Pensaukee River Watershed

Surface Water Resource

Appraisal Results

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Water Resource Conditions and Goals

This section describes the general conditions of the surface and groundwater resources in the Pensaukee River watershed. It describes the classifications used for Wisconsin's waters, then describes the surface water resources in the watershed. Descriptions of subwatersheds are also included. Table 2-[*] provides a summary of the surface water resources in each subwatershed. Groundwater resources and quality is also discusses.

Water Use Classifications

Surface water quality standards and criteria are expressions of the conditions considered necessary to support biological and recreational uses. Water quality standards for recreational and biological uses are contained in Chapters NR 102, NR 104, and NR 105 Wisconsin Administrative Code.

Fish and Other Aquatic Life Uses

The biological use of the watershed streams is defined by the fish and other aquatic life communities currently living in the stream. Use assessment of the watershed streams are defined as follows:

COLD = Coldwater Communities include surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for coldwater fish species.
WWSF = Warmwater Sport Fish Communities include surface waters capable of supporting a community of warmwater sport fish and/or serving as a spawning area for warmwater sport fish.
WWFF = Warmwater Forage Fish Communities include surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF = Limited Forage Fish Communities include surface waters of limited capacity because of very low, naturally poor water quality or poor habitat.

Surface Water Resources

For the purposes of this project, the Pensaukee River Watershed is subdivided into six individual subwatersheds. Major tributaries, lakes, wetlands, and subwatershed divides are shown in map 1-[*].

Subwatersheds in the Pensaukee River Watershed

Upper Pensaukee	(UP)
Pensaukee Lakes	(PL)
North Branch Pensaukee	(NB)
Middle Pensaukee	(MP)
Lower Pensaukee	(LP)
Kirchner Creek	(KC)

Streams

The Pensaukee River Watershed is located in Shawano and Oconto Counties. Streams in the watershed include the Pensaukee River and its tributaries and several direct drainage tributaries to Green Bay. The Pensaukee River discharges to Green Bay near the community of Pensaukee. Spring Creek, Brookside Creek, and Kirchner Creek are the only named intermittent streams in this watershed. Spring Creek and Brookside Creek discharge to the Pensaukee River, but Kirchner Creek drains directly to Green Bay.

The Pensaukee River originates just west of Pautz Lake and has many intermittent tributaries that discharge to it. These intermittent drainage tributaries are a major source of pollution to the Pensaukee River system. The river is generally flashy and floods with snowmelt and rain runoff. The headwaters often dry up in summer. Aquatic life habitat and macroinvertebrate communities in these headwater areas are generally in fair to poor condition. Heavy deposits of silt and sand cover much of the streambed. Nutrients (especially phosphorus) promote excessive aquatic plant (periphyton and algae) growth that influence the dissolved oxygen levels in the water column. Aquatic plants produce abundant oxygen in the daylight as the plants photosyntheses, but the oxygen is used during plant respiration at night. Dissolved oxygen levels often drop to zero in early morning hours when high water temperatures depress oxygen solubility. These severe oxygen fluctuations stress aquatic life. The Wisconsin State standard for dissolved oxygen is 5 mg/l for these warm water streams.

Continuous flow starts at about the confluence of the North Branch Pensaukee River. The North Branch Pensaukee River is a major tributary entering the Pensaukee River near the Morgan Marsh. This river is significantly impacted by the many nearby wetlands. As the river gradient increases, the rocky substrate and subsequent reaeration improves aquatic life and habitat although shallow water depths still limit available cover for adult gamefish. Excessive nutrients in the water column cause periphyton growth, which in turn, effects dissolved oxygen levels. The river becomes wider and deeper as velocity slows and the Pensaukee River nears its mouth. Sediment, thus, settles out and has accumulated near the river mouth. Many of the tributaries and Pensaukee River have been ditched and straightened to quickly convey water off the land and dry the soils. Eliminating the natural meandering destroys pools and increases stream velocity. Deep pools provide critically needed mid-summer aquatic habitat. High stream velocities increase erosion and suspended

solids concentrations and prevent reproduction of some fish species.

The fishery of the Pensaukee River Watershed is heavily influenced by spawning migrations which run up the Pensaukee River and up streams discharging directly to Green Bay. The many small perennial and intermittent tributaries to the river and to Green Bay proper provide important existing and potential spawning and rearing habitat for game and forage species. High water levels in the spring provide extensive spawning and rearing habitat. As water levels decline, usually by the middle of June, many fish have traveled downstream with the current to Green Bay. Known spawning runs include northern pike, walleye, white sucker, and smallmouth bass. Stream bank stabilization and extending base flow would improve spawning habitat and instream cover for both adult and young fish. Deeper pools would result in more and larger adult fish such as northern pike, white sucker, and smallmouth bass. The greater redhorse (Moxostoma valenciennesi), a Wisconsin threatened species, was found in the Pensaukee River at three monitoring stations in 1975; however, none were captured in the 1995 survey.

The water resources in the Pensaukee River watershed show extensive nonpoint source pollution problems. Erosion from streambank pasturing, flooding, and cropland runoff, along with excess nutrient loading has impaired the potential of these watershed streams. Low stream flow and shallow depths, high water temperature, beaver dams, and stream channelization also have negative impacts on water quality. Nonpoint source control measures installed in this watershed would most significantly benefit aquatic life by increasing available aquatic life habitat and providing better water quality year-round in the watershed streams in addition to supplying less pollutants to Green Bay.

Lakes

There are only four named lakes in the Pensaukee River watershed; Pensaukee, Pautz, Mud and Delzer Lakes. Pensaukee Lakes consists of three separate basins connected by navigable channels. The total acreage is 109 acres. The east and west basins are shallow with abundant vegetation that offers good habitat for waterfowl and fish. The middle basin has a maximum depth of 49 feet, and the greatest amount of open water acreage. Extensive wetlands surround the system. A critical area for nutrient and sediment input to the west basin is by means of the public access. The road and access are asphalt on steep slopes with row crops on both sides. The road ditch collects runoff from the fields where it drains unimpeded to the west basin of the lake. A redesign of this access site is a critical need for the long term protection of Pensaukee Lake. Pautz Lake is a shallow drainage lake surrounded by wetlands. Mud Lake is a shallow lake surrounded by wooded wetlands and drains to a tributary to the North Branch Pensaukee River. Delzer Lake is even smaller than Mud Lake and is surrounded with fields. This lake also drains to a tributary to the North Branch Pensaukee River.

Water Quality Goals and Project Objectives

The DNR staff with assistance from the Shawano and Oconto County Land Conservation Department staff and the DATCP developed water quality goals and project objectives. Goals and objectives for each subwatershed are included in the next section.

Following are the type of goals for water resources:

- **Protection**: Protection refers to maintaining the present biological and recreational uses supported by a stream or the reservoir. For example, if a stream supports a healthy cold water fishery and is used for full-body contact recreational activities, the goal seeks to maintain those uses.

- **Enhancement**: Enhancement refers to a change in the overall condition of a stream or lake within its given biological and recreational use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the goal focuses on changing those water quality conditions which keep it from achieving its full biological potential.

- **Restoration**: Restoration refers to upgrading the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warmwater game fish, but no longer does. This goal seeks to improve conditions allowing viable populations of forage and warmwater game fish species to become reestablished.

The water quality conditions needed to support the goals for streams and lakes are the basis for determining the type and level of nonpoint source control to be implemented under the priority watershed project.

Overall water resources goal for the project:

Protect, enhance, and restore the water quality of the streams of the subwatersheds in order to improve the water quality of all the subwatersheds and ultimately Green Bay.

Subwatershed Discussions

This section describes the physical and water quality conditions for each subwatershed in the Pensaukee River Priority Watershed Project. Discussions for each subwatershed are broken into four parts: a general description, water quality conditions, the nonpoint source pollutants impairing the subwatershed, and the goals and objectives for the subwatershed. Table 2-[*] summarizes the subwatershed conditions.

Upper Pensaukee Subwatershed (UP)

Description

Upper Pensaukee Subwatershed consists of the Pensaukee River from its headwaters just west of Pautz Lake downstream to the confluence of the North Branch Pensaukee River. Several unnamed intermittent tributaries discharge to the Pensaukee River. The communities of Zachow, Krakow, Sampson and Angelica are in this subwatershed. The village of Krackow Wastewater Treatment Plant and Graf Creamery near Zachow both discharge to the Pensaukee River.

Water Quality Conditions

The Pensaukee River in this subwatershed is classified as warmwater sport fish although the upper reaches do not have flow year-round. Snowmelt and rain runoff cause extreme flooding, bank erosion, and a widening of the stream channel. The resulting shallow stream depth allows the water to warm up and limits adequate cover for adult gamefish. The river channel becomes deeper and much wider just upstream of Krakow. In summer, water ponds in the river channel and becomes stagnate with low dissolved oxygen levels and thick aquatic plant growth.

The Pensaukee River received aquatic life habitat ratings (using methods described by Ball, 1982) from fair to poor depending upon location. In the upper-most reaches, there is a heavy deposit of silt and sand covering the stream bed. Aquatic plants are abundant and some bank erosion is evident. Many of the tributaries and the Pensaukee River have been ditched and straightened. Aquatic life near Nichols Drive is abundant in early summer when water flow is still good. Crayfish, snails, minnows, and tadpoles are common.

Pautz Lake is a small and shallow drainage lake surrounded by wetlands in the headwaters of the Pensaukee River.

The lower reaches of this subwatershed have somewhat better aquatic life habitat with rock and rubble substrate more common then the silt and sand bottom in the upper reaches.

However, many of the rocks are covered by a layer of fine silt. Significant deposits of soft sediment are common near the river banks and in slow current areas. Thick mats of filamentous algae cover much of the stream substrate. Cattle and horses pasturing along the river and tributaries have caused significant bank erosion.

