

M.L. 2016, Chp. 186, Sec. 2, Subd. 03h  
For the Period Ending June 30, 2019

**PROJECT TITLE:** State Spring Inventory for Resource Management and Protection – Phase II  
**PROJECT MANAGER:** Jim Berg  
**AFFILIATION:** Minnesota Department of Natural Resources  
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**WEBSITE:** <https://www.dnr.state.mn.us/>  
**FUNDING SOURCE:** Environment and Natural Resources Trust Fund  
**LEGAL CITATION:** M.L. 2016, Chp. 186, Sec. 2, Subd. 03h

**APPROPRIATION AMOUNT:** \$370,000  
**AMOUNT SPENT:** \$370,000  
**AMOUNT REMAINING:** \$0

### **Sound bite of Project Outcomes and Results**

The Minnesota Spring Inventory currently holds approximately 6,900 features. Fieldwork during this funding period added an additional 900 field verified spring locations. Approximately 800 additional locations were also added to the inventory through file searches and online citizen submittals with a DNR-created application.

### **Overall Project Outcome and Results**

Springs are natural points of groundwater discharge. Springs provide flow for:

- coldwater (trout streams) and cool water fisheries;
- base flow in streams during dry periods;
- create and sustain unique ecological habitats; and
- maintain the integrity of aquatic systems against invasive species.

Sustainable management of natural resources requires easily accessible location and feature characteristics data. Natural resources cannot be managed and conserved if we don't know where they are.

A permanent, web accessible map and comprehensive, easy to use database (Minnesota Spring Inventory, or MSI) was finalized and populated with spring locations and associated information that had been assembled through previous projects. The Minnesota Spring Inventory currently holds approximately 6,900 features including a combination of field verified and likely, but non-verified locations. Field work during this funding period included most of the state with much of the activity focused on the greater Twin Cities area, east central (St. Croix River valley), and western Minnesota (Minnesota River valley) for a total of 900 locations. Approximately 600 additional locations were added to the inventory through file searches, and an additional 200 likely locations were added through online citizen submittals with a DNR-created application.

Approximately 30 percent of the locations entered into the inventory during this funding period were seeps (groundwater flow rates less than a gallon per minute -- gpm). The remaining 70 percent of the locations were springs with flow rates as high as 100 gpm. Approximately 20 percent of the springs had flow rates of 10 gpm or greater. These higher flow locations were found in every portion of the state that was surveyed during this project.

These data can be accessed through the following link: [mndnr.gov/MnSpringInventory](http://mndnr.gov/MnSpringInventory). Data can be downloaded from the Minnesota Geospatial Commons: <https://gisdata.mn.gov/dataset/env-mn-springs-inventory>.

### **Project Results Use and Dissemination**

In March 2018, the Minnesota Spring Inventory web page went live: [mndnr.gov/MnSpringInventory](http://mndnr.gov/MnSpringInventory). The webpage has an online, interactive map that allows users to quickly find information about springs throughout the state. The webpage also provides a link to a reporting app that can be used by citizens on a desktop or mobile device to provide location and basic spring characteristic information. DNR staff evaluate these submittals for possible inclusion into the spring inventory. Background information about the project and springs are also available through the web page.

During this funding period the project was promoted (dissemination) through at least 28 formal documented outreach activities by 4 members of the spring inventory team including 17 presentations, 6 interviews and articles through media organizations, and 5 articles for science organizations. Numerous informal contacts have been made by team members and others.



# Environment and Natural Resources Trust Fund (ENRTF) M.L. 2016 Work Plan Final Report

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**Date of Report:** July 17, 2019

**Final Report**

**Date of Work Plan Approval:** June 7, 2016

**Project Completion Date:** June 30, 2019

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**PROJECT TITLE:** State Spring Inventory for Resource Management and Protection – Phase II

**Project Manager:** Jim Berg  
**Organization:** Minnesota Department of Natural Resources  
**Mailing Address:** 500 Lafayette Road  
**City/State/Zip Code:** St. Paul, MN 55155-4032  
**Telephone Number:** (651) 259-5680  
**Email Address:** jim.a.berg@state.mn.us  
**Web Address:** <https://www.dnr.state.mn.us/>

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**Location:** Statewide

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**Total ENRTF Project Budget:**

**ENRTF Appropriation:** \$370,000

**Amount Spent:** \$370,000

**Balance:** \$0

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**Legal Citation:** M.L. 2016, Chp. 186, Sec. 2, Subd. 03h

## **Appropriation Language:**

\$370,000 the second year is from the trust fund to the commissioner of natural resources to continue a systematic inventory of springs statewide to provide fundamental data needed to maintain spring flows and protect groundwater-dependent resources. Increased outreach to the public and other entities must be conducted to assist in the identification, documentation, and publication of spring locations. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

**I. PROJECT TITLE:** State Spring Inventory for Resource Management and Protection, Phase 2

**II. PROJECT STATEMENT:**

Springs are natural points of groundwater discharge. Springs provide flow for:

- coldwater (trout streams) and cool water fisheries;
- base flow in streams during dry periods;
- create and sustain unique ecological habitats; and
- maintain the integrity of aquatic systems against invasive species.

An existing research database of southeast Minnesota springs maintained by the Minnesota Geological Survey identifies about 2,600 of the estimated 15,000 to 22,000 springs statewide.

The goals of this project include expanding the number of springs in this inventory; verifying some spring locations and documenting important characteristics; and establishing a permanent, web accessible map and comprehensive, easy to use database (Minnesota Spring Inventory, or MSI) available to the people of Minnesota.

This project is a continuation of a current project to develop a statewide spring inventory. Significant progress has been made during the first year of the Phase 1 project with approximately 1,100 springs added to a working version of the database. The current spring inventory project is developing the procedures and methods for conducting spring mapping statewide, including evaluating the effectiveness of thermal imaging technology for certain areas.

