Region	Area	D.O.W. Number	County	D.O.W. Lake Name	Acreage	Date	Page
2	Tower – F214	69-0378	St. Louis	Vermilion	40,557	03/30/2007	1 of 6

DEPARTMENT OF NATURAL RESOURCES

NTA-01570-01

LAKE MANAGEMENT PLAN

Long Range Goal:

Maintain a diverse and sustainable fish community that provides angling opportunities to the public. Maintain average walleye gill net CPE of 14.0 fish/net. Maintain summer walleye harvest (May-Sept.) at or below the safe harvest level of 65,000 pounds. Maintain muskie trap net CPE of 1.5 fish/net with at least 15% of the catch over 50 inches long. Maintain CPE of black crappie, bluegill, northern pike, and smallmouth bass near their historical averages.

Operational Plan:

* Conduct annual assessments based on the "Large Lake Sampling Guide" including seining, gillnetting, and water chemistry.
* Conduct optional assessments including spring trapnetting targeting muskie, spring electrofishing targeting smallmouth bass, summer trapnetting targeting bluegill and black crappie, and fall electrofishing targeting young-of-the-year walleye.
* Conduct creel surveys 2 years out of every 6 years. The next creel surveys are scheduled for 2008 and 2009.
* Protect aquatic habitat and water quality through DOW permit process, APM program, and public education.
* Minimize potential for invasive species introductions by educating lake users, working with stakeholder groups, and using preventive procedures while conducting fisheries management operations.
* Stock at least 10% of annual walleye egg production from the Pike River Hatchery into lake as fry.
* Stock 4,000 fin-clipped muskie fingerlings biennially.
* Operate Sunset Creek northern pike spawning area as a cooperative project with the Sportsmen's Club of Lake Vermilion.
* Set whitefish netting season based on water temperature and historical spawning patterns.
* Meet at least once a year with major stakeholder groups including; the Sportsmen's Club of Lake Vermilion (SCLV), the Lake Vermilion Resort Association (LVRA), and local guides to disseminate information on fish stocks and management activities.

Midrange Objective:

* Evaluate special walleye regulation implemented in 2006.
* Evaluate experimental northern pike regulation implemented in 2003.
* Continue development and refinement of Biological Performance Indicators.

Potential Plan:

* Mark stocked walleye fry with oxytetracycline to evaluate stocking and estimate wild fry production.
* Conduct winter creel survey to obtain estimates of winter fishing pressure and fish harvest.
* Conduct walleye tagging study to determine population size, exploitation rate, and fishing mortality.

TOTAL $

NARRATIVE: (Historical perspectives – various surveys; past management; social considerations; present limiting factors; survey needs; land acquisition; habitat development and protection; commercial fishery; stocking plans; other management tools; and evaluation plans)

Check the appropriate boxes below:	
	BWCAW
X	Superior National Forest
	Chippewa National Forest
	Leech Lake Indian Reservation
X	1854 Ceded Territory
	1837 Ceded Territory
	Fond du Lac Indian Reservation
	Voyageurs National Park

Primary Species Management	Secondary Species Management	DJ-F-29R Segment:	Date of Last Survey or Population Assessment:
WAE, MUE	NOP, SMB, BLC, BLG	26	04/06/2006
Area Supervisor Signature: Joseph L. Hess	Date: 3-30-2007	Date sent from DNR Area Fisheries to USFS District Ranger:	
Regional Manager Signature: James Reed	Date: 4/16/07	Date sent from DNR Regional Fisheries to USFS Forest Supervisor:	