The Pensaukee River at Nichols Drive has severe dissolved oxygen and temperature problems. Continuous monitoring from May 25 to June 23, 1995 (WDNR files), showed extreme dissolved oxygen and temperature fluctuations. It was common to see dissolved oxygen concentrations fluctuate between 20 mg/l down to zero in a 24-hour period. Water temperatures reached as high as 94°F. These low dissolved oxygen levels and high temperatures are extremely stressful to aquatic life in the stream. Rain runoff events appear to temporarily cool river water temperature and dampen these daily dissolved oxygen fluctuations.

Aquatic macroinvertebrate samples (using methods described by Hilsenhoff, 1987) collected at Safian Road received fair water quality ratings both spring and fall, 1993; fair ratings at Green Valley Road and CTH C in spring, 1979; and good ratings at CTH C in fall, 1979. These ratings indicate some to fairly significant organic pollution present in the river.

Water chemistry samples collected at Safian Road in 1993 (WDNR files) showed elevated levels of dissolved phosphorus during four rain runoff events sampled. Total phosphorus concentrations were elevated one out of four events sampled.

The lack of stream flow year-round is the most limiting factor in this subwatershed; however, the Pensaukee River has the potential to offer better aquatic life habitat for most of the year when water is available if sediment and nutrient loading were reduced. Sediment has filled in pool areas and covered substrate. Nutrients have caused excessive plant growth in the river which effects the dissolved oxygen level. Ditching, warm summer water temperatures, and streambank flooding which decreases stream depth are also factors which prevent the water resources from meeting its potential.

Nonpoint Source Pollutants

- The Upper Pensaukee Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Upper Pensaukee Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the Upper Pensaukee Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the Upper Pensaukee River subwatershed:

1. Improve aquatic life habitat and water quality by:

    a. creating and maintaining buffers that filter sediments and other pollutants, provide shading and stabilize streambanks.
    b. preventing the trampling of the streambanks by limiting livestock access.
    c. reducing nutrient/phosphorus loading by a high level which will reduce macrophyte growth and stabilize oxygen levels.
    d. reducing sedimentation rates by a high level.
    e. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    f. protecting, enhancing, and restoring wetlands to slow the release of water to the stream and filter sediment and other pollutants.
    g. decreasing extreme flooding which widens the stream channel, warms water, and decreases water depth and cover for adult fish.

2. Improve wildlife habitat by:

    a. protecting, enhancing, and restoring streambank corridors.
    b. protecting, enhancing, and restoring wetlands.

3. Extend duration of base flow past May in the tributaries to the Pensaukee River and the Pensaukee River to provide spawning and nursery areas for fish by:

    a. creating and maintaining buffers to decrease peak flooding and increase infiltration of precipitation into the soil.
    b. protecting, enhancing and restoring wetlands to slow the release of water to the streams.
    c. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    d. increasing cropland best management practices, such as conservation tillage, which will increase infiltration.

Pensaukee Lakes Subwatershed (PL)

Description

Pensaukee Lakes subwatershed consists of the Pensaukee Lakes and the direct drainage to the lakes. Pensaukee Lakes consists of three separate basins connected by navigable channels. The total acreage is 109 acres. The east and west basins are shallow with abundant vegetation that offers good habitat for waterfowl and fish. The middle basin has a maximum depth of 49 feet and the greatest amount of open water acreage. Extensive wetlands surround the system.

Water Quality Conditions

Surface total phosphorus values are in the high mesotrophic/lower eutrophic category from data that was collected in 1977 and again in 1995. Significant stratification occurs during the summer. The hypolimnion became anoxic after two meters in a nine meter profile in August of 1995. Very high phosphorus levels (179 ug/l) were measured in the hypolimnion during summer stratification. The lake does mix during spring and fall. (Rasman, WDNR files, 1995). This indicates a high internal phosphorus source.

The immediate shoreline is not heavily developed and is in a natural or wild condition. Agricultural activities taking place approximately 1000 feet beyond the shoreline are extensive. The agriculture consists of dairy farms with accompanying row crops. A critical area for nutrient and sediment input to the west basin is by means of the public access. The road and access are asphalt on steep slopes with row crops on both sides. The road ditch collects runoff from the fields where it drains unimpeded to the west basin of the lake. A redesign of this access site is a critical need for the long term protection of Pensaukee Lake.

In general, internal nutrient cycling from sediment in the Pensaukee Lakes will probably keep it in the high mesotrophic/lower eutrophic category; however, a reduction in nutrients and sediment inputs from the lake drainage area and public access site will prevent the lake from becoming more eutrophic.

Nonpoint Source Pollutants

- The Pensaukee Lakes Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Pensaukee Lakes Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the Pensaukee Lakes Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the Pensaukee Lakes subwatershed:

1. Protect the Pensaukee Lakes from becoming more eutrophic by:

    a. redesigning the public access site to decrease sediment and nutrient runoff from croplands to the west basin.
    b. reducing the amount of development and impermeable surfaces in the immediate drainage area of the lake.
    c. reducing sediment and nutrient loading by a medium level.

2. Protect wildlife habitat by:

    a. preserving the natural or wild condition of the undeveloped shoreline.

North Branch Pensaukee Subwatershed (NB)

Description

The North Branch Pensaukee subwatershed consists of the North Branch Pensaukee River from the outlet of Pensaukee Lake downstream to the confluence of the Pensaukee River, and several unnamed intermittent tributaries to the North Branch Pensaukee River. Mud Lake and Delzer Lake are also in this subwatershed. A significant portion of this subwatershed is wetland, including Morgan Marsh. The communities of Advance, Green Valley, and Morgan are in this subwatershed.

Water Quality Conditions

Since wetlands contribute a significant flow to the North Branch Pensaukee River, the water is generally a stained brown color with somewhat cooler temperatures than the Pensaukee River.

The North Branch Pensaukee River received aquatic life habitat ratings from good to poor depending upon location. In the upper reaches of the North Branch, the river has the characteristics of a channel through a marsh. The wetland corridor extends downstream to about Green Valley Road. The channel is wide with fairly undefined banks. The substrate is mostly soft dark organic matter. The deep, slow-moving water is stained, and wetland

and/or lake-type aquatic plants are common.

Further downstream, the river develops more of a river channel and flow increases. The river channel is wide and shallow. The substrate is mostly rock, rubble and sand with some soft sediment accumulated near the banks and in slow areas. Stream bank erosion does not appear to be a problem in this subwatershed. Most of the stream corridor is buffered with dense trees, shrubs, and grasses. Historically, the river has been dammed by beavers in the lower reaches.

The North Branch Pensaukee River has significant dissolved oxygen problems. Continuous monitoring from June 23 to July 17, 1995, at CTH E showed several daily dissolved oxygen violations (dissolved oxygen below the state standard of 5 mg/l); however, the daily fluctuation was not nearly as severe as the Pensaukee River at Nichols Drive. Daily dissolved oxygen fluctuations were within 6 mg/l (as opposed to 20 mg/l). This is probably because aquatic plants are not nearly as abundant in the river at CTH E. High water temperatures and periphyton growth are the cause of the oxygen violations.

Water temperatures reached as high as 85°F on July 14, 1995. These warm temperatures can be stressful to fish and other aquatic life. Rain events appear to decrease water temperature and temporarily stabilize dissolved oxygen levels.

A fishery survey was conducted on the North Branch Pensaukee River upstream from CTH E in July, 1995. This stretch of the river received a biotic integrity rating of excellent to good (Langhurst, WDNR files, 1996). This rating means the fish community has species richness somewhat below expectation especially due to the loss of the most intolerant forms; some species, especially top carnivores, are present with less than optimal abundances or size/age distributions; trophic structure shows some signs of imbalance.

Aquatic macroinvertebrate samples ranged from good to poor. A sample collected at CTH BB in fall, 1979 received a fair water quality rating. At CTH E, samples received a good rating in spring, 1979 and also in spring, 1993. Three samples at Hwy 32 in 1993 showed poor, fair, and good water quality. These ratings indicate some to very significant organic pollution present in the river.

Water chemistry samples collected at Hwy 32 in 1993 showed elevated levels of dissolved phosphorus during three out of four rain runoff events sampled. Total phosphorus was also elevated during one of the rain events sampled.

Wooded wetlands surround Mud Lake. This small lake drains to a tributary to the North Branch Pensaukee River upstream of CTH BB. Delzer Lake is even smaller than Mud Lake and is surrounded by fields. This lake discharges to an unnamed tributary to the North Branch Pensaukee River downstream of the Shawano and Oconto County line. Many of the intermittent tributaries to the North Branch have been ditched and straightened.

The marshy nature of the North Branch Pensaukee River corridor will inhibit the upper reaches from achieving habitat ratings higher than it already supports; however, the lower reaches have potential to improve with the reduction in sediment and nutrient loading in this subwatershed. A reduction would stabilize dissolved oxygen levels, decrease sediment accumulation in the streambed, and decrease overall loading to the Pensaukee River. Beaver dams, stream channelization, shallow stream depth which provides little overhead and instream cover, and high water temperatures are also limiting the aquatic life in this subwatershed.

Nonpoint Source Pollutants

- The North Branch Pensaukee Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the North Branch Pensaukee Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the North Branch Pensaukee Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the North Branch Pensaukee subwatershed:

1. Improve aquatic life habitat and water quality by:

    a. creating and maintaining buffers that filter sediments and other pollutants, provide shading and stabilize streambanks.
    b. reducing nutrient/phosphorus loading by a medium level which will reduce macrophyte growth and stabilize oxygen levels.
    c. reducing sedimentation rates by a medium level.
    d. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    e. protecting, enhancing, and restoring wetlands to slow the release of water to the stream and filter sediment and other pollutants.
    f. decreasing extreme flooding which widens the stream channel, warms water, and decreases water depth and cover for adult fish.

2. Improve wildlife habitat by:

   a. protecting, enhancing, and restoring streambank corridors.
   b. protecting, enhancing, and restoring wetlands.

