct vegetative communities and substrate types and 4) control of sedimentation and eutrophication.
- Lowering of winter water levels has the potential to cause some localized winterkill in already shallow habitats, especially in years of low fall water levels, opaque ice and heavy snow.
- Lowering of the summer minimum would have lesser negative effects if instituted after the spring spawn.
- Graphs of the actual water levels in relation to the water level orders and the success of Northern fish spawning were shown. They revealed that Lake Mendota water levels appeared to affect the spawning success but a correlation was not evident for Lake Monona. It appears to be critical that the lake levels be rising between March 1 and May 16<sup>th</sup> of each year. There may be drawdown potential from May 16<sup>th</sup> into June. Water levels had to correlate with "ripe" females for successful spawning.

### **Potential Water Level Changes – Sanitary Sewer**

- MMSD's current effluent is not suitable for discharge into the Yahara Lakes due primarily to the level of phosphorus. The level of treatment at the Nine Springs plant would need to be improved to include tertiary treatment. Technology to reach the proper water quality is available, but are people willing to spend the money? Conventional treatment plants cost approximately \$5-10 million/MGD, and tertiary treatment could double that cost.
- MMSD is looking in the next 10-20 years at having to replace the Waunakee and DeForest area interceptor sewers to expand their capacity. That could be the time to put new technology in place to meet higher water quality standards. MMSD has purchased land north of Lake Mendota as a site for a new treatment plant.
- During storm events as rainfall intensity increases and lake levels increase, the flow rates in the sanitary sewers increase. At some point in the 2-10 year rain events, flooding in the Lake Monona low-lying areas takes place, and at certain lake levels the 5 and 10-year events lead to overflows at the MMSD plant. The August 2000 storm led to the bypass of approximately 30 million gallons of effluent to Lake Waubesa due to overloading the capacity of the effluent pumping system to Badfish and Badger Mill Creeks.

### **Potential Water Level Changes – Navigation Effects**

- The potential navigation trouble spots if the water levels are lowered include: upper Yahara River channel to Mendota, Lake Mendota "six-pack", shallow landings (Olin Park, Gov.

Nelson State Park, and inlet on Mendota near the governor's mansion), and on the entire Yahara River except between Mendota and Monona and Monona and Waubesa.

- The potential navigation trouble spots if water levels were higher include: Yahara River (Tenney locks), Winnebago Street bridge, County Highway AB and State Highway 51 bridges and beltline causeway bridge to Monona Bay.

### **Floodplain Management**

- Dane County is currently developing a flood mitigation plan to be completed about June 2003. This plan will include food mitigation strategies and projects such as the purchase of lands that are continually flooded or elevation of at-risk structures. FEMA can pay up to 75% for select projects within the approved plan.
- Climatic change may have a significant impact on flood frequencies in the Upper Midwest. Current models predict that precipitation in North America will be greater in the winter and lower in the summer. This is consistent with historical trends in Wisconsin.
- FEMA's 2003 budget request has \$350 million to update floodplain maps. FEMA will work with local governments to include future condition projections in the flood insurance maps. While insurance cost may rise, there is currently no data to support the hypothesis that updated floodplain maps will result in property value reductions.

### **Economic Impacts, Funding Sources**

- Currently there is no specific information on the economic impact or contribution by anglers and others using the lakes to the local economy. This is a complex question because the same dollar can turn over two or three more times through stimulated economic activity by people who live here as well as visitors. There is no doubt these activities provide a substantial base for tourism, recreation and the quality of life.
- Waterfront parcels are treated differently on the municipalities. Depending on the municipality, waterfront parcels make significant contributions to the total property tax revenues well beyond their relative small number.
- Only 44% of the waterfront is taxed on the Yahara Lakes System
- 2,250 residential waterfront parcels are available
- Less than 2% of the waterfront parcels turnover in a typical year
- Taxable waterfront land assessments total about \$420 million with an estimated land value of over a half of billion dollars.
- A variety of funding sources are available for such projects as channel improvements, gaging, dam improvements, monitoring, modeling, and infiltration or stormwater control. Such sources would include the Waterway Commission, WDNR Urban Stormwater grants, State Stewardship monies, River and Lake Planning Grants, USGS gaging monies, WDNR Fish SEG funds, US Fish and Wildlife Grants and EPA money.
- The high water of 1993, 1996, and 2000 caused about one million dollars in public damages to the City of Madison shoreline. Along Monona Bay the city intends to raise the shoreline to one foot above the flood elevation and protect it with riprap.

