



## Environment and Natural Resources Trust Fund (ENRTF) M.L. 2013 Work Plan

---

**Date of Status Update Report:** October 30, 2013

**Date of Next Status Update Report:** October 30, 2013

**Date of Work Plan Approval:**

**Project Completion Date:** June 30, 2016

**Is this an amendment request?** No

---

**PROJECT TITLE:** Sustaining Lakes in Changing Environment - Phase II

**Project Manager:** Dr. Donald L. Pereira

**Affiliation:** Minnesota Dept. Natural Resources, Division of Fish and Wildlife, Fisheries Research & Policy Manager

**Mailing Address:** 500 Lafayette Road

**City/State/Zip Code:** St. Paul, MN, 55155

**Telephone Number:** (651) 259-5231

**Email Address:** don.pereira@state.mn.us

**Web Address:** <http://www.dnr.state.mn.us/fisheries/management/research.html>

---

**Location:** Statewide. See map in Section IX.

---

**Total ENRTF Project Budget:**

**ENRTF Appropriation:** \$1,200,000

**Amount Spent:** \$0

---

**Balance:** \$1,200,000

---

**Legal Citation:** M.L. 2013, Chp. 52, Sec. 2, Subd. 05a

**Appropriation Language:**

\$1,200,000 the first year is from the trust fund to the commissioner of natural resources in cooperation with the United States Geological Survey, the University of Minnesota, and the University of St. Thomas to continue development and implementation of monitoring, modeling, and reporting protocols for Minnesota lakes to be used in water and fisheries management. This appropriation is available until June 30, 2016, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE: Sustaining Lakes in a Changing Environment (SLICE): Phase 2**

### **II. PROJECT STATEMENT:**

As Minnesota's population grows, increased demands are being placed on our resources. Hunting and fishing related activities fuel \$3.6 billion in annual expenditures and a vibrant Minnesota economy demands on effective and efficient lake habitat and fisheries conservation. Thanks to the initial investments from the ENTF, multiple partners' in-kind contributions, and motivated citizen volunteers, DNR Fisheries successfully launched and is near completion of a 4-yr pilot effort in 24 sentinel lakes (SLICE Phase 1). Sentinel systems are specific ecosystems (in this case lakes) chosen for focused monitoring in order to better capture important changes or trends through time, and to give us the information to better understand the mechanisms to explain those changes. Thus, in Phase 1, we have established a suite of 24 lakes across Minnesota that capture the full breadth of the basic conditions (e.g. fertility, climate) that shape our lake resources, and in large part determine the goods and services (e.g. fishing and water recreation) that our lakes provide for our citizenry. Phase 1 identified baseline conditions in a wide variety of Minnesota lake types, their initial responses to various environmental stressors, and outlined some expectations for future conditions given various changing scenarios. Phase 1 also fortuitously (and perhaps unfortunately) gave us the opportunity to set up a rigorous system to understand pending impacts from zebra mussels following the invasion of this pest in Lake Carlos, near Alexandria, in 2009. Phase 1 will be completed in June 2013.

Phase 2 (2013 - 2016), proposed here, will take lessons learned from the first phase to develop and implement rigorous monitoring, modeling, and reporting protocols that will deliver timely information on lake trends, reduce uncertainty about potential causes, and result in more precise conservation approaches. Phase 2 also includes applying lake models to predict ecosystem impacts of major environmental and ecological stressors (e.g., possible future invasive species introductions, changing land use, and climate changes) in six Tier 1 sentinel lakes. In addition to continuing to develop and test our biophysical models of oxy-thermal habitat in Elk, Carlos, and Trout lakes, we propose new modeling efforts focused on the state's shallow, agriculturally-impacted lakes in Phase 2. Thus, we propose developing three new lake models (Shaokotan, Madison, and Pearl lakes) to enhance understanding of nutrient loading from watershed sources, in-lake nutrient and food web dynamics, and resulting fish habitat conditions related to current and changing land use practices, dynamic hydrological inputs, and physical processes such as evapotranspiration and wind mixing of water column and underlying sediments. In order to implement proactive lake conservation measures, we must acquire information about baseline habitat conditions (the past), long-term changes to that baseline (the present), and models that forecast the risk of various impairments (the future).