3. Increase stream flow in the North Branch Pensaukee River by

   a. creating and maintaining buffers to decrease peak flooding and increase infiltration of precipitation into the soil.
   b. protecting, enhancing and restoring wetlands to slow the release of water to the river.
   c. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
   d. increasing cropland best management practices, such as conservation tillage, which will increase infiltration.

Middle Pensaukee Subwatershed (MP)

Description

The Middle Pensaukee subwatershed consists of the Pensaukee River from the confluence of the North Branch Pensaukee River downstream to just below the confluence of Brookside Creek. This subwatershed includes Spring Creek, Brookside Creek, and several unnamed intermittent tributaries to the Pensaukee River. The communities of Abrams and Brookside are in this subwatershed.

Water Quality Conditions

The Pensaukee River in this subwatershed is classified as warm water sport fish and flows year-round, though flows are minimal in mid-summer. The Pensaukee River received aquatic life habitat ratings of good at Sandalwood Road and CTH J; and good to fair at Valentine Road. The river is generally wide and shallow, limiting available cover for fish. The substrate is dominated by rocks and rubble and is covered by periphyton growth. Some sedimentation has occurred near the banks and in slow areas. Stream bank erosion from high stream flows appear to be significant at some locations even though the bank vegetation is present and appears to be a good buffer.

The Pensaukee River has significant dissolved oxygen and temperature problems in this section. Continuous monitoring at Valentine Road from June 30 to July 17, 1995, and at CTH J from August 29 to September 6, 1995, showed dissolved oxygen violations on a daily basis especially at Valentine Road when water temperatures were the warmest. Water temperatures reached as high as 91°F in July. These high water temperatures depress

oxygen solubility in the water column.

A fishery survey was conducted on the Pensaukee River upstream from Valentine Road in July, 1995. This stretch of the river received a biotic integrity rating of excellent. This rating means the fish community is comparable to the best situations with minimal human disturbance; all regionally expected species for habitat and stream size, including the most intolerant forms, are present with a full array of age and size classes. The trophic structure is balanced.

Aquatic macroinvertebrate samples in the Pensaukee River showed good and very good water quality at Valentine Road in spring and fall, 1993. Water quality rated good at Sandalwood Road in spring, 1992, and good in spring and fall, 1979 at STH 141. These ratings indicate some to possible slight organic pollution present in the river.

Water chemistry samples collected at Valentine Road in 1993 showed elevated levels of dissolved phosphorus during three out of four rain runoff events sampled. Total phosphorus and suspended sediment were also high in one of the runoff samples collected.

Spring Creek is a 6-mile-long intermittent flowing tributary to the Pensaukee River. Aquatic life habitat rated fair at CTH E in spring, 1995 but overall, habitat is considered poor. The stream bed is completely covered with soft sediment. Pools and riffles are absent. Without continuous flow, aquatic life is severely limited in Spring Creek most of the year. A macroinvertebrate sample collected in spring 1993 at Hwy 141 when flow was good, rated water quality as very good indicating possible slight organic pollution. Several sections of Spring Creek have been channelized and are impacted by beaver dams. Much of the Spring Creek drainage area is wooded.

Brookside Creek is a 5-mile-long intermittent flowing tributary to the Pensaukee River. Aquatic life habitat is poor because of the lack of stream flow during most of the year. Brookside Creek has a history of significant runs of northern pike, and therefore, probably other fish species. The stream bed substrate is mostly soft sediment and sand. Riffles are absent and water ponds near bridges and culverts. Most of Brookside Creek has been ditched. Water chemistry samples collected at CTH J showed elevated levels of dissolved phosphorus during all three rain runoff events sampled in 1995. Biochemical oxygen demand, ammonia, and total phosphorus levels were also found at elevated concentrations in some samples.

Since the Pensaukee River in this subwatershed flows continuously, has a good gradient and rocky substrate, aquatic life habitat is fairly good. An increase in stream depth and available cover would considerably increase the habitat for adult gamefish. Flooding and erosion of the streambanks cause the wide and shallow stream channel. A reduction of nutrients and sediment, not only from this subwatershed but also from the upstream subwatersheds, could still improve aquatic life and habitat conditions by stabilizing dissolved oxygen levels and decreasing sediment accumulation.

Aquatic life in both Spring Creek and Brookside Creek is limited by intermittent stream flow. A nutrient and sediment loading reduction would most significantly benefit the receiving waterbody (Pensaukee River); however, it would still improve aquatic life and habitat in the streams themselves when water is present. Stream channelization expedites rain runoff and causes these creeks to dry up earlier than they normally would.

Nonpoint Source Pollutants

- The Middle Pensaukee Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Middle Pensaukee Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the Middle Pensaukee Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the Middle Pensaukee subwatershed:

1. Improve aquatic life habitat and water quality by:

    a. creating and maintaining buffers that filter sediments and other pollutants, provide shading and stabilize streambanks.
    b. reducing nutrient/phosphorus loading by a high level which will reduce macrophyte growth and stabilize oxygen levels.
    c. reducing sedimentation rates by a high level.
    d. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    e. protecting, enhancing, and restoring wetlands to slow the release of water to the stream and filter sediment and other pollutants.
    f. decreasing extreme flooding which widens the stream channel, warms water, and decreases water depth and cover for adult fish.

2. Improve wildlife habitat by:

    a. protecting, enhancing, and restoring streambank corridors.
    b. protecting, enhancing, and restoring wetlands.

3. Extend duration of base flow past May in Spring Creek and Brookside Creek to provide spawning and nursery areas for fish by:

   a. creating and maintaining buffers to decrease peak flooding and increase infiltration of precipitation into the soil.
   b. protecting, enhancing and restoring wetlands to slow the release of water to the creeks.
   c. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
   d. increasing cropland best management practices, such as conservation tillage, which will increase infiltration.

Lower Pensaukee Subwatershed (LP)

Description

The Lower Pensaukee subwatershed consists of the Pensaukee River from just below the confluence of Brookside Creek to the river mouth on Green Bay. This subwatershed includes several unnamed intermittent tributaries to Pensaukee River and also several direct drainage ditches to Green Bay. The Pensaukee State Wildlife Area is along the shore of Green Bay. Wetlands cover a significant portion of land in this subwatershed. The communities of Pensaukee and Oak Orchard are in this subwatershed.

Water Quality Conditions

The Pensaukee River in this subwatershed is classified as warm water sport fish and flows year-round. In the upper reaches it received aquatic life habitat ratings of good at Bell Bridge Road and between good and fair at Hwy 41. The substrate is mostly rocks and rubble with some hard sand in the slow areas. The rocky substrate is covered by periphyton growth. Bank erosion is moderate from high stream flow even though the stream corridor is mostly trees and shrubs. Shallow stream depths limit available cover for fish. Near the mouth, the river is wide, deep, and slower moving then upstream. Sediment accumulates in the river mouth and Green Bay and has been dredged in the past.

Continuous dissolved oxygen and temperature monitoring in the Pensaukee River August 30 through September 13, 1995, at Bell Bridge Road did not show any problems. This is probably because cooler water temperatures in September hold more oxygen than warmer summer temperatures that were monitored upstream. The most critical period for aquatic life is mid-summer during the highest temperatures and lowest flows. Aquatic macroinvertebrate samples showed good water quality in spring and fall, 1979 which indicates some organic pollution present in the Pensaukee River at Bell Bridge Road.

A fishery survey was conducted on the Pensaukee River upstream from Hwy 41 in July, 1995. This stretch of the river received a biotic integrity rating of excellent. This rating means the fish community is comparable to the best situations with minimal human disturbance; all regionally expected species for habitat and stream size, including the most intolerant forms, are present with a full array of age and size classes. The trophic structure is balanced.

Water chemistry samples collected on the Pensaukee River at Bell Bridge Road monthly from 1977 to 1993 shows total phosphorus concentrations elevated on numerous occasions. Suspended sediment concentrations were elevated only a few times and dissolved oxygen levels were recorded only five times below the 5 mg/l state standard.

No specific monitoring was conducted on the direct drainage ditches to Green Bay. Many of these tributaries are small intermittent streams that flow through wetland areas. Since most have been channelized and have little buffers, they can be flashy during rain events. Cattle pasturing has caused some bank erosion.

The Pensaukee River in this subwatershed is significantly impacted by sediment and nutrient loading from all of the upstream subwatersheds. As the current slows when it reaches Green Bay, sediment and attached nutrients settle out and accumulate near the mouth. A reduction in nutrients and sediment loading to both the upstream subwatersheds and this subwatershed would not only improve conditions in the river mouth and benefit Green Bay, but would also improve aquatic life habitat and reduce periphyton growth in the river upstream of CTH SS. Also, an increase in stream depth and available cover would considerably increase the habitat for adult gamefish.

Nonpoint Source Pollutants

- The Lower Pensaukee Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Lower Pensaukee Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the Lower Pensaukee Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the Lower Pensaukee subwatershed:

1. Improve aquatic life habitat and water quality by:

    a. creating and maintaining buffers that filter sediments and other pollutants, provide shading and stabilize streambanks.
    b. preventing the trampling of the streambanks by limiting livestock access.
    c. reducing nutrient/phosphorus loading by a medium level which will reduce macrophyte growth.
    d. reducing sedimentation rates by a medium level.
    e. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    f. protecting, enhancing, and restoring wetlands to slow the release of water to the stream and filter sediment and other pollutants.
    g. decreasing extreme flooding which widens the stream channel, warms water, and decreases water depth and cover for adult fish.

2. Improve wildlife habitat by:

    a. protecting, enhancing, and restoring streambank corridors.
    b. protecting, enhancing, and restoring wetlands.

3. Protect, enhance, and restore perennial and intermittent streams and ditches to the Pensaukee River and Green Bay to provide spawning and nursery areas for fish by:

    a. creating and maintaining buffers to decrease peak flooding and increase infiltration of precipitation into the soil.
    b. protecting, enhancing and restoring wetlands to slow the release of water to the streams.
    c. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
    d. increasing cropland best management practices, such as conservation tillage, which will increase infiltration.