Existing spring information from various agency records is being collected for inclusion in the statewide spring database that is in development. Responses to requests for information have been very positive. Citizens across the state have also supplied spring information and have been extremely enthusiastic and interested in the current project. Local governments have been very positive as well when contacted for information. This Phase 2 project will capitalize on this citizen appreciation of springs by promoting submittal of spring locations through a special email address.

The new database (MSI) will contain both reported and verified spring location information and physical, chemical, and historical data for spring sites if available. The current and proposed projects will maintain the spring inventory database at the Minnesota Department of Natural Resources for long-term management and public access.

Specific uses of these data include:

- Environmental Assessment Worksheet (EAW) and Environmental Impact Statement (EIS) resource. Springs and associated biota can be adversely affected or entirely eliminated by construction or development projects that pump groundwater.
- Impaired waters remediation strategies using Total Maximum Daily Load (TMDL) models. These surface water quality modeling efforts need reliable groundwater contribution data to produce accurate water quality estimates.
- Trout stream and calcareous fen management. Springs are commonly a major source of water to these critical natural resources. Understanding the contribution of associated springs is critical to predicting effects of nearby high capacity groundwater pumping through the appropriation permitting process.
- Local land and water management decisions. Springs have their own aesthetic and historical value that creates a special “sense of place” for local residents and visitors. Preserving springs contributes

to a love of the land and an environmental ethic that helps create a Minnesota quality of life. You can't protect something if there is no public or government awareness of its existence.

### III. OVERALL PROJECT STATUS UPDATES:

#### **Project Status as of December 30, 2016:**

The project is on track to create a functioning web accessible inventory database and citizen reporting application. The citizen app is for use on smartphones and other mobile devices or desktop computers to enlist public help in locating springs. We drafted an internal work plan that will guide fieldwork on public lands in the chief spring corridors. We established a routine to identify private landowners likely to have springs so that postcards can be sent to them requesting access to their property.

We learned more about spring related files kept by the Rochester office of the Minnesota Pollution Control Agency MPCA and have begun to examine them for spring that may not have already been entered into the inventory database. Limited field work was completed during this period to test procedures, applications and equipment.

#### **Project Status as of June 30, 2017:**

The web based application used by the project team was operational during this period. All the spring and seep features in the previous database (Karst features database) maintained by the Minnesota Geological Survey, were migrated to the new system. Use by the team helped identify needed enhancements to the application. These enhancements included adding additional base map options and redesigning the data entry interface. The application worked well in the field to collect new features (on ipads) and in the office to add attributes and edit features (on a desktop computer). By the end of this period approximately 600 seeps or springs had been entered into or edited in the database.

A much simpler Citizen application (<https://arcgis.dnr.state.mn.us/gis/CitizenSprings/>) was created for online mobile use by the public and has been available since February 2017. By the end of this period 142 locations had been submitted by the public.

#### **Project Status as of December 30, 2017:**

By the end of 2017 there were 4,357 springs in the database with approximately 1,800 springs entered or edited since the beginning of 2017. Significant field work areas during the past year have included the greater Twin Cities metro area and the valleys of the Minnesota and St. Croix rivers. Additional field work has included the North Shore of Lake Superior; southwestern and western Minnesota. Extensive editing of spring information and location corrections in the database have focused mainly on southeastern Minnesota.

#### **Amendment Request (1/5/2018)                      Amendment Approved by LCCMR 1-11-2018**

We request the following budget reductions:

Activity 1, Personnel (Overall Wages and Benefits) from \$245,000 to \$200,000

Activity 1, Professional/Technical/Service Contracts (Minnesota Geological Survey) from \$10,000 to \$6,716

Activity 1, Professional/Technical/Service Contracts (MNIT) from \$15,868 to \$15,800

Activity 1, Other (training, etc.) from \$2,000 to \$0

Activity 2, Equipment/Tools/Supplies from \$9,000 to \$5,000

We request the following budget increases:

Activity 2, Personnel (Overall Wages and Benefits) from \$31,179 to \$93,352

The main purpose of the proposed reductions is to provide more funds for field work. We have learned since the beginning of the project that there are fewer existing spring location records to compile and much more field

work required to discover new spring locations, verify locations of features in the existing karst features database (KFDB) that weren't accurately located, and recover historic spring locations such as Mankato Springs and the Sacred Heart geyser.

**Project Status as of July 13, 2018:**

Staff visited DNR Fisheries offices (St. Paul, Lake City, and Glenwood) to review paper documents stored on site and located material on 144 spring locations. The historic and valuable Surber linen map showing springs of the north shore has been georeferenced. Each spring on the Surber map was also evaluated for landownership status, nearness to roads, and accuracy of the location. This will be the basis for planning the next North Shore trip. Fieldwork was conducted at locations in Western Minnesota, East Central, Greater Twin Cities area, Southeastern Minnesota, and Southwestern Minnesota.

**Project Status as of December 30, 2018:**

**Office work** included stratigraphic data entry (182 springs) into the Minnesota Spring Inventory (MSI) database for locations in southeastern Minnesota. These stratigraphic data were from the Minnesota Geological Survey's analysis of southeastern Minnesota (Open File Report 18-02) that was completed for this project. Also in July and September, the list of evaluated properties for this project was updated. In September, the Dunn Library (St Croix Watershed Research Station) was visited and searched for records of spring locations. A 1920 Surber map showing the springs of St Croix State Park, and several other maps were found.

**Field work** included many locations in the greater Twin Cities area, east central, southwestern and northern Minnesota.

