Management Priority: 6

NA-01570-01

LAKE MANAGEMENT PLAN

Ecological Lake Class: 23

Region 2	Area Grand Rapids 216	D.O.W Number 31-0395	County Itasca	D.O.W. Lake Name Bluewater	Acreage 364-Surface 72-Littoral

Long Range Goal:

- Maintain a Lake Trout population through natural reproduction and stocking with a gill net catch rate of 3.0/net.

Operational Plan:

- Continue to stock 1,820 Mountain Lake strain yearling Lake Trout (5 fish/surface acre) biennially in odd years. Stocked fish will have an identifying fin clip.
- Conduct a targeted survey in early August, 2021 setting 9 deepwater gill nets, collecting otoliths and scales, as well as sex and maturity from Lake Trout.
- Collect scale samples from all Lake Trout for genetic analysis.

Midrange Objective:

- Monitor the Lake Trout population to determine if stocking and natural reproduction are maintaining the desired population.
- Monitor the contribution of Mountain Lake strain Lake Trout to the population.

Potential Plan:

- Consider a targeted survey for Lake Trout in 2017 to increase sample size for genetic testing.
- Consider discontinuing Lake Trout stocking if natural reproduction is capable of sustaining the population.
- Consider discontinuing Lake Trout stocking if Mountain Lake strain fails to contribute to the fishery.
- Consider a length based special regulation to protect spawning size female Lake Trout.

TOTAL $ 0

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)

Initial Survey-July 1949
Re-survey-July 1975
Population Assessment-July 1980, July 1981, Aug. 1991, Aug. 1996, Aug. 2002, July 2007
Standard Survey-Aug. 2015
Special Assessment-Sept. 2009
Tullibee Assessment Netting- 1973
Winter Creel Survey -1987
Boat-in Campsite Development Plan- 1990
MNDNR Water Hydrographic Work Report- 1991
Water Chemistry- 1991
Lake Mapped-1981
Lake Management Plan- 1992, 1998, 2008, 2010, 2016

Check the appropriate boxes below:

- ☐ **Superior National Forest**
- ☒ **Chippewa National Forest**
- ☐ **Leech Lake Indian Reservation**
- ☐ **1854 Ceded Territory**

Primary Species Management:	**Secondary Species Management:**	
Lake Trout	Smallmouth Bass	
Area Supervisor Signature:	**Date:**	
Regional Manager Signature:	**Date:**	

Various surveys and past management

Bluewater Lake is in ecological lake class 23 and is located in the Mississippi River Watershed. Lakes in this classification average 289 acres, 30% littoral area, 86 ft deep, and have moderately hard, clear water. Bluewater Lake is 364 acres, has a littoral area of 72 acres (20%) and a maximum depth of 120 feet. Water chemistry analysis in 1991 indicated the total phosphorus concentration was 0.006 ppm, total alkalinity was 112 ppm, total dissolved solids were 148 ppm, and chlorophyll *a* concentration was 4.5 ppb. The Secchi disk reading was 21 ft in 2015. Bluewater Lake has no inlets and one outlet to Wabana Lake. Various surveys and assessments have been conducted since 1948 (Table 1).

Table 1. Deepwater gill net (GDE) and trap net catch rates for selected species from 1980 to 2015.

Year (Gear)	No. of nets (GDE/TN)	Lake Trout (GDE)	Tullibee (GDE)	Northern Pike (GDE)	Bluegill (TN)	Smallmouth Bass (GDE)
7/29/1980	9/0	2.1	1.4	0.1	-	1.5
7/28/1986	6/8	4.3	0.7	0	10.3	0.3
8/5/1991	12/16	1.3	0.5	0	8.1	0.8
8/5/1996	9/9	3.3	0.4	0	29.1	0.7
8/5/2002	9/9	2.8	1.8	0	11.6	1.3
7/16/2007	9/9	2.8	0.1	0.1	8.6	0.4
9/8/2009	8/0	4.1	5.0	1.3	-	0.5
8/24/2015	9/9	1.9	2.9	0.1	10.6	0.9
Lake Mean		2.8	1.6	0.2	13.1	0.8
Lake Median		2.8	1.1	<0.1	10.5	0.8