Kirchner Creek Subwatershed (KC)

Description

The Kirchner Creek subwatershed consists of the entire drainage area of Kirchner Creek.

Water Quality Conditions

Kirchner Creek is a 5-mile-long intermittent tributary to Green Bay. Most of this creek and its tributaries have been ditched and straightened causing flows to be very flashy and the creek to dry up earlier than it normally would. Kirchner Creek received an aquatic life habitat rating of fair at CTH S, but overall is considered poor because of the limited supply of water available to aquatic life. The stream banks are protected from erosion with grass growth, although some banks are pastured.

Water chemistry samples collected on Kirchner Creek at CTH S in 1995 showed elevated levels of total and dissolved phosphorus during all three runoff events sampled. Ammonia levels were high in two out of the three samples and biochemical oxygen demand was high once. The creek is very turbid during runoff events.

Aquatic life is most significantly limited by the intermittent stream flow of Kirchner Creek. The channelized creek speeds runoff rates and supplies adequate aquatic life habitat only during snow melt and rain events. The extremely turbid runoff water indicates a high loading of sediment to this creek and ultimately to Green Bay. A loading reduction would not only benefit the bay of Green Bay, but also provide habitat when water is available.

Nonpoint Source Pollutants

- The Kirchner Creek Subwatershed contains [* #] animal lots which contribute [* #] pounds of phosphorus [organic], annually. This represents an estimated [* #] percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Kirchner Creek Subwatershed is [* #] tons, annually, or [* #] percent of the entire watershed load. [*] is the major source in this subwatershed, contributing [* #] percent of the load.

- [* Number] percent of the sediment delivered from streambanks in the watershed comes from the Kirchner Creek Subwatershed.

Water Resource Goals and Objectives

The following goals and objectives are recommended for the water resources of the Kirchner Creek subwatershed:

1. Improve aquatic life habitat and water quality by:

   a. creating and maintaining buffers that filter sediments and other pollutants, provide shading and stabilize streambanks.
   b. preventing the trampling of the streambanks by limiting livestock access.
   c. reducing nutrient/phosphorus loading by a medium level.
   d. reducing sedimentation rates by a medium level.
   e. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
   f. protecting, enhancing, and restoring wetlands to slow the release of water to the stream and filter sediment and other pollutants.
   g. decreasing extreme flooding which widens the stream channel, warms water, and decreases water depth and cover for adult fish.

2. Improve wildlife habitat by:

   a. protecting, enhancing, and restoring streambank corridors.
   b. protecting, enhancing, and restoring wetlands.

3. Protect, enhance, and restore perennial and intermittent streams and ditches to Kirchner Creek and Green Bay to provide spawning and nursery areas for fish by:

   a. creating and maintaining buffers to decrease peak flooding and increase infiltration of precipitation into the soil.
   b. protecting, enhancing and restoring wetlands to slow the release of water to the streams.
   c. discouraging maintenance dredging of drainage ditches to allow the natural meandering of the stream channels.
   d. increasing cropland best management practices, such as conservation tillage, which will increase infiltration.

Table 2-[illegible]. Surface Water Resource Conditions, Problems, and Nonpoint Sources of Pollution of Each Subwatershed in the Pensaukee River Watershed

Subwatershed	Stream Name	Fish and Other Aquatic Life Uses[1]	Fishery IBI[2]	Habitat Rating[3]	Biotic Index Rating[4]	Chemistry[5]	Problems/ Limiting Factor[6]	Observed or Potential Sources of Pollution[7]
Upper Pensaukee	Pensaukee River	WWSF	___	Fair to Poor	Good to Fair	DP, TP, DO, TEMP	FLO, SED, PL, DO, NUT, TEMP, HAB, CH, FLD, DEPTH	CL, SB, PSM, PSI, PSB, BY, WSM
Pensaukee Lakes	Pensaukee Lakes	___	___	___	___	TP, DO	NUT, SED, DO, STRAT	CL, PAS, WSM
North Branch Pensaukee	North Branch Pensaukee River	WWSF	Excellent to Good	Good to Poor	Good to Poor	DP, TP, DO, TEMP	DO, TEMP, HAB, BD, SED, CH, NUT, DEPTH	CL, BY, WSM
Middle Pensaukee	Pensaukee River	WWSF	Excellent	Good to Fair	Very Good to Good	TP, DP, SS, DO, TEMP	SED, DO, PL, NUT, TEMP, DEPTH, FLD	SB, CL, BY, WSM
	Spring Creek	WWSF	___	Fair	Very Good	___	FLO, SED, HAB, CH, BD	CL, BY, WSM
	Brookside Creek	WWSF	___	Poor	___	BOD, AMM, TP, DP	FLO, SED, HAB, NUT, CH	CL, BY, WSM
Lower Pensaukee	Pensaukee River	WWSF	Excellent	Good to Fair	Good	TP, SS, DO	PL, NUT, SED, HAB, DEPTH, FLD	SB, CL
	Unnamed Direct Drainage Tributaries	WWSF	___	Poor	___	___	CH, FLO, FLD	CL, PSB
Kirchner Creek	Kirchner Creek	WWSF	___	Fair	___	AMM, TP, DP, BOD	FLO, CH, TURB, HAB, NUT, FLD, SED	CL, PSB, BY, WSM

LEGEND:

[1] **Fish and Other Aquatic Life Uses** - this column indicates the current biological use and classification supported by the stream.
COLD - coldwater communities
WWSF - warmwater sport fish communities
WWFF - warmwater forage fish communities
LFF - limited forage fishery (intermediate surface waters)

[2] **Fishery IBI** - this column indicates fish assemblages for assessing biotic integrity and environmental health in warm water streams based on fish habitat and communities present.

[3] **Habitat Rating** - this column indicates the relative quality and quantity of aquatic life habitat in the stream.

[4] **Biotic Index Rating** - this column indicates water quality condition based on the Hilsenhoff Biotic Index which uses macroinvertebrates as an indicator of organic pollution.

[5] **Chemistry** - this column indicates water chemistry monitoring values exceeding acceptable levels (except dissolved oxygen)
DP - Dissolved Phosphorus
TP - Total Phosphorus
SS - Suspended Solids
AMM - Ammonia
BOD - Biochemical Oxygen Demand
DO - Dissolved Oxygen (less than the state standard of 5 mg/l)
TEMP - Temperature

[6] **Problems/Limiting Factors**
HAB - Habitat (lack of sufficient habitat)
SED - Sedimentation
TEMP - Temperature (warm)
DO - Dissolved oxygen problems
FLO - Limited stream flow
PL - Aquatic plants/algae (abundant)
NUT - Nutrient enrichment
TURB - Turbidity
CH - Channelization (ditching)
BD - Beaver dams
STRAT - Summer stratification
DEPTH - Shallow stream depth and little overhead cover
FLD - Flooding stream banks

[7] **Observed or Potential Sources of Pollution**
CL - Cropland erosion
SB - Streambank erosion
PSB - Streambank pasturing
BY - Barnyard or exercise lot runoff
PSM - Point source, municipal treatment plant discharge
PSI - Point source, industrial discharge
PAS - Public access site
WSM - Winter spread manure

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Pensaukee River Watershed Habitat Evaluations

Subwatershed	River	Location	Date	Habitat Score points/ranking (Fish Habitat)
Upper Pensaukee	Pensaukee River	CTH C	5/25/95	213/poor
		Nichols Road	5/25/95	152/fair
		CTH C-Sampson	6/15/95	107/fair
		Beach Drive	6/9/95	164/fair
		Hickory Drive	8/3/95	219/poor
		Zachow Road	8/3/95	216/poor
	Unnamed Trib. to Pensaukee River	Townline Road	6/15/95	163/fair
North Branch Pensaukee	North Branch Pensaukee River	HWY 32	5/31/95	98/good
		CTH C-Oconto	5/31/95	103/good
		CTH E	5/31/95 (7/18/95)	103/good (49/good to fair)
		CTH BB	5/25/95	202/poor
		CTH C -Shawano Co.	5/22/95	202/poor
Middle Pensaukee	Pensaukee River	Sandalwood Road	5/13/93	80/good
		Valentine Road	6/29/95 (7/18/95)	118/good (45/good to fair)
		CTH J	8/29/95	122/good
	Spring Creek	CTH E	5/31/95	187/fair
Kirchner Creek	Kirchner Creek	CTH S	6/23/95	163/fair
Lower Pensaukee	Pensaukee River	Bell Bridge Road	6/23/95	124/good
		Bell Bridge Raod	8/23/95	121/good
		HWY 141	(7/18/95)	(49/good to fair)

