

Memorandum of Understanding between the
Minnesota Department of Natural Resources, Central Region Fisheries
and the Carnelian-Marine-St. Croix Watershed District
Regarding the Temporary Suspension of Trout Stocking in Square Lake

November 16, 2012

1. BACKGROUND AND INTRODUCTION

This Memorandum of Understanding (MOU) is between the Minnesota Department of Natural Resources (MDNR) Central Regions Fisheries and the Carnelian-Marine-St. Croix Watershed District (CMSCWD).

2. TERM OF MOU AND CANCELATION

This is effective upon execution by the parties and will remain in effect until canceled by either party. A thirty-day notice shall be given by the party wishing to cancel this agreement, and that party shall be responsible for any implementation, monitoring, and data evaluation expenses of the three-year stocking suspension, including reimbursing the other party for those expenses incurred.

3. AMENDMENTS

Any amendments or modifications to this MOU must be in writing and will not be effective until executed by the parties.

4. ENTIRE AGREEMENT

This MOU contains the entire agreement between the parties.

Minnesota Department of Natural
Resources, Central Region Fisheries

Carnelian-Marine-St. Croix Watershed
District



Regional Fisheries Manager Brad Parsons

Date: 11-16-12



Board President Steven Kronmiller

Date: 12-3-12

The following discussion addresses two areas of agreement listed by topic. Additional issues may be amended onto this agreement as they are completed and approved by both parties.

Contents:

PART I. Fisheries Stocking in Square Lake

PART II. Monitoring Data Collection and Evaluation

Attachment: Square Lake Monitoring Plan, 2013-2015

PART I. Fisheries Stocking in Square Lake

The MDNR will suspend all stocking of rainbow trout in Square Lake, for the remainder of 2012 through the end of 2015. During this time period, the MDNR will not stock Square Lake with any other fish.

PART II. Monitoring Data Collection and Evaluation

During the time that Square Lake is not stocked with fish, the effects of the stocking suspension on zooplankton abundance and community composition, surface water algal biomass (chlorophyll-*a*), and water clarity will be evaluated with respect to whether or not the suspension leads to an increase in the abundance of *Daphnia pulicaria* in Square Lake and an increase in the lake's water clarity.

A. Expectations for changes in *Daphnia* abundance and water clarity

If the hypothesis that trout stocking is one of the main causes of the decline in transparency in Square Lake is correct, the following is expected:

Zooplankton

- 1) Greater population density of the large-bodied *Daphnia* (*Daphnia pulicaria*, or *D. pulicaria*) compared to recent years (data available from 2010 and 2012) when rainbow trout (hereafter, RBT) were stocked in the lake. Expect larger populations over the winter through mid-summer (before oxygen depletion diminishes the volume of *D. pulicaria* habitat).
- 2) Larger mean body size of *D. pulicaria* compared to pre-moratorium data.

Water quality

- 1) Greater water transparency (Secchi depth) than in years when RBT were stocked.
- 2) Lower levels of epilimnetic algal biomass (measured as chlorophyll-*a*) than in years when RBT were stocked.
- 3) More prominent spring clear-water phase than in years when RBT were stocked.
- 4) Total phosphorus concentrations similar to pre-moratorium.
- 5) Less hypolimnetic oxygen depletion compared to years when RBT were stocked. This would result in a greater volume of *D. pulicaria* habitat (metalimnetic and hypolimnetic water with dissolved oxygen concentrations > 1 mg/L) during summer stratification. However, summer stratification and hypolimnetic oxygen depletion are also affected by climate conditions (e.g., ice-out date, extent of spring mixing, timing of onset of stratification) and therefore no change (or an increase) in hypolimnetic oxygen depletion does not necessarily disprove the hypothesis.

Zooplankton densities and sizes are likely to respond more quickly to a suspension of trout stocking than would summer averages of water transparency and algae concentrations (measured as chlorophyll-*a*).

B. Monitoring

The following data will be collected and analyzed to determine if the above patterns are observed. The CMSCWD will coordinate the data collection and evaluation. See attached work plan and budget for more details.

Zooplankton

- Monthly water column sampling of zooplankton during winter (January, February, and March) from the three locations sampled in previous (2004, 2010, 2012) studies.
- Twice monthly sampling of zooplankton from April through September: incremental depth sampling (4 depths) from the deepest location and water column sampling at all three sites.