Bluewater Lake has a long history of trout management beginning with Rainbow Trout fingerlings and yearlings being stocked 10 times from 1942 to 1952. No Rainbow Trout were sampled in the first survey in 1948, despite the stocking effort. It was thought that trout might have migrated from Bluewater Lake. Yearling Rainbow Trout stocked in 1949 were given a pectoral fin clip. A fish trap was placed in the outlet and monitored through June, 1950. Emigration accounted for only a small number, as only 21 marked Rainbow Trout were captured. The cause of the low return was not determined and Rainbow Trout stocking was discontinued, except on two occasions (1965-66).

Brown Trout were stocked in 1982 but none were ever sampled in any gear. Interestingly, a photograph of an angled Brown Trout was taken in 1951, and the origin of this fish is unclear. Splake were sampled in 1980 and 1986, but were never stocked directly into Bluewater. It appears Splake emigrated from Trout Lake since they were stocked during the same period.

Lake Trout were stocked 39 times since 1942, and have been biennially stocked with yearlings since 1993 (Table 2). To better assess the Lake Trout population, deepwater gill nets have been employed since 1980. Deepwater gill nets are set in the cold, well-oxygenated depths preferred by Lake Trout. Catch rates for other species are not a meaningful indicator of species abundance, due to their shallower, warmer preference. However, length and growth information provides some information on other species. A strain evaluation project comparing Mountain and Gillis was conducted between 2005 and 2009. The Gillis Lake strain performed better than Mountain Lake in the three Grand Rapids Area lakes; however

Mountain Lake will be the only strain available for inland stocking at this time. It is unknown what effect the shift to Mountain Lake strain will have on the Lake Trout population.

Table 2. Stocking History for Bluewater Lake from 1980 to 2015.

Year	Species	Size (strain)	Number	Year	Species	Size (strain)	Number
1980	LAT	yrl	997	1999	LAT	yrl (GIL)	1,821
1982	LAT	yrl	3,703	2001	LAT	yrl (GIL)	1870
1982	BNT	yrl	299	2003	LAT	yrl (GIL)	1925
1983	LAT	yrl	1,000	2005	LAT	yrl (GIL)	1,082
1984	LAT	yrl	1,000	2005	LAT	yrl (MTN)	888
1985	LAT	yrl	1,008	2007	LAT	yrl (GIL)	940
1986	LAT	yrl	1,019	2007	LAT	yrl (MTN)	940
1989	LAT	yrl (GIL)	808	2009	LAT	yrl (GIL)	935
1990	LAT	yrl (IRY)	700	2009	LAT	yrl (MTN)	905
1991	LAT	yrl (GIL)	1,000	2011	LAT	yrl(MTN)	1,820
1993	LAT	yrl (IRY)	1,820	2013	LAT	yrl(MTN)	1,820
1995	LAT	yrl (GIL)	1,820	2015	LAT	yrl(MTN)	1,972
1997	LAT	yrl (GIL)	1,809				

(GIL)- Gillis Lake strain, (MTN)-Mountain Lake strain, (IRY)-Isle Royal strain. (LAT)-Lake Trout, (BNT)-Brown Trout

***Lake Trout*:** Lake Trout are the primary management species due to habitat suitability/angler interest and have been sampled in every assessment since 1948 (Table 1). Catches were low in 1948 (0.6/net) and 1975 (0.4/net), likely due to shallower netting, but size distributions indicate multiple year classes were present. Deepwater gill net catch rates varied from 1.3 to 4.3/net with a mean catch of 2.8/net since 1980. Length frequencies from these assessments suggested multiple age classes were present. The 2015 catch rate (1.9/net) was the second lowest observed. Lengths ranged from 7.4 to 32.5 inches and a mean length of 24.0 inches and a mean weight of 6.2 pounds. Field analysis identified one marked fish correlating to age 1 and the 2015 spring stocking. The remaining fish were likely from natural reproduction except the longest fish (32.5 inches) which potentially predated the fin clipping program. The length frequency from 2015 was comparable to the 2009 assessment in which ages were determined from otoliths and correlated to the length frequency. This comparison suggests multiple age classes were present with most of the 2015 sample at least nine years old.