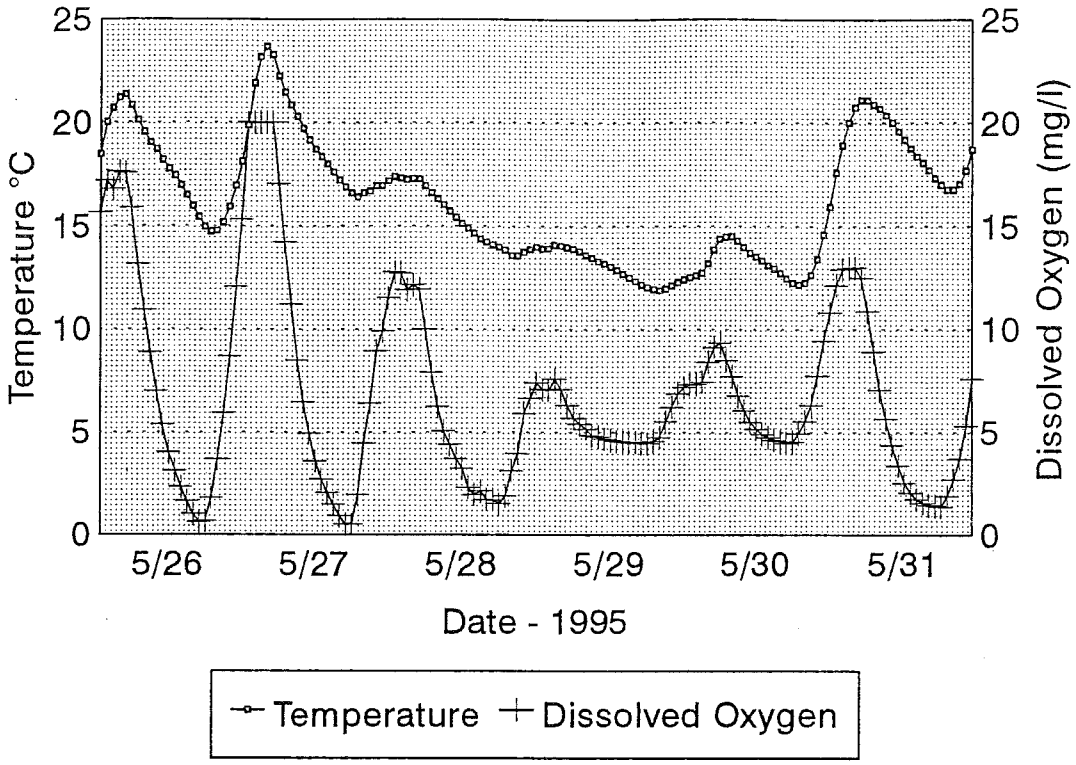
Scores: <70 = excellent, 71-129 = good, 130-200 = fair, >200 = poor
(Fish Habitat: 99 = excellent, 66 = good, 33 = fair, 0 = poor)

Pensaukee River Watershed Macroinvertebrate Sample Results

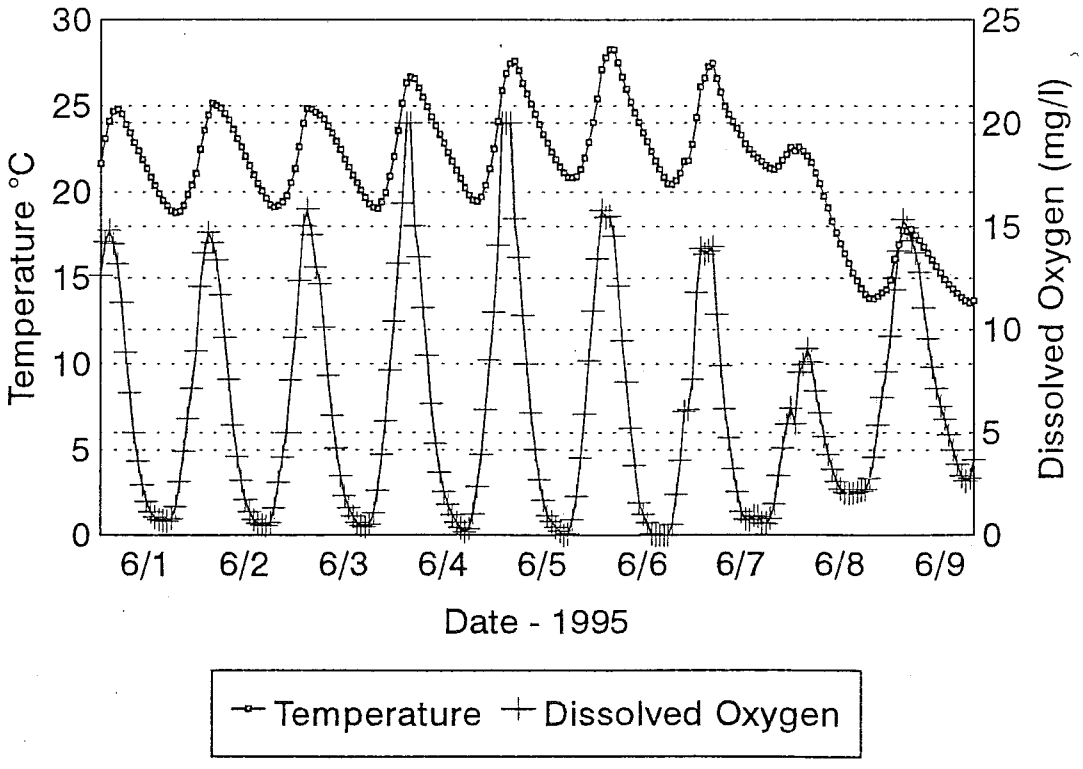
Subwatershed	River	Location	Date	Macroinvertebrtate points / rating
Upper Pensaukee	Pensaukee River	Green Valley Rd	5/24/79	2.86 / fair
		CTH C	5/24/79	2.73 / fair
		CTH C	11/2/79	2.57 / good
		Safian Rd	5/19/93	6.01 / fair
		Safian Rd	11/3/93	5.57 / fair
North Branch Pensaukee	North Branch Pensaukee River	CTH BB	5/24/79	2.37 / good
		CTH BB	11/2/79	3.85 / fair
		CTH E	5/24/79	2.04 / good
		CTH E	11/2/79	3.09 / fair
		CTH E	5/19/93	4.54 / good
		HWY 32	4/13/93	8.05 / poor
		HWY 32	5/19/93	5.75 / fair
		HWY 32	11/3/93	4.99 / good
Middle Pensaukee	Pensaukee River	STH 141	5/24/79	2.61 / good
		STH 141	11/2/79	2.48 / good
		Valentine Rd	5/19/93	4.98 / good
		Valentine Rd	11/3/93	4.25 / very good
		Sandlewood Rd	5/13/92	5.01 / good
	Spring Creek	HWY 141	5/19/93	4.38 / very good
Lower Pensaukee	Pensaukee River	Bell Bridge Rd	5/24/79	2.16 / good
		Bell Bridge Rd	11/2/79	2.37 / good

Excellent = No apparent organic pollution
Very Good = possible slight organic pollution
Good = Some organic pollution
Fair = Fairly significant organic pollution
Fairly Poor = Significant organic pollution
Poor = Very significant organic pollution
Very Poor = Severe organic pollution

Pensaukee River
Nichols Drive



Pensaukee River
Nichols Drive



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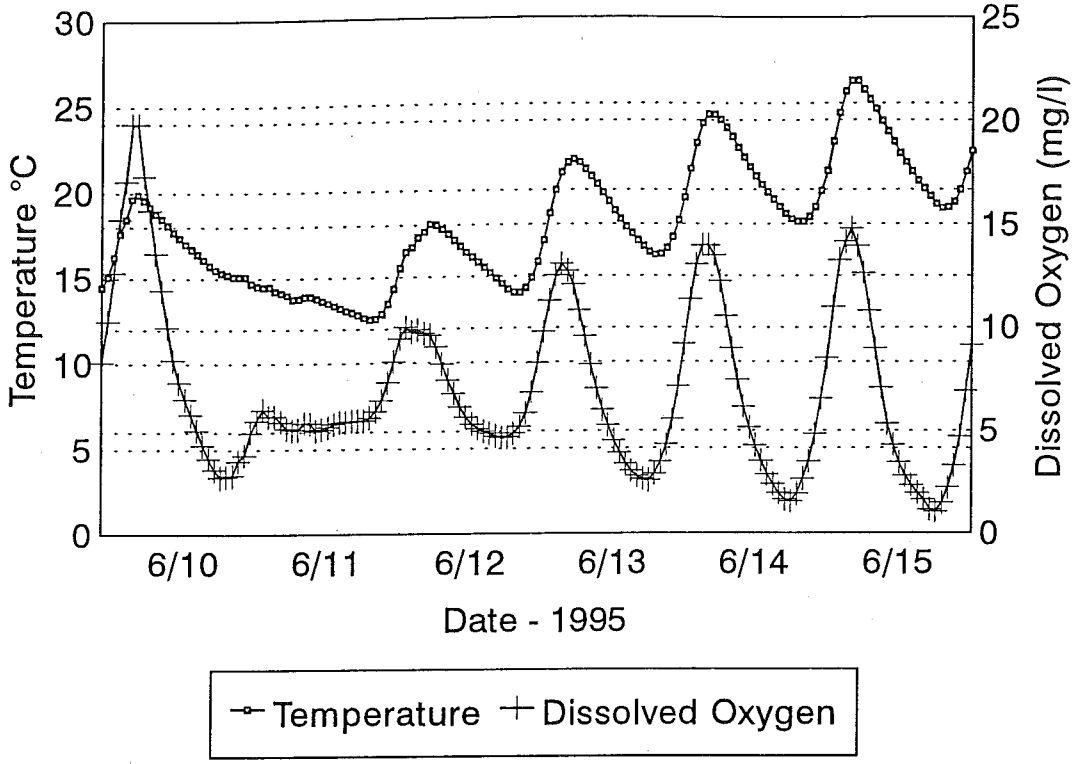