**Recommendations and Voting Criteria**

The stakeholder group discussed and determined brief criteria for proposed recommendations, which could be used to evaluate them. These would help to frame the discussion. The criteria included:

- A. Can this be part of the best overall solution to the problem?
- B. Will this recommendation satisfy the most people, be cost effective and practical (can be implemented), and help produce a long-term solution?
- C. Is it in the best interests of the larger community?
- D. Does it address the group’s primary mission?

It was decided by the group to have a 5-tier system to rank the level of support for a proposed recommendation. The recommendations supported by at least two-thirds of the group follow.

**Recommendations (received at least 12 of 18 votes)**

No	Lakes Management & Operations	Strongly Agree 2	Agree 1	Neutral /Abstain 0	Disagree -1	Strongly Disagree -2
1	All control structures from Lake Mendota to below the Stebbinsville Dam be unified under a coordinated and recordable management strategy based on a Yahara River System management plan to be developed which would be able to articulate responses to various scenarios such as development of the basin.	17	1	0	0	0
2	Evaluate methods such as modification of bridge constrictions, aquatic plant modification, dredging, channel modification, etc. to increase flow conveyance.	12	5	1	0	0
3	Operations rules for the lakes must provide for stable and predictable lake levels that are protective of public and private properties, wetland, shorelines, fisheries, water quality and recreational users.	11	7	-	-	-
4	Design orders to address all four seasons, not just summer maximum and winter minimum.	3	10	5	0	0
5	Develop lake and shoreline regulations affecting all riparians, both public and private, in a uniform way.	4	8	5	1	0
6	Establish a structure and process for planning and funding capital improvement and maintenance of flood control and navigation structures on the Yahara River system (i.e. locks, dams, conveyance channels).	11	7	-	-	-
7	Establish specific processes for responding to flooding that set specific standards for use restriction on recreational users necessary to protect property and the environment.	3	13	1	1	-
8	Consider property values and uses in adjusting lake levels.	5	8	2	2	1
9	A flood management plan shall be developed with shoreline protection elevations.	9	7	1	1	-
10	Dane County Public Works and DNR fisheries should coordinate lake levels in the Yahara River system and particularly Lake Mendota must remain high enough from March 15 to mid-May to allow fish to spawn, young fry to grow to sufficient size to survive once water levels are lowered.	12	4	1	1	-

11	Reevaluate user fees to finance operations and maintenance of boat launch facilities and locks.	6	6	4	1	1
12	When the level of Lake Mendota rises above the OHWM (850.7 MSL)* a state of high flow shall be declared. This state of high flow will remain in effect until all the lakes in the chain are at or below their maximum summer operating level. A declared state of high flow will result in 1. The Babcock and LaFollette Dams discharging under free flow conditions (without stoplogs) and the Stoughton Dam increasing discharge in order to maximize discharge at LaFollette. During this period of declared high flow the Stoughton dam’s minimum operating level will not apply. The discharge of the Stoughton dam will be increased until the flow at the LaFollette dam is unaffected by downstream conditions (or until some upstream restriction becomes apparent). 2. Discharge of the Tenney Park Dam will consider flow conditions at the LaFollette Dam and will operated in order to maximize discharge (downstream channel bank full) at the lock but not exacerbate flooding on the downstream lakes as long as dam conditions at Tenney are deemed safe (2000 flood levels minus six inches*). When levels of Lake Mendota approach unsafe conditions the gate setting at the Tenney Dam shall be increased to prohibit any increasing in the lake level of Lake Mendota. *recommended levels to be reviewed and finalized later based on further studies and public and expert input	8	8	-	1	1
13	Evaluate the need to renovate Tenney, Babcock and LaFollette lock and dams. The evaluation should include the possibility of automating the gates at one or all of the dams.	13	4	-	1	-
No	<b>Monitoring/Modeling</b>	<b>Strongly Agree 2</b>	<b>Agree 1</b>	<b>Neutral /Abstain 0</b>	<b>Disagree -1</b>	<b>Strongly Disagree -2</b>
1	Maintain an active monitoring program on the lower Yahara River to obtain accurate data on channel hydraulics.	16	2	-	-	-
2	Reconvene Yahara Lakes Advisory group or modified group to evaluate and act on the flow measurements, data, provide education, and monitor progress of recommendations after one year.	11	6	1	-	-
3	Use the calibrated USGS Yahara Lakes model currently under development to optimize management of Yahara Lake system and to achieve multipurpose objectives.	8	5	2	2	1
4	Promote and continue development of a state-of-the-art hydrologic monitoring network (i.e. rain gages, lake level recorders, river flow gages) for the Yahara River system	17	1	-	-	-
5	Survey and evaluate the recreational trends, and uses, and economic impacts by various user groups of the Yahara River System.	7	6	5	-	-
6	Promptly develop and apply a continuous hydraulic/hydrologic/water quality model of the watershed including the lakes and connecting channels that can account for present and potential land use conditions and land management practices in the watershed and the potential modification of control structures and channels.	16	1	1	-	-