### **III. PROJECT STATUS UPDATES:**

**Project Status as of 10/30/2013:**

**Project Status as of 4/15/2014:**

**Project Status as of 10/30/2014:**

**Project Status as of 4/15/2015:**

**Project Status as of 10/30/2015:**

**Project Status as of 4/15/2016:**

### **IV. PROJECT ACTIVITIES AND OUTCOMES:**

**ACTIVITY 1:** Monitoring a comprehensive suite of important lake and watershed indicators in 24 sentinel lakes to gage status and trends of lake health (see map in Section IX).

**Description:**

Several scientific and programmatic lessons learned from the Phase 1 pilot will be applied to this activity. Three dedicated field staff will provide regional expertise regarding status and trends of important water and fisheries resources in each of the State's four major land types. A programmatic adaptation proposed in Phase 2 is a tiered classification of sentinel lakes with comprehensive, intensive monitoring in 8 Tier 1 Sentinel Lakes (see also activity 2) and reduced monitoring schedules in the remaining 16 sentinel lakes. Thus all lakes will receive regularly scheduled monitoring of the following parameters: Water quality (according to established MPCA protocols), Fisheries population assessments (primarily game fish), IBI surveys (index of biotic integrity) of all fish (thus including non-game species) and aquatic rooted plants, zooplankton sampling, sampling of deepwater and nearshore macroinvertebrates, and continuous water temperature monitoring. The specific frequency for conducting the individual monitoring components will be determined from rigorous statistical analysis soon to be completed as a key part of the Phase 1 project. Automated sensors will also be installed in the eight Tier 1 lakes. We will measure naturally-occurring stable isotope abundances in lake biota to track food web and ecosystem responses to expanding zebra mussel populations in Lake Carlos, and to characterize baseline food web linkages, energy flow, and ecological niches of piscivore species in Elk Lake. Additionally, chironomid pupal skins will be sampled to assess chironomid communities in each of the Tier 1 sentinel lakes, with the goal of developing species or community indicators that reflect lake trophic and thermal conditions. Chironomids are sensitive indicators of lake conditions, and probably respond rapidly to lake degradation or improvement, thus will be receiving increased research attention in Phase 2.

**Summary Budget Information for Activity 1:**

**ENRTF Budget:** \$ 992,456  
**Amount Spent:** \$ 0  
**Balance:** \$ 992,456

**Activity Completion Date: June 30, 2016**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1. Conduct standard lake surveys; data QA/QC &amp; database management</b>	<i>Ongoing</i>	\$591,919
<b>2. Inventory watershed land cover &amp; uses (incl. BMP's) &amp; drainage features and archive in DNR's GIS database</b>	<i>June 30, 2016</i>	\$18,480
<b>3. Establish automated temperature sensors in 8 Tier 1 Lakes</b>	<i>May 2014</i>	\$38,800
<b>4. Use carbon and nitrogen stable isotopes to examine food web responses to expanding zebra mussel populations in Lake Carlos and to characterize the Elk Lake food web</b>	<i>June 30, 2016</i>	\$55,312
<b>5. Relate chironomid (pupal exuvia) communities to sentinel lake trophic and thermal characteristics</b>	<i>June 30, 2016</i>	\$82,633
<b>6. Reports on status and trends for 4 major landtypes, with stressors or BMP influence</b>	<i>Annual to June 2016</i>	\$205,312

**Activity Status as of 10/30/2013:**

**Activity Status as of 4/15/2014:**

**Activity Status as of 10/30/2014:**

**Activity Status as of 4/15/2015:**

**Activity Status as of 10/30/2015:**

**Activity Status as of 4/15/2016:**

**Final Report Summary:**

**ACTIVITY 2:** Build or adapt biophysical lake ecosystem models for 6 Tier 1 lakes capable of forecasting future lake conditions based on scenarios that cause change but vary across lakes.

