

## Diana Griffith

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**From:** Michael McDonough  
**Sent:** Thursday, July 23, 2015 4:27 PM  
**To:** Steven Hauck  
**Cc:** Susan Thornton; Mike Banker; Diana Griffith  
**Subject:** Amendment Approval - M.L. 2013, Chp. 52, Sec. 2, Subd. 05b-Assessment of Natural Copper-Nickel Bedrocks on Water Quality  
**Attachments:** 2013-06-06WP Attach A June152015 4-NRRI\_final.xls; 2013-06-06 WP\_June23\_2015\_ammendment\_request\_final.docx

Hi Steve,

Regarding M.L. 2013, Chp. 52, Sec. 2, Subd. 05b-Assessment of Natural Copper-Nickel Bedrocks on Water Quality, we have reviewed your and approve part of your amendment request as follows:

1. Activity 1 – increase the “Contracts (DNR travel)” budget by \$500 up to \$1,000
2. Add Steven Monson Geerts from NRRI as a co-manager for the project since Steve Hauck, the current manager for the project, will be retiring in summer 2016, and Steve Monson Geerts would be replacing Steve Hauck’s position.

As we discussed, since the contract with the MN DNR is funding a state employee that is a classified staff, the ENRTF governing Minnesota Statute 116P requires that the LCCMR work plan approval specifically approves the use of state agency classified staff. When the work plan was originally approved, since the funding was directly to the U of M, we did not realize that there would be funding for a classified state employee so we approve the following part of the request conditionally pending LCCMR action

3. Activity 1 - decrease the “Contracts (USGS personnel)” budget by \$13,800 down to \$42,767
4. Activity 1 – increase the “Contracts (DNR personnel)” budget by \$13,300 up to \$17,300

The LCCMR is meeting on September 16 and 17 and we will add this issue to the agenda to ask for retroactive approval of the use of classified staff. I inserted the revised language regarding classified staff into your work plan for you – see attached dated 7-23-2015.

Regarding your request to extend the availability of the funds for an additional six month until December 31, 2016, this has to be done legislatively. Most years we have some projects that need more time to complete their work so we have put yours down as one we will include in the LCCMR legislative bill to extend your availability. We will double check with you as it gets closer to the 2016 legislative session to confirm that you still want the extension.

We will notify you via email once the LCCMR has acted on the request.

Thanks, Michael

Michael C. McDonough  
Manager Research and Planning  
Legislative-Citizen Commission on Minnesota Resources  
651 296-2443

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**From:** Mike Banker  
**Sent:** Tuesday, June 16, 2015 1:24 PM

To: Diana Griffith <diana.griffith@lccmr.leg.mn>

Subject: Fwd: LCCMR

*Sent from my Verizon Wireless 4G LTE DROID*

----- Original Message -----

Subject: Fwd: LCCMR

From: Steven Hauck <[shauck@nrri.umn.edu](mailto:shauck@nrri.umn.edu)>

To: Mike Banker <[mike.banker@lccmr.leg.mn](mailto:mike.banker@lccmr.leg.mn)>

CC: Elizabeth Rumsey <[erumsey@d.umn.edu](mailto:erumsey@d.umn.edu)>, Denise Endicott <[dendicot@nrri.umn.edu](mailto:dendicot@nrri.umn.edu)>

Mr. Banker,

Attached are required documents for the June 30, 2015 submittal of **Assessment of Natural Copper-Nickel Bedrocks on Water Quality**. Please note we have some amendments.

Please direct any comments, [etc.to](#) me with a copy to Perry Jones (USGS - [pmjones@usgs.gov](mailto:pmjones@usgs.gov))

Steven A. Hauck

Manager

Economic Geology and Peat Group

Natural Resources Research Institute

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E-mail - [shauck@nrri.umn.edu](mailto:shauck@nrri.umn.edu)



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

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**Date of Status Update Report:** December 31, 2014  
**Date of Next Status Update Report:** June 30, 2015  
**Date of Work Plan Approval:** June 11, 2013  
**Project Completion Date:** ~~June 30, 2016~~ December 31, 2016 **Is this an amendment request?** Yes

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**PROJECT TITLE: Assessment of Natural Copper-Nickel Bedrocks on Water Quality**

**Project Manager:** Steve Hauck

**Affiliation:** Natural Resources Research Institute (NRRI), University of Minnesota Duluth

**Mailing Address:** 5013 Miller Trunk Highway

**City/State/Zip Code:** Duluth, MN 55811

**Telephone Number:** (218) 720-4294

**Email Address:** shauck@nrri.umn.edu

**Web Address:** <http://www.nrri.umn.edu/cartd/min/default.htm>

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**Location:** St. Louis and Lake Counties

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<b>Total ENRTF Project Budget:</b>	<b>ENRTF Appropriation:</b>	<b>\$585,000</b>
	<b>Amount Spent:</b>	<b>\$0</b>
	<b>Balance:</b>	<b>\$585,000</b>

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

**Appropriation Language:**

\$585,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota in cooperation with the United States Geological Survey to assess impacts of existing mineralization and potential mining on northeastern Minnesota regional water quality, including impacts from copper, nickel, and other metal concentrations in rocks, streambed sediments, and soils in areas of potential base-metal mining. This appropriation is available until June 30, 2016, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE: How Do Natural Copper-Nickel Concentrations in Bedrock Influence Water Quality?**

**II. PROJECT STATEMENT:** The large deposits of copper, nickel, cobalt, and platinum-group-elements, and titanium oxide minerals occurring in the Duluth Complex of northeast Minnesota could provide huge economic and employment benefits to the State and provide critical metals to the Nation. The complicated geologic setting of the mineral deposits within the Duluth Complex and the complex glacial history of the region make assessment of any potential water-quality impacts from future metal mining challenging. Streams and rivers that flow over mineralized rocks discharge into the Boundary Waters Canoe Area Wilderness as well as other environmentally sensitive watersheds. Federal, State, local, and tribal entities, mining companies, and environmental groups need up-to-date and accurate geochemical data to assess and predict water-quality impacts of existing mineralization and potential impacts from future mining. This study will determine if copper, nickel, and other metal concentrations in bedrock, streambed sediments, and soils are currently influencing regional water quality in areas of potential base-metal mining. The geochemical and water quality data and accompanying hydrologic analysis will be used by Federal, State, local, and tribal entities to better assess water-quality impacts of existing mineralization and any future mining.