Amendment Request (1/18/2019)      Amendment approved by LCCMR (2/5/2019)

We request the following budget increases:

Activity 1, Personnel (Overall Wages and Benefits) from \$200,000 to \$232,543

Activity 1, Professional/Technical/Service Contracts (MNIT) from \$15,800 to \$16,750

We request the following budget reductions:

Activity 1, Professional/Technical/Service Contracts (MGS) from \$6,716 to \$6,543

Activity 2, Personnel (Overall Wages and Benefits) from \$93,352 to \$68,826

Activity 2, Equipment/Tools/Supplies from \$5,000 to \$1,254

Activity 2, Travel expenses from \$21,000 to 16,000

**Overall Project Outcomes and Results:** (information to be added here at the end of the project)

Springs are natural points of groundwater discharge. Springs provide flow for:

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Sustainable management of natural resources requires easily accessible location and feature characteristics data. Natural resources cannot be managed and conserved if we don't know where they are.

A permanent, web accessible map and comprehensive, easy to use database (Minnesota Spring Inventory, or MSI) was finalized and populated with spring locations and associated information that had been assembled through previous projects. The Minnesota Spring Inventory currently holds approximately 6,900 features including a combination of field verified and likely, but non-verified locations. Field work during this funding period included most of the state with much of the activity focused on the greater Twin Cities area, east central

(St. Croix River valley), and western Minnesota (Minnesota River valley) for a total of 900 locations. Approximately 600 additional locations were added to the inventory through file searches, and an additional 200 likely locations were added through online citizen submittals with a DNR-created application.

Approximately 30 percent of the locations entered into the inventory during this funding period were seeps (groundwater flow rates less than a gallon per minute -- gpm). The remaining 70 percent of the locations were springs with flow rates as high as 100 gpm. Approximately 20 percent of the springs had flow rates of 10 gpm or greater. These higher flow locations were found in every portion of the state that was surveyed during this project.

These data can be accessed through the following link: [mndnr.gov/MnSpringInventory](http://mndnr.gov/MnSpringInventory). Data can be downloaded from the Minnesota Geospatial Commons: <https://gisdata.mn.gov/dataset/env-mn-springs-inventory>.

**IV. PROJECT ACTIVITIES AND OUTCOMES:**

**ACTIVITY 1:** Inventory existing spring information (office) and data management

**Description:** Continue compiling existing and reported spring location information from Department of Natural Resources-Fisheries records, topographic maps, and other federal, state, and local sources. Determine and document, where possible, the geologic context of known springs.

<b>Summary Budget Information for Activity 1</b>	<b>Budget:</b>	\$283,920
	<b>Amount Spent:</b>	\$283,920
	<b>Balance:</b>	\$ 0

<b>Outcome</b>	<b>Completion Date</b>
<b>1.</b> Continue to compile existing and reported spring location information and enter reported data into the spring inventory database.	June 30, 2019
<b>2.</b> Manage and improve database; further develop and improve web usability of spring inventory data for public access.	June 30, 2019

**Activity Status as of December 30, 2016:**

Activity for this period was focused around finishing the development of the spring inventory database, and the citizen reporting application with MNIT staff. Development of the inventory database included collaboration and testing with key staff from the University of Minnesota (Calvin Alexander) and Minnesota Geological Survey (Bob Tipping). The citizen reporting application is currently functional and will be publicly available in early 2017. A publicity plan for the citizen app is currently being developed. A plan to promote the app is being developed.

An internal field work plan was developed for some of the main spring corridors of the state to hope us efficiently survey the state within the workplan budget. In addition, a safety plan (JSA) was developed for fieldwork.

**Activity Status as of June 30, 2017:**

DNR fisheries files on the Zumbro River Water Shed and White Water River Watershed were evaluated and checked for new locations. Documents from the DNR Lanesboro office were scanned and new locations entered into the database.

**Activity Status as of: December 30, 2017**

Binders of spring survey documents related to the Fillmore County geologic atlas were donated to DNR by Calvin Alexander. Attribute data were entered as needed. Locations of springs in Lyon, Mower and Winona counties were verified and recorded in the database. The Lyon County work focused on the Camden State Park area.

**Activity Status as of: July 13, 2018**

Staff visited DNR Fisheries offices (St. Paul, Lake City, and Glenwood) to review paper documents stored on site and located material on spring locations. The Surber linen map of the north shore has been georeferenced. Each spring was also evaluated for its landownership status, nearness to roads, and exactitude of location. This will be the basis for planning the next North Shore trip.

The original GLO survey maps and Salt Spring Lands maps for much of northwestern MN were georeferenced and spring locations turned into a shapefile that will help planning this upcoming winter's trips to western MN. A DNR-commissioned study of prime habitat for Hine's emerald dragonfly proved to be a gold mine of information about potential spring locations along the Mississippi River.

Staff Reviewed county history documents for southwest Minnesota to locate springs to be field-checked.

**Activity Status as of: December 30, 2018**

In July stratigraphic data (location in the geologic column or geologic formation) for 182 springs was entered into the Minnesota Spring Inventory (MSI) database for locations in southeastern Minnesota. These stratigraphic data were from the Minnesota Geological Survey's analysis of southeastern Minnesota (Open File Report 18-02) that was completed for this project. Also in July and September the list of evaluated properties for this project was updated.

In September the Dunn Library (St Croix Watershed Research Station) was visited and searched for records of spring locations. A 1920 Surber map showing the springs of St Croix State Park, and several other maps were found.

**Final Report Summary**

The spring inventory database, and the citizen reporting application were finished by MNIT staff in collaboration with key staff from the University of Minnesota (Calvin Alexander) and Minnesota Geological Survey (Bob Tipping). The citizen reporting application (citizen app) was functional in early 2017. The citizen app was promoted in DNR publications and media interviews. Other preparation work included field work plans and a field work safety plan.