**Description:**

To understand complex systems like natural lakes, we need both high quality and comprehensive monitoring data, but also the capacity to synthesize those data in mechanistic system models. For example, we have a generalized idea what zebra mussels do to lake food webs, and those effects likely vary across lakes. Consequently, we can develop sound mechanistic models to explain these changes, but these models need to be fit and calibrated to our specific lakes. To further elaborate on this example, biologists have learned a lot about how zebra mussels have changed Oneida Lake in New York state, but it would be very wrong to use the Oneida data and model to predict changes in Lake Carlos. This is because the two lakes are so different, Oneida is very fertile and shallow while Carlos is deep and of moderate fertility. In Activity 2, we propose to continue building mechanistic lake models for distinct classes of Sentinel Lakes and to refine the three existing models developed for deep, coldwater lakes. The planned 6 lake models will continually be used and recalibrated with new monitoring data to forecast lake conditions given certain scenarios that will cause some type of change.

**Summary Budget Information for Activity 2:**

**ENRTF Budget:** \$ 207,544  
**Amount Spent:** \$ 0  
**Balance:** \$ 207,544

**Activity Completion Date: June 30, 2016**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1. Build biophysical lake system models for 6 Tier 1 lakes &amp; establish change scenarios</b>	<i>June 30, 2015</i>	\$88,948
<b>2. Calibrate and validate models</b>	<i>December 31, 2015</i>	\$59,298
<b>3. Develop and run forecast scenarios for evaluating various lake management tools &amp; BMPs</b>	<i>June 30, 2016</i>	\$59,298

**Activity Status as of 10/30/2013:**

**Activity Status as of 4/15/2014:**

**Activity Status as of 10/30/2014:**

**Activity Status as of 4/15/2015:**

**Activity Status as of 10/30/2015:**

**Activity Status as of 4/15/2016:**

**Final Report Summary:**

**V. DISSEMINATION:**

**Description:**

In addition to the scheduled status updates, and final report due to LCCMR, we currently provide or envision:

1. An updated description of the overall long-term lake monitoring program will be available on MN DNR's public website at (<http://www.dnr.state.mn.us/fisheries/slice/index.html>). Basic "fact-sheets and retrospective lake assessment reports on all 24 sentinel lakes are available on MN PCA's public website at (<http://www.pca.state.mn.us/water/sentinel-lakes.html>).
2. Data visualization and data download tools for variables measured as part of the long-term lake monitoring program will be available on the MN DNR's public website (forthcoming, and to be updated yearly once tools are developed). Currently, status and trends graphs for several indicators measured 2008-2011 are available at (<http://www.dnr.state.mn.us/slice/indicator-graphs.html>). Graphs and data accessible for download will be updated as data become available, typically within a few months after the field season.
3. Several manuscripts submitted to peer-reviewed journals by project coordinators, long-term monitoring biologists, Fisheries Research Unit staff, and other project partners (PCA, USGS, and university partners to name just three). Due to length of time required to process and analyze samples, and the time frames required for true long-term patterns to emerge and be detected, some manuscripts for peer-review journals will necessarily need to be developed after June 2016.
4. Several technical presentations given at state, regional, national, and potentially international symposia. Local outlets include MN chapter of the American Fisheries Society and organized lake groups.
5. Water quality data will be housed in EPA's national water quality database STORET (<http://www.epa.gov/storet/dbtop.html>). GIS data is available at (<http://deli.dnr.state.mn.us/>). Fish, zooplankton, and aquatic plant data will be housed in central databases and be made available upon request.
6. Multiple publications and online database portals will provide open access to all data collected by the USGS for the Sentinel Lakes Program (organized by topic below):
  - a. Discrete water quality data in manuscript and database format will be accessible through an interactive web portal at: <http://wdr.water.usgs.gov/adrgmap/>
  - b. Water quality data, water level data, and discharge data will be in the National Water Information System, or NWIS. NWIS data will be available for download at: <http://waterdata.usgs.gov/mn/nwis/qw>
  - c. Interactive, web-based data portal for all continuous temperature data will be available at: [http://mn.water.usgs.gov/projects/sentinel\\_lakes/map.html](http://mn.water.usgs.gov/projects/sentinel_lakes/map.html)
7. Sentinel lakes data will be housed on a shared network drive that will be available to all internal DNR staff throughout the state.
8. A "file transfer protocol" (ftp) site will also be maintained by the project coordinators which will house all GIS layers, reports, analyses, and raw data relevant to the project. This information will be available to any interested parties.
9. A data sharing philosophy that encourages free access to comprehensive high quality data by outside researchers. The program and the state benefit greatly from analyses performed by outside researchers on raw datasets. These partnerships may bring in additional matching grants from outside funding sources.