Water-quality, streambed sediment, soil, and rock samples will be collected and analyzed in three watersheds with differing mineral potential: (1) Filson and South Filson Creeks with known copper, nickel, cobalt, and platinum group-element mineralization, (2) St. Louis River with titanium-oxide potential, and (3) Keeley Creek, with no known mineralization. In each of these three watersheds, water samples will be collected 4 times a year for two years (total of a maximum of 96 samples). Water samples will be analyzed for 18 metals, 12 major constituents (ions) and dissolved organic carbon. Up to 20 soil samples, 10 streambed sediment samples, and 10 bedrock samples will be collected in each of the three watersheds. All solid media samples will be analyzed for 46 major and trace elements. In addition, streambed sediment and soil samples will be analyzed for 10 metals by a weak-leach method. Streamflow data from 2 installed stream gages and one existing stream gage will be combined with existing and new water-quality data to develop conceptual hydrologic models for each watershed. Water-quality and modeling results will be compared to data available in the 1979 *Minnesota Regional Copper-Nickel Study* to assess long-term trends in water quality.

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

Project status reports will be submitted not later than December 31, 2013, June 30, 2014, December 31, 2014, June 30 2015, December 31, 2015, and June 30, 2016. A final work program report and associated products will be submitted between June 30 and August 1, 2016 on December 31, 2016 as requested by the LCCMR.

#### **Project Status as of December 31, 2013:**

A cooperative agreement between USGS and University of Minnesota for the flow of LCCMR funding was completed in December.

A first round of water quality and stream bed sediment sampling was completed in September 11-13, 2013. A second round of sampling was delayed because of the federal government shut down.

Streamflow was measured and water-quality samples were collected during September 11-13 in three northeastern Minnesota watersheds. Sample sites are located along, upgradient, or downgradient of the basal contact of the Duluth Complex. Water-quality samples were collected at 5 sites on Filson Creek, 4 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes. All streamflow measurements and water-quality data were entered in USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>). Solid media samples were dried, but have not been submitted for chemistry until LCCMR funding is available.

Permits were submitted to the U.S. Forest Service, Superior National Forest to install continuous streamflow gages on Filson and Keeley Creek. These permits have yet to be approved, with final approval delayed in part by the federal government shutdown and retirements in the U.S. Forest Service. Continuous streamflow data were collected at the St. Louis River near Skibo, MN gage between July 1, 2013 and December 31, 2013. Streamflow measurements were measured at the gage on July 30, September 10, September 12, and October 22.

Geographic Information System (GIS) coverages outlining hydrologic, geologic, and other physical characteristics for the three watersheds (Filson Creek, Keeley Creek, headwaters of the St. Louis River) were constructed in ArcMap 10. Data interpretation and hydrologic models will be developed using these coverages.

An abstract for a poster presentation was submitted to the upcoming Minnesota Lake Superior Stream Science Symposium, to be held in Duluth, January, 2014. The poster will summarize project objectives and activities to be done in the study.

**Project Status as of June 30, 2014:**

A second and third round of water quality sampling was completed in April 28-May 1, 2014 and June 16-20, 2014, respectively. Streamflow was measured and water-quality samples were collected during both sampling trips in three northeastern Minnesota watersheds. Sample sites are located along, upgradient, or downgradient of the basal contact of the Duluth Complex. Water-quality samples were collected during the second round of water quality sampling at 5 sites on Filson Creek, 3 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. During the third round of water quality sampling, water-quality samples were collected at 9 sites on Filson Creek, 4 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. During both sampling trips, poor road access and high water levels prevented access to collecting water samples at some sites on Keeley Creek and on the headwaters of the St. Louis River. Water-quality sampling was done in cooperation with the U.S. Forest Service during both trips at one site on Filson Creek and one site on Keeley Creek. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes. All streamflow measurements and water-quality data were entered in USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>).

Permits were approved by the U.S. Forest Service, Superior National Forest to install continuous streamflow gages on Filson and Keeley Creek in February 12, 2014. The streamflow gages were installed on the south fork of Filson Creek (USGS station number 05124982) on March 13 and on Keeley Creek above its confluence with Birch Lake (USGS station number 05125039) on February 19. Streamflows were measured at the south fork of Filson Creek gage on March 18, April 28, May 13, June 19, and June 23. Streamflows were measured at the Keeley Creek gage on March 18, April 28, April 29, and June 18. Gage height is measured at each gage at 15-minute intervals, and the real-time data are available on the USGS National Water Information System web site (<http://waterdata.usgs.gov/mn/nwis/rt>). Continuous streamflow values will be available once a stream discharge/gage height rating curve is established with additional stream discharge measurements.

Continuous streamflow data were collected at the St. Louis River near Skibo, MN gage between January 1, 2014 and June 30, 2014. Streamflows were measured at the gage on January 28, March 10, April 15, April 23, and June 16.

A GIS with the distribution of bedrock units within each of the watersheds and all known outcrop locations was completed. Some bedrock samples in the Filson watershed were collected in May, 2014. Bedrock in outcrop in the Filson and Keeley Creek watersheds is abundant and representative samples easily accessible in the field. Some bedrock samples the St. Louis watershed were selected by Mark Severson (formerly NRRI) from the NRRI bedrock archive. Samples have been crushed and are ready for submittal for chemistry. Bedrock in the St. Louis watershed is sparse; possible sites have been located. Sampling trips for all watersheds have been planned.

### **Amendment Request of December 31, 2014**

We are requesting to shift funds between budget categories under Activities 1 and 2. Under Activity 1, we are requesting to shift funds from Natural Resources Research Institute Personnel (Mark Severson) to USGS Personnel. Mark Severson, a geologist assigned to work on Activity 1, has recently taken a permanent position with Teck American on their Mesaba Copper-Nickel deposit near Babbitt, and therefore will no longer be working on the project. The Natural Resources Research Institute does not currently have a qualified geologist to replace his position on the project. However, the USGS geologist already assigned to the project will be able to complete the work assigned to Mark with some of the ENRTF funds budgeted to Natural Resources Research Institute for the work. We are requesting \$13,800 be shifted from Natural Resources Research Institute Personnel to USGS Personnel to complete the work.

Under Activity 2 we are requesting to shift funds within USGS Contract to account for increases in USGS shipping costs and USGS water-quality sampling supplies costs, and a decrease in USGS travel costs. Additional USGS water quality assurance and quality control requirements for water-quality sampling have resulted in higher shipping and supplies costs. Travel costs (less vehicles, fewer overnight stays) have been reduced to compensate for these additional costs. We are requesting \$9,358 be shifted from USGS travel category to USGS water-quality sampling supplies category (\$9358) and \$3,897 be shifted from USGS travel category to USGS shipping category.

### **Project Status as of December 31, 2014:**

A first round of solid media sampling is complete. In August, samples of the basal contact of the Duluth Complex with the older Virginia Formation were collected from outcrop. These samples along with several samples collected in June were submitted for geochemical analysis in August using expiring USGS funds in Woodruff's geochemistry contract (no charge to LCCMR). Woodruff and Jennings collected both bedrock and soil samples from the three watersheds in September-October. Twenty-five additional bedrock samples were collected: 13 additional samples from the Filson watershed (for a total of 15 samples); 10 samples from the Keeley watershed, and 2 additional samples from the St. Louis watershed (for a total of 8 samples). Soils were collected from selected sites within watershed – up to 3 samples/site (an organic O horizon, and the soil A and C horizon, if all samples present – note: the activity of invasive earthworms often destroys the O horizon, so that sample is not always available). For the Filson (15 sites) and Keeley (14 sites) watersheds, sample sites were selected along transects that crossed most major rocks units. The glacial cover in this area is very thin, and typically rock clasts in the till reflect local bedrock. Where possible, soil samples were paired with bedrock samples. In the St. Louis watershed (13 sites), sample sites were selected based on the glacial deposit type. In this area the glacial cover is thick, and the depositional style controls soil parent material.

