

and occurs on a flat, sandy lake plain, and supports agriculture, forestry, recreation, and wildlife management. The ecological landscape formed in and around what was once Glacial Lake Wisconsin, which contained glacial melt water extending over 1.1 million acres at its highest stage.

Description of problem to be addressed by project

A look back through the three Basin Plans that are included in Waushara County make it clear that lake planning, management & protection are of great concern. No significant effort has been made to upgrade Lake Management Plans that reflect the successes or the need for continued efforts. There has been very little effort to develop Lake Management Plans for lakes that have no public access.

Lakes groups in Central Wisconsin are at all levels of activity in their lake management planning. Some groups have yet to become active in developing a plan, while some groups already have a well-organized management plan in action. Most are somewhere in between.

In an effort to take a pro-active approach, Waushara County sees a need for involvement with and guidance to lake management units grappling with plan development and implementation. The need is viewed as a local problem, of course, but also as a region-wide problem and beyond. Waushara County seeks to develop and/or update specific lake management plans for each lake group.

Given the conditions outlined above, we want to advance efforts in three main areas: lake management plan development, knowledge of our lakes, and non-point source pollution control.

Description of project goals and objectives

The ultimate purpose of this study is to provide long term benefits to the community by protecting and improving water quality and habitat in and near Waushara County lakes. Our efforts will lead us to develop a County-wide Lake Management Plan that will drive the development of lake specific planning and subsequent implementation. We propose a 3 phase project leading up to implementation activity.

Phase 1 - Includes 2 primary objectives

- Lake plan appraisals on 97 lakes ; 31 w/ public access
- Shore zone appraisals on 31 public access lakes

Phase 2 - Lake and watershed condition appraisals on 33 public access lakes

Phase 3 - Lake plan development (dependent upon phase 1 and 2 outcomes)

Phase 4 - Implementation

Phase 1

Objective 1- An inventory and appraisal of the status of current lake management plans within the county

Actions on lakes with existing plans

- Content evaluation - criteria for implementation (figure 1)
- Status of plan actions/development - stage of completion and efficacy
- Appraisal of management capacity and partnerships
- Appraisal of financial viability

Actions on lakes without plans

- Appraisal of need for planning
- Appraisal of management capacity and partnerships
- Appraisal of financial viability

Objective 2 - An appraisal of shoreline and shore land conditions on a suite of lakes

- Identify and inventory natural features and critical habitat
- Characterize lake development status
- Identify, inventory, and prioritize erosion, sediment/nutrient delivery sites

Expected outcomes:

- An information & education strategy that includes brochures, fact sheets, local contacts and make that available to the public and cooperators
- A prioritized listing of potential projects needing non-point pollution control with a focus on shoreline and shore land protection and restoration and a systematic approach to shoreline and shoreland protection
- Lake management plan evaluation report w/ subsequent recommendations for further plan development

Description of project products or deliverables - Phase 1

- Shoreline/Shoreland analysis report indicating project location for nps control, areas of natural features, critical habitat, ecological corridors, and water quality buffers and development status
- A geo-data base in the County GIS containing riparian parcels, pictorial data, and shoreline assessments
- A Waushara County lakes plan appraisal report summarizing the planning status of all county lakes

Description of data to be collected and methods - Phase 1

1. Mapping, data presentation, and interpretation- Utilize GPS and County GIS system to enhance the usefulness and accessibility of acquired project data for County staff, local officials, external agencies, and the public.
2. Complete an I&E effort targeting lake property owners with a focus on lake

- management planning and shore restoration
3. Data “mining” will compile existing data from CLMN, UW-Stevens Point WQ program, USGS, and other sources.

Items 4-5 support the lake plan appraisal objective . Lakes (and associated organizations) will be evaluated for:

4. Need for planning- The degree of existing protection will be assessed through a review of private/public ownership, areas of conservancy, perceived and existing threats, % of critical habitat, endangered or threatened species, and public use levels.
5. Management Capacity - Management groups will be identified for each lake in addition to significant user groups. Evidence of lake management activity and success will be appraised.
6. Financial viability - The stability of lake management units and their funding sources will be appraised.
7. Plan content evaluation - Planning documents will be reviewed for conformance to criteria adopted for the eligibility of Lake Protection Grant Implementation funding. (see criteria on page 7). Plans will be reviewed for relevance as it relates to current needs and threats.