**Status as of 10/30/2013:**

**Status as of 4/15/2014:**

**Status as of 10/30/2014:**

**Status as of 4/15/2015:**

**Status as of 10/30/2015:**

**Status as of 4/15/2016:**

**Final Report Summary:****VI. PROJECT BUDGET SUMMARY:****A. ENRTF Budget:**

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Explanation</b>
Personnel:	\$539,983	3 Long-Term Monitoring Fisheries Specialists (100% FTE) to coordinate project surveys, train and lead field crews in data collection efforts, perform database management and data QA/QC, and report on status and trends for sentinel lakes located in 4 different landtypes.  7 Student Interns (100% FTE), field data collection activities (6students) and GIS work (1 student) in support of project objectives.
Professional/Technical/Service Contracts:	\$345,489	USGS Water Sciences Center to build or adapt biophysical lake ecosystem models for 6 Tier 1 lakes capable of forecasting future lake conditions based on scenarios that cause change but vary across lakes. University of St. Thomas to use carbon and nitrogen stable isotopes to track food web responses to expanding zebra mussel populations in Lake Carlos, and to characterize food web linkages in Elk Lake. University of Minnesota to develop pupal chironomid indicators of lake trophic and thermal conditions.
Direct and Necessary Services:	\$70,268	Direct and Necessary Services for the Appropriation
Equipment/Tools/Supplies:	\$128,100	Water level gauges, remote continuously-recording temperature and dissolved oxygen sensors, fish and invertebrate sampling equipment, field wear and safety equipment, other miscellaneous survey equipment, and analytical services in support of long-term monitoring objectives outlined in the proposal.
Travel Expenses in MN:	\$116,160	In support of project objectives, with approximate breakdown as follows: 40% for fleet for travel to study lakes to install sensors and conduct survey work, and to attend coordination meetings; 40% for hotels for overnight stays associated with lake survey work and project coordination, 20% for meal reimbursement in accordance to DNR travel guidelines, and meal reimbursement limits.
<b>TOTAL ENRTF BUDGET:</b>	<b>\$1,200,000</b>	

**Explanation of Use of Classified Staff: N/A**

**Explanation of Capital Expenditures Greater Than \$3,500: N/A**

**Number of Full-time Equivalent (FTE) funded with this ENRTF appropriation: 13.5**

**Number of Full-time Equivalent (FTE) estimated to be funded through contracts with this ENRTF appropriation: 4.0**

**B. Other Funds:**

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
<b>Non-state</b>			
USGS Water Science Center	\$140,000	\$	In-kind matching funds in support of proposal objectives
University of St. Thomas, Department of Biology	\$6,900	\$	In-kind match funds in support of stable isotope study of L. Carlos and Elk L. food webs (undergraduate assistant support, travel to study sites, and lab supplies)
<b>State</b>			
DNR Div. of Fish and Wildlife	\$171,000	\$	In-kind match funding for approximately 11 DNR staff (\$130,000) involved in field data collection and data analysis efforts.
DNR Div. of EWR	\$83,750	\$	In-kind match funding to support bi-monthly zooplankton and monthly (in some cases annual only) benthic invertebrate sampling and sample processing costs. In-kind matching funds to support stream gauging and the subsequent watershed modeling efforts of Jim Solstad and others.
MPCA – Env. Anlys. & Outcomes	\$74,200	\$	In-kind matching funds to support water quality sampling and analytical costs. In-kind labor provided by citizen lake monitoring volunteers (not quantified).
<b>TOTAL OTHER FUNDS:</b>	<b>\$475,850</b>	<b>\$</b>	