Soil samples were dried and sieved to < 2mm. All soil and bedrock samples have been submitted for analysis to the USGS geochemistry contract lab SGS for the following constituents: total C, carbonate C, Al, Ca, Fe, K, Mg, Na, S, Ti, Ag, Ba, Be, Bi, Cd, Ce, Co, Cr, Cs, Cu, Ga, Hg, In, La, Li, Mn, Mo, Nb, Ni, P, Pb, Rb, Sb, Sc, Se, Sn, Sr, Te, Th, Tl, U, V, W, Y, and Zn. Data should be back by late winter, 2015.

Streamflow was measured and a fourth and fifth rounds of water-quality sampling were completed in August 4-8, 2014 and September 29 – October 3, 2014, respectively, in the three study watersheds. During the fourth and fifth rounds of water-quality sampling, samples were collected at 9 sites on Filson Creek, 4 sites on Keeley Creek, and 7 sites on the headwaters of the St. Louis River. Water-quality sampling was done in cooperation with the U.S. Forest Service during both trips at one site on Filson Creek and one site on Keeley Creek. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes.

Continuous gage height data were collected and streamflows were determined between July 1, 2014 and December 31, 2014 at the south fork of Filson Creek (USGS station number 05124982) and Keeley Creek above

its confluence with Birch Lake (USGS station number 05125039), and between September 10 and December 31, 2014 at the St. Louis River near Skibo, MN gage (USGS station number 04015438). Continuous data at the St. Louis River near Skibo, MN gage were lost between April 22 and September 10 due to an inability to download the data from the data logger and pressure transducer present at the site. Continuous streamflows will be estimated for this data gap from streamflows measured at nearby stream gages.

Water-quality data were examined to determine trends within and across the three watersheds. Dissolved ion concentrations generally were low in all of the water-quality samples collected in the three watersheds, with specific conductance values for the all of the samples less than 110  $\mu\text{s}/\text{cm}$ . Waters generally were neutral to slightly acidic, with pH values ranging from 5.0 to 8.3. The lower pH values were likely related to stream water interactions with acidic waters in attached or nearby wetlands and bogs or more mineralized parts of local bedrock. Sulfate concentrations in all of the water samples were relatively low, less than 3.0 mg/L. The range of sulfate concentrations varied little with flow conditions and among the three watersheds. Concentrations for the major cations (calcium, magnesium, sodium, iron, manganese, and dissolved organic carbon) were higher during periods of lower flows. Dissolved copper and nickel concentrations in all of the water samples were less than 10 and 6  $\mu\text{g}/\text{L}$ , respectively, with the highest mean concentrations of both copper and nickel present in waters sampled from Filson Creek. Dissolved organic carbon concentrations were high in all three watersheds, with concentrations ranging from 17 to 46 mg/L. The streams and river likely obtain much of their dissolved organic carbon from interaction with waters from attached or nearby wetlands, which are abundant in all three watersheds.

Water-quality data were examined to assess stream water interactions with wetlands and groundwater. Dissolved organic carbon concentrations were compared to the percentage and topographic location of wetlands in the three watersheds to determine the relations between wetlands and water quality. Geographic Information System (GIS) coverages outlining hydrologic, geologic, and other physical characteristics for the three watersheds (Filson Creek, Keeley Creek, headwaters of the St. Louis River) were updated with lineament assessments in ArcMap 10. The lineament assessment identified possible structural features in the shallow bedrock in Filson and Keeley Creek watersheds that may influence water flow, and will be used with water-quality data to identify where groundwater flow may be prevalent in these two watersheds. Data interpretation and hydrologic models will be developed using these coverages. Base maps have been compiled into a GIS in ArcMap. These coverages include surficial and bedrock geology, hydrology, LiDAR, and historic geochemical data from MGS, DNR, and USGS data bases.

#### **Amendment Request of June 15, 2015**

We are requesting to shift funds between budget categories under Activity 1. In our previous amendment (December 31, 2014) we requested a shift funds from Natural Resources Research Institute Personnel (Mark Severson) to USGS Personnel. Recent discussions between USGS and MDNR geologists have determined that the MDNR geologist has the time and expertise to do the additional geologic work need for the project. However, the MDNR geologist will require some of the ENRTF funds budgeted to Natural Resources Research Institute for the work. We are requesting \$13,800 that was previously amended for USGS Personnel be shifted from Natural Resources Research Institute Personnel to MDNR Personnel to complete the work.

We would also like to request to change the project completion date from June 30, 2016 to December 31, 2016. Water-quality sampling will continue until September 2015. Analysis and review of the water-quality samples has taken approximately five months to complete (completion date: February 2016). Interpretation of all of the water-quality data and incorporation of the final water-quality data into hydrologic models and a draft copy of the final report will require five months to complete (completion date: July, 2016). The report review will require six months (completion date: December 2016). Changing the project completion date from June 30, 2016 to December 31, 2016 will allow for all of the water-quality data to be included in the final report. This change in the project completion date will not require any additional funding for the project.



We would also like to request that Steven Monson Geerts from NRRI be added to the project in June 2015 as a co-manager for the project. Steve Hauck, the current manager for the project, will be retiring in summer 2016, and Steve Monson Geerts would be replacing Steve Hauck's position.

**Project Status as of June 30, 2015:**

**Project Status as of December 31, 2015:**

**Project Status as of June 30, 2016:**

**IV. PROJECT ACTIVITIES AND OUTCOMES:**

**ACTIVITY 1: Characterize distribution of major and trace elements in streambed sediment, soil, and bedrock samples from mineralized and non-mineralized watersheds along the basal Duluth Complex.**

**Description:** Solid media (streambed sediments, soils, and bedrock) sampling will be conducted in the first year of the proposed work. A second round of solid media sampling from a reduced number of sites may be done if results from the first round identify areas of special geochemical interest. Collection sites for streambed sediments are in conjunction with water quality sites (Activity 2). Ten streambed sediment samples will be collected from Filson/South Filson Creeks, 4 streambed sediments will be collected from Keeley Creek, and 7 streambed sediments will be collected from the St. Louis River for a total of 21 streambed sediment samples. Within each of the 3 watersheds, 20 upland soil sites will be selected and 2 samples (topsoil/deeper soil) will be collected at each site, for a total of 120 soil samples. Also within each watershed, up to 10 bedrock samples will be collected from outcrop, supplemented by drill core samples for a total of 30 bedrock samples. Bedrock samples and the < 2 mm fraction of streambed and soil samples will be submitted to the USGS geochemistry contract laboratory (SGS) for total analysis for 48 major and trace elements. In addition, soils and streambed sediments will be analyzed by a partial leach method for 10 metals.