Files evaluated for spring locations included:

- DNR fisheries files on the Zumbro River Water Shed and White Water River Watershed and documents from the DNR Lanesboro office.
- Binders of spring survey documents related to the Fillmore County geologic atlas including locations and attributes of springs in Lyon, Mower and Winona counties.
- Documents in the DNR Fisheries offices (St. Paul, Lake City, and Glenwood).
- A Surber linen map of the north shore was georeferenced and evaluated for its landownership status, nearness to roads, and exactitude of location.
- Original government land office (GLO) survey maps and Salt Spring Lands maps for much of northwestern MN.
- A DNR-commissioned study of prime habitat for Hine's emerald dragonfly along the Mississippi River.



- County history documents for southwest Minnesota.
- Stratigraphic data were from the Minnesota Geological Survey's analysis of southeastern Minnesota (Open File Report 18-02).
- Several maps at the Dunn Library (St Croix Watershed Research Station).
- A 1920 Surber map showing the springs of St Croix State Park.

In addition to all of these tasks and products, the costs of preparing for the field oriented activity (Activity 2) were included in Activity 1.

**ACTIVITY 2:** Field verification of existing spring information, inventory unmapped priority areas, and interoffice travel.

**Description:** Field verify compiled spring information to collect location, elevation, and site information such as geologic setting, aquifer source, flow, temperature, and the source of spring water if known. Enter data into the Minnesota Spring Inventory database for long-term management and web access to the public.

Conduct field surveys in unmapped priority areas to collect spring locations and site information such as geologic setting, aquifer source, flow, temperature, and the source of spring water if known. Unmapped priority areas include state parks, scientific and natural areas, wildlife management areas, state historic sites, state forests, and city, local, and possibly federal lands. Other priority areas are expected to be identified by detailed analysis of the verified spring data. Some interoffice travel is anticipated to gather records and to meet with state and local government staff.

<b>Summary Budget Information for Activity 2</b>	<b>ENRTF Budget:</b>	\$ 86,080
	<b>Amount Spent:</b>	\$ 86,080
	<b>Balance:</b>	\$ 0

<b>Outcome</b>	<b>Completion Date</b>
<b>1.</b> Field verify location and characteristics of compiled, preliminary spring information.	June 30, 2019
<b>2.</b> Conduct field surveys of springs in priority areas to locate and collect site-specific data	June 30, 2019

**Activity Status as of December 30, 2016:**

Field surveys were completed at Minneopa, Flandreau, and Fort Ridgely State Parks; Gaylord City Park, Camp Norseland. In addition, roughly a dozen springs discharging from several Paleozoic bedrock formations were found in the Root River and Zumbro River watersheds.

**Activity Status as of June 30, 2017:**

**Greater Twin Cities area** Cold Springs WMA, Golden Gate, Klabunde WMA, Whispering Ridge AMA, Camp Coldwater/Dogpark, Prairie Creek Forest SNA, Nerstrand SP; Baker, Elm, and Rebecca park preserves, Hajduk Springs, Chalybeate Springs, Irvine Street (St Paul), Lilydale claypits, Water Street (St. Paul), Kaposia Coast, BNSF bluffs, Renaissance Festival grounds, Highland Springs (St. Paul), Willowbrook Hatchery,

**Southeastern Minnesota** Hastings Sand Coulee SNA

**Southwestern Minnesota** St. Peter area, 7 Mile County Park, Swan Lake WMA, Hindeman Creek AMA, Beaver Falls County Park, Vicksburg County Park, Montevideo, Lac Qui Parle WMA, Big Stone Lake NWR,

Big Stone Lake, Mankato Springs, Henderson Brewery spring, Spring Island (Blue Earth River), Upper Sioux Agency SP, Skalbakken Co Pk.

**Western Minnesota** Glenwood Hatchery, Minnewashta Lake, Glacial Lakes SP, Lake Carlos SP, Bonanza Prairie SNA, Barnesville WMA, Fergus Falls Federal Wetland Management District, Mineral Lake, Inspiration Peak (Leaf Hills).

**St. Croix River Valley** St. John Ridge, Kettle River in St Croix SP, Douglas Fault in Kettle River SNA, Barns Spring AMA, St Croix SP —the Yellowbanks area, Crystal Spring, Lawrence Creek, Franconia Bluffs, Zavoral Creek gorge, Spring Brook AMA.

**Activity Status as of:** *December 30, 2017*

**Greater Twin Cities area** Mississippi River Valley, Ramsey County, Savage area, Crow-Hassan Park, Crow Spring County Park, North Sunrise County Park, North Branch area, Coon Rapids Regional Park, Spring Brook, Spring Hill Park, Checkerboard Park, Willowbrook springs, Indian Mounds Park, Battle Creek Park, Bunker Hills Park.

**Southeastern Minnesota** Fillmore County (15 springs).

**Southwestern Minnesota** Lac qui Parle Wildlife Management Area (3 spring lines were distinguished)

**North Shore of Lake Superior** Duluth area, Grand Marais area, Cascade River, Grand Portage National Monument several state parks. We have found that it is more productive to map springs along glacial beach lines than along stream courses.

**Activity Status as of:** July 13, 2018

**Western Minnesota** Lac qui Parle Wildlife Management Area (WMA), Big Stone Lake, Lake Traverse, Barnesville WMA, Glenwood area, New Ulm springs, Redwood falls waterworks springs, Alexander Ramsey Park, Spring Creek (Montevideo), Whispering Ridge AMA, Mustinka WMA, and Buffalo River SP.