***Tullibee*:** Catches for Tullibee tend to be variable with catch rates ranging from 0.1/net in 2007 to 5.0/net in 2009, and were typically low in most assessments (Table 1). Tullibee were the most numerous species sampled with deepwater gill nets in 2015, at a rate of 2.9/net. Larger fish have typically not been sampled in Bluewater Lake until 2009 when 25% of the sample exceeded 10 inches. Lengths from the 2015 sample ranged from 6.3 to 18.2 inches with a mean length of 8.1 inches. Internal examinations of 23 Tullibee identified Triaenophorus (an internal parasitic grub) in 26% of the sample.

***Northern Pike*:** Northern Pike have only been observed in half of the assessments and only in very low numbers (Table 1). Gill net catch rates ranged from 0 to 1.3/gill net. One Northern Pike was sampled in 2015, down from the 10 sampled in 2009, which was a historical high. The one sampled was 30.5 inches and weighed 6.8 pounds. Though Northern Pike likely prey on Lake Trout, the low densities of pike probably have little impact in Bluewater Lake.

***Bluegill*:** The Bluegill catch rate in 2015 was 10.6/trap net and has varied from 0.1 in 1948 to 29.1/trap net in 1996 (Table 1). Catch rates have been below the lake class median of 19.8/trap net in all assessments except 1996. Size structure has generally been moderate with fish up to 8 inches sampled in several assessments. Lengths in 2015 ranged from 3.4 to 8.3 inches and a mean length 5.6 inches.

Growth in the 1991 assessment was similar to the lake class average with fish averaging 6.5 inches by age-7.

***Smallmouth Bass*:** Smallmouth Bass are considered a secondary management species, providing additional angling opportunities. The Smallmouth Bass population can be characterized by low numbers and a quality size structure. Gill net catch rates have varied from 0 to 1.5/net (Table 1). The Smallmouth Bass gill net catch rate was 0.9/net in 2015, up from 0.4/net in the previous assessment. The population has good size structure with fish up to 19 inches sampled in the last four assessments. Lengths in 2015 ranged from 10.5 to 18.9 inches with a mean length of 16.1 inches. Age and growth was last assessed in 1996. Ages 1 to 7 were identified with growth slower than statewide averages by age 5.

***Yellow Perch*:** Yellow Perch have rarely been sampled in deepwater gill nets. One was sampled in 2009 and two in 2015. Catch rates in trap nets have generally been low varying from 0.1 to 1.3/net, which has been similar to the lake class median of 0.8/net. Yellow Perch were sampled at a rate of 1.0/trap net in 2015. Size structure has been good with fish up to 10 inches sampled in most assessments.

***Other species*:** Other species sampled include Blacknose Shiner, Bluntnose Minnow, Black and Yellow Bullhead, Common Shiner, Creek Chub, Green Sunfish, Hybrid Sunfish, Iowa and Johnny Darter, Largemouth Bass, Mimic Shiner, Pumpkinseed Sunfish, Rock Bass, Spottail Shiner, Walleye and White Sucker.

As part of IBI (Index of Biotic Integrity) near shore sampling, Iowa Darter, Banded Killifish, Blackchin Shiner, Bluegill, Bluntnose Minnow, Hybrid Sunfish, Largemouth Bass, Least Darter, Mimic Shiner, Rock Bass, and Yellow Perch were sampled in eight seine hauls. Backpack electrofishing sampled Iowa Darter, Johnny Darter, Banded Killifish, Bluegill, Bluntnose Minnow, Central Mudminnow, Green Sunfish, Hybrid Sunfish, Least Darter, Mimic Shiner, Mottled Sculpin, and Tadpole Madtom.