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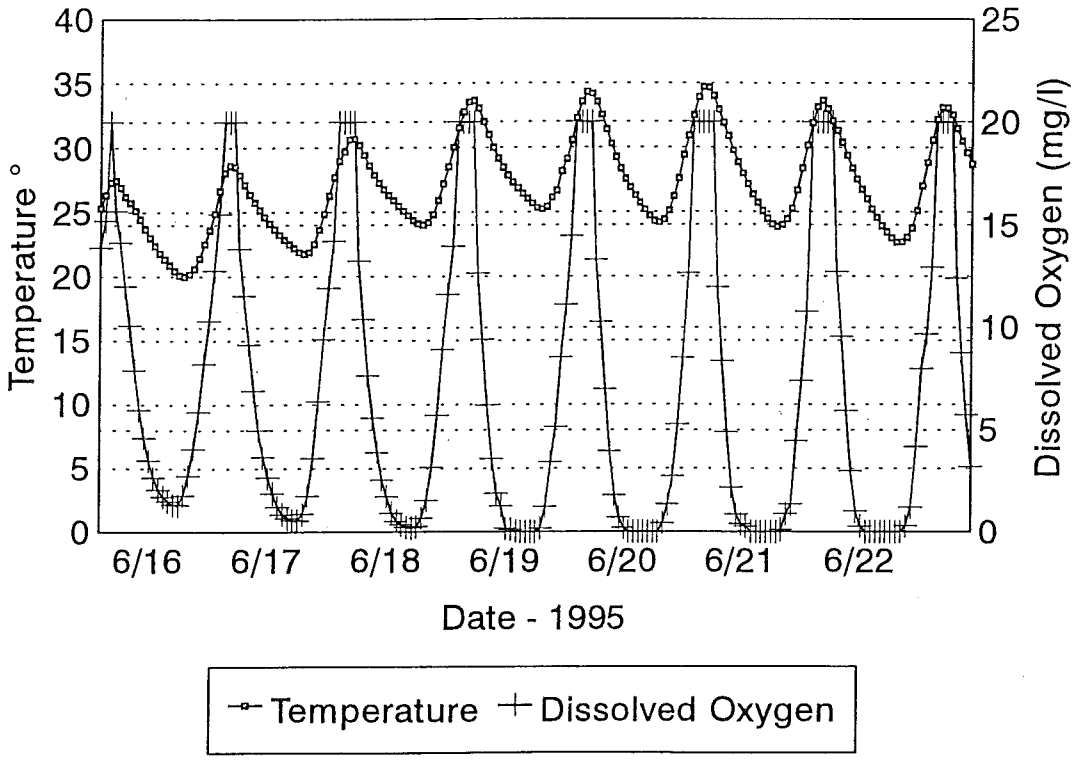
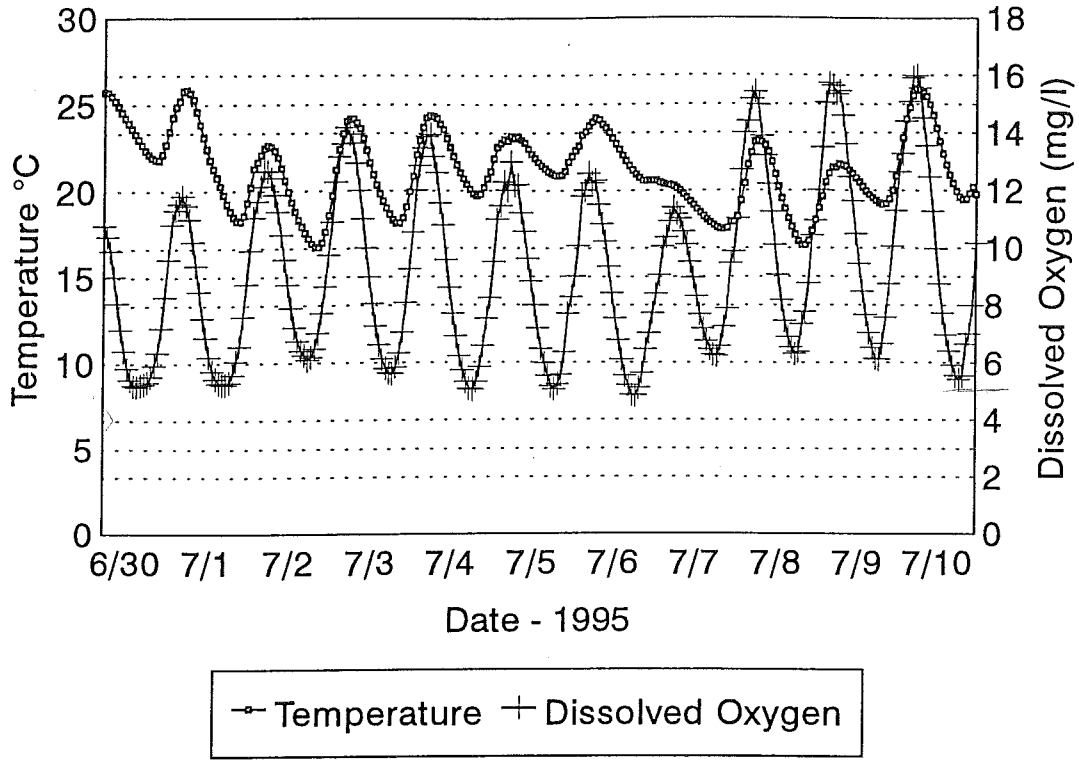
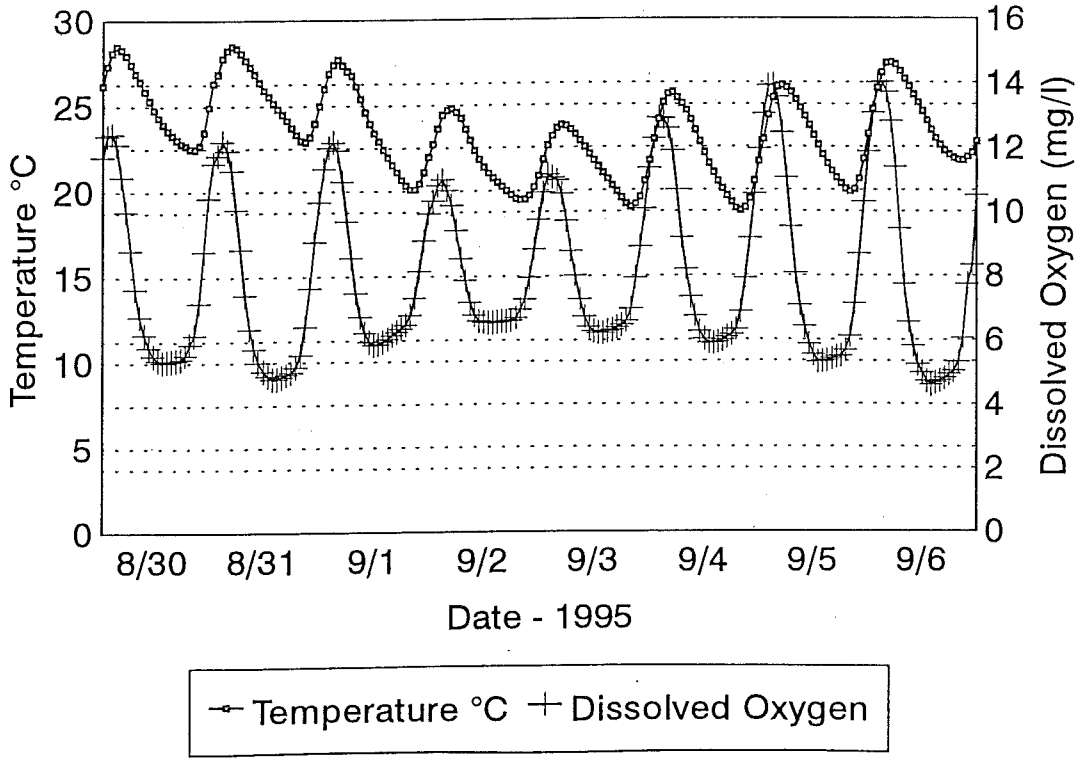
Nichols Drive



