2016 Project Abstract

For the Period Ending June 30, 2019

PROJECT TITLE: Completing National Wetland Inventory Update for Minnesota
PROJECT MANAGER: Steve Kloiber
AFFILIATION: Minnesota DNR
MAILING ADDRESS: 500 Lafayette Road, Box 25
CITY/STATE/ZIP: St. Paul, MN 55155
PHONE: 651-259-5155
E-MAIL: steve.kloiber@state.mn.us
WEBSITE: http://www.dnr.state/mn.us/eco/wetlands/nwi_proj.htm
FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2016, Chp. 186, Sec. 2, Subd. 03e

APPROPRIATION AMOUNT: $ $1,500,000
AMOUNT SPENT: $1,489,060
AMOUNT REMAINING: $10,940

Sound bite of Project Outcomes and Results

Completing the statewide update of the National Wetland Inventory (NWI) was a key objective of the strategy to ensure healthy wetlands and clean water for Minnesota. These data are used by government, private industry and non-profit organizations for land use planning, wetland conservation, wetland permitting and environmental impact assessment.

Overall Project Outcome and Results

The National Wetlands Inventory (NWI) update project was a collaborative effort lead by the Minnesota DNR that:

- Developed new methods for integrating lidar data into wetland mapping,
- Created of a suite of lidar-derived topographic datasets to assist with wetland mapping,
- Acquired new statewide, high-resolution spring leaf-off aerial imagery,
- Completely re-mapped and classified all wetlands larger than 0.5-acre in size,
- Engaged stakeholders in the development and review of the updated data,
- Enhanced the NWI with additional attributes, and
- Efficiently delivered data to various user groups through multiple means.

These data replace the original 1980s NWI data. In this final phase of the overall effort, we updated wetland inventory maps for the remaining 20,700 square miles of northwestern Minnesota covering 19 counties. All the wetland data from each project phase has been edge-matched to create a single statewide wetland inventory containing nearly 2.4 million wetland polygons.

Quality assurance of the data included visual inspection, automated checks for attribute validity and consistency, as well as a formal accuracy assessment based on independent field data. The updated NWI data have a 95% user accuracy for wetland identification. Further details on the methods employed can be found in the technical procedures document for this project located on the DNR wetland-mapping website.

Project Results Use and Dissemination

Wetland map data developed by this project are freely available through web-based data distribution hubs and online viewing through web mapping applications including the Minnesota Geospatial Commons and the DNR Wetland Finder. The final statewide updated data were posted to these distribution points on May 31, 2019.

The DNR issued a press release on June 3, 2019 announcing the availability of the statewide NWI. The DNR also included social media posts regarding this release. The story was picked up by several media outlets. The DNR developed a web application to support ongoing stewardship of the NWI data. The web application provides a simple and consistent method for state and local wetland professionals to submit change requests to the DNR. DNR plans to incorporate these user requests into annual updates of the NWI.

The DNR also developed a NWI User Guide and Summary Statistics. This guide provides a brief overview of the potential uses, limitations, access and technical aspects of the Minnesota Wetland Inventory. This guide also provides summary statistics of wetland types by county and major watershed. Printed copies are being distributed to local Soil and Water Conservation Districts, BWSR wetland specialists, DNR area hydrologists, and others. In addition, the DNR developed and printed 1000 copies of a map poster. These are being sent to a broad array of potential users of the NWI including SWCDs and local government units.

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

Date of Final Report: October 31, 2019

Date of Work Plan Approval: June 7, 2016

Project Completion Date: June 30, 2019

Does this submission include an amendment request? _No_

PROJECT TITLE: Completing National Wetland Inventory Update for Minnesota

Project Manager: Steve Kloiber

Organization: Minnesota DNR

Mailing Address: 500 Lafayette Road North, Box 25

City/State/Zip Code: St. Paul, MN 55155-4025

Telephone Number: (651) 259-5164

Email Address: steve.kloiber@state.mn.us

Web Address: http://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html

Location: Nineteen counties in northwestern Minnesota: Pope, Stevens, Traverse, Grant, Douglas, Otter Tail, Wilkin, Clay, Becker, Clearwater, Mahnomen, Norman, Polk, Red Lake, Pennington, Marshall, Kittson, Roseau, Lake of the Woods.