**Summary Budget Information for Activity 1:**

**ENRTF Budget:** \$ 119,858  
**Amount Spent:** \$ 44,720  
**Balance:** \$ 75,138

**Activity Completion Date:** 12/2015

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
Determine major and trace elements in 30 bedrock samples, 120 soil samples, and 21 streambed sediment samples in 3 watersheds, with the possibility of an additional round of sampling from a reduced number of sites	12/2015	\$ 119,858

**Activity Status as of December 31, 2013:**

Fine-grained (< 63 micron silt and clay) bed sediment samples were collected at 10 sites in the 3 study watersheds using USGS NAWQA protocols. Samples are dried and ready for analysis for 42 major and trace elements. Bedrock sample of the Virginia Formation collected from the St. Louis River watershed. Funding for the field work (salary and travel expenses = \$5,730) and supplies (\$260) was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

**Activity Status as of June 30, 2014:**

A GIS with the distribution of bedrock units within each of the watersheds and all known outcrop locations has been completed. Historical geochemical data layers that overlap the study areas, including soils, lake sediments, bedrock, and seepage analyses, have been added to the GIS. Carrie Jennings and Laurel Woodruff have examined the 1-meter hillshade LiDAR data for Lake and parts of St. Louis counties to develop a soil sampling strategy that will be based on the distribution of glacial materials. Mark Severson and Laurel Woodruff met to



discuss bedrock sampling. The funding for all future geochemical analyses of solid media has been committed to the UGSG geochemical contract. Currently available bedrock samples from the Filson and St. Louis watersheds and <63 micron sediment samples have been submitted for analysis. Environmental and Natural Resources Trust Funding for travel (\$163) and salary for Woodruff (\$6,128) between January 1 and June 30, 2014 was \$6,291.

**Activity Status as of December 31, 2014:**

Several of the < 63 micron stream sediment samples were had insufficient quantity for analyses, so a second round of collection is planned. A new sieve was purchased to ensure greater success with sample collection. A first round of soil and bedrock sampling is complete. Soil samples were dried and sieved to < 2mm. All soil and bedrock samples have been submitted for analysis to the USGS geochemistry contract lab SGS for the following constituents: total C, carbonate C, Al, Ca, Fe, K, Mg, Na, S, Ti, Ag, Ba, Be, Bi, Cd, Ce, Co, Cr, Cs, Cu, Ga, Hg, In, La, Li, Mn, Mo, Nb, Ni, P, Pb, Rb, Sb, Sc, Se, Sn, Sr, Te, Th, Tl, U, V, W, Y, and Zn. Geochemical data should be back by late winter, 2015. Thus, from June 30 to December 31, 2014 Environmental and Natural Resources Trust Funding for Activity 1, including these analyses (\$8650.28), field work expenses for Woodruff (\$806.69), sample shipping (\$26.61), a new 63 micron sieve (\$121.83), salary for Woodruff (\$28,944.83), field expenses for Jennings [DNR contract] (\$416.83) and salary for Jennings [DNR contract] (\$2329.14) were \$41,296.01.

**Activity Status as of June 30, 2015:**

**Activity Status as of December 31, 2015:**

**Final Report Summary:**

**Activity 2: Determine natural metal and major constituent loads in streams.**

**Description:** Streamflow will be continuously monitored at three USGS gage sites. One gage will monitor flow rates in Filson Creek , one gage on Keeley Creek, and a third gage, which has been operating since 2011, will monitor flow in the St. Louis River. Two USGS stream gages (Filson and Keeley Creeks) will be installed in the fall of 2013 and maintained for two years. Once the gages are in operation, stream discharge measurements will be taken between October 2013 and September 2015 under varying flow rates to develop a water-level/flow rating curve at each gage. This water-level/flow rating curve will be used with continuous water-level data collected at the gages to determine continuous flow data over the two years. Water quality samples will be collected from Filson/South Filson Creeks, Keeley Creek, and the St. Louis River between August 2013 and September 2015 and analyzed for 18 metals, 12 major constituents, and dissolved oxygen to determine temporal and spatial variations in metals, major constituents, and dissolved oxygen concentrations. A total of 96 samples (12 quarterly samples over 8 quarters) will be collected over the two years from the three streams under differing flow rates. Streamflow and water-quality data will be used to compute metal and major constituent loads in each of the stream systems and assess variations in loads under various flow rates.

**Summary Budget Information for Activity 2:**

**ENRTF Budget:** \$ 275,612  
**Amount Spent:** \$ 154,170  
**Balance:** \$ 121,442

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Determine temporal flow rates in streams/installation and maintenance of two stream gages	6/2015	\$ 127,240
2. Determine background metal and major constituent loads in streams	6/2015	\$ 148,372

**Activity Status as of December 31, 2013:**

Streamflow was measured and water-quality samples were collected between September 11-13 in the three study watersheds in northeastern Minnesota. The sample sites were located along, upgradient, or downgradient

of the basal Duluth Complex. Water-quality samples were collected at 5 sites on Filson Creek, 4 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes. All streamflow measurements and water-quality data were entered in USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>). Funding for this field work, including salary (\$20,520), travel expenses(\$3,350), shipping (\$462), vehicle expenses(\$400), water-quality analytical costs (\$12,100), and water-quality supplies (\$660), was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

Permits were submitted to the U.S. Forest Service, Superior National Forest to install continuous streamflow gages on Filson and Keeley Creek. These permits have yet to be approved, with final approval delayed in part by the federal government shutdown and retirements in the U.S. Forest Service. Continuous streamflow data were collected at the St. Louis River near Skibo, MN gage between July 1, 2013 and December 31, 2013. Streamflow measurements were measured at the gage on July 30, September 10, September 12, and October 22. Operation and maintenance costs for the St. Louis River near Skibo, MN gage between July 1, 2013 and December 31, 2013 was \$9,244 (\$5,546 charged to **ENRTF**, \$3,698 charged to U.S. Geological Survey Water Cooperative Program).

**Activity Status as of June 30, 2014:**

Streamflow was measured and a second and third round of water quality sampling were completed in April 28-May 1, 2014 and June 16-20, 2014, in the three study watersheds. Sample sites are located along, upgradient, or downgradient of the basal contact of the Duluth Complex. During the second round of water quality sampling, samples were collected at 5 sites on Filson Creek, 3 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. During the third round of sampling, water-quality samples were collected at 9 sites on Filson Creek, 4 sites on Keeley Creek, and 4 sites on the headwaters of the St. Louis River. During both sampling trips, poor road access and high water levels prevented access to some sites on Keeley Creek and on the headwaters of the St. Louis River. Water-quality sampling was done in cooperation with the U.S. Forest Service during both trips at one site on Filson Creek and one site on Keeley Creek. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes. All streamflow measurements and water-quality data were entered in USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>). Environmental and Natural Resources Funding for water-quality sampling between January 1 – June 30, 2014 was \$39,905, including expenses for salary (\$24,012), travel expenses (\$2,198), shipping expenses (\$545), vehicle expenses (\$500), water-quality analytical costs (\$9,449), and water-quality supplies expenses (\$3,201).