Social Considerations

Bluewater Lake, named for the unique blue color of the water, is located about 12 miles north of Grand Rapids, MN, off of County Road 335. There is a U.S. Forest Service walk-in access on the northwest shore and boats can access from Wabana Lake. Bluewater Lake is one of four waters managed for Lake Trout in the Grand Rapids management area. There is a winter only easement to access Bluewater Lake through the camp on the north end.

Lakeshore development increased from 1948 to 1975, the last time counts were made. One resort, seven cottages, and two youth camps were recorded in the 1948 survey. No resorts, 48 cottages and two youth camps were recorded in 1975. Data from the Itasca Land Parcel Information System indicated similar lakeshore development in 2009. A large portion of the shoreline is in federal and state ownership.

Bluewater Lake was one of 90 lakes included in an aerial creel survey during the summer of 2001 (Walleye opener to mid-September) and winter of 2001-02 (December 15th to the end of the Walleye season). Bluewater Lake had a fishing pressure estimate for the summer of 2,508 angler-hours or 6.9 hours/acre. Pressure estimates for the winter of 2001-02 was 1,040 angler-hours or 2.7 hours/acre. Winter hours were less than that observed on Caribou (5.5 hours/acre) but more than on Trout Lake (0.4 hours/acre).

Limiting Factors

Lake Trout are naturally limited due to their unique habitat requirements and adaptations. Lake Trout are only found in unproductive, low fertility lakes that are cold and well oxygenated. Lake Trout exhibit slow growth and late maturity. Reproduction can be inconsistent as females do not spawn annually. As such, Lake Trout are susceptible to overexploitation.

The 1975 survey described Lake Trout spawning habitat as 'poor'. Suitable spawning habitat may not be well understood as recent assessments provide evidence that natural reproduction does exist and may at times be good. All Lake Trout stocked since 1993 have been fin clipped. This strategy will aid in the evaluation of natural reproduction of this species in future surveys.

Mountain Lake strain appears to be performing poorly and the reasons are unclear. It is unknown what effect this will have on the Lake Trout population. Natural reproduction has been evident in past assessments and introducing an inferior strain may have long-term consequences. Cross breeding can be detrimental to the genetic make-up of naturalized Lake Trout populations.

Lake Trout prey may be a limiting factor. Tullibee and Yellow Perch are present, though not abundant. This may influence growth and abundance of Lake Trout. The 1948 survey recommended, "Netting for Tullibee should be prohibited in order to build up amounts of available forage fish for Lake Trout."

Lakes which are capable of supporting Lake Trout have generally low productivity with limited shallow water habitat. These conditions may limit the amount of prey available for Tullibee and panfish and may account for the relatively low abundance and below average growth observed in past assessments.

Lake Trout require cold, well-oxygenated water to survive and become stressed when water temperature exceeds 55 degrees F or when the oxygen is below 5.0 ppm. The temp/DO profiles from assessments between 1996 and 2009 suggest a decreasing trend in preferred habitat with a slight increase in 2015 (Figure 1). The DO profile in 2015 indicated the preferred habitat range meeting the oxygen and thermal requirements were between 30-55 feet, representing 25 vertical feet of separation (Figure 2). Typically, Lake Trout require at least a five-foot vertical separation between the upper and lower limits to avoid being stressed.

Survey Needs and Evaluation Plans:
Conduct a targeted survey in early August 2021, setting 9 deepwater gill nets at the same locations set in 2015. Collect otoliths and scales from Lake Trout as well as sex and maturity.

Collect scale samples from Lake Trout in 2021 for genetic analysis to identify ancestry. Past samples of non-clipped fish should be included along with samples from Caribou and Trout lakes, if not already analyzed. Recent evidence suggests stocked fish do not reproduce well with native Lake Trout populations in some lakes. Native/naturalized populations appear to maintain the fishery while stocked fish appear to have had a limited influence on the population. In this regard, stocking may be counter to meeting management objectives. Perhaps a better strain would be more conducive for meeting management goals.