Lake Vermilion is a large natural reservoir located in northeastern Minnesota near the cities of Tower and Cook. The lake is irregularly shaped and consists of several distinct basins, numerous small bays, and over 35 islands. Lake Vermilion has a surface area of 40,557 acres, a littoral area of 15,039 acres, and a maximum depth of 76 feet. Most of the shoreline and islands are steep and rocky with only a thin covering of glacial soil. Shoal water substrate on the large basins is predominantly ledgerock, boulder, and rubble, while many of the shallow bays have bog shorelines and muck substrate. Lake Vermilion is located at the headwaters of the Hudson Bay drainage system and has a watershed area of about 432 square miles. There is a small fixed head dam at the outlet to the Vermilion River. The primary land types within the watershed are forests and wetlands. There are approximately 2,600 homes and cabins, 30 resorts, and 5 marinas located on the lake. Most of the development is concentrated along the southern and western shorelines. Lake Vermilion has a diverse fish community that is dominated by cisco, northern pike, white sucker, bluegill, smallmouth bass, yellow perch, and walleye. Other species that are present in lesser numbers include whitefish, muskellunge, brown bullhead, burbot, rock bass, largemouth bass, and black crappie.

Various Surveys:

The first comprehensive survey of Lake Vermilion was done during the period 1940-1943 (Carlander and Hiner 1943). Information was collected on fish species composition, abundance, size, age, growth, and life history. A creel survey was conducted to estimate angler catch rates although pressure estimates were not done. Physical and chemical characteristics of the lake were also reported.

Complaints of poor walleye fishing resulted in a special assessment in 1953 to evaluate the status of fish populations (Johnson 1953). It was observed that the walleye population had increased since the 1940's while northern pike and cisco numbers had declined. Poor fishing was attributed to a weak 1950 year class.

A detailed study of the interspecific relationships between walleye and cisco was made during the period 1957-1959 (Dobie 1966). Data was collected on fish abundance, size distribution, and walleye food habits. Basic limnological data was also collected. The study concluded that walleye and cisco did not compete for food and that cisco were relatively unimportant as a food source for walleye.

Complaints of poor walleye fishing resulted in a special assessment in 1968 to evaluate the status of fish populations (Johnson 1968). Poor fishing was attributed to weak 1962 and 1963 year classes. Differences in walleye abundance, size distribution, and growth rates were noted between the two major basins of the lake (East Vermilion and West Vermilion) and it was recommended the two lakes basins be managed separately.

Gill net assessments were conducted in 1973, 1975, 1977, 1979, 1981, and 1983 to monitor the abundance of the major species, particularly walleye. The major species maintained stable populations through the period.

A trap net assessment was done in 1982 to measure the abundance of bluegill and black crappie. The bluegill catch was high, indicating a large increase in the population had occurred. The crappie population appeared to be stable at a level much lower than bluegill.

Beach seining was conducted during the period 1972-1983 to monitor young-of-the-year yellow perch and walleye. Seine catches varied widely and did not appear to be a good indicator of eventual year class strength.

Walleye were tagged at the Pike River spawning run in 1984 to determine dispersion patterns and harvest characteristics (Williams 1989). Walleye dispersed throughout the lake although most stayed in East Vermilion. The uncorrected angler exploitation rate was 15.8% for the 1984 angling season.

A creel survey was conducted during the 1985 whitefish netting season (Mix and Heywood 1987). There were an estimated 3,099 net-days of pressure during the 27 day season. The estimated whitefish harvest was 1,240 fish. An estimated 1,859 northern pike were caught and were susceptible to illegal harvest.

Heywood and Mix (1987) compared characteristics of the walleye spawning stock at Pike River from the period 1926-1942 to the period 1972-1985. They concluded there was no change in numbers, size, and sex ratio between the two time periods.

Annual assessments based on the Large Lake Program were started in 1984. The assessments include gillnetting and seining as well as optional sampling with trap nets and electrofishinging. Walleye gill net catches were relatively high from 1997 to 2006. Populations of other major species have been relatively stable, although cisco and perch populations exhibited greater variation than other species.

An intensive muskie management program was started on Lake Vermilion in 1987. Muskie trap net assessments were conducted in 1993-1994, 1997-1998, 2001-2002, and 2005-2006. East Vermilion and West Vermilion were sampled in different years due to the large size of the lake. Trap net catches increased from 0.1 fish/net for the 1993-1994 assessments to 1.5 fish/net for the 2005-2006 assessments. The mean length increased from 35.9 inches during the 1993-1994 assessments to 44.5 inches during the 2005-2006 assessments. Examination of fish for fin-clips indicates some natural reproduction is likely taking place, especially on East Vermilion.