Items 8-10 support the shore zone appraisal objective

8. Lake development status - Percent frontage developed, number of residential units, average lot size, setback distances, and back lot development tiers characterized.(see page 6)
9. Identify and prioritize sites for shore land and shoreline restoration and map potential protection practices needed to control non-point source pollution- Willing partners will be identified after an appraisal of existing shoreline erosion rates/unstable vegetative cover/ and shore land sediment delivery is completed. Sensitivity of lakes will be considered in priority setting. (see page 6)
10. Shore appraisals - natural features, critical habitat, ecological corridors, and water quality buffers will be appraised and mapped.(see page 6)

Lake Runoff Appraisal Protocol

Near shore attributes that affect runoff to the lakes will be evaluated over a two year period. Waushara county staff will conduct these surveys from the lake using survey forms and orthophotos. Sites will be documented using GPS and digital photographs. The following information will be assessed at each lake:

The runoff protocol will target 5 sections:

1. Erosion
 - A. Length of eroded shoreline- The length of shoreline is set in increments of < 20ft, 21-60 ft, and > 61ft. This is a visual estimate
 - B. Soil erosion severity- Set in increments of low, medium & high. The lower the severity the better it is. The severity depends on the length of it on the shoreline and the depth inland from the water.
 - C. Erosion type- Set as overland, toe, & ground water
 - D. Bank slope- Set as < 30 or > 30. Slope of the bank is related to the conveyance of water along the channel, and to the susceptibility of the bank to erosion. Slopes will be confirmed by use of clinometers.

2. Vegetation
 - A. Amount of shoreline vegetation coverage is described in 3 sections, 70-100%, 30-70%, and 0-30% as described within the 35foot shoreline buffer zone.
 - B. Vegetation layers present described as two or more layers, one layer, mowed grass, or bare soil.
 - C. Vegetation layers describe include impervious surfaces, such as pathways, stairs, decks, sidewalks etc.

3. Land use of lot
 - A. Described as residential, cropland, fallow, or forest.
 - B. Described as a waterfront lot.

4. Surrounding Land use
 - A. Described as the lot adjacent to the inventoried lot.
 - B. Described as residential, cropland, fallow, or forest.

5. Need for Best Management Practices
 - A. Inventoried lots will have a tally sheet indicating the need for BMP's and based on the severity (total score) will determine type of bmp required for restoration or protection.

Criteria for Appraisals of Plan Content

1. An assessment of the lake's historical water quality, including at least one year of current baseline limnological data.
2. An identification of the water quality problems or threats to lake water quality including degradation of fish habitat and wetlands caused by nonpoint sources of pollution in the watershed.
3. An assessment of the lake's fishery and aquatic habitat including the extent of the lake area covered by aquatic plants and a characterization of the shoreline habitat and any known ecological relationships.
4. An identification of the need for the protection and enhancement of fish and wildlife habitat, endangered resources, aesthetics or other natural resources.
5. An assessment of the lake's watershed including:
 - a. A description of land uses listing each land use classification as a

- percentage of the whole and an estimate of the amount of nonpoint pollution loading produced by each category.
- b. Identification and ranking of the most significant nonpoint source types and contributing areas.
 - c. A listing of known point sources of pollution affecting the lake or that have affected the lake.
 - d. A characterization of the habitat conditions and any known ecological relationships.
 - e. A description of the institutional framework affecting management of the lake including, local government jurisdictional boundaries, plans, ordinances including an analysis of the need for adoption of local ordinances for lake protection.
6. A summary of the historical uses of the lake, including recreational uses up to the time of application, and how these uses may have changed because of water quality or habitat degradation.
 7. A description of any other problems or issues perceived to need management actions.
 8. A description of any management actions taken or are in progress.
 9. Identification of objectives to maintain or improve the lake's water quality, fisheries, aquatic habitat and recreational and other uses.
 10. Identification of target levels of control and resource protection needed to meet the objectives.
 11. Identification and discussion of the alternative management actions considered for pollution control, lake restoration or other management including expected results.
 12. An analysis of the need for and a list of the proposed management actions that will be implemented to achieve the target level of pollution abatement or resource protection.
 13. A strategy for tracking, evaluating and revising the plan including water quality monitoring.
 14. A plan for operation and maintenance of any structural management practice. The operation and maintenance period shall be for a minimum of 25 years.

Description of existing and proposed partnerships

The LCD has current relationships with twenty two Lake District/Associations more commonly known as the Waushara County Watershed Lakes Council. We provided the council with control of aquatic invasive species, capacity building and facilitation, educational programming, technical assistance, and cost sharing.

We also work with area schools and service groups on projects and to provide some level of lake education programs. County staff has at times assisted the DNR with lake management issues, fish surveys, enforcement of regulations, and educational programs. We currently have one priority watersheds in implementation. We have signed over 375 cost share agreements. Drainage from several project sites flows to the Pine & Willow rivers and ultimately Lake Poygan.

We have and continue to work with the US Fish & Wildlife Service, Natural Resources & Conservation Service, Wisconsin Association of Lakes, and the Wisconsin Water fowlers

Association on mutual goals and specific projects.