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$1,500,000**
	Amount Spent:	**$1,489,060**
	Balance:	**$10,940**

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

Appropriation Language:
$1,500,000 the second year is from the trust fund to the commissioner of natural resources to complete the update and enhancement of wetland inventory maps for counties in central and northwestern Minnesota. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Completing the National Wetland Inventory Update for Minnesota

II. PROJECT STATEMENT:
Over the past 100 years, about half of Minnesota's original 22 million acres of wetlands have been drained or filled. Some regions have lost more than 90 percent of their original wetlands. The function and quality of remaining wetlands are often impaired. Updating the National Wetland Inventory (NWI) is a key component of a strategy to monitor and assess wetlands to ensure healthy watersheds and clean water for Minnesota.

- NWI is the only comprehensive inventory of wetlands for Minnesota. To protect wetlands, we need to know how many wetland acres we have and where they are. Unfortunately, the original NWI is 30 years out-of-date and not very accurate in many locations, partly due to its age and partly due to the limitations of the mapping technology at the time it was produced.
- NWI is an important screening tool for land use planning and for evaluating potential wetland impacts. Having accurate wetland inventory data is critical for state, regional, and local agencies when evaluating the potential impact of proposed projects and striving to preserve the integrity of our remaining wetlands. Wetland programs such as Minnesota's Wetland Conservation Act and the US Army Corps' Clean Water Act Permit Program rely on the NWI as the initial resource for evaluating these impacts. Having accurate maps upfront prevents problems later on; saving time and money for permit applicants and wetland program managers as well as preventing wetland impacts.
- NWI is useful for wetland restoration and conservation planning. The NWI includes information about wetlands that helps identify potential restoration opportunities such as partially drained wetlands. In addition, the updated NWI will provide enhanced attributes to support assessment of wetland functions like flood storage capability, water quality protection, and wildlife habitat. Information on which wetlands are providing what benefits helps conservation professionals make better decisions about where to use restoration funding.

This project phase will:

- Complete the update NWI maps for the remaining 19 counties in northwestern Minnesota (20,700 mi^2)
- Conduct a pilot demonstration using the updated NWI to assess wetland function and develop a report

Through previous project phases, we have already acquired statewide high-resolution (0.5 meter & 1-foot) aerial imagery. Wetland maps will be produced by contractors under the supervision of the DNR. All wetland map data will be available free of charge to the public.

III. OVERALL PROJECT STATUS UPDATES:

Amendment Request (8/30/19) – Amendment Approved by LCCMR (10/3/19)
This final amendment request for this project is intended to reconcile unanticipated small negative balances in the software budget line ($488) and to add a line item for the conference registration fee to present the NWI project results at the 2018 MN Water Resources Conference ($250). Overall, the project has a net positive budget balance of $7,349.

Amendment Request (6/24/19) – Amendment Approved by LCCMR (6/25/19)
As the project winds down, there is a need to shift a small amount of funding from a budget item with an expected surplus to an item with an expected shortfall. We propose to shift $2,400 from graphical design and desktop publishing support to service level agreement with MNIT for project management and application development. The costs for the MNIT SLA is split 75% for activity 1 and 25% for activity 2, resulting in a shift of $600 from activity 1 to activity 2. There is no change to the overall budget.

Amendment Request (6/6/19)

The DNR has recomputed the Direct and Necessary Costs for this project and will not be charging for the remaining $5,891.53. We propose to redirect these funds to the MNIT service level agreement to help support project closeout, documentation, and archiving additional project related information. This will also allow us to prepare a copy of the data to submit to the federal wetland inventory database managed by the USFWS. This will provide an additional source for people to access the data. There is no change to the overall budget.

Amendment Request (3/8/19) – Amendment Approved by LCCMR (3/12/19):
As the NWI update project approaches completion, we have realized some cost savings. We are proposing to re-allocate these savings toward developing and publishing a user guide for the NWI data and a promotional wall map. The purpose of the user guide will be to help potential users of the NWI data understand the data and use it more effectively for natural resource analysis and decision support. The user guide will include information on how the data were developed, limitations, how to access the data, and example applications. We will also develop a poster or wall map of the NWI data conceptually similar to the one that was developed for the original NWI data in Minnesota in the mid-1980s. The poster will show the data and provide key messages about the variety of wetlands in Minnesota and their many ecological benefits. This will be done as part of the project outreach and to aid in disseminating the project results. We will move $9,000 from the budget line for IT support to a new budget line for DNR graphical design and desktop publishing support. In addition, we will shift the unspent balances from the budget lines for supplies and travel to a new budget line for printing costs. The total amount of this shift is $5,287.