Creel surveys were conducted during the periods 1984-1985, 1990-1991, 1996-1997, and 2002-2003 as part of the Large Lake Program. Fishing pressure increased from an estimated 9.1 hours/acre in 1984-1985 to 15.1 hours/acre in 2002-2003. The estimated walleye harvest increased from 1.5 lbs./acre in 1984-1985 to 2.1 lbs./acre in 2002-2003. The walleye harvest in 2002-2003 exceeded the safe harvest level for the lake and management action was taken to reduce the harvest. A winter creel survey was conducted during the winter of 1985-86. The estimated fishing pressure was 0.7 hours/acre and the estimated walleye harvest was 0.04 pounds/acre.

A number of invasive species have been identified in Lake Vermilion. Rusty crayfish are abundant in the eastern part of the lake and are spreading to other areas of the lake. Purple loosestrife has been found at a number of sites on the lake. Curly leaf pondweed has been found in Everetts Bay and Niles Bay. Heterosporis has been identified in two walleyes and one yellow perch in recent years. Several other invasive species are found in northeast Minnesota and may pose a risk to Lake Vermilion.

The Arrowhead Regional Development Commission (ARDC), a St. Louis Co. planning agency, conducted a survey of development patterns on Lake Vermilion in 2002, as part of a comprehensive shoreland use plan developed for the lake. Citizen volunteers were used to map structures on assigned sections of shoreline, with the results incorporated into a GIS database. Approximately 45% of the shoreline has been developed, including 2,647 homes and cabins, and 36 resorts or other commercial properties. Because 87% of the undeveloped shore is privately owned, approximately 1,500 new residences could be added under current zoning regulations.

The ARDC, in conjunction with the DNR, conducted another citizen-based survey in 2004 to map aquatic vegetation and shoreline substrate. Approximately 2,770 acres of the lake (6.8%) contains aquatic vegetation. Ledgerock, boulder, and rubble accounted for 63% of the total shoreline substrate.

Past Management:

A major walleye spawning run occurs where the Pike River enters Lake Vermilion and this run has been utilized as an egg source dating back to the 1890's. A walleye hatchery was operated at the site from about 1917 to 1946. A new hatchery started operating in 1972 and continues to the present. Since 1972, the average annual walleye catch at the Pike River trap has been 16,900 fish and the average production has been 106 million eggs. In recent years the Pike Hatchery has accounted for about 20% of the total walleye egg production in Minnesota. Walleye fry were stocked into Lake Vermilion most of the years walleye eggs were harvested.

A variety of species were stocked from 1908 to 1960 including; herring, lake whitefish, Loch Leven trout, lake trout, northern pike, muskie, sucker, smallmouth bass, largemouth bass, and crappie. Northern pike yearlings and adults were stocked from 1963 to 1983. Small numbers of Shoepac L. strain muskie fingerlings were stocked in 1967 and 1969. Shoepac L. strain muskie fry were stocked in 1972. Shoepac L. strain muskie fingerlings were stocked again in 1984 and Wisconsin strain muskie fingerlings were stocked in 1985. The current muskie stocking program using Leech L. strain fingerlings began in 1987. The Sunset Creek northern pike spawning area has been operated since 1984 as a cooperative project with the SCLV.

White suckers were trapped and removed by "B" permit at various sites around the lake from 1968 to 2000. Suckers have also been removed from the Pike River walleye trap since 1972. The suckers are sold to the SCLV and then resold to the public as a fund raiser.

The Large Lake Program was started in 1984 to more actively manage the 10 largest lakes in Minnesota, including Lake Vermilion. Large Lake Specialists were assigned to each management area that had a large lake to direct the program at the area level. The "Large Lake Sampling Guide" (Special Publication No. 140) was developed to provide sampling guidelines. Population assessments were to be done annually on all the large lakes. Most of the large lakes, including Lake Vermilion, were scheduled to have creel surveys done two consecutive years out of every six years.