Phase 1 will incorporate UW-Stevens Points Center for watershed Science and Education as project manager. Subsequent phases 2 and 3 will contract with CWSE to complete the primary objectives in those phases.

Discussion of role of project in planning and/or management of lake

The initiatives described will directly support state and local efforts to manage shoreline activities. The plan to tie pictorial and alphanumeric data to shoreline parcels will greatly aid enforcement by showing the pre-existing shoreline and littoral zone conditions. Assimilating the data described in this project scope as well as fisheries data, into the County GIS will help us track development trends, determine impacts of exotic species, and tie land use practices to fisheries quality.

The lakes plan appraisal will support lake plan development and evolution. The outcome will be improved lake protection and understanding. The effect of the project will likely drive future lake strategies for many years.

Performance standards compliance checking in lake drainage basins will also allow Waushara County to better target our efforts. This type of planning effort is highly encouraged by the WDNR Bureau of Watershed Management.

In 2006, Waushara County was successful in applying for and receiving a multi-county Regional AIS grant. The data gathered from the AIS grant as well as from this grant will be integrated with the county comprehensive land use plan.

Timetable for implementation of key activities

Phase I

- *Lake MGT Plan Assessment/Appraisals ,- January 1, 2010 - Summer 2011
- *Shoreline/shoreland Appraisals lakes with Public Access , Spring 2010 - Fall 2011
- *Shoreline/Shoreland Appraisals with/out Public Access, Spring 2010 - Fall 2011

Phase II

- *Lake and watershed appraisals on 33 public access lakes January 2011 - Fall 2012

Phase III

- *Lake plan development (dependent on phase 1, 2 outcomes) January 2012 - January 2015

Phase IV

- *Implement shoreline & shoreland Bmp's, January 2015 - December 2020

Plan for sharing project results

The data and final report will be made available on CD, via email, or hard copy to partner agencies, local government, and the public. News releases will be used to increase awareness. Furthermore, the actions proposed will require a high level of public integration and sharing of findings during and after

project completion.

Other information in support of the project not described above

Waushara County currently has three staff involved in the enforcement of our Manure Storage Ordinance. The manure storage ordinance has been updated & codified to include the four animal waste prohibitions described in NR151 Agricultural Performance Standards.

A thorough investigation in Phase 1 will help to reduce collection of duplicate or unneeded data (in Phase 2) yet ensure that data needs for the development of lake management plans (in Phase 3) are met. The project manager will communicate routinely with and assist Waushara County personnel with 1. Development of the strategies and logistics associated with the collection of erosion and shoreline data; 2. Provide guidance for the identification and/or acquisition of existing water quality, aquatic macrophyte, and other data that may exist for the Waushara County lakes; 3. Provide input on the organization of the data that are acquired; 4. Provide guidance in the summarization of lake management plan assessment; 5. Assist in the refinement of the needs/proposal for data collection in Phase 2.

Phase 2

Phase 2 will include the collection of data that are needed to develop/update lake management plans in Phase 3, to begin disseminating information about the Waushara County lakes to the general public, municipalities, agency personnel, etc., and to synthesize and summarize new and existing data in reports to be used in Phase 3.

Primary objectives include:

- Characterize the existing aquatic plant communities (submersed, floating-leaved, and emergent) to establish a baseline for future monitoring for lake management and detection of invasive species.
- Characterize the existing water quality of the Waushara County lakes.
- Develop tools for relating lake water quality to land uses through calibration with historical and current water quality.
- Develop tools for relating lake water quality to land uses through calibration with historical and current water quality.
- Predict sensitivity of water and habitat quality to future changes in land use.
- Identify critical landscape features for protection of water quality.
- Provide a practical summary of these results for use by citizens and county staff for planning and land management decisions and apply this information to the update of their Land and Water Management Plan.
- Characterize and map levels of shoreline development and determine any relationships between development and wildlife communities.

Water quality/watershed work will occur on 16 lakes, with paleolimnology on 5 lakes, and aquatic macrophyte surveys on 16 lakes along with appropriate information/outreach, and project coordination. Matching in-kind work would come from UWSP, citizen monitoring time and participation of county employees at meetings for data collection, entry, mileage, etc.

The 16 lakes (w/public access) to be included in Grant 2 are:

Gilbert Lake
Big Hills Lake
Johns Lake
Kusel Lake
Lake Lucerne
Lake Morris
Lake Napowan
Long Lake
Pearl Lake
Pine Lake
Porters Lake
Round Lake
Silver Lake
Spring Lake
Twin Lake
Wilson Lake

Water Quality and Watersheds

The primary investigators for the water quality study include faculty and staff in the Center for Watershed Science and Education (Turyk, McNelly, Miskowski). Lakes will be evaluated for trophic conditions and DACT (atrazine). Water quality data generated by citizens and DNR staff will be used when available. A general survey of groundwater will be conducted in the natural lakes to identify the areas of greatest contribution.