**VII. PROJECT STRATEGY:**

**A. Project Partners:**

1. DNR Division of Fish and Wildlife Section of Fisheries – Program administration, Fisheries technical and field support, data management, (\$492,456 ENRTF + in-kind; Dr. Don Pereira Project Manager).
2. USGS Water Science Center – Hydrologic and limnologic technical and field support (\$207,544 ENRTF + in-kind; Dr. Richard Kiesling PI).
3. University of St. Thomas – Stable isotope analysis of Carlos and Elk lake food webs: technical, lab, and field support (\$55,312 ENRTF + in-kind, Dr. Kyle Zimmer PI)
4. University of Minnesota – Analysis of chironomid pupal exuvia as indicators of lake trophic and thermal conditions: technical, lab, and field support (\$82,633 ENRTF, Dr. Leonard Ferrington Jr. PI)

Partners providing support but not receiving funds from the ENRTF:

5. DNR Divisions of Parks and Trails, Ecological and Water Resources – Survey support on Bear Head Lake (Parks), lake level gauging, watershed modeling, invertebrate data (DNR Div. EWR, in-kind).

6. MPCA – Environmental Analysis and Outcomes Division – Water quality assessments, ground-water monitoring, volunteer coordination (in-kind).

**B. Project Impact and Long-term Strategy:**

Healthy lakes are an important component of our Minnesota identity. While losses to lake health have already undoubtedly occurred in many areas, numerous high-quality lakes still exist throughout the state, yet all lakes remain vulnerable to a myriad of threats (excess nutrients from land use and human populations, climate changes, and invasive species, to name a few). Lakes are especially vulnerable as not only are lakes the collectors of waters moving across our landscape (thus strongly reflect human modifications within watersheds), but are also sensitive integrators of climatic conditions. For these reasons, timing is urgent for effective monitoring and protection tools not only to prevent further, possibly irreversible damage, but also to document lake improvements to our actions. Foremost, we hope to offer lake managers, conservation planners, lakeshore residents, fishers, other lake users, and the Minnesota public a better understanding of historical, present-day, and future factors influencing lake conditions. Our monitoring and modeling efforts will not only help reveal the cause-effect mechanisms affecting lake status, but will also help lead us to the most appropriate indicators to track the status of our state's lakes. Detailed assessment and modeling of lake conditions will inform revisions to lake monitoring programs, provide an empirical foundation for understanding impacts of state's varied land uses and watershed restoration programs, and inform climate change adaptation policies related to lake management. Understanding the myriad of factors driving changes to lake habitats is one our main project goals, and critical to the societal, economic, and ecological well-being of our state.

Our long-term strategy is to complete development of a fully integrated lake monitoring program that combines and focuses the activities of key, collaborative management agencies (e.g. DNR and MPCA). Such a system will greatly increase our understanding of how these lakes change, and what management actions are most likely to provide cleaner water and healthier fish populations. After funding Phase 2, our hope will be to fully incorporate this program in to the regular activities of both agencies (thus move from concept development to operational), and thus cover future work with regular agency funding sources.

**C. Spending History:**

<b>Funding Source</b>	<b>M.L. 2007 or FY08</b>	<b>M.L. 2008 or FY09</b>	<b>M.L. 2009 or FY10</b>	<b>M.L. 2010 or FY11</b>	<b>M.L. 2011 or FY12-13</b>
ENRTF			\$825,000		
In-kind support originating from the Game and Fish Fund, USGS cooperative funds, US Forest Service operating budgets, PCA operating budgets and Clean Water Legacy. FY12-13 includes 50% salary for project coordinators, Jeff Reed and Brian Herwig, to finish the SLICE Phase 1 project and to design and coordinate the implementation of the SLICE Phase 2 project.			\$169,000	\$169,000	\$243,000
DJ Study 605 - Designing a long-term monitoring program to track the status of fish communities and their		\$157,775	\$174,585	\$196,855	\$66,658