**East Central** Lawrence Creek SNA, Bailey Newport Forest, and Marine on St Croix.

**Greater Twin Cities area** Old Cedar Rd, Shakopee waterfront, Louisville NWR sulfur springs, Murphy-Hanrehan Regional Park, and mapping the springs of Hastings and the Ravenna Trail, Northrop “black wall” springs along the Winchell Trail, and MSP area.

**Southeastern Minnesota** Chub Lake, Frontenac area, Fillmore (Camp Creek area and in and near the Choice WMA), Winona and Houston Counties.

**Southwestern Minnesota** Jackson, Lincoln, Lyon (Camden State Park), Nobles, and Rock Counties (Blue Mounds State Park).

**Activity Status as of:** *December 30, 2018*

**Greater Twin Cities area:** Spring mapping at Battle Creek Park, Overlook Park, Nicols Fen peat springs, Cedar Cliff series, I-694 springs, Minneapolis waterfront, High Bridge area (St. Paul), Cottage Grove Ravine, St Croix Bluffs Park, Ravenna Trail, Crosby Farm Park, Ft Snelling State Park, Shakopee Mill Canal, and Lake Rebecca (Hastings).

Many sites in eastern Washington County along the St. Croix River including: Browns Creek AMA, St Croix Boomsite, Pine Needles Reserve, Van Wie's property, Wolf Marina, Cedar Bend Trout Farm, St Croix Watershed Research Station, Arcola Bluffs, Valley Creek area. Much of the St. Croix valley work was remapping and refining locations that were estimated 20 years ago. These points with associated chemistry data were included in the Washington County Geologic Atlas, Part B.

**East Central** Spring mapping at Interstate SP, along MN 95, Rock Marsh WMA, and Banning State Park.

**Northern:** Duluth area (Chester Park), Iron Springs Bog Scientific and Natural Area (SNA), and Itasca State Park (source springs of the Mississippi River).

**Southwestern Minnesota:** Mankato and St. Peter areas.

### **Final Report Summary:**

A permanent, web accessible map and comprehensive, easy to use database (Minnesota Spring Inventory, or MSI) was finalized and populated with spring locations and associated information that had been assembled through previous projects. The Minnesota Spring Inventory currently holds approximately 6,900 features including a combination of field verified and likely, but non-verified locations. Field work during this funding period included most of the state with much of the activity focused on the greater Twin Cities area, east central (St. Croix River valley), and western Minnesota (Minnesota River valley) for a total of 900 locations. Approximately 600 additional locations were added to the inventory through file searches, and an additional 200 likely locations were added through online citizen submittals with a DNR-created application.

Approximately 30 percent of the locations entered into the inventory during this funding period were seeps (groundwater flow rates less than a gallon per minute -- gpm). The remaining 70 percent of the locations were springs with flow rates as high as 100 gpm. Approximately 20 percent of the springs had flow rates of 10 gpm or greater. These higher flow locations were found in every portion of the state that was surveyed during this project.

These data can be accessed through the following link: [mndnr.gov/MnSpringInventory](http://mndnr.gov/MnSpringInventory). Data can be downloaded from the Minnesota Geospatial Commons: <https://gisdata.mn.gov/dataset/env-mn-springs-inventory>.

### **V. DISSEMINATION:**

**Description:** This project will reduce the fragmentation of groundwater spring data by providing a single spatial database for all DNR collected spring data, consistent with DNR's enterprise hydrological data domain. It will facilitate cross-agency cooperation to manage and protect Minnesota's groundwater resources and provide standardized structure to store data for long-term retention. The completed spring inventory database should provide capability for sharing data collected by the DNR with the Minnesota Geological Survey in a way that is compatible with their karst feature database and create an efficient means to share this data with the public via the Minnesota Geospatial Commons and a web map application. The senior project staff for this project plan to present the project results at public meetings and conferences so that people who need to use this information know of its existence.

#### **Status as of December 30, 2016:**

We have conducted outreach programs or presentations for several organizations, including Master Naturalists, Minnesota Association of Soil and Water Conservation Districts (MASWCD), and MGWA. A geographic systems (GIS) shapefile of Hennepin County springs for the landslide hazards staff in the county.

#### **Status as of June 30, 2017:**

Greg Brick wrote an editorial for OUTDOOR NEWS and was interviewed by the *Great Lakes Echo* about the MSI. Jim Berg was interviewed by Minnesota Public Radio and KARE 11 about the MSI.

**Status as of December 30, 2017:**

Greg Brick promoted the MSI during this period through the following activities:

Day-long, hands-on workshop for the Master Naturalist's program, "SPRINGS OF THE TWIN CITIES ROAD TRIP, LEARN ABOUT THE MINNESOTA SPRING INVENTORY, HOW SPRINGS ARE CLASSIFIED AND HOW TO CONTRIBUTE" (August 17)

Paper and presentation for the St. Croix Research Rendezvous (held 10 Oct, 2017), "The Glacial Lake Lind Spring-Line of the St. Croix Valley," presenting the big picture on the springs of that valley as revealed by new mapping by MSI.

MPCA talk, "Spring Hunter's Diary: The Diversity of Minnesota Springs" (August 24)

Article The Glacial Lake Lind Spring-Line of the St. Croix Valley on the MSI for an upcoming MGWA Newsletter (December 2017).

Poster at the MGWA Fall Conference, "The Glacial Lake Lind Spring-Line of the St. Croix Valley," which reveals the most important pattern of springs north of Washington County.

Interview about MSI on Channel 6 (Duluth).

**Status as of July 13, 2018:**

Staff participated in the followed dissemination of MSI information:

January—Jeff Green presented the basics of the MSI at the Cascade Meadow Wetlands and Environmental Science Center as part of the Rochester Stormwater Speaker Series. John Barry spoke at the MPCA Water Issues Seminar about Karst of SE Minnesota, Minnesota Groundwater Tracer Database (MGTD) and MSI.