Watersheds and Modeling

Surface and groundwater watersheds will be delineated for each lake. CWSE will use digital elevation and/or lidar coverages in conjunction with ArcGIS to delineate surface watersheds and field observations will be made to refine the watersheds. Groundwater watersheds will be delineated by CWSE staff using existing water table maps that are modified using private well data.

The County land use coverage will be used for the interpretation of land use within the surface and groundwater watersheds. This information will be enhanced with shoreland data collected in Phase 1. WILMS and seepage lake models will be calibrated and used to model the study data to predict phosphorus response in each lake. When available, historic data will be evaluated and changes over time will be identified. This information will be shared with the Paleolimnologist to corroborate her analyses.

Lake Sample Collection and Lab Analysis

Lake water quality data will be collected the first two years of Phase 2. GPS will be used to locate the deep hole sampling sites at 16 lakes. Samples will be collected during spring and fall over turn, late winter, and five times during the growing season (between late June and mid Sept). Temperature and dissolved oxygen profiles will be collected and Secchi depth will be measured prior to sample acquisition. Electronic sondes will be used for DO and temperature field measurements; meters will be calibrated routinely prior to use. Samples will be obtained for lab analysis of water quality using a 0-4 foot integrated sampler for surface samples and a Van Dorn bottle for winter samples. Samples will be stored on ice for delivery to the state certified UWSP Water and Environmental Analysis Lab (WEAL) for analysis. These data will be transferred to the DNR's SWIMs database. Standard methods will be followed in the analysis of the samples following the lab's QAPP. Citizen monitoring is being conducted at ten lakes during the summer (following DNR protocol) and at twelve lakes during spring and fall over turn. Data from these sites will be used in this study; the balance of sampling will be conducted by Waushara County with training and guidance provided by CWSE.

Dissolved oxygen, temperature, and conductivity profiles and Secchi depth will be measured at the deep hole during each sampling event.

Spring and Fall overturn Samples: Samples will be collected from the deep hole following overturn. Analyses will include TP, TRP, TKN, NO₂+NO₃-N, NH₄, pH, alkalinity, Ca, Mg, K, Na, SO₄, Cl, turbidity, and color.

Summer Samples: Integrated samples will be collected five times during the growing season from each lake. Analyses will include TP and chlorophyll a. Each year one early-summer sample will be analyzed for DATC (a measure of atrazine).

Winter Samples: Samples will be collected from the deep hole during winter. Analyses will include TP, TRP, TKN, NO₂+NO₃-N, NH₄, conductivity, and Cl.

Groundwater Sample Collection and Lab Analysis

Groundwater can provide a substantial amount of water to some these lakes. The groundwater inflow

areas can also be sources for contaminants originating in the groundwater watershed from various land use practices including agriculture, septic systems, and lawn and garden nutrient applications. Sources may also be natural including wetlands and in impoundments, submerged organic sediments.

Observations of open ice during late winter will provide insight about the regions within the lakes with the most substantial groundwater inflow. UW-Stevens Point CWSE will provide citizens with instructions and air photos for this exercise. Citizens will mark the maps with approximate areas of open water and CWSE staff will create electronic maps of this information.

Activities associated with water quality analysis and project responsibilities	Waushara County	CWSE
Project management	X	X
Collect water samples	X	
Enter field and lab data	Field	Lab
Delineate surface watersheds		X
Clip land cover for surface and groundwater watersheds	X	
Table and graph land cover for watersheds	X	
Delineate groundwater watersheds		X
Develop WiLMS models		X
Water quality interpretation		X
Mini reports, lake by lake, County report		X
Project updates, Media contact, outreach	X	
Quarterly progress/logistical meetings	X	X

Macrophyte Assessment

Aquatic macrophyte surveys will be conducted on lakes that lack surveys in the last five years. Samples will be collected from Waushara Co lakes in early July to mid-August over a three year period. The point-intercept approach, where sampling sites are distributed in a grid across the lake, will be used in combination with a boat survey. The boat survey will help compensate for bays and shoreline areas often missed by the point-intercept approach (grid). GPS sampling locations in accordance with a lake map will be used to select random sampling sites at each lake. A rake sampler, both on a pole and a weighted-rope sampler will be used to collect macrophytes from shallow and deep water sites. Field data, both point-intercept and boat survey, will include: GPS coordinates (latitude & longitude), depth, dominant sediment type (muck, sand, or rock), collection method, macrophyte identification, invasive species presence (particularly Eurasian watermilfoil and curly-leaf pondweed), species occurrence, rake fullness, and habitat information. A voucher specimen of each macrophyte type will be collected at each sample location and compared to herbarium specimens for verification and accuracy. Voucher specimens will be stored at the Robert Freckmann Herbarium, located on the UW-Stevens Point campus.