No	Land Use	Strongly Agree 2	Agree 1	Neutral /Abstain 0	Disagree -1	Strongly Disagree -2
1	A standard watershed-wide legal ordinance be instituted to infiltrate runoff from impervious surfaces at a target level.	6	7	1	-	4
2	Low-lying riparians be invited to voluntarily provide right-of-first-refusal for future ownership of their property in order to revert it to public ownership.	3	9	1	1	4
3	Opportunities to significantly increase the infiltration of stormwater and snow melt into the groundwater should be identified and emphasized to all areas that significantly impact lake levels.	14	3	1	-	-
4	Commercial, industrial and residential development north of Lake Mendota, should if necessary, be restricted by zoning to minimize the impact of stormwater runoff caused by development into the Yahara River system.	11	2	-	3	2
5	Planning and new laws be introduced to reduce stormwater volumes delivered to the Yahara River system.	10	7	1	-	-
6	Where possible we should encourage reestablishment of natural vegetation along public (and private? lake frontage.	5	7	2	2	2
7	Control the inflow of sediment, animal waste, pesticides, fertilizer and other pollutants into the Yahara River system.	14	4	-	-	-
8	Stop the draining of wetlands for either farming or possible future development within the Yahara River System.	13	2	2	1	-
9	Ensure new developments adhere to current standards of control to prevent sediment and erosion into the Yahara River system	15	3	-	-	-
10	Strengthen county stormwater ordinance to control floodwater from the real 100-year rain event using current rainfall information	8	6	3	1	-
11	Preserve and restore wetlands to improve lake quality, natural habitat, and flood storage within the Yahara River System.	11	3	1	-	3
12	Develop better county internal coordination between Land Conservation Department, Lakes and Watershed Commission and Parks Department.	7	5	3	2	1
13	Setup a purchase and/or transfer development rights program to reduce the future development footprint north of the lakes in the entire floodplain.	2	10	3	3	-
14	Update the 100-year flood maps and end new building in 100-year floodplain area.	9	5	-	-	4
15	Identify and target sites for wetland restoration that offer the greatest promise for preventing future increases in flooding in the Yahara lakes.	10	8	-	-	-
No	Education and Other Efforts	Strongly Agree 2	Agree 1	Neutral /Abstain 0	Disagree -1	Strongly Disagree -2
1	Create an account and increase support to fund watershed restoration and improvement work.	8	5	5	-	-
2	Create educational programs focusing on increasing awareness of lake and watershed issues among the general public.	9	9	-	-	-
3	Communicate all key recommendations to officials and the general public via e-mail, brochures, newsletter and other educational efforts.	11	7	-	-	-

4	Encourage the development and real estate industry to go beyond minimum water quality best management.	13	4	1	-	-
5	Investigate and implement more efficient public access to Yahara lakes information on the Internet.	9	8	1	-	-
6	Implement demonstration practices (ie. Rain gardens, shoreline habitat, stormwater detention, aquatic vegetation control and evaluate their effectiveness.	9	9	-	-	-