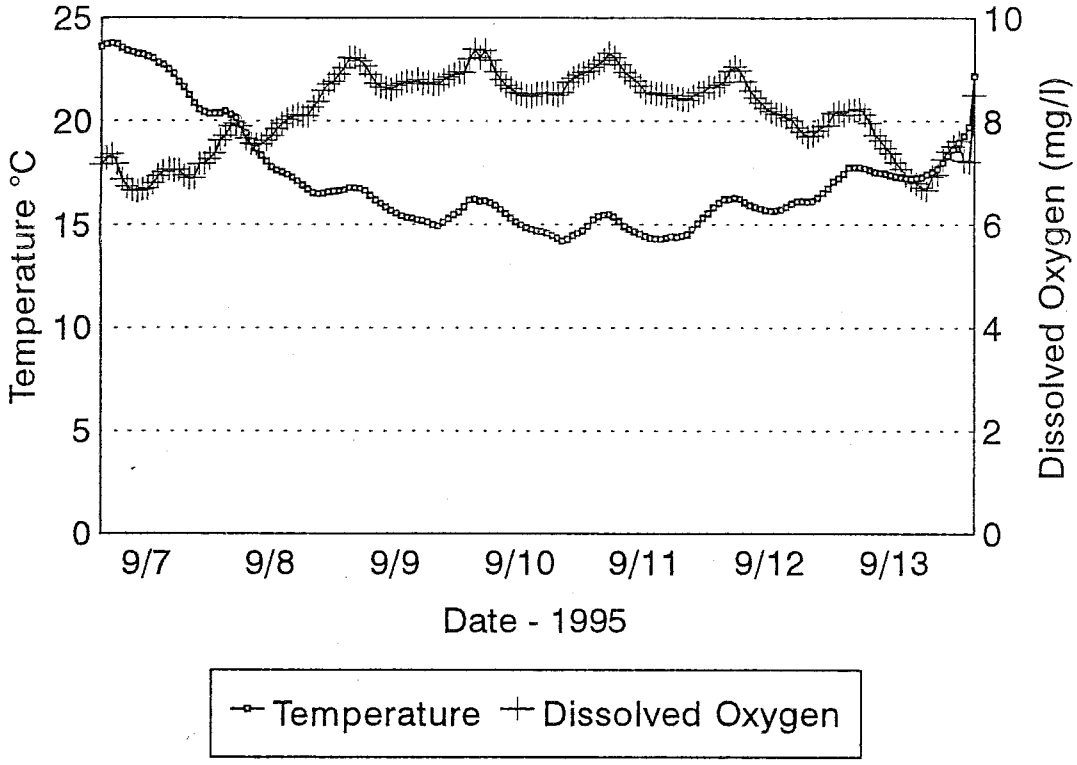
Pensaukee River
Valentine Road



Pensaukee River
CTH J



Pensaukee River
Bell Bridge Road



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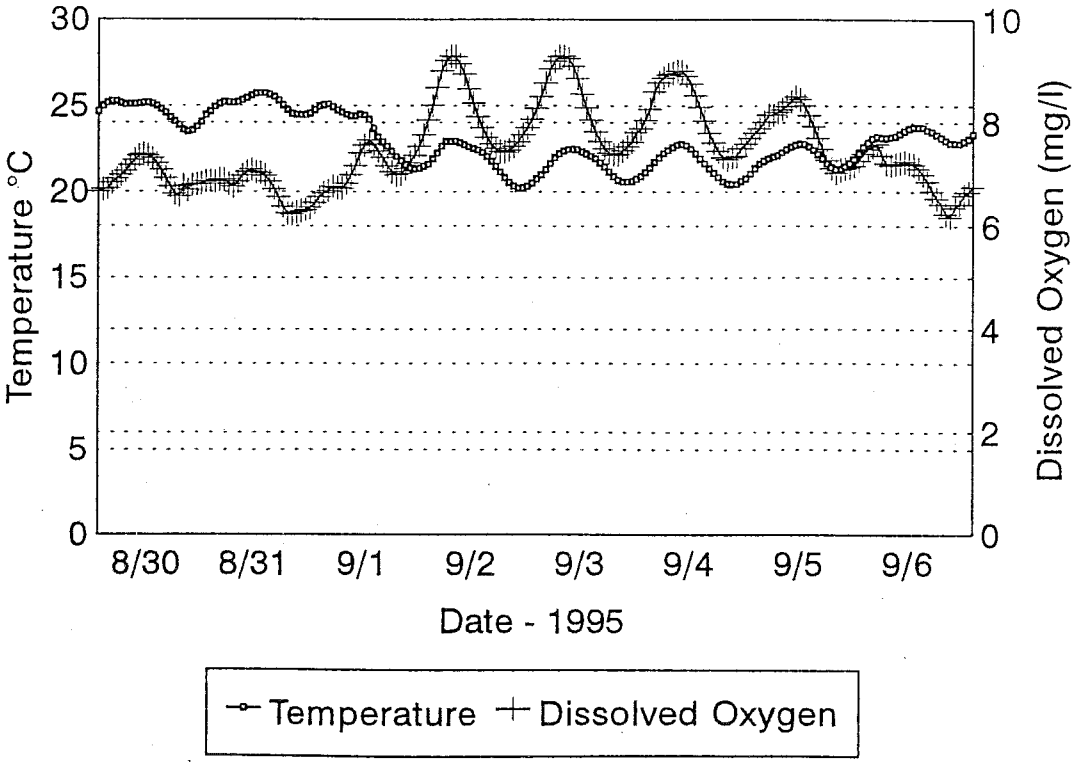
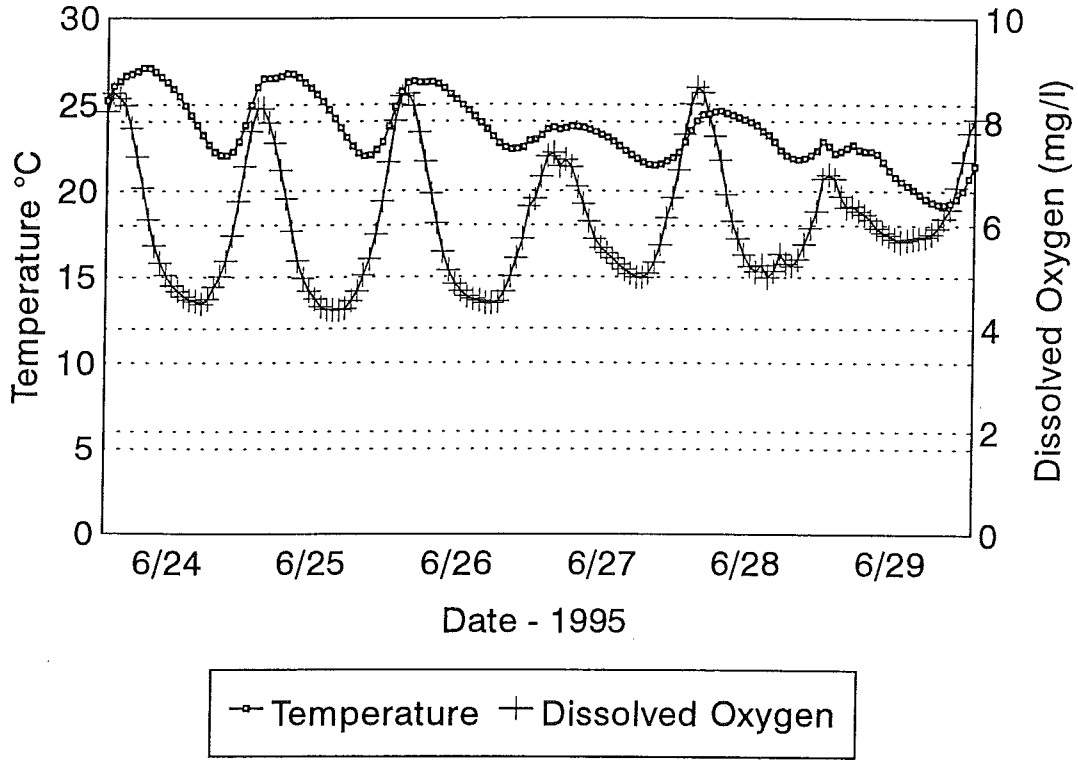
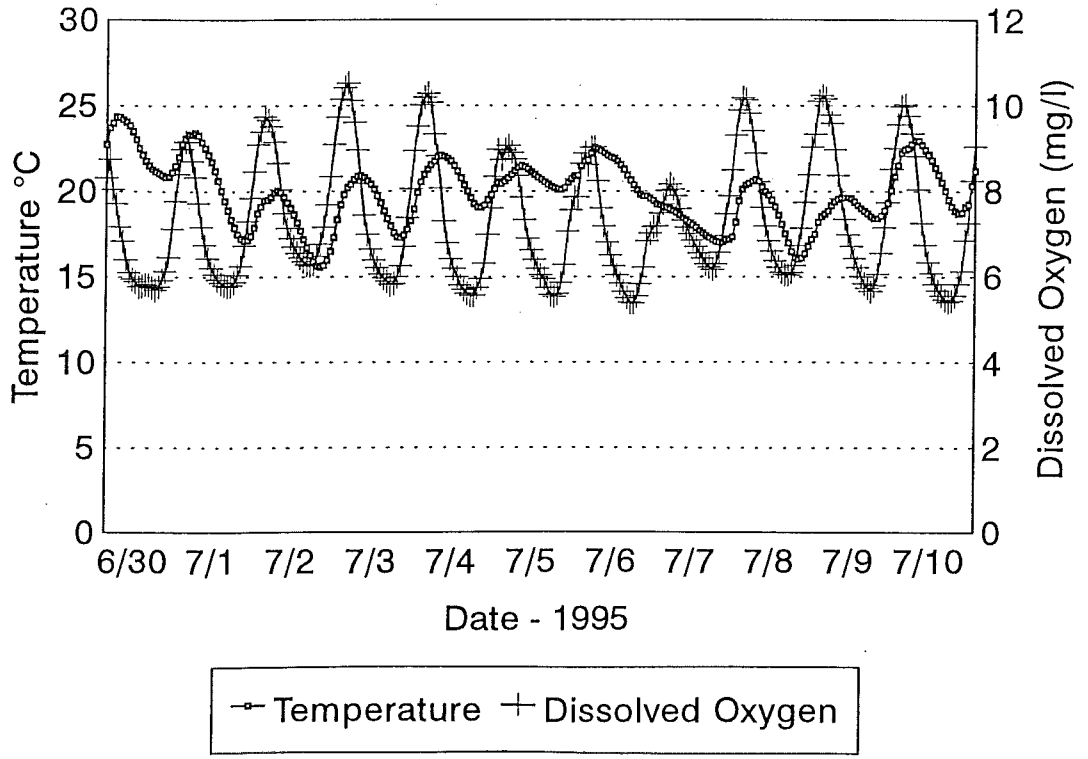