Consider a targeted survey in mid-August 2017 for Lake Trout to increase sample size for genetic testing. Past samples of non-clipped fish should be included along with samples from Caribou and Trout lakes. Otoliths, as well as, sex and maturity should be collected from expired fish. This is one part of a study with Loren Miller (MNDNR Fisheries Geneticist), to determine the ancestry of Lake Trout in Bluewater Lake. In the event the 2017 survey is not conducted, the study will resume with the 2021 survey.

Habitat Development and Protection:
A Water Quality and Trend Monitoring Study was done in 2000 by the Minnesota Pollution Control Agency. The results compare favorably with the ecoregion reference values. The Carlson Trophic State Index (TSI) values based on total phosphorous (TP), chlorophyll-*a* and Secchi readings were 32, 35 and 40, respectively and indicate mesotrophic conditions for the lake. In the report it states that Bluewater

Lake would "be very susceptible to increased eutrophication with an increase in TP loading; therefore, every effort should be made to minimize TP loading to the lake whenever possible.

In order to maintain or improve fish and wildlife populations, water quality and habitat must be protected. People often associate water quality problems with large-scale agricultural, forestry, urban development or industrial practices in the watershed. However, the impact of land use decisions on many lake lots can result in a significant decline in water quality and habitat. For example, removing shoreline and aquatic vegetation, fertilizing lawns, mowing to the water's edge, installing sand blankets, failing septic systems and uncontrolled run-off, contribute excess nutrients and sediment that degrades water quality and habitat. Understanding these cumulative impacts and taking steps to avoid or minimize them will help to insure that our quality fisheries can be enjoyed by future generations.

Commercial Fishery:
No commercial fishery exists or has existed on Bluewater Lake.

Stocking Plans:
Continue with the past stocking schedule; stock 1,820 Mountain Lake strain yearlings (5 fish/surface acre) biennially in odd years. Stocked fish will have a fin clip to differentiate from naturally reproduced fish.

If Mountain Lake strain does not make a noticeable contribution to the Lake Trout population by 2021, stocking this strain should be discontinued. The hatchery system should be encouraged to identify another strain or expand the Isle Royal strain for inland stocking. If an alternative strain becomes available for inland stocking, it should be immediately programed into the stocking schedule at the same rate (5 fish/surface acre biennially in odd years). If no other strain is available for inland stocking, the long-range management goal may have to reflect a preservationist philosophy.

If genetic analysis identifies a distinct Lake Trout strain unique to Bluewater (or the Grand Rapids Area) that is responsible for successful natural reproduction, discontinuing stocking should be considered. However, supplemental stocking may be required to help attain management goals, but the introduction of foreign genetics may have a long-term effect on the Lake Trout population.

Other Management Tools:
It appears the popularity of Lake Trout fishing has been growing in the Grand Rapids Area, based on the increasing number of inquiries in the last 10 years. Lake Trout are a long-lived, slow growing species that tend to mature later and are not managed as a put-and-take fishery like other trout species. Unfortunately, there is not a catch-and-release mentality associated with them, as with other long-lived species like Muskellunge, and harvest oriented anglers can have a significant impact on the population. This uniqueness makes Lake Trout vulnerable to over-exploitation. Genetic analysis may identify a discrete Lake Trout population that is naturally occurring and maintaining the population despite stocking efforts (Mountain Lake strain). Stocking another strain may improve the contribution to the population and attaining management goals, but at the risk of possibly contributing unknown genetic potential.

A regulation change may be necessary for achieving management goals. Reducing the harvest limit from two to one would likely be ineffectual by itself because it is perceived that individual angler catches are low. However, the cumulative angler catch does have the potential to impact low density Lake Trout populations.