Permits were approved by the U.S. Forest Service, Superior National Forest to install continuous streamflow gages on Filson and Keeley Creek in February 12, 2014. The streamflow gages were installed on the south fork of Filson Creek (USGS station number 05124982) on March 13, and on Keeley Creek above its confluence with Birch Lake (USGS station number 05125039) on February 19. Streamflows were measured at the south fork of Filson Creek gage on March 18, April 28, May 13, June 19, and June 23. Streamflows were measured at the Keeley Creek gage on March 18, April 28, April 29, and June 18. Gage height is measured at each gage at 15-minute intervals, and the real-time data are available on the USGS National Water Information System web site (<http://waterdata.usgs.gov/mn/nwis/rt>). Continuous streamflow values will be available once a stream discharge/gage height rating curve is established with additional stream discharge measurements. Continuous streamflow data were collected at the St. Louis River near Skibo, MN gage between January 1, 2014 and June 30, 2014. Streamflows were measured at the gage on January 28, March 10, April 15, April 23, and June 16. Environmental and Natural Resources Trust Funding for stream gage installation and streamflow monitoring work between January 1 – June 30, 2014 was \$24,766.

**Activity Status as of December 31, 2014:**

Streamflow was measured and a fourth and fifth rounds of water-quality sampling were completed in August 4-8, 2014 and September 29 – October 3, 2014, respectively, in the three study watersheds. During the fourth and fifth rounds of water-quality sampling, samples were collected at 9 sites on Filson Creek, 4 sites on Keeley Creek, and 7 sites on the headwaters of the St. Louis River. Water-quality sampling was done in cooperation with the U.S. Forest Service during both trips at one site on Filson Creek and one site on Keeley Creek. Water-quality samples were submitted to the USGS National Water Quality Laboratory and EMERSC Stable Isotope Laboratory for analyses for total and dissolved concentrations of major constituents (ions) and trace metals, dissolved organic carbon, alkalinity, sulfate-sulfur, oxygen, and hydrogen isotopes. All streamflow measurements and water-quality data were entered in USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>). Environmental and Natural Resources Funding for water-quality sampling between July 1 and December 31, 2014 was \$69,072, including expenses for salary (\$28,743), travel expenses (\$4,707), shipping expenses (\$1,976), vehicle expenses (\$2,000), water-quality analytical costs (\$27,720), and water-quality supplies expenses (\$3,926).

Continuous gage height data was collected and streamflows were determined between July 1, 2014 and December 31, 2014 at the south fork of Filson Creek (USGS station number 05124982) and Keeley Creek above its confluence with Birch Lake (USGS station number 05125039), and between September 10 and December 31, 2014 at the St. Louis River near Skibo, MN gage (USGS station number 04015438). Continuous data at the St. Louis River near Skibo, MN gage was lost between April 22 and September 10 due to an inability to download the data from the data logger and pressure transducer at the site. The logger was sent back to the manufacturer to see if the gage height data could be recovered by specialists, but no data were recoverable. The data logger and pressure transducer were replaced with a new data logger and pressure transducer on September 10. Continuous streamflows will be estimated for this data gap from streamflows measured at nearby stream gages.

On-site streamflow measurements were done at the Keeley Creek gage on six days (June 24, July 21, August 6, September 16, September 29, and October 27), at the Filson Creek gage on six days (June 23, July 21, August 6, September 16, September 30, and October 27), and at the St. Louis River near Skibo, MN gage on six days (July 23, August 7, August 26, October 2, October 7, and November 24) between July 1, 2014 and December 31, 2014. These measurements were used to determine continuous stream discharge from continuous gage heights. Gage height is measured at each gage at 15-minute intervals, and the real-time streamflow and gage height data are available on the USGS National Water Information System web site (<http://waterdata.usgs.gov/mn/nwis/rt>). Environmental and Natural Resources Trust Funding for stream gage and streamflow monitoring work between July 1 and December 31, 2014 was \$14,881.

Water-quality data were examined to determine trends within and across the three watersheds. Dissolved ion concentrations generally were low in all of the water-quality samples collected in the three watersheds, with specific conductance values for the all of the samples less than 110  $\mu\text{s}/\text{cm}$ . Waters generally were neutral to slightly acidic, with pH values ranging from 5.0 to 8.3. The lower pH values were likely related to stream water interactions with acidic waters in attached or nearby wetlands and bogs or more mineralized parts of local bedrock. Sulfate concentrations in all of the water samples were relatively low, less than 3.0 mg/L. The range of sulfate concentrations varied little with flow conditions and among the three watersheds. Concentrations for the major cations (calcium, magnesium, sodium, iron, manganese, and dissolved organic carbon) were higher during periods of lower flows. Dissolved copper and nickel concentrations in all water samples were less than 10 and 6  $\mu\text{g}/\text{L}$ , respectively, with the highest mean concentrations of both copper and nickel present in waters sampled from Filson Creek. Dissolved organic carbon concentrations were high in all three watersheds, with concentrations ranging from 17 to 46 mg/L. The streams and river likely obtain much of their dissolved organic carbon from interaction with waters from attached or nearby wetlands, which are abundant in all three watersheds.

**Activity Status as of June 30, 2015:**

**Activity Status as of December 31, 2015:**

**Final Report Summary:**

**Activity 3: Assess hydrologic conditions prior to potential future mine development. Report all findings.**

**Description:** Existing hydrologic data and streamflow and water-quality data collected during Activity 2 will be used to develop a conceptual hydrologic model for each of the three watersheds between September 2014 and September 2015. The type of conceptual model (i.e., watershed rainfall/runoff model, groundwater-flow model) chosen to represent each watershed will be based on: 1) the main factors controlling stream water chemistry in each of the watersheds determined from the water-quality data and streamflow data collected during this study, and 2) the ability of the model to represent potential water-quality impacts from different mine settings (i.e., surface mine versus underground mine). Once constructed, these conceptual models will be used to assess hydrologic settings present in the watersheds prior to mine development and to assess potential mining-related impacts on water quality. A final interpretive report will be written, summarizing all collected data, interpretations, and hydrologic modeling results, and describing the regional geochemical and hydrological landscape.