February – Greg Brick prepared an article on the Sacred Heart Geyser for their historical society newsletter. The article was also submitted to the MGWA Newsletter. Jeff Green presented the MSI and highlighted the citizen's app to the Master Naturalist class at Whitewater State Park

March – Greg Brick was interviewed by the Star Tribune in February for an article that appeared on March 18. St. Charles Press article by Jeff Green on karst, springs, MSI. MSI Presentation to DNR Region 4 staff by Greg Brick.

April-- A presentation was made by Jeff Green on springs and the Minnesota Spring Inventory to the Bluffview Montessori school students at Whitewater SP. The presentation was filmed by the park naturalists so they can use it with other school groups. After the presentation, DNR went in the field with the students to conduct an inventory of springs in an area of the park that had not been previously checked. Jeff Green presented at the MGWA Spring 2018 Conference on the MGTD/MSI. John Barry made a presentation to the National Karst Conference on MSI, SE MN Springs, MGTD.

May – Greg Brick was interviewed by KEYC reporter in New Ulm about the springs at DNR Region 4 Headquarters and he introduced the MSI to Three Rivers Parks staff. GovDelivery Notification was sent to over 3,000 email addresses about MSI Citizen App and the MGTD.

June – A summary paper on MSI was presented by Greg Brick at the Springs Stewardship Institute in Flagstaff, AZ. An article on MGTD and MSI appeared in the MGWA June 2018 newsletter.

**Status as of December 30, 2018:**

Greg Brick prepared and presented abstracts/posters at the MGWA Fall Conference: THE CRENOREGIONS CONCEPT IN MINNESOTA and GLACIAL BEACH SPRINGS OF MINNESOTA’S NORTH SHORE.

Greg Brick gave an outreach talk in Duluth to the Arrowhead Anglers meeting; posted YouTube videos about the spring-cut ravine and traveling springs; and gave an outreach talk and fieldtrip a group of students at the DNR Region 3 headquarters.

Greg Brick made a springs presentation to Corp of Engineers at the Historic River Days gathering on Nov. 13.

**Status as of June 30, 2019:**

On May 1 and June 5, 2019 a workshop and field trip were presented to county and other local government staff to highlight the results of the recently completed Washington County Groundwater Atlas. The spring inventory was explained to the group and specific springs near Stillwater were visited.

On March 25, 2019, Jeff Green made a presentation to the EQB board that included information about the spring inventory. The purpose of the meeting was to evaluate a proposal to prepare a Generic EIS for nitrates in the karst aquifers of SE Minnesota

In the March – April Conservation Volunteer Magazine an article titled “The Spring Hunters”, was published which included information about this project.

On May 30, 2019 – Karst Training was provided for DNR Region 3 staff in the LeRoy area, which included a discussion about the spring inventory.

**Final Report Summary:**

In March 2018, the Minnesota Spring Inventory web page went live: [mndnr.gov/MnSpringInventory](http://mndnr.gov/MnSpringInventory). The webpage has an online, interactive map that allows users to quickly find information about springs throughout the state. The webpage also provides a link to a reporting app that can be used by citizens on a desktop or mobile device to provide location and basic spring characteristic information. DNR staff evaluate these submittals for possible inclusion into the spring inventory. Background information about the project and springs are also available through the web page.

During this funding period the project was promoted (dissemination) through at least 28 formal documented outreach activities by 4 members of the spring inventory team including 17 presentations, 6 interviews and articles through media organizations, and 5 articles for science organizations. Numerous informal contacts have been made by team members and others.

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget Overview:**

Budget Category	\$ Amount	Overview Explanation
<b>Personnel:</b>		
Research Scientist 3		1 classified @ 0.1 FTE for two years, 74.2 % salary, 25.8 % benefits

Hydrologist 3		1 classified @ 0.3 FTE for two years, 73.3% salary, 26.7% benefits
Research Analysis Specialist		1 unclassified @ 1 FTE for two years, 79% salary, 21% benefits
Hydrologist 1 temporary		1 unclassified @ 0.6 FTE for two years, 100% salary
<b>subtotal</b>	\$301,369	
<b>Professional/Technical/Service Contracts:</b>		
Minnesota Geological Survey	\$6,543	Geologic interpretations of spring location data, field review of selected spring sites to confirm geologic conditions, and assistance and coordination with development of the spring inventory database. MN Geological Survey
MN.IT	\$16,750	Database and specialty programming services; web design and user support. MN.IT service level agreement
	\$25,132	Direct and Necessary Services*
<b>Equipment/Tools/Supplies:</b>		
Field equipment	\$1,254	Two field chemistry meters and probes (\$3,500), one field data tablet with GPS capabilities (\$1,000), sub-meter GPS data collector (\$4,000) and misc. tools and supplies for field data collection and equipment maintenance (\$500).
<b>Travel Expenses in MN:</b>	\$16,000	Fleet charges, lodging and meals for travel to statewide spring locations for on-site verification of reported springs and to find new locations. Provides funding for approximately 4 months of total field work time.
<b>Other:</b>	\$0	Required and necessary project personnel training for safety, technical, web and data management, and professional development in support of and to enhance the spring inventory project. This is not the same as the direct and necessary funding which is for office administration personnel and expenses and not project personnel.
	\$2,952	Expenses in support of developing presentations and communicating the results of this project at events such as the Minnesota Ground Water Association, the Minnesota Water Resources conference, or the Minnesota Area Watershed District. These presentations are an important part of outreach and dissemination.
<b>TOTAL ENRTF BUDGET:</b>		\$370,000

\*Estimated Direct and Necessary expenses include both Department Support Services (Human Resources \$5,820, IT Support \$11,176 Safety \$1,372, Financial Support \$4,464, Communications Support \$1,236, Planning Support \$829, and

Procurement Support \$235) and Division Support Services \$0. Department Support Services are described in the agency Service Level Agreement, and is billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services (Commissioner’s Office and Regional Directors) are not assessed. Division Support Services include costs associated with Division business offices and clerical support. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisitions, and funds that are passed-thru to other entities are not assessed Direct and Necessary costs for those activities. For this work plan, database development and maintenance activity (Activity 1) with an associated cost of \$15,868 has not been assessed Direct and Necessary costs.