The preferred option would be a length based special regulation which would reduce the harvest, without restricting opportunity, by protecting spawning size females. Minimum length limits offer adequate

protection when set at a length where 50% of the females are at a length equal or greater when spawning begins, provided there is limited natural reproduction, good growth, low natural mortality and high exploitation (Burr, 1991). Setting size limit regulations for Lake Trout is complicated by differences in growth potential among populations (OMNR, 2007). The limited data suggests female Lake Trout began to mature around 20 inches in the Grand Rapids area (longest immature = 20.5", smallest mature = 19.3"). A minimum length limit of 20 inches, while maintaining the statewide bag limit (two), may offer adequate protection. A goal of a minimum length limit is to allow fish to spawn at least once before recruiting to an exploitable size. One consideration with this approach would be the fear of "stockpiling" fish below the minimum length limit. As the number of fish increases below the minimum length, competition may also increase and adversely affect growth.

Another option may be a protected slot length limit. A protected slot centering near the first maturity of females would protect a large portion of the spawning stock. A protected slot length limit from 16 to 22 inches with one fish over 22 inches would offer adequate protection to the population while still allowing some angler harvest without significantly stockpiling juvenile fish. A combined gill net length frequency between Caribou and Bluewater lakes from 2007 to 2015 indicated 47 Lake Trout were sampled between 16 and 22 inches (30%), while the mean and median length sampled was 19.1 inches. Interestingly, 34% of the catch was below and 35% above the potential protected slot length limit.

Public input:
This plan was available for public review and comment during March 2016; no comments were received.

Revised by: Doyle Hass
This plan replaces the 2010 management plan.

Literature cited

Burr, J. M. 1991. Length Limit Regulations as Applied to Alaskan Lake Trout Fisheries, A Synthesis of Available Data with Recommendations. Alaska Department of Fish and Game. Fishery Manuscript No 91-5. Anchorage. 52 pp.

Ontario Ministry of Natural Resources (OMNR). 2007. Regulatory Guidelines for Managing the Lake Trout Recreational Fishery in Ontario. Fisheries Section, Fish and Wildlife Branch, Peterborough. 29 pp.

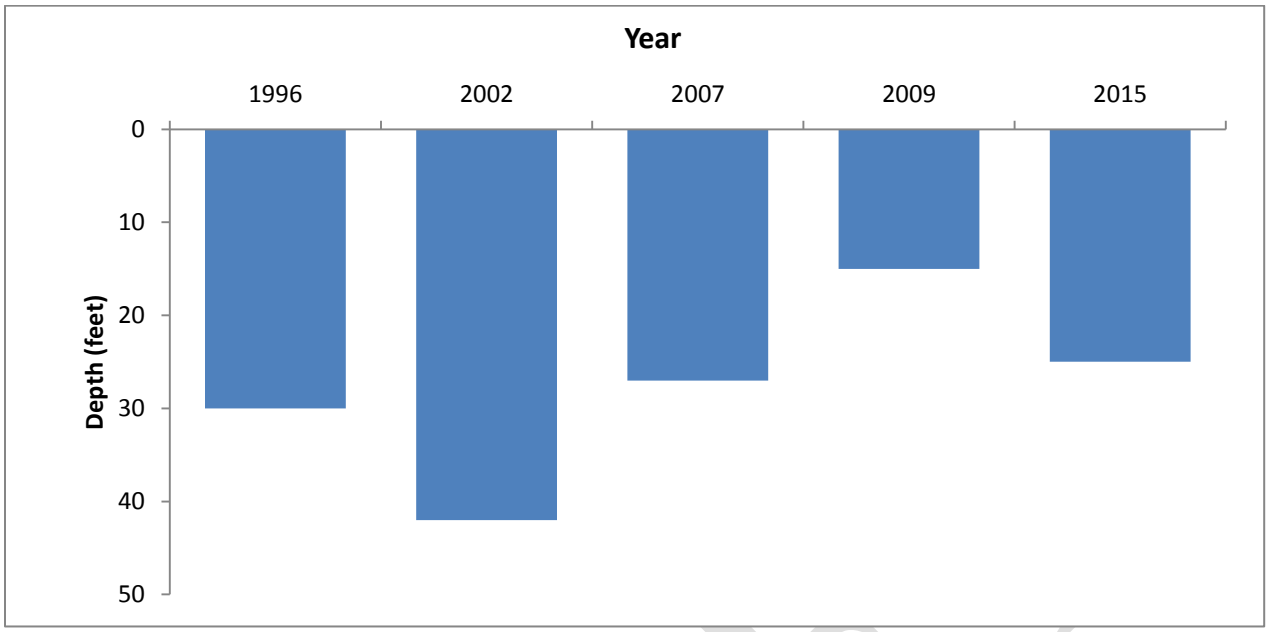

Figure 1. Vertical separation, in feet, between the thermal and oxygen requirements for Lake Trout; defining the zone of preferred habitat by assessment.