North Branch Pensaukee River
CTH E

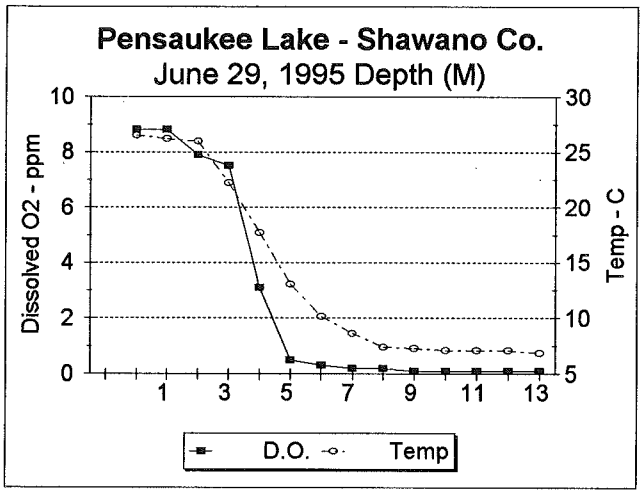


North Branch Pensaukee River
CTH E

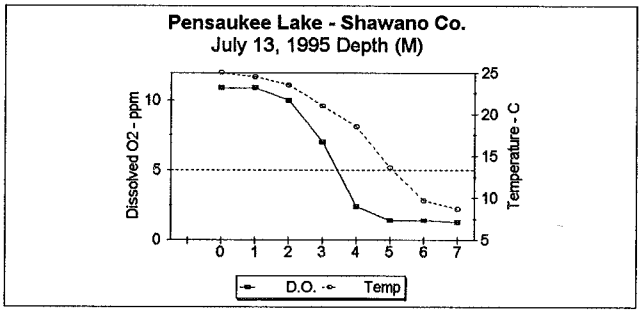


Pensaukee Lake - Shawano County

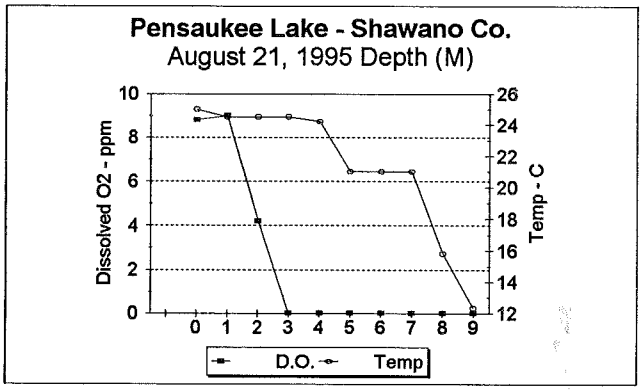
6/29/95 Dep	D.O. (ppm)	Temp (C)
0	8.8	26.5
1	8.8	26.2
2	7.9	26
3	7.5	22.2
4	3.1	17.7
5	0.5	13
6	0.3	10.1
7	0.2	8.6
8	0.2	7.4
9	0.1	7.3
10	0.1	7.1
11	0.1	7.1
12	0.1	7.1
13	0.1	6.9



7/13/95 De	D.O. (ppm)	Temp (C)
0	10.9	25
1	10.9	24.5
2	10	23.5
3	7	21
4	2.4	18.5
5	1.4	13.6
6	1.4	9.7
7	1.3	8.7



8/21/95 De	D.O. (ppm)	Temp (C)
0	8.8	25
1	9	24.5
2	4.2	24.5
3	0	24.5
4	0	24.2
5	0	21
6	0	21
7	0	21
8	0	15.8
9	0	12.3



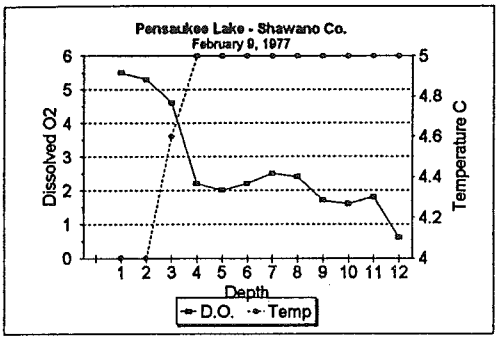
Water Quality

	Depth M	Tot-P ug/l	TSI Tot-P	Secchi (M)	TSI Secchi	Chl-a ug/l	TSI Chl-a
2/9/77	7	320	N/A				
5/18/77	4	40	56.8	3.5	41.9		
8/10/77	5	80	N/A	2.5	46.8		
10/16/77	4	30	54.5	2.5	46.8		
4/25/95	1	29	54.3	1.8	51.5	14.3	54.9
6/29/95	1	12	47.4	6.2	33.7		
7/13/95	1	10	46.0	3.9	40.4		
8/21/95		17	50.1	3.2	43.2	6.6	49.1

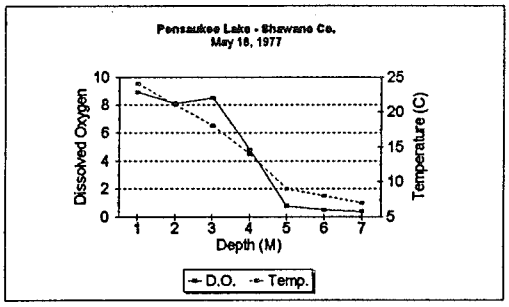
Hypolimnetic Total - P for same 1995 dates ranged from 22 to 179 ug/l.
This shows a significant internal phosphorus source.

Pensaukee Lake - Shawano Co.

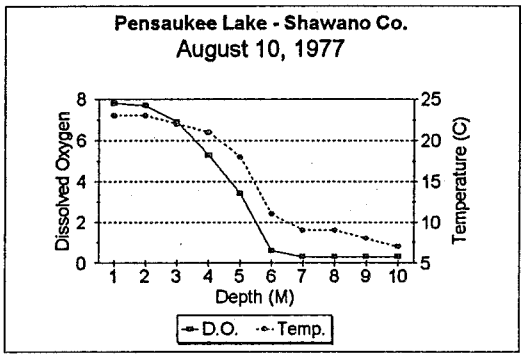
	Depth	D.O.	Temp
2/9/77	1	5.5	4
	2	5.3	4
	3	4.6	4.6
	4	2.2	5
	5	2	5
	6	2.2	5
	7	2.5	5
	8	2.4	5
	9	1.7	5
	10	1.6	5
	11	1.8	5
	12	0.6	5



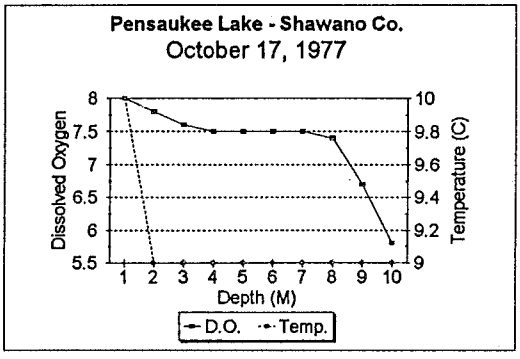
	Depth	D.O.	Temp.
5/18/77	1	8.9	24
	2	8.1	21
	3	8.5	18
	4	4.8	14
	5	0.8	9
	6	0.5	8
	7	0.4	7



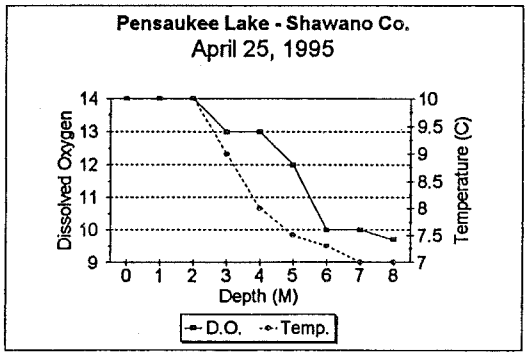
	Depth	D.O.	Temp.
8/10/77	1	7.8	23
	2	7.7	23
	3	6.9	22
	4	5.3	21
	5	3.4	18
	6	0.6	11
	7	0.3	9
	8	0.3	9
	9	0.3	8
	10	0.3	7



	Depth	D.O.	Temp.
10/17/77	1	8	10
	2	7.8	9
	3	7.6	9
	4	7.5	9
	5	7.5	9
	6	7.5	9
	7	7.5	9
	8	7.4	9
	9	6.7	9
	10	5.8	9



	Depth	D.O.	Temp.
4/25/95	0	14	10
	1	14	10
	2	14	10
	3	13	9
	4	13	8
	5	12	7.5
	6	10	7.3
	7	10	7
	8	9.7	7



Water Chemistry Sample Results 1993 & 1995
Pensaukee River Watershed

Subwatershed	Location	Date	Flow CFS	Biochemical Oxygen Demand mg/l	Ammonia mg/l	Nitrate & Nitrite mg/l	Total Phosphorus mg/l	Dissolved Phosphorus mg/l	Suspended Solids mg/l	Temp. °C	D.O. mg/l	pH SU
Upper Pensaukee	Pensaukee River at Safian Road	04/13/93	109.38	< 1	0.038	1.15	0.09	0.049*	4	6.5	13.0	8.2
		05/19/93	16.56	1.6	0.037	1.69	0.09	0.064*	3	---	---	--
		07/07/93	---	1.7	0.051	0.738	0.30*	0.192*	23	22	6.8	7.4
		11/03/93	10.09	1.0	0.020	2.13	0.07	0.033*	2	3.4	15.4	8.9
North Branch Pensaukee	North Branch Pensaukee River at Hwy 32	04/13/93	73.20	< 1	0.017	0.068	0.03	0.008	< 2	6.7	12.5	7.8
		05/19/93	9.75	1.4	0.049	0.191	0.09	0.047*	4	15.5	10.7	8.2
		07/07/93	---	1.1	0.043	0.136	0.17*	0.119*	4	23	5.9	7.5
		11/03/93	6.06	1.2	0.110	0.791	0.04	0.015*	< 2	5.3	14.4	8.7
Middle Pensaukee	Pensaukee River at Valentine Road	04/13/93	---	1.1	<0.1	0.719	0.06	0.029*	8	6.7	12.6	8.1
		05/19/93	45.93	1.4	0.032	0.583	0.04	0.030*	2	14.0	15.1	8.6
		07/07/93	---	2.1	0.069	0.639	0.24*	0.140*	53*	22.0	7.0	--
		11/03/93	27.66	1.1	0.014	1.36	0.03	0.010	< 2	5.8	18.0	9.1
	Brookside Creek at CTH J	03/13/95	16.00	10.0*	0.758*	0.631	0.40*	0.188*	14	11.0	---	--
		04/19/95	25.69	2.8	0.030	0.241	0.08	0.025*	ND	5.8	10.0	--
		8/14/95	3.17	1.1	0.030	0.058	0.123*	0.074*	ND	---	---	--
Kirchner Creek	Kirchner Creek at CTH S	03/13/95	28.83	10.0*	0.589*	0.528	0.51*	0.345*	12	11.0	---	--
		04/19/95	---	3.4	ND	0.452	0.15*	0.062*	12	5.4	9.3	--
		08/14/95	0.53	1.9	0.716*	0.051	0.477*	0.084*	ND	---	---	--

Legend
* = Elevated Concentrations
ND = No Detect
Chemistry data for Pensaukee River at Bell Bridge Road (Lower Pensaukee Subwatershed) not included here.