A catch and release program was initiated in 1986 as a cooperative project with the SCLV. The program encouraged anglers to release walleye greater than 17 inches.

A compendium atlas was developed in 1997 to summarize past management on the large lakes and set target harvests based on empirical yield models and past harvest (Special Publication No. 151). The following target harvests were established for Lake Vermilion; walleye - 76,000 lbs., northern pike - 29,000 lbs., bluegill - 15,000 lbs., smallmouth bass - 12,000 lbs., yellow perch - 10,000 lbs., black crappie - 11,000 lbs., largemouth bass - 3,000 lbs., cisco and whitefish - 15,000 lbs. Harvest has generally been near or under target, although targets were exceeded for northern pike in 1985, for bluegill in 1991, and for walleye in 1990, 2002, and 2003. In 1998 the walleye target harvest was refined to allocate 85% of the target (65,000 lbs.) to the summer boat fishery quantified by creel survey. The remaining 15% of the target (11,000 lbs.) was allocated to undocumented harvest including Indian subsistence netting, dock fishing, late fall fishing, and winter fishing.

An experimental regulation for northern pike was implemented on Lake Vermilion in 2003. The regulation adopted was a 24-36 inch protected slot with one fish over 36 inches allowed in the bag. The regulation change was part of a state-wide initiative to improve the size structure of pike populations in a number of lakes across the state.

A special walleye regulation was implemented in 2006, after creel surveys in 2002 and 2003 documented walleye harvest well above the harvest target. The new regulation is a 17-26 inch protected slot with one fish allowed over 26 inches, and a 4-fish bag limit. The goal of the new regulation is to maintain walleye harvest at or below the harvest target.

Social Considerations:

There are about 30 resorts, 5 boat marinas, and 3 campgrounds on Lake Vermilion that have a vested interest in the lake's fish populations. The LVRA represents the interests of the resort community, including those issues that affect fishing. The SCLV has long been active in promoting healthy fish populations, improved water quality, and safe boating. The SCLV has partnered with the DNR and other government agencies on a number of projects over the years. Many of the riparian property owners are interested in issues that could impact the lake, including fish management. The cities of Tower and Cook promote tourism in the area that is centered on Lake Vermilion.

Members of the Bois Forte Band of Ojibwae harvest walleye with gill nets for subsistence and cultural purposes near the Nett Lake Reservation on Pike Bay. Lake Vermilion is within the 1854 Treaty Area.

A number of fishing tournaments are held on Lake Vermilion each year, occasionally creating conflicts with other lake users. Tournaments should be managed to minimize impact to fish stocks and reduce conflicts with other lake users.

A March 12, 2007 news release distributed by the Regional Public Affairs Officer, announced the DNR was seeking comments on the listed Lake Management Plans (LMP) in the Tower Fisheries Area thru March 26, including the LMP for Lake Vermilion. We received 48 requests for copies of the Lake Vermilion LMP and received comments on the LMP from two people. One of the people who commented wanted to see som allowance from the 24-36" protected slot on northern pike for spearing. The other person indicated there is no information on rusty crayfish in the LMP, commented on the 17-26" protected slot on walleyes on Lake Vermilion, and indicated the DNR and MPCA should embark on an individual septic system inspection

rogram. There is currently no plan to change the 24-36" protected slot on northern pike. Information on invasive species has now been added to the LMP. The 17-26" protected slot on walleye was implemented to reduce the walleye harvest to the safe harvest level that has been developed for Lake Vermilion. The St. Louis County Health Department is the agency that has authority for individual septic systems.

Present Limiting Factors:

Lake Vermilion is a moderately soft water lake and biological production is limited. Heavy exploitation and slow growth limit the size attained by walleye.

Survey Needs:

Continue annual population assessments, including gillnetting, trapnetting, seining, and electrofishing. Continue muskie population assessments, switching from current schedule of every four years for each lake basin to every six years for each lake basin. Continue creel surveys two years out of every six years.