**Explanation of Use of Classified Staff:** Any classified position paid for with ENRTF funds will either be 1) backfilled with a new position or 2) the work previously done by this position will be delayed, eliminated, or completed by the start of the project.

There are two classified positions currently working on a separate ENRTF project to be paid partially by this grant: 1) Hydrologist 3 (0.3 FTE) provides technical expertise in the subject matter which will add value to the database design and the development of procedures and methods. 2) Research Scientist 3 (0.1 FTE) who will be managing the project.

**Explanation of Capital Expenditures Greater Than \$5,000:** N/A

**Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:** 4.0 FTE

**Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:** 0.2 FTE

**B. Other Funds:**

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state, state, and federal			We anticipate getting help from a full range of government entities and resource management organizations. These entities are often eager to provide in-kind assistance with technical guidance and known spring locations. Assistance for the first phase of the spring inventory has been received from: University of Minnesota – Departments of Entomology and Earth Sciences; Minneapolis Park & Recreation Board; Wisconsin Geological and Natural History Survey; US Forest Service; City of Grand Marais; Cook County SWCD; and several Watershed Management Organizations.
<b>TOTAL OTHER FUNDS:</b>	\$ N/A	\$	

**VII. PROJECT STRATEGY:**

**A. Project Partners:** The Minnesota Geological Survey will assist with geologic interpretations of spring location data, field review of selected spring sites. They will also provide assistance and coordination with development of the spring inventory database.

**B. Project Impact and Long-term Strategy:** Springs are natural features that return groundwater to surface waters. The groundwater that discharges from springs is critical for maintaining surface stream flow in Minnesota’s streams and rivers. The quantity and quality of that water has a direct impact on surface water

ecosystems and human use of those rivers and streams. This information is critical for Total Maximum Daily Load (TMDL) implementation strategies, impaired waters remediation; trout stream management, groundwater protection and allocation issues, and local land and water management decisions. The Minnesota Spring Inventory is part of a long-term continuing need to identify, assess, and monitor all parts of the hydrologic cycle so that observed or projected hydrologic system response to change, whether climatic or anthropogenic, can be measured and accurately evaluated. The long-term strategy is to conduct the inventory and establish the Minnesota Spring Inventory at DNR as an ongoing hydrologic cycle database on the same basis as the existing DNR stream gaging, groundwater level monitoring, lake level, climatology, and related hydrologic cycle databases. On-going support of the spring inventory database will be needed to assure the assembled data are current and remain accessible to users.