Project Status as of January 31, 2017:
The project began with issuing a request for proposals for wetland mapping services. St. Mary's University (SMU) was selected as the best value proposal for the northwestern Minnesota NWI update. A service level agreement was also developed with the DNR Resource Assessment Program (RAP) to support the project. RAP will be pre-processing data and providing it to SMU. RAP will also be participating in field work and quality control review of draft NWI data. A sole source contract was also developed with the St. Croix Watershed Research Station (SCWRS) to develop, test, and disseminate methods for landscape level wetland functional assessments using the updated NWI data. A project kick-off meeting was held on October 7, 2016 to coordinate various aspects of this project.

SMU has developed a draft technical procedures document to guide the NWI update for northwestern MN. Initial field work was conducted to develop and refine wetland photo-interpretation signatures for the project area. In addition, SMU has developed draft wetland inventory data for 10 quarter quadrangle tiles for initial review by the DNR.

RAP has been working on compiling and pre-processing data. RAP has completed and delivered the several LiDAR derived layers for the NW NWI Study Area.

SCWRS has compiled and reviewed available data for the wetland functional assessment demonstration. In particular the availability of hydro-modified DEMs that are co-located with available updated NWI data in southern and east-central MN. The hydro-modified DEM is an important component of a potential wetland functional assessment because it can be used to analyze the flow paths and watersheds of wetlands. SCWRS has selected four pilot watershed areas for this part of the project; Yellow Medicine headwaters, Lake Wakanda, Madison Lake, and Browns Creek.

Amendment Request (6/2/2017) – Approved by LCCMR (6/27/2017):
As the NWI update project approaches completion, we have realized some cost savings. Savings for the northwest Minnesota update include $65,000 in IT personnel time as a result of the project being completed earlier than originally anticipated. We are proposing to re-allocate these savings to make some important improvements to the overall statewide data layer focusing on two tasks; improving and integrating the NWI data

for the Koochiching pilot study area and conducting a statewide quality assurance review of the database attributes to ensure consistency across project boundaries.

The very first effort on the statewide update of the NWI for Minnesota included a pilot study area covering an area defined by 50 USGS quarter quad maps in Koochiching County. This pilot was performed by the Resource Assessment Office of the Minnesota DNR as part of technology transfer involving the University of Minnesota and Ducks Unlimited. The data for the Koochiching pilot area have differences in terms of both the quality of the line work for wetland boundaries as well as some differences in how classifications were assigned. This pilot area requires additional editing and review to resolve these differences. This task will use the pilot data and other data sources including lidar elevation, imagery, and soils to create final updated NWI data for this area and to integrate it with the final NWI data for the adjacent areas through an edge-matching process. The data will undergo a complete QA/QC review including an evaluation using the U.S. Fish and Wildlife Service's QA/QC tool. Any issues found using this tool will be fixed prior to the edge-matching and integration. The additional cost for performing this work to finalize and integrate the NWI data for the Koochiching pilot area is $30,000. This work is proposed as a contract amendment under the current northwest Minnesota NWI update with St. Mary's University of Minnesota.

In addition, changes in personnel, federal mapping guidance, and method improvements over time have resulted in some inconsistencies in database attributes across project boundaries. This task will involve conducting a graphical and/or statistical analysis of key attribute variables across the assembled statewide NWI data layer to identify inconsistencies and to address these inconsistencies wherever possible. The attributes evaluated will include:

- Cowardin wetland classification codes and specific components including water regime classes and special modifiers
- Simplified hydrogeomophic classifications and specific components including landscape class, landform/waterbody class, and water flow path

The wetland mapping contractor will conduct a review and analysis of the data and prepare a technical memorandum describing the type and extent of issues found. The analysis will focus on ensuring that all attribute values are considered valid values and that the values are applied with reasonable consistency across the entire statewide data layer. We anticipate that some issues will be addressed with a simple search and replace text process, while other issues may require a more sophisticated selection process. The DNR, with input from the technical advisory committee, will prioritize the issues considering both the potential impact as well as the level of effort required to address the issue. The DNR will direct the contractor to address any issues using the prioritized issue list. If there are any issues that were identified that cannot be addressed within the budget and time constraints, they will be documented in the final metadata and added to a list of issues to be handled in the ongoing maintenance of the data. The additional cost for performing this additional QA/QC analysis and addressing these issues for the final statewide seamless data layer is $35,000. This work is proposed as a contract amendment under the current northwest Minnesota NWI update with St. Mary's University of Minnesota.

Project Status as of June 23, 2017:
SMU has completed draft data for 40 USGS quarter quads spread across the northwest project area as part of an effort to refine and review mapping procedures prior to full-scale map production. Subsequently, SMU has produced draft data for Traverse, Clay, Wilkin, and Stevens counties as well as for the western part of Marshall and Polk counties. Draft data are approximately 25% complete for the project area. SMU also conducted additional field work during the month of May to further refine the photo-interpretation guidelines for this region. The field work included visits to 110 additional sites.