In accordance with the Aquatic Plant Management in Wisconsin Lakes Program of UW-Extension and the WDNR, the following individual species statistics will be calculated for samples collected at each lake:

- Frequency of occurrence within vegetated areas
- Frequency of occurrence at sites shallower than maximum depth of plants
- Relative frequency
- Number of sites where each species of macrophyte was found
- Average rake fullness

- Number of visual sightings
- Presence of each species

Likewise, the following summary statistics will be calculated for each lake sampled in Waushara County:

- Total number of points sampled at each lake
- Number of sites with vegetation
- Total number of sites shallower than maximum depth of plants
- Frequency of occurrence at sites shallower than maximum depth of plants
- The Simpson Diversity Index (nonparametric estimator of community heterogeneity)
- The maximum depth of plants
- Number of sites sampled by device
- Average number of all species per site
- Average number of native species per site
- Species richness (total number of species collected)

These data will provide the information needed for an aquatic plant lake management program for each lake sampled. Encompassing macrophyte data will provide information needed for determining the Floristic Quality Index (FQI). Macrophyte data can also be combined with water quality and chlorophyll data to determine the Trophic State Index (TSI). Lake maps will be developed to display some of the data spatially. Categories to be mapped may include sediment type, location of sampling sites, max FQI at each station, location of species of special concern, location and abundance of aquatic invasive species, etc.

Paleolimnology (Kaplan)

In order to place lake health into the greater context of natural and anthropogenic environmental change in a lake basin, an historical perspective is needed. This facet of the project will examine changes in lake status prior to and subsequent to major episodes of human activity and/or disturbance in the individual lake basins. Land clearing, vegetation alteration, fire and other disturbances leave signals in lake sediment that can be interpreted alongside other measures of water quality and lake health.

Paleolimnology allows us to identify these past events and assess the impact they had on variables such as water clarity, lake level, pH, and nutrient budgets. Historical records of human activity in the lake basin are combined with data obtained from sediment cores to assess the response and resiliency of an individual lake to a range of impacts. More fundamentally, paleolimnology provides a baseline of lake status and health prior to European settlement against which recent changes in water quality and the surrounding environment can be measured.

This part of the Waushara County lake study will involve a sub-set of 5 lakes (which will be identified based on summary information from Phase 1). Paleolimnology involves taking sediment cores from each lake which are then analyzed for sediment chemistry, diatoms, pollen, charcoal, and magnetic susceptibility, among other proxy techniques. These tools provide a robust picture of the type and degree of landscape alteration surrounding a lake through time. Land clearing that accompanied European settlement produces a predictable signal in most Wisconsin lakes. Terrigenous materials washed or blown into the lake basin, often accompanied by charcoal and *Ambrosia* sp. pollen, result in a distinct marker horizon in the lake sediment that can be used to separate non- or minimally-altered lake environments from more recent human influences. Radiometric dating techniques, including Cesium-137 and Lead-210 provide more complete chronological control of lake changes evidenced in the sedimentary

record.

While a top-bottom core will provide a snapshot of lake status at an unknown point in the past as compared to modern conditions, the proposed technique will track changes in lake health on a decade-by-decade basis from a known point in time prior to European settlement to the present day as the lake responds to natural events, land use changes, and climate. Most importantly, the data gleaned from this approach can be used to set up a cause-and-effect model of disturbance and climate change on a given lake, that in-turn, can be used to make future predictions about lake health.

Field Methods

Two parallel one-meter sediment cores will be obtained from the deepest part (hole) of each of the 5 lakes selected for the study using a modified Livingstone piston corer using a 2 or 3-inch barrel in the deepest part of the lake. One core, to be used for lead-210 dating, will be sub-sampled in 1 cm increments in the field; the second core will be preserved whole for the proxy analyses (pollen, diatoms, charcoal, etc.).

Age Control

The most expensive yet most critical component of this type of research is precise age control. Without absolute age control it is very difficult to place changes in the lake into temporal context. The most appropriate and accurate method of age determination for recent sedimentary events is Lead-210. Samples for Lead-210 will be sent to the Science Museum of Minnesota or another facility experienced in developing Lead-210 chronologies. The presence of Cesium-137 may also be used to identify the sedimentary horizon correlating to the peak of nuclear weapon testing in 1964.

Relative dating techniques will also be used to provide chronological control of the sedimentary record of lake events. A spike in ragweed (*Ambrosia* sp.) pollen serves as a strong indicator of initial European land clearance. Late Nineteenth and early Twentieth century plat maps and tax records will be used to date the onset of these activities, and thus the ragweed spike, for each of the lakes. Other well-dated historical events (fires, storms, road construction, etc.) may also leave recognizable markers in the sediment that provide age control.