**Summary Budget Information for Activity 3:**

**ENRTF Budget:** \$ 189,530  
**Amount Spent:** \$ 19,569  
**Balance:** \$ 169,961

**Activity Completion Date:**

Outcome	Completion Date	Budget
1. Develop conceptual hydrologic models – 3 watersheds	12/2015	\$ 23,598
2. Develop hydrologic scenarios of various mining activities – 3 watersheds	5/2016	\$ 90,419
3. Preparation of final interpretive report of all data and hydrologic modeling results	6/2016 12/2016	\$ 75,513

**Activity Status as of December 31, 2013:**

Geographic Information System (GIS) coverages outlining hydrologic, geologic, and other physical characteristics for the three watersheds (Filson Creek, Keeley Creek, headwaters of the St. Louis River) were constructed in ArcMap 10. LiDAR data for the study sites were also downloaded. The hydrologic models will be developed using these coverages. Funding for the construction of the GIS coverages (salary = \$13,700) was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

**Activity Status as of June 30, 2014:**

Additional Geographic Information System (GIS) coverages outlining hydrologic, geologic, and other physical characteristics for the three watersheds (Filson Creek, Keeley Creek, headwaters of the St. Louis River) were constructed in ArcMap 10. These coverages include surficial and bedrock geology, hydrology, LiDAR, and historic geochemical data from MGS, DNR, and USGS data bases. The hydrologic models will be developed using these coverages. Funding for the construction of the GIS coverages (salary = \$13,700) was provided by the U.S. Geological Survey Midwest Region Mining Initiative. Environmental and Natural Resources Trust Funding for this work between January 1 – June 30, 2014 was \$7,098.

**Activity Status as of December 31, 2014:**

Water-quality data were analyzed to assess stream water interactions with wetlands and groundwater. Dissolved organic carbon concentrations were compared to the percentage and topographic location of wetlands in the three watersheds to determine the relations between wetlands and water quality. Geographic Information System (GIS) coverages outlining hydrologic, geologic, and other physical characteristics for the three watersheds (Filson Creek, Keeley Creek, headwaters of the St. Louis River) were updated with lineament assessments in ArcMap 10. The lineament assessment identified potential features in the shallow bedrock in Filson and Keeley Creek watersheds, and will be used with water-quality data to identify where groundwater flow may be prevalent in the two watersheds. Data interpretation and hydrologic models will be developed

using these coverages. Base maps have been compiled into a GIS in ArcMap. These coverages include surficial and bedrock geology, hydrology, LiDAR, and historic geochemical data from MGS, DNR, and USGS data bases. Environmental and Natural Resources Trust Funding for this work between July 1 – December 31, 2014 was \$12,471.

**Activity Status as of June 30, 2015:**

**Activity Status as of December 31, 2015:**

**Final Report Summary:**

**V. DISSEMINATION:**

**Description:** A U.S. Geological Survey Scientific Investigations Report will be prepared that will summarize analytical results, present interpretations of bedrock, soil, streambed sediment, and water-quality data, and describe conceptual hydrologic modeling results. Presentations will be given at mining, geologic, and hydrologic conferences in the State outlining project results. Geochemical data for bedrock, soils, and streambed samples will be entered and stored in the USGS National Geochemical Database ([http://minerals.cr.usgs.gov/projects/geochem\\_database/index.html](http://minerals.cr.usgs.gov/projects/geochem_database/index.html)). Metal and major constituent concentrations for water samples collected in the project will be entered and stored in the USGS National Water Information System (NWIS) (<http://waterdata.usgs.gov/nwis>). A link on the NRRI website ([http://www.nrri.umn.edu/egg/pubs\\_nonferrous.html](http://www.nrri.umn.edu/egg/pubs_nonferrous.html)) will be established.

**Status as of December 31, 2013:**

On September 25, Perry Jones gave a presentation at the Lake Superior Cooperative Science and Monitoring Workshop in Duluth, MN outlining water-quality, streamflow, and bed-sediment sampling being conducted in the study. An abstract for a poster presentation was submitted to Minnesota Lake Superior Stream Science Symposium, to be held in Duluth, MN on January 7-8, 2014. The poster will summarize project objectives and activities to be done in the study. Funding for the workshop presentation preparation and attendance (salary and travel expenses = \$10,280) and the symposium abstract/presentation development (salary = \$ 4,940) was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

**Status as of June 30, 2014:**

Initial drafts of base map figures for the three watersheds were constructed. These figures will be used in the final report.

On April 11, Perry Jones participated in the Rainy River Headwater (RRHW) Core Team Meeting for MN Watershed Restoration and Protection Strategies (WRAPS) process, outlining the team on work done on this project.

A poster titled: *Potential for Copper Toxicity Caused by Surface Water and Stream Sediments in Unmined Mineralized Watersheds of the Duluth Complex*, by Nadine Piatak, Robert Seal, Perry Jones, and Laurel Woodruff (all USGS) was presented at the 60<sup>th</sup> Annual Meeting of the Institute on Lake Superior Geology, Hibbing, MN, May 15-16, 2014. Funding for the conference presentation preparation and was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

Perry Jones submitted an abstract to U.S. Environmental Protection Agency (EPA), which was accepted, for an oral presentation at the EPA National Conference on Mining-Influenced Waters in Albuquerque, NM from August 12-14, 2014. The presentation will summarize project objectives, activities, and initial findings. Funding for the conference presentation preparation and attendance (salary and travel expenses = \$13,100) will be provided by the U.S. Geological Survey Midwest Region Mining Initiative.

**Status as of December 31, 2014:**

Perry Jones gave an oral presentation outlining the water-quality data collected in this project in the characterization session of the U.S. Environmental Protection Agency (EPA) National Conference on Mining-Influenced Waters in Albuquerque, NM from August 12-14, 2014. Funding for the workshop presentation, preparation, and attendance (salary and travel expenses = \$13,100) was provided by the U.S. Geological Survey Midwest Region Mining Initiative.

Perry Jones attended the EPA Lake Superior Collaborative meeting in Duluth, Minnesota on November 19 and 20 to discuss water-quality data collection efforts in this study and other studies conducted in the Lake Superior basin. Funds from the Environmental and Natural Resources Trust Funding used for preparing and attending this meeting was \$1,000 (USGS personnel salary – covered under Activity 3 budget).