The DNR has deployed the updated online review tool along with a user guide. The tool is being used by the DNR Resource Assessment Program (RAP) and the U.S. Fish and Wildlife Service (USFWS) to provide comments on the draft NWI data. Other project stakeholders are also being invited to use the tool to review and comment on the

draft data. RAP and USFWS have reviewed draft NWI data for Traverse, Polk, and Marshall Counties. We also held a project status meeting in April with the project team for both the northwest and central update areas.

SCWRS has created a prototype procedure for the wetland functional assessment demonstration composed of ArcGIS and R functions/codes. The procedure identifies and delineates wetland depressions and their catchments (i.e., the direct drainage to the depression) as well as determines the network topological relationships between series of up- and downstream-connected depressions. Cumulative runoff into and out of each depression is determined based on depressional network topology, watershed runoff predicted from design storms, and each depression's storage volume. The functional assessment procedure was tested on the project's Yellow Medicine headwaters pilot watershed composed of approximately three HUC-12 subwatersheds. The pilot watershed consists of 1,100 wetland depressions aggregated into greater than fifty multi-depressional network watersheds.

Project Status as of January 31, 2018:
SMU has submitted draft data for a cumulative 54% of the project area. The DNR has provided review comments for about 39% of the submitted draft data (about 21% of the total project area). In addition, SMU has submitted an NWI update for the Koochiching pilot area. It is anticipated that approximately two counties of draft data will be delivered each month for the next several months.

SCWRS has continued development of a set of GIS tools and procedures to quantify wetland hydrologic and water quality function at individual-wetland to watershed scales. The pilot study area has been expanded to comprise several larger watersheds including all of the Lac qui Parle, Yellow Medicine and Le Sueur (HUC-8) watersheds and parts of the Blue Earth and Watonwan watersheds. The expanded study area is composed of approximately 20,000 NWI delineated wetlands, their respective drainage areas and their network connectivity with up- and downstream wetlands. Currently, analyses are underway to statistically mine this greatly expanded dataset to develop additional relationships between NWI wetland type and hydrologic and water quality function.

Project Status as of July 31, 2018:
SMU has submitted draft data for a cumulative 85% of the project area. The DNR has provided review comments for about 80% of the submitted draft data (about 68% of the total project area). SMU is on target to complete the project on time and within budget.

SCWRS expanded upon the previous data analysis by expanding it from the original four pilot areas to nearly the entire extent of hydrologically conditioned lidar DEMs in southern Minnesota. This expanded study area allows examination of a vastly larger (and variable) set of wetlands and soil, climate and landscape conditions to gain a better understanding of wetland function across Minnesota. Analysis results include the computation of wetland storage volumes, direct drainage areas and up/downstream neighbors for all NWI polygons within the study area. In addition, the fill-and-spill responses to 2yr/24hr and 10yr/24hr design storms have also been calculated.

Amendment Request (November 20, 2018) – Approved by LCCMR (11/27/2018):
The purpose of this amendment is to redirect funds from two budget line items that have come in under budget toward additional quality control and quality assurance efforts. The budget line for support from DNR Resource Assessment Program will be reduced by $30,000 and the budget line for support from MNIT will be reduced by $10,000. These funds will be redirected toward an amendment to the contract with St. Mary's University of Minnesota to perform additional analysis and improve the accuracy and completeness of the NWI. The contract amount will be increased by $40,000. In addition, $15,000 from the budget line for MNIT project management support will be used for MNIT application development. These funds will be directed at making minor modifications and enhancements to two web-based applications that have been developed to support the NWI program. Approximately, $2,500 will be used to make minor improvements to the Wetland Finder application, which is a public-facing web map that allows non-GIS users to access the NWI data. The remaining $12,500 will

be used to modify the NWI review tool to adapt it for ongoing data stewardship efforts. The modified tool will serve as a mechanism for users to report errors as well as wetland gains and losses to the DNR, so that updates may be made to the data. There is no change in the budget for this activity. These changes only involve shifting funds from one budget line to another.

Project Status as of January 31, 2019:
St. Mary's University completed wetland mapping for the northwest Minnesota project area (20,700 square miles). All draft data was finalized for this region and delivered to the DNR. Subsequently, SMU has edge-matched all of the NWI data for the various project regions into a statewide seamless NWI layer and delivered this to the DNR. SMU is working with the DNR to address potential inconsistency issues across project boundaries. An issue tracking system was developed and several issues have already been resolved. Efforts to ensure consistency and accuracy are ongoing and weekly meetings are held to discuss progress and new issues as they arise.