Land Acquisition:

Acquire sensitive habitat areas as Aquatic Management Areas when appropriate. Use conservation easements to protect shoreline as opportunities develop. Maintain ownership of publicly owned lakeshore.

Habitat Development and Protection:

The shoreline of Lake Vermilion is extensively developed, making protection of shoreline habitat a priority issue. Permit applications for shoreline alterations and aquatic vegetation removal should be scrutinized to minimize habitat degradation. Educate stakeholders and riparian landowners on ecologically sound shoreline management.

Only 15% of the shoreline is in public ownership and protected from shoreline development. These shorelines should be maintained in public ownership as they provide critical habitat for many aquatic species. Land exchanges that result in a net loss of publicly owned shoreline should be opposed. Maintaining public ownership of shoreline should be addressed in Federal, State, and local land use plans.

Commercial Fishing:

There is no history of commercial fishing on Lake Vermilion and none is planned. Some interest has been expressed in commercial harvest of crayfish. Proposals for harvesting crayfish should be evaluated on an individual basis.

Stocking Plans:

Continue annual walleye fry stocking at a rate equivalent to 10% of the walleye egg production from the Pike River Hatchery (10-20 million). Surplus production should also be stocked into Lake Vermilion if not needed elsewhere.

Continue biennial stocking of fin-clipped muskie fingerlings. Stocking will be reduced to 4,000 fish biennially, starting in 2008. The previous quota was 5,000 fish biennially.

Lake Vermilion has a littoral area of 15,039 littoral acres with about 70% of the acreage in East Vermilion and about 30% in West Vermilion. Under the previous stocking quota of 5,000 muskie fingerlings every other year attempts were made to evenly distribute muskie fingerlings to the two major basins proportional to area and based on loads, but numbers of fingerlings stocked in each major basin were not exactly proportional to area to avoid additional handling stress that would result from counting individual fingerlings. Based on this procedure about 3,500 fingerlings were stocked in East Vermilion and about 1,500 in West Vermilion.

During spring trap net assessment on East Vermilion in 2005 and West Vermilion in 2006 all muskies captured were examined for fin-clips. Fin clipping of muskie fingerlings stocked in Lake Vermilion started in 1993 to aid in analysis of natural reproduction. Analysis of fin-clip data from the 2005 and 2006 muskie assessments indicated 32% of trap netted muskie less than 40" on East Vermilion and 73% of muskie less than

40"on West Vermilion had identifiable fin-clips. Less than 40" was selected to assure that all muskies in this analysis were from years since fin clipping was initiated. Discussions with Fisheries Management and Researc. staff indicate a fair amount of fin regeneration occurs in muskies, to the extent that some fin-clips are not identifiable. The percentage of unidentifiable fin-clips is not known, but could be substantial.

The data from identifiable fin-clips indicates substantial natural reproduction is likely occurring on East Vermilion, but while some natural reproduction is likely occurring on West Vermilion, the muskie population on West Vermilion is primarily the result of fingerling stocking. The actual amount of natural reproduction occurring in each major basin could be substantially less than indicated by the fin-clip analysis due to unidentifiable fin-clips. Due this uncertainty, we proposed a modest decrease in the muskie fingerling quota from 5,000 to 4,000 fingerlings every other year, in even numbered years. We also propose to continue stocking West Vermilion with about 1,500 fingerlings and reduce the stocking on East Vermilion to about 2,500 fingerlings.

Other Management Tools:

Experimental or special regulations should be considered for major species if angler harvest consistently exceeds harvest targets or excessive exploitation is indicated.

Evaluation Plans:

Evaluate northern pike regulation with ice-out trapnetting in 2008 and 2014.

Evaluate walleye regulation with regularly scheduled creel surveys. Creel surveys are scheduled for 2008-2009 and 2014-2015.

Muskie trap net assessments have historically been done every four years on each lake basin. Future assessments will be done every six years. The next assessments will be 2010 and 2011.

Priority:

Lake size (5) + fishing pressure (5) = 10

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