**Status as of June 30, 2015:**

**Status as of December 31, 2015:**

**Final Report Summary:**

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget:**

Budget Category	\$ Amount	Explanation
Personnel:	<del>\$ 61,800</del> \$ 48,000	A total of two positions at NRRI will be paid: A <b>Geologist</b> to assess bedrock geology.199 FTE ; <b>Project Manager</b> (1) to manage the project (.263 FTE) <b>total over three years.</b>
Professional/Technical/Service Contracts:	<del>\$ 518,200</del> \$ 532,000	<p><b>U.S. Geological Survey, (total: \$505,200)</b> (1) geologist to assess bedrock, glacial overburden, soil, and streambed samples. (.38FTE)  <b>Hydrologist</b> (1) to assess water-quality and loads in streams and conduct conceptual hydrologic models for the watersheds (.81 FTE);  <b>Hydrologic Technicians</b> (2) to collect and manage water-quality, bed-sediment, and streamflow data (.85 FTE and .1 FTE). All FTEs are expressed as a total over 3 years, not as an average for each year.</p> <p>Geochemical Laboratory - geochemical analysis of soil, bed-sediment, and bedrock samples (\$17,541). U.S. Geological Survey National Water-Quality Laboratory analysis of water-quality samples (major constituents, dissolved oxygen, and trace elements) (\$43,288). U.S. Geological Survey Minnesota Water Science Center, Data Section - installation and maintenance of two stream gages (\$116,507). Water-quality sampling equipment and supplies – e.g., peristaltic pumps, filters, sample bottles, preservatives for the samples, tubing for the</p>

		pumps (\$4,772). Printing: editing and publishing USGS Scientific Investigations Report (\$7,000). Shipping costs to send bedrock, soil, and streambed sediment samples to USGS Geochemical Laboratory, and send water-quality samples to USGS National Water-Quality Laboratory (\$1,395). Vehicle mileage, lodging, and meals costs for (2) bedrock, soil, and streambed sediment sampling trips and (2) water-quality sampling trips (\$44,582). <b>MN DNR (\$26,800)</b> ; One glacial geologist to assist with understanding and interpreting the effects of the glacial material in each watershed (.115 FTE total over 3 years). Mileage, lodging, and meals costs for (2) bedrock, soil, and streambed sediment sampling trips (\$1,000).
Travel Expenses in MN:	\$5,000	NRRI Vehicle mileage, lodging, and meals costs for (2) bedrock, soil, and streambed sediment sampling trips.
<b>TOTAL ENRTF BUDGET:</b>	<b>\$ 585,000</b>	All Items listed above

**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:** .462 FTE total over 3 years

**Number of Full-time Equivalent (FTE) estimated to be funded through contracts with this ENRTF appropriation:** 2.25 FTE total over 3 years

**B. Other Funds:**

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
<b>Non-state</b>			
U.S. Geological Survey Water Cooperative Program	<del>\$ 253,098</del> \$ 208,748	\$ 112,155	To cover computer, cell phone, office space, and other USGS MN Water Science Center costs for the project (estimated amount; not a specific match commitment)
U.S. Geological Survey Midwest Region Mining Initiative	\$ 216,000	\$ 216,000	To cover computer, cell phone, office space, conference travel, first round of streambed sediment/water-quality/streamflow sampling, and other USGS MN Water Science Center and Eastern Minerals Resources Science Center costs for the project (estimated amount, not a specific match commitment)
<b>TOTAL OTHER FUNDS:</b>	<del>\$ 469,098</del> \$ 424,748	\$ 328,155	To cover computer, cell phone, office space, and other USGS MN Water



			Science Center and Eastern Minerals Resources Science Center costs for the project
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**VII. PROJECT STRATEGY:**

**A. Project Partners:**

**Partners receiving funding from the Environment and Natural Resources Trust Fund**

**Duluth Minerals Section of the Natural Resources Research Institute [NRRI]: Steve Hauck** (Director) will co-manage the project; **Mark Severson** (geologist) will provide the bedrock samples and mineral deposit expertise. (~~\$66,800~~ \$48,000)

**U.S. Geological Survey: Laurel Woodruff** (geologist) will co-manage the project, overseeing streambed sediment, soil, and bedrock sampling and geochemical analyses; **Perry Jones** (hydrologist) will oversee stream gaging, water-quality sampling and analyses, and hydrologic model development. (\$505,200)

**Minnesota Department of Natural Resources: Carrie Jennings** (geologist,) will provide expertise on glacial and sediment geochemistry. (~~\$13,000~~ \$26,800)

**Collaborative partners not receiving funding from the Environment and Natural Resources Trust Fund**

U.S. Forest Service – Superior National Forest

Duluth Metals

Twin Metals Mining

Great Lakes Indian Fish and Wildlife Commission

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

Minnesota faces a daunting challenge. A world-class domestic resource for copper (Cu), nickel (Ni), cobalt (Co), platinum-group-elements (PGE) and titanium (Ti) hosted by rocks of the Duluth Complex in northeastern Minnesota could provide tremendous economic and employment benefits to that part of the State. However, northeastern Minnesota also contains the Boundary Waters Canoe Area Wilderness, one of the most pristine and environmentally sensitive regions of the country. The large tonnage of metals in the basal part of the Duluth Complex and increasing metal prices strongly suggest that metal mining in the area is inevitable. If regional details about current, existing surface water quality, and the concentration and distribution of elements in rocks, soils, and stream bed sediments are not available before mining begins, then it will not be possible for any regulatory agency to formulate accurate predictions of mining impacts on the environment. This lack of data could make it more problematic for mining companies to demonstrate remediation of mine sites to pre-mining ‘baseline’ water quality levels. Water-quality and modeling results will be compared to data available in the 1979 *Minnesota Environmental Quality Board Regional Copper-Nickel Study* to assess long-term trends in water quality. The new data and hydrologic analysis will be used by Federal, State, local, and tribal entities to better assess water-quality impacts of existing mineralization and potential mining.

**C. Spending History:**

Funding Source	M.L. 2007 or FY08	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13
U.S. Geological Survey Midwest Region Mining Initiative					\$72,500

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

**IX. MAP(S): N/A**

**X. RESEARCH ADDENDUM:**

Research Addendum will be added following USGS internal review.

**XI. REPORTING REQUIREMENTS:**

Periodic work program progress reports will be submitted not later than December 31, 2013, June 30, 2014, December 31, 2014, June 30 2015, and December 31, 2015. A final work program report and associated products will be submitted ~~between June 30 and August 1,~~ on-December 31, 2016 as requested by the LCCMR.

Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects

Project Title: How Do Natural Copper-Nickel Bedrocks Influence Water Quality?