Laboratory Analyses

Sediment cores will be transported to the Limnological Research Center at the University of Minnesota for whole and split core analyses, including Gamma ray attenuation (bulk density), magnetic susceptibility, core imaging, and description.

Standard laboratory procedures will be used for isolating charcoal, pollen, and diatoms trapped in the sediment. Charcoal, pollen, and diatoms are typically measured every 0.2 to 2.0 cm along the length of the core depending on the sedimentation rate. Once charcoal particles are isolated from the sediment they are measured and counted under a microscope to arrive at quantitative estimates of fire frequency and intensity. Pollen grains are likewise identified and counted under a microscope to determine the composition of plant and macrophyte communities in the lake and its basin. The relative abundance of different diatom species provides information on changes in lake temperature, pH, nutrient status and lake level. Diatom counting and analysis will be performed by third party contract.

Loss on ignition (LOI) will also be used to measure the carbonate and organic carbon content of lake sediments. An increase in the abundance of carbonate relative to organic carbon is often indicative of reduced water levels and/or the relative contribution of groundwater versus meteoric inputs. LOI is performed by combusting a sample of sediment in a furnace and recording the weight, and hence organic matter, lost.

Outreach

Education and outreach program:

As water quality data becomes available such as the results of the aquatic plant surveys, paleolimnology, and the watershed land use information (Jan 2012), we plan on sharing this information with individual lake groups at their regularly scheduled meetings, the Waushara County Watershed Lakes Council's quarterly meetings, County Board, etc. We will do this initially through PSA's, direct mailings, e-mails and follow up phone calls, and where no lake group exists, direct mailings will go to all riparian owners. Additionally, we will attend the Waushara County Watershed Lakes Council quarterly meetings and share this information with them. LCD staff will provide public education, via speaking engagements or attending board and annual meetings as requested or as opportunities present themselves. Lastly, we will host a series of night meetings throughout Waushara County with each Lake Group or groups in an attempt to meet Lake Owner schedules. These meetings will be used to share and distribute the water quality data that has been collected. UWSP will assist with providing and organizing the data to be presented by the LCD staff and may include staff from UWSP to assist. Staff from UWSP will also assist with meeting preparation as it relates to data dissemination.

Project Deliverables for Phase 2 (beginning with the May 2010 grant application)

Deliverables will be designed for a variety of audiences including individual citizens, lake associations and other local conservation groups, local government, and county agencies. Following the first year of study a summary of preliminary project results will be provided to the county and towns and presentations will be made for the community.

A comprehensive final report will include the interpretation of the collected data; this information will be presented by lake. Recommendations from each study component will be provided for use in the development/update of lake management plans. Recommendations may be targeted for individual citizens, particularly those who live, work or recreate on the lakes or in the watersheds; organizations interested in water protection such as individual lake associations, Trout Unlimited, etc.; government units including the County and Town Committees, Land Conservation Department and DNR staff.

A report will also be generated that will summarize the lake/watershed information at a county scale. This report will provide reference conditions for lakes in the county and can be utilized by the county and municipalities to direct/prioritize implementation strategies.

Newspapers and other media will be kept up to date on the study, its progress, and associated meetings. Communication with land owners that aren't full time residents will be with the usual media sources. The County's webpage, necessary PSA's and direct mailings to lake property owners as well as notifications to the Waushara County Watershed Lakes Council will be used.

Water Quality/Watersheds/Modeling

A final report will be prepared that will present results from each lake individually and Waushara County's lake system on the whole. This report will include data summary in tables, graphs, and figures and will be comprehensive in nature. Lake-by lake information will include description of individual lake with general characteristics, current water quality, comparison to historic water quality, areas of concern in the lake (e.g. groundwater inflow, direct discharge points, phosphorus sensitivity, etc.), and modeling results.

Recommendations will be made to address the areas of concern and to best protect/remediate water quality. Examples may include less dense housing or septic system setback in a given area, shoreline and watershed land management practices, etc. This information will be summarized in a format that can be used by citizens, municipalities and communities for lake management and in developing and implementing their village, town and county plans and ultimately for implementation. This will include the use of groundwater and surface watershed maps, lake maps accompanied by text describing areas of concern and recommendations.

Macrophyte Assessment

A brief report will be prepared for each lake. Each report will include a general summary of the aquatic macrophytes of the lake, an evaluation of the ecological quality of the lake (e.g. cultural trophic status of the lake based on macrophyte abundance and commonness or rareness of species present), and an indication of the presence of invasive species. Quantitative lake survey results will be combined with an annotated checklist of species present, abundance, and distribution data sets prepared by other investigators on this project. In accordance with the Aquatic Plant Management in Wisconsin lakes Program of UW-Extension and WI-DNR sample and lake statistics will be computed and presented in the report. The comprehensive macrophyte survey will be used to determine the Floristic Quality Index (FQI) and be combined with water quality and chlorophyll data to verify the Trophic State Index (TSI). Results of the field survey should provide information for aquatic plant lake management decisions and detection/location of any invasive species observed. Baseline data will provide for long-term monitoring and provide a comparable data set to the Aquatic Plant Management in Wisconsin Lakes Program of UW-Extension.