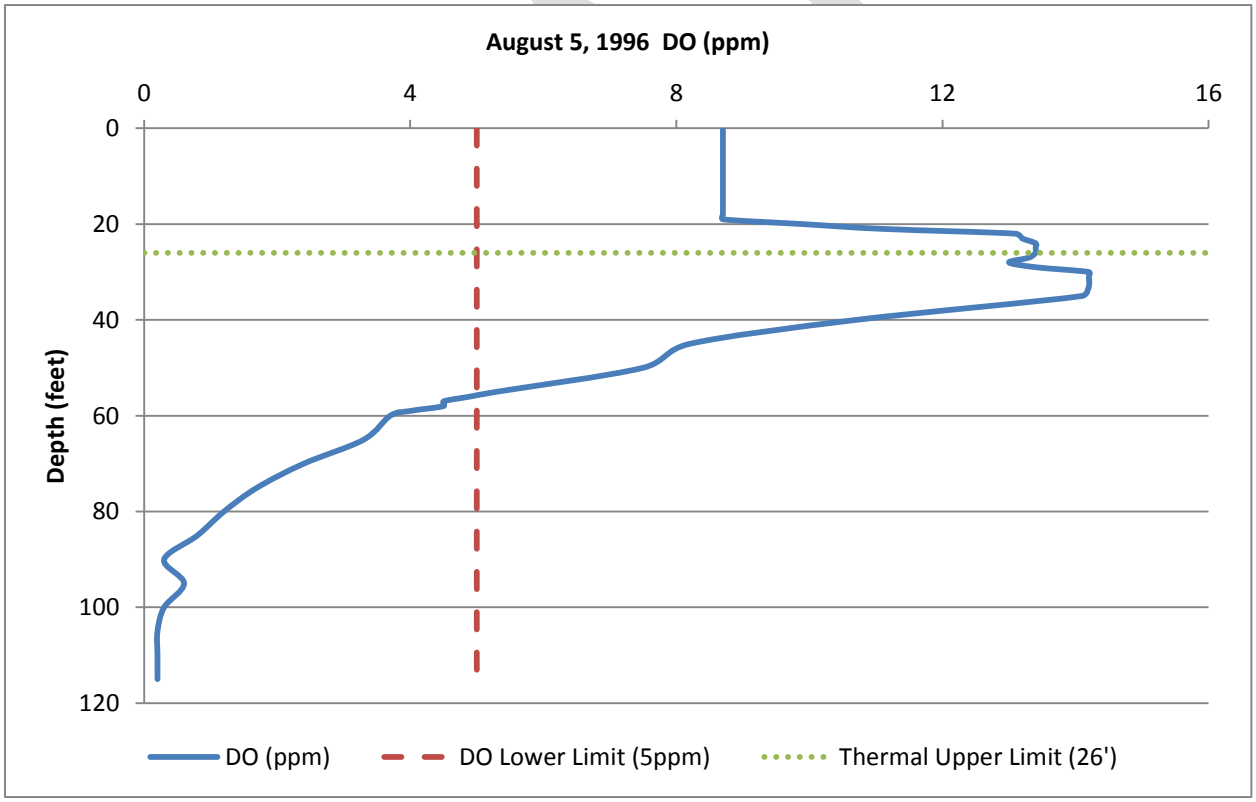

Figure 2. The dissolved oxygen profile in the 2015 assessment; identifying the zone of preferred habitat for Lake Trout.