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

Project Manager: Steven Hauck

M.L. 2013 ENRTF Appropriation: \$ 585,000

Project Length and Completion Date: 3 years, 06/30/2016

Date of Update: June 15, 2015

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Revised Activity 1 Budget 12/31/2014	Revised Activity 1 Budget 6/15/2015	Amount Spent	Balance	Activity 2 Budget	Revised Activity 2 Budget 12/31/2014	Amount Spent	Balance	Activity 3 Budget	Amount Spent	Balance	TOTAL BUDGET	Revised Total Budget 12/31/2014	Revised Total Budget 6/15/2015	TOTAL BALANCE
<b>BUDGET ITEM</b>	Characterize streambed sediment, soil, and bedrock chemistry				Determine natural metal and major constituent loads in streams				Assess hydrologic conditions prior to potential future mine development							
<b>Personnel (Wages and Benefits)</b>	<del>\$48,800.00</del>	<del>\$35,000.00</del>	<del>\$35,000.00</del>	\$0.00	<del>\$35,000.00</del>	\$0.00	\$0.00	\$0.00	\$0.00	\$13,000.00	\$0.00	\$13,000.00	<del>\$61,800.00</del>	<del>\$48,000.00</del>	<del>\$48,000.00</del>	<del>\$48,000.00</del>
Steve Hauck, Project Manager, Natural Resources Research Institute Director, \$38,400 (.263 FTE over 3 years, 36% fringe)																
Mark Severson, Natural Resources Research Institute Geologist, \$23,400 (.199 FTE over 3 years, 36% fringe)																
<b>Professional/Technical/Service Contracts</b>																
<b>USGS Contract Total</b>	<del>\$65,958.00</del>	<del>\$79,958.00</del>	<del>\$65,058.00</del>	\$44,719.93	<del>\$34,138.07</del>	<del>\$275,612.00</del>	<del>\$275,612.00</del>	<del>\$154,170.09</del>	<del>\$121,441.91</del>	<del>\$164,530.00</del>	<del>\$19,568.90</del>	<del>\$144,961.10</del>	<del>\$505,200.00</del>	<del>\$519,000.00</del>	<del>\$505,200.00</del>	<del>\$300,541.08</del>
<b>USGS Personnel</b>	<del>\$42,767.00</del>	<del>\$56,567.00</del>	<del>\$42,767.00</del>	<del>\$35,236.35</del>	<del>\$21,330.65</del>	<del>\$69,696.00</del>	<del>\$69,696.00</del>	<del>\$52,755.00</del>	<del>\$16,941.00</del>	<del>\$157,530.00</del>	<del>\$19,568.90</del>	<del>\$137,961.10</del>	<del>\$269,993.00</del>	<del>\$283,793.00</del>	<del>\$269,993.00</del>	<del>\$176,232.75</del>
Laurel Woodruff, U.S. Geological Survey, Geologist, \$55,497 (.38 FTE over 3 years, 30% fringe)																
Perry Jones, U.S. Geological Survey, Hydrologist, \$140,560 (.81 FTE over 3 years, 26% fringe)																
U.S. Geological Survey, Hydrologic Technician, \$63,203 (.85 FTE over 3 years, 22% fringe)																
U.S. Geological Survey, Hydrologic Technician, \$10,733 (.1 FTE over 3 years, 30% fringe)																
U.S. Geological Survey, Geochemical Laboratory - geochemical analysis of soil, bed-sediment, and bedrock samples	\$17,541.00	\$17,541.00	\$17,541.00	<del>\$8,650.28</del>	\$8,890.72							\$0.00	\$17,541.00	\$17,541.00	\$17,541.00	\$8,890.72
U.S. Geological Survey National Water-Quality Laboratory - analysis of water-quality samples (major constituents, dissolved oxygen, and trace elements)						\$43,288.00	\$43,288.00	\$37,168.62	\$6,119.38				\$43,288.00	\$43,288.00	\$37,168.62	\$6,119.38
U.S. Geological Survey Minnesota Water Science Center, Data Section - installation and maintenance of two stream gages						\$116,507.00	\$116,507.00	\$45,193.26	\$71,313.74				\$116,507.00	\$116,507.00	\$45,193.26	\$71,313.74
USGS Travel: Eastern Minerals Science Center Lodging/Meals/Vehicle Costs - for soil, bed-sediment, and bedrock sampling	\$4,500.00	\$4,500.00	\$4,500.00	\$806.69	\$3,693.31								\$4,500.00	\$4,500.00	\$4,500.00	\$3,693.31
USGS Travel: Minnesota Water Science Center Lodging/Meals/Vehicle Costs - for water-quality sampling and streamflow measurements						<del>\$40,082.00</del>	\$26,827.00	\$9,405.26	\$17,421.74				<del>\$40,082.00</del>	\$26,827.00	\$9,405.26	\$17,421.74
USGS Water-Quality Sampling Supplies - bottles, sampling tubing, filters, pumps						<del>\$4,894.00</del>	\$14,252.00	\$7,126.62	\$7,125.38				<del>\$4,894.00</del>	\$14,252.00	\$7,126.62	\$7,125.38
USGS Shipping Costs: Soil, Bed-Sediment, and Bedrock Samples	\$250.00	\$250.00	\$250.00	<del>\$26.61</del>	\$223.39								\$250.00			\$223.39
USGS Shipping Costs: Water-Quality Samples						<del>\$1,146.00</del>	\$5,042.00	\$2,521.33	\$2,520.67				<del>\$1,146.00</del>	\$5,042.00	\$5,042.00	\$2,520.67
USGS EPN Printing Costs										\$7,000.00	\$0.00	\$7,000.00	\$7,000.00	\$7,000.00	\$7,000.00	\$7,000.00
<b>MN DNR Contract Total</b>	<del>\$3,500.00</del>	<del>\$3,500.00</del>	<del>\$17,300.00</del>	\$0.00	<del>\$17,300.00</del>	\$0.00	\$0.00	\$0.00	\$0.00	<del>\$9,500.00</del>	<del>\$0.00</del>	<del>\$9,500.00</del>	<del>\$13,000.00</del>	<del>\$13,000.00</del>	<del>\$26,800.00</del>	<del>\$26,800.00</del>
Carrie Jennings, Minnesota Department of Natural Resources Glacial Geologist, \$12,000 (.115 FTE over 3 years, 30% fringe)	\$3,000.00	<del>\$3,000.00</del>	<del>\$16,300.00</del>	\$0.00	<del>\$16,300.00</del>					\$9,000.00	\$0.00	\$9,000.00	\$12,000.00	<del>\$12,000.00</del>	<del>\$25,300.00</del>	\$25,300.00
MN DNR Travel: Minnesota Department of Natural Resources Lodging/Meals/Vehicle Costs - for soil, bed-sediment, and bedrock sampling	\$500.00	<del>\$500.00</del>	<del>\$1,000.00</del>	\$0.00	<del>\$1,000.00</del>					\$500.00		\$500.00	\$1,000.00	<del>\$1,000.00</del>	<del>\$1,500.00</del>	\$1,500.00
<b>Travel</b>																
Natural Resources Research Institute Lodging/Meals/Vehicle Cost - for soil, bed-sediment, and bedrock sampling, management meetings	\$2,500.00	<del>\$2,500.00</del>		\$0.00	\$2,500.00					\$2,500.00	\$0.00	\$2,500.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00
<b>COLUMN TOTAL</b>	<b>\$119,858</b>	<b>\$119,858</b>	<b>\$119,858</b>	<b>\$44,720</b>	<b>\$88,938</b>	<b>\$275,612</b>	<b>\$275,612</b>	<b>\$154,170</b>	<b>\$121,442</b>	<b>\$189,530</b>	<b>\$19,569</b>	<b>\$169,961</b>	<b>\$585,000</b>	<b>\$585,000</b>	<b>\$585,000</b>	<b>\$380,341</b>