Paleolimnology

A report will be prepared for each lake detailing the results of the analyses performed. Each lake report will synthesize the various results to provide a picture of what the lake system and water quality were like prior to large-scale human disturbance. The report will also describe how natural and anthropogenic disturbances in the lake basin have affected the lake and its water quality through time. Lakes will be categorized/ranked by the degree of human activity and the response of each lake to those disturbances. Lakes that are particularly fragile or resilient will be identified.

Phase 3

Ph 3 Countywide Lake Management Plan (to be integrated in Co LWRCP)
Ph 3 -Develop specific lake management plans for each lake group

Phase 4

Ph 4 Implementation of ongoing non-point pollution control practices and other actions identified in the lake management plans.

Phase 2 Timeline

Water Quality and Watersheds : Summer 2010 – Spring 2013
Sample collection: Winter 2011 – Fall 2012
Data analysis: ongoing
Report preparation: Winter 2012 (preliminary) and Spring 2013 (final)

Aquatic Macrophyte (point intercept and boat survey) sampling: early July to mid-August 2011, 2012
Sample processing: as samples are collected
Data analyses: as data are collected
Report preparation: annually, with final report submitted by December 2013

Paleolimnology Survey: Winter 2011 – Spring 2013
Sample collection beginning winter 2011
Analysis and report through winter 2013

Final Report: June 2013

Phase 2 Project Budget for 33 lakes.

Sub-Project Topic	Grant Funds Requeste	UWSP In-Kind	County and Citizen In-Kind	Total Cost
Water Quality/Outreach/Project Management - County	80784		45200	125984
Water Quality/Watersheds-UWSP	107342	13022		120364
Aquatic Plant Survey-UWSP	45070	38500		83570
Paleolimnology Survey-UWSP &DNR	25703	10620		36323
Project Management/Information and Education - UWSP	63187			63187
Total Cost	322086	62142	45200	429428

Budget for Phase 2 Grant 2

Sub-Project Topic	Grant 2 Request	Grant 2 Match
Water Quality/Outreach/Project Management - County	11624	6306
Water Quality/Watersheds-UWSP	17890	2170
Aquatic Plant Survey-UWSP	7512	6417
Paleolimnology Survey-UWSP &DNR	4284	1770
Project Management/Information and Education - UWSP	8691	
Total Cost	50000	16663

Budget Details

January 2011 - December 2012 Budget

Item	Unit	Purchase	Donated	Dontation Source
SALARIES				
Waushara County LCD Staff Salary & Benefits	2400 hours	\$80,784.00		Lakes Class Grant Request
Waushara County Project Coordinator Ed Hernandez (LCD)	\$40/hr 160hrs		\$6,400	Waushara County
Waushara County Project Assistance Administrative Secretary (LCD)	\$26.50/hr gross 40hrs		\$1,060	Waushara County
UWEXT Project assistance = Pat Nehring	\$45/hr gross x 20 hours		\$900	Waushara County
UWSP Faculty & Staff	Project Management			Lakes Class Grant Request
GIS Production	\$33/hr at 20 hrs		\$660	Waushara County
Lake Group Participation				
Provide water quality data updates for each lake group	32 lakes 3 hrs/lake/10 x \$12 attendees		\$23,040	Lake Groups
Quarterly Meetings w/WCWSLC	3 mtgs x 3 hrs/mtg x 15 attend x \$12/hr		\$3,240	Waushara County
Speaking/info mtgs	3 mtgs x 3 hrs/mtg x 10 attending x \$12/hr		\$2,160	Waushara County
EQUIPMENT				
Boat/Canoe & Equipment	\$25/day x 8 days x 7 rounds		\$2,800.00	Waushara County
Ice Auger Rental	\$10/day x 11 days		\$220.00	Waushara County
Water sampling storage	\$5/day x 8 days x 8 rounds		\$640.00	
MATERIALS				
Mileage (4000 miles total)	\$0.485/mile (state rate)		\$3,880.00	Waushara County
Postage- Mailings	incl. 2 bulk mailings, approx. 100 pieces		\$200	Waushara County
	TOTALS:	\$80,784	\$45,200	