Water Quality

- Twice monthly monitoring of water quality parameters (Secchi depth, chlorophyll-*a*, total phosphorus, and depth profiles of temperature and dissolved oxygen).

C. Data Evaluation

Monitoring data from pre-moratorium years (2010 and 2012) will be compared to post-moratorium years (2013-2015) to assess whether *Daphnia pulicaria* abundance, biomass, and body size; water clarity; total phosphorus; algal biomass; and hypolimnetic dissolved oxygen are significantly different ($p < 0.05$) using ANOVA statistical tests. ANOVA was chosen because it can differentiate seasonal changes in zooplankton and water quality by accounting for both months and years. We expect the strongest, most immediate response to the stocking moratorium in *Daphnia pulicaria* abundance and mean body size, but a weight of evidence approach will be used to account for other changes observed in water clarity, total phosphorus, chlorophyll-*a*, and hypolimnetic dissolved oxygen. In addition, these effects should be most pronounced during the spring clear-water phase from April to June (a period of reduced algal biomass due to seasonally high levels of zooplankton grazing). However, a strong response to the stocking moratorium may result in significant changes to be observed later in the season (June to September) as well.

Any or all of the following changes, measured from April to June or from June to September, would provide support to continue the rainbow trout stocking moratorium:

1. Any or all of the following changes in *Daphnia pulicaria* abundance or body size:
 - a. Significantly greater *Daphnia pulicaria* densities (#/liter) in post-moratorium years than pre-moratorium years
 - b. Significantly greater large (> 1.3 mm in length) *Daphnia pulicaria* densities (#/liter) in post-moratorium years than pre-moratorium years
 - c. Significantly greater total *Daphnia pulicaria* biomass ($\mu\text{g/liter}$) in post-moratorium years than pre-moratorium years
 - d. Significantly greater *Daphnia pulicaria* average length (mm) in post-moratorium years than pre-moratorium years
2. No significant change (leveling off) or a significant increase in Secchi transparency depth (m) in post-moratorium years than pre-moratorium years. A statistical trend analysis will be used to identify if and when the Secchi transparency depth begins to change over the entire period of record (1980-2015).

3. Significantly less algal biomass (μg chlorophyll-*a*/liter) in post-moratorium years than pre-moratorium years
4. Significantly less hypolimnetic oxygen depletion during the summer in post-moratorium than pre-moratorium years, evidenced by:
 - a. Significantly greater mean depth where dissolved oxygen concentration is greater than 1 mg/liter in post-moratorium than pre-moratorium years
OR
 - b. Significantly shorter annual time period when hypolimnetic dissolved oxygen concentrations are less than 1 mg/liter in post-moratorium than pre-moratorium years.

No significant changes in the criteria listed above would suggest that RBT stocking is not a significant driver for the eutrophication trend in Square Lake, and it would be reasonable for the MDNR to resume the RBT stocking program should they so desire. Additionally, there should be no significant change in growing season (June-September) mean surface water total phosphorus concentration (μg P/liter) in post-moratorium years than pre-moratorium years. Significant changes in total phosphorus may confound the effects of the stocking moratorium on monitoring data. In this case, additional years of the moratorium may be warranted to provide three years of post-moratorium data without significantly different total phosphorus concentrations from pre-moratorium years.

The following deliverables will be produced in accordance with this MOU:

1. Monitoring data will be evaluated on an annual basis by the CMSCWD, and an annual summary memo of the monitoring data will be provided to the MDNR by the CMSCWD.
2. A final report, including a preliminary recommendation of whether to continue the trout stocking suspension for the benefit of the water quality in Square Lake, will be completed by the CMSCWD by June 2016.
3. The final report will be reviewed by an impartial, scientific expert in limnology from a local institution of higher education and research to provide a third party recommendation to the MDNR Central Region Fisheries by December 1, 2016.
4. A decision will be made by the MDNR Central Region Fisheries by January 1, 2017 as to whether to continue the trout stocking suspension in Square Lake.
5. An amendment to this agreement will be developed by the MDNR and the CMSCWD after January 1, 2017 to define further actions required by the parties according to the outcome of Deliverable 4.