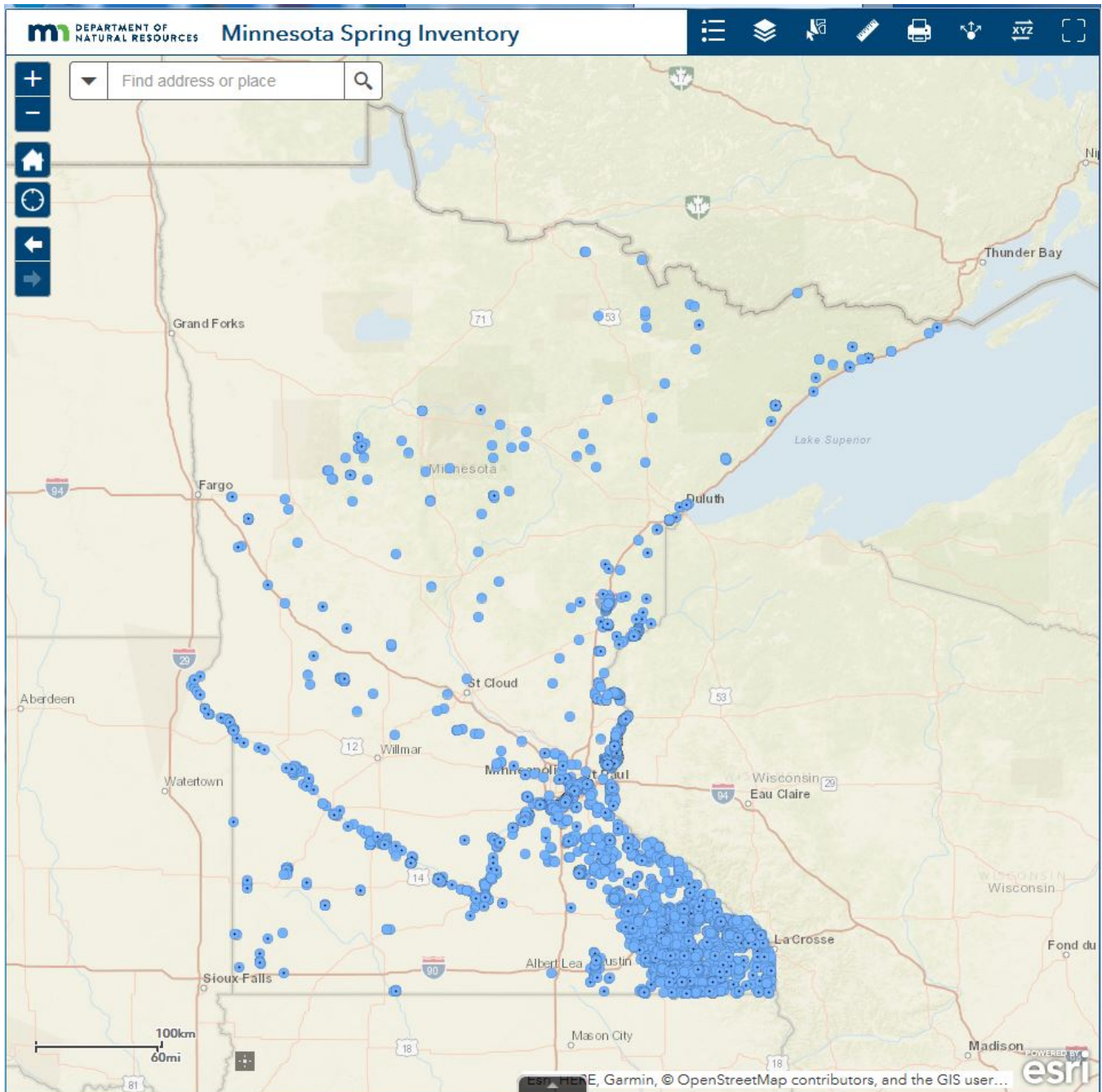
**C. Funding History:**

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
Minnesota Spring Inventory for Resource Management and Protection (Phase 1) M.L. 2014, Chp. 226, Sec. 2, Subd. 05b	July 1, 2014 to June 30, 2017	\$200,000

**VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS: N/A**

**IX. VISUAL COMPONENT or MAP(S):**





**Spring locations as of July 2019 that are currently in the DNR Minnesota Spring Inventory. The goals of this project include expanding the number of springs in this inventory; verifying some of these spring locations and documenting important characteristics; and established a permanent, web accessible map and comprehensive database.**

**X. RESEARCH ADDENDUM: N/A**

**XI. REPORTING REQUIREMENTS:**

**Periodic work plan status update reports will be submitted no later than *December 30, 2016, June 30, 2017, and December 30, 2017, June 30, 2018, and December 30, 2018.* A final report and associated products will be submitted between **June 30 and August 15, 2019.****

**Environment and Natural Resources Trust Fund**  
**M.L. 2016 Project Budget**

**Project Title:** State Spring Inventory for Resource Management and Protection – Phase II

**Legal Citation:** M.L. 2016, Chp. 186, Sec. 2, Subd. 03h

**Project Manager:** Jim Berg

**Organization:** Minnesota Department of Natural Resources

**M.L. 2016 ENRTF Appropriation:** \$ 370,000

**Project Length and Completion Date:** 3 Years, July 1, 2016 through June 30, 2019

**Date of Report:** July 17, 2019



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
<b>BUDGET ITEM</b>								
<b>Personnel (Overall Wages and Benefits)</b>	\$232,543	\$232,543	\$0	\$68,826	\$68,826	\$0	\$301,369	\$0
Research Scientist 3 - 1 classified @ 0.1 FTE for two years, 74.2 % salary, 25.8 % benefits. Project manager (A1 \$24,000, A2 \$0)								
Hydrologist 3 - 1 classified @ 0.3 FTE for two years, 73.3% salary, 26.7% benefits (A1 \$55,000, A2 \$12,000)								
Research Analysis Specialist - 1 unclassified @ 1 FTE for two years, 79% salary, 21% benefits (A1 \$124,000, A2 \$13,000)								
Hydrologist 1 temporary - 1 unclassified @ 0.6 FTE for two years, 100% salary. Field and project support. (A1 \$42,000, A2 \$14,000)								
<b>Professional/Technical/Service Contracts</b>								
Geologic interpretations of spring location data, field review of selected spring sites to confirm geologic conditions, and assistance and coordination with development of the spring inventory database. MN Geological Survey	\$6,543	\$6,543	\$0		NA	NA	\$6,543	\$0
Database and specialty programming services; web design and user support. MN.IT service	\$16,750	\$16,750	\$0		NA	NA	\$16,750	\$0
Direct and Necessary expenses include both Department Support Services (Human Resources \$5,820, IT Support \$11,176 Safety \$1,372, Financial Support \$4,464, Communications Support \$1,236, Planning Support \$829, and Procurement Support \$235)	\$25,132	\$25,132	\$0				\$25,132	\$0
<b>Equipment/Tools/Supplies</b>								
Field equipment such as current meters, data loggers, specific expenses for use of specialized field data tablets to collect field data, waders, hip boots, GPS equipment, GIS or specialty software, and misc. tools and supplies for field data collection and equipment maintenance.		NA	NA	\$1,254	\$1,254	\$0	\$1,254	\$0
<b>Travel expenses in Minnesota</b>								
Fleet charges, lodging and meals for travel to statewide spring locations for on-site verification of reported springs and to find new locations. Fleet estimated using \$0.575/mile and meal costs according to MAPE contract.		NA	NA	\$16,000	\$16,000	\$0	\$16,000	\$0
<b>Other</b>								
Required and necessary project personnel training for safety, technical, web and data management, and professional development in support of and to enhance the spring inventory project. This is not the same as the direct and necessary funding which is for office administration personnel and expenses and not project personnel.		\$0	\$0		NA	NA		\$0
Expenses in support of developing presentations and communicating the results of this project at events such as the Minnesota Ground Water Association, the Minnesota Water Resources conference, or the Minnesota Area Watershed District. These presentations are an important part of outreach and dissemination.	\$2,952	\$2,952	\$0		NA	NA	\$2,952	\$0
<b>COLUMN TOTAL</b>	<b>\$283,920</b>	<b>\$283,920</b>	<b>\$0</b>	<b>\$86,080</b>	<b>\$86,080</b>	<b>\$0</b>	<b>\$370,000</b>	<b>\$0</b>