Waushara Co Lake Study - Water Quality/Watersheds, Project Management, Reports

			YEAR 1 - Total Cost	YEAR 1- Match	YEAR 1- Grant Request
Personnel	Salary	Fringe			
Water quality staff (Salary + fringe) and students	20,500	9,123	29,623		29,623
Water faculty			1,000	1,000	
UWSP Project Coordination, Training, Meetings, Reports	10,000	4,450			0
Printing and Supplies					0
Travel (meetings, etc)					0
	Number	Cost/Item (minus match)	Total Cost	Match	Grant Request
In-lake Water Quality					
Summer Samples - TP and Chlor <i>a</i>	165	44	7,920	660	7,260
Summer Samples - DACT	33	27	891		891
Overturn (Analyses 2)	66	143	13,332	3,894	9,438
Winter (Analyses 1)	33	68	3,399	1,155	2,244
Groundwater Survey					
Open ice observations (volunteers)				1188	
Total			56,165	7,897	49,456
Analyses 1 = NO2+NO3, NH4, TKN, TP, SRP, Cl, Temp, DO, Secchi					
Analyses 2 = pH, conductivity, alkalinity, total hardness, calcium hardness, reactive phosphorus, total phosphorus, color, turbidity, ammonium, nitrate+nitrite, TKN, chloride, sulfate, sodium, potassium					
Analyses 3 = NO2+NO3, NH4, TP, Cl, Temp, Cond					

Waushara Co Lake Study - Water Quality/Watersheds, Project Management, Reports					
			YEAR 2 - Total Cost	YEAR 2- Match	YEAR 2- Grant Request
Personnel					
Water quality staff (Salary + fringe)	Salary	Fringe			
	29,760	13,243	43,003		43,003
Water faculty			1,000	1,000	
UWSP Project Coordination, Meetings, Reports	28,780	12,807	41,587		41,587
Printing and Supplies					
Travel (meetings, etc)			4,500		4,500
			500		500
	Number	Cost/Item (minus match)	Total Cost	Match	Grant Request
In-lake Water Quality					
Summer Samples - TP and Chlor _a	165	44	7,920	660	7,260
Summer Samples - DACT	33	27	891	0	891
Overturn + Winter (Analyses 2)	99	68	9,900	3,168	6,732
Total			109,301	4,828	104,473
Analyses 1 = NO2+NO3, NH4, TKN, TP, SRP, Cl, Temp, DO, Secchi					
Analyses 2 = pH, conductivity, alkalinity, total hardness, calcium hardness, reactive phosphorus, total					

Waushara County				
Aquatic Macrophyte Field Sampling and Analysis 2010 - 2012				
Based on sampling 33 lakes over three years (11 lakes per year)				
July - August 2010	Grant request	Matching funds	Total funds	
Supplies & Equipment	3500	11000	14500	
Travel	800	0	800	
Fuel for boat	240	0	240	
Lake voucher specimens	2200	0	2200	
Student salary	3900	0	3900	
Investigator salary	5300	4000	9300	
Office supplies	250	1000	1250	
Printing final report	400	0	400	
Total	15940	16000	31940	
July - August 2011				
Supplies & Equipment	300	7000	7300	
Travel	800	0	800	
Fuel for boat	240	0	240	
Lake voucher specimens	2200	0	2200	
Student assistant salary	3900	0	3900	
Investigator salary	5300	4000	9300	
Office supplies	250	1000	1250	
Printing final report	400	0	400	
Total	12740	12000	24740	
July 2012 - March 2013				
Supplies & Equipment	300	5000	5300	
Travel	800	0	800	
Fuel for boat	240	0	240	
Lake voucher specimens	2200	0	2200	
Student assistant salary	3900	0	3900	
Investigator salary	8300	4500	12800	
Office supplies	250	1000	1250	
Printing final report	400	0	400	
Total	16390	10500	26890	
	Grant request	Matching funds	Total funds	
Grand total	45070	38500	83570	

Paleolimnology Budget Request		
		with age control and pollen
3 days of coring at \$100 a day required for sediment collection		300 3500
\$120 per day		120
\$60 per lake		360
tube caps, floral foam, misc. per lake		60
	Sub total	4340
\$2200 per lake		13200
\$500 per lake		3000
	Sub total	16200
Fireboard + replacement crucibles		130
20 hours per lake at \$10.50 per hour (including fringe)		205
	Sub total	335
\$70 per lake (chemicals, slides, etc.)		420
\$100 per sample contract rate, 10 samples per lake		6000
\$150 per sample contract rate, 10 samples per lake		9000
	Sub total	15420
\$300 per lake contract rate		300
	Sub total	300
\$600 per lake (2 samples) contract rate		3600
	Sub total	3600
er		
440 miles at \$0.59 per mile		236
\$160 room + \$120 board (3 days)		280
\$15 user fee		15
		0
		0
\$40 per lake (D-tubes, end-caps, slides)		240
	Sub total	771
\$5894 + \$2682 fringe		8576
	Sub total	8576
	TOTAL	49542
Total Expenses Less Match		42422
	Match	7120