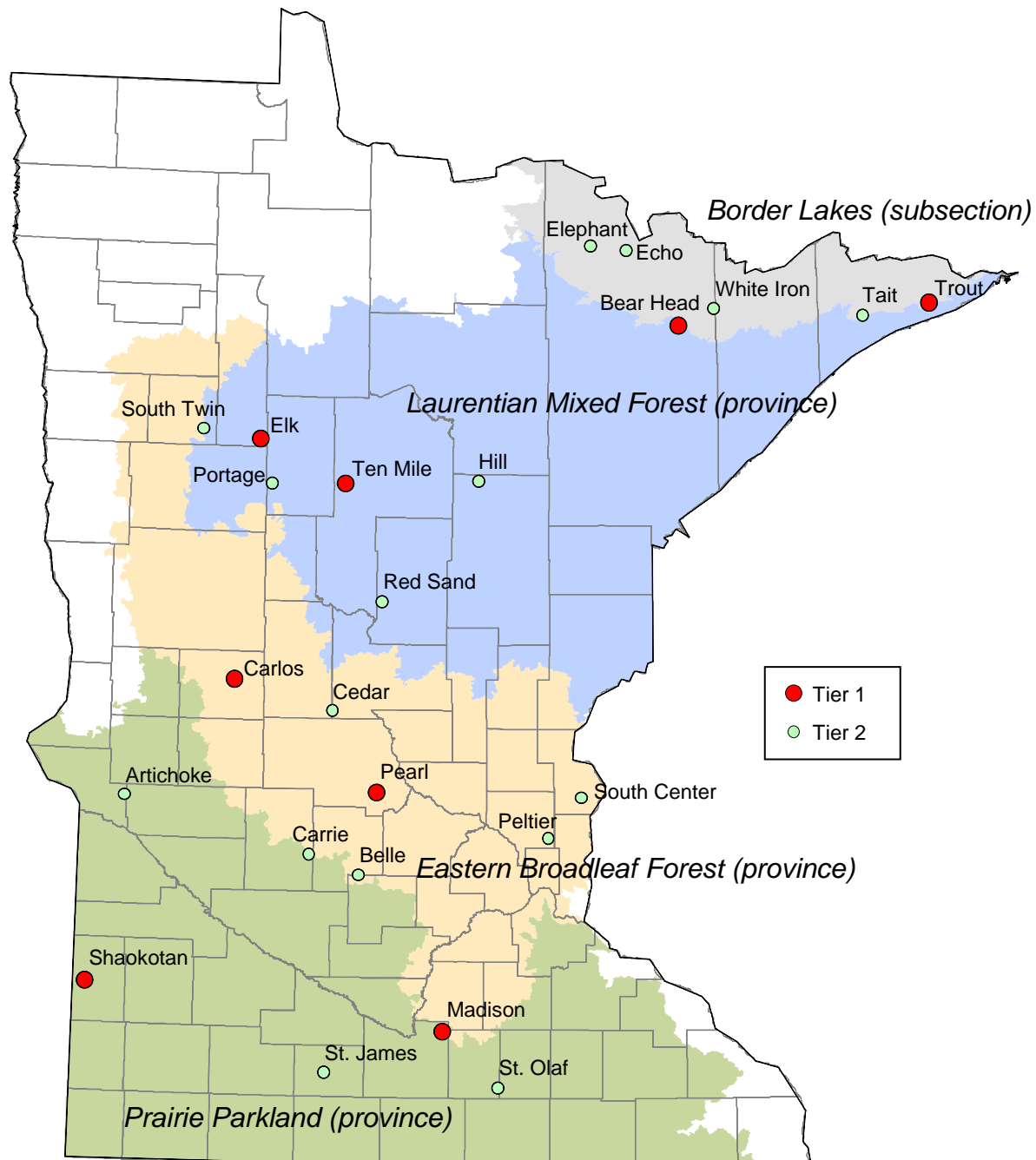
habitats in Minnesota lakes, identify efficient indicators, and evaluate mechanisms.					
--	--	--	--	--	--

**VIII. ACQUISITION/RESTORATION LIST: N/A**

**IX. MAP(S):** Map showing the location of all 24 sentinel lakes in Minnesota, and the four major land types that they cover. Proposed tiered classification of lakes is also indicated. Tier 1 lakes (red) are the focus of work presented in this proposal and will receive annual sampling in 2013-16 (and beyond). Tier 2 lakes (green) will be sampled at a reduced frequency of approximately one in every 4-5 years.



## Environment and Natural Resources Trust Fund (ENRTF) M.L. 2013 Work Plan



### X. RESEARCH ADDENDUM: N/A

**XI. REPORTING REQUIREMENTS:** Periodic work plan status update reports will be submitted not later than 10/30/2013, 4/15/2014, 10/30/2014, 4/15/2015, 10/30/2015, and 4/15/2016. A final report and associated products will be submitted between June 30 and August 15, 2016 as requested by the LCCMR.

Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects								
Project Title: Sustaining Lakes in a Changing Environment (SLICE): Phase 2								
Legal Citation: tbd								
Project Manager: Dr. Donald L. Pereira								
M.L. 2013 ENRTF Appropriation: \$1,200,000								
Project Length and Completion Date: June 30, 2016								
Date of Update: 12/31/2012								
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Monitoring sentinel lakes to gage status and trends of lake health			Build or adapt biophysical lake ecosystem models and forecast future lake conditions				
Personnel (Wages and Benefits) - Overall	539,983		539,983				539,983	539,983
3 Long-Term Monitoring Fisheries Specialists (8L): 77% salary, 23% benefits; 100% FTE (30 mos: Jul 1, 2013 - Dec 30, 2015) (Est. \$410,623)								
7 Student Interns: 100% salary; 100% FTE (14 weeks in FY14, 14 weeks in FY15, 14 weeks in FY16) (Est. \$129,360)								
Professional/Technical/Service Contracts								
USGS Water Sciences Center - Dr. Richard Kiesling (PI) • Lake model constuction (three 0.25 FTE Hydrologists for three years; \$183,644) • Supplies (\$7,800) • Travel (\$3,000) • Water sample shipping (\$600) • Analytical lab costs (\$13,100)				207,544		207,544	207,544	207,544
Univ of St. Thomas, Dept. of Biology - Dr. Kyle Zimmer (PI) • Collect, process, and analyze stable isotope samples to examine food web reponses to expanding zebra mussel populations in Lake Carlos and to obtain baseline characterization of the Elk Lake food web - UST intern salary (Est. \$11,299) - Equipment and stable isotopes analytical costs (Est. \$31,003) -1.5 mos summer salary for K. Zimmer (Est. \$13,010)	55,312		55,312				55,312	55,312
UMN, Department of Entomology - Dr. Len Ferrington (PI) • Sample chironomid pupal exuvia communities from 8 Tier 1 sentinel lakes, explore relationships within and among lakes, and develop indicators that reflect lake trophic and thermal conditions - Graduate Research Assistant (M.S.) - 2 yrs (Est. \$76,137) - Travel Expenses (Est. \$6,496)	82,633		82,633				82,633	82,633
Direct and Necessary Services for the Appropriation	70,268		70,268				70,268	70,268
Equipment/Tools/Supplies (estimates, actual may vary slightly)								
Transducers for water level gauges	11,400		11,400				11,400	11,400
Temperature thermistors and buoys	16,400		16,400				16,400	16,400
Dissolved oxygen sensors (8 @ \$1250/ea) and buoys (\$1000)	11,000		11,000				11,000	11,000
Lowrance HDS7 depth finder with card and sidescan (1 @ \$1,700/ea)	1,700		1,700				1,700	1,700
Contour Innovations BioBase online subscription to aquatic bathymetric and vegetation mapping software for 8 Tier 1 lakes for 3 yrs	4,000		4,000				4,000	4,000
Factory calibration and new calibration sphere for Biosonics DTx (or Biosonics DTE) and 420 kHz transducer	2,000		2,000				2,000	2,000
2 sets of vertical gill nets (\$3,500/set)	7,000		7,000				7,000	7,000
Supplies for invertebrate sampling (e.g., sample jars and preservative ethanol)	4,000		4,000				4,000	4,000
Waders, rain gear, PPE, etc.	2,400		2,400				2,400	2,400
Miscellaneous survey equipment and repairs	16,000		16,000				16,000	16,000
Phytoplankton taxonomy (MN Rapid Assessment Method)	23,040		23,040				23,040	23,040
Analytical services (water chemistry \$29,160)	29,160		19,440				29,160	19,440
Travel expenses in Minnesota For DNR field staff to conduct regular bi-monthly sampling to all study lakes, and specialized seasonal sampling at study lakes, and to attend coordination meetings (hotels, fleet costs, meals)	116,160		125,880				116,160	125,880
COLUMN TOTAL	\$992,456		\$992,456	\$207,544	\$207,544		\$1,200,000	\$1,200,000