During this reporting period, the DNR reviewed data for the northwest project area covering approximately 4,200 square miles. An accuracy assessment was performed on the northwest project area using ground validation data. The overall accuracy for wetland mapping is 93%. Wetland classification accuracy is 78%. DNR staff reviewed approximately 26,800 square miles of the statewide seamless data layer. Project presentations were made at several locations around the state. DNR updated the metadata and published the statewide NWI data to MN Geospatial Commons. The data have also been made available through an updated web map (DNR Wetland Finder).

The SCWRS completed analyses for wetland flood storage, connectivity, providing estimates of permanent, and temporary storages across the project study of over 2 million acres in Southern Minnesota. Provisional wetland metrics for surface hydrologic and water quality functions were developed using results from wetland storage and connectivity analyses resulting in normalized metric scores based on relative ranking at different watershed scales. Current results were presented at the Water Resources Conference.

Overall Project Outcomes and Results:
The NWI update project was a collaborative effort lead by the Minnesota DNR that:

- Developed new methods for integrating lidar data into wetland mapping,
- Created of a suite of lidar-derived topographic datasets to assist with wetland mapping,
- Acquired new statewide, high-resolution spring leaf-off aerial imagery,
- Completely re-mapped and classified all wetlands larger than 0.5-acre in size,
- Engaged stakeholders in the development and review of the updated data,
- Enhanced the NWI with additional attributes, and
- Efficiently delivered data to various user groups through multiple means.

In this final phase of the overall effort, we updated wetland inventory maps for the remaining 20,700 square miles of northwestern Minnesota covering 19 counties. All the wetland data from each project phase has been edge-matched to create a single statewide wetland inventory containing nearly 2.4 million wetland polygons.

Quality assurance of the data included visual inspection, automated checks for attribute validity and consistency, as well as a formal accuracy assessment based on independent field data. The updated NWI data have a 95% user accuracy for wetland identification. Further details on the methods employed can be found in the technical procedures document (Attachment B) for this project located on the DNR wetland-mapping website.

The DNR finalized the NWI user guide (attachment C) and computed final summary statistics for the wetland data, computing area for the various wetland classifications systems by both county and major watershed.

These summary statistics are provided in the appendix of the NWI user guide. The DNR also developed and printed a promotional wetland poster.

The SCWRS submitted a final report (attachment D) summarizing the wetland functional assessment demonstration project. The previous water quality and water quantity functional assessment procedures were documented and the analysis was expanded to also include groundwater function and wildlife habitat function (i.e. dabbling duck habitat).

The completed statewide data were posted the MN Geospatial Commons and added to the DNR Wetland Finder web application at the end of May. The DNR issued a press release on June 3, 2019 to announce the availability of these data and the story was picked up by several media outlets (attachment E). A copy of the data was also provided to the USFWS to post on the federal Wetland Mapper website. Finally, the project was nominated for and received the Governor's Geospatial Commendation (attachment F).

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Updated Wetland Maps for Northwestern Minnesota
Description:
Produce updated wetland maps for 1,634 USGS quarter quadrangles (20,700 miles^2) for the remaining 19 counties in northwestern MN (see attached map). The map production will be conducted by contractors under the supervision of the DNR and will be based on recommendations for wetland mapping methods developed by the University of Minnesota (UMN) and refined through previous phases. This work will consist of digital photo-interpretation, topographic analysis of LiDAR data, and analysis of ancillary data such as soils maps and forest inventory maps, as well as quality control review. The project will require substantial input data and generate a large dataset. Secure, reliable data storage and back up will be provided by MN.IT. Completed digital map data will be available to the public through several websites, including the DNR and the U.S. Fish and Wildlife Service.

Summary Budget Information for Activity 1:

ENRTF Budget: $1,243,650
Amount Spent: $1,234,000
Balance: $9,650

Outcome	Completion Date
1. *Draft wetland maps for 19 counties*	September 2018
2. *Quality control review of draft data*	October 2019
3. *Finalized updated NWI data for 19 counties*	November 2019
4. *Statewide seamless NWI*	January 2019
5. *Printed user guide and wall map*	June 2019

Activity Status as of January 31, 2017:
The first report period of the project began with issuing a request for proposals for wetland mapping services. St. Mary's University (SMU) was selected as the best value proposal for the northwestern Minnesota NWI update. The contract with SMU includes two value-added enhancements; edge-matching data between the various completed project area and extended watercourse mapping for all watercourses contained within the DNR Public Water Inventory. A service level agreement was also develop with the DNR Resource Assessment Program (RAP) to support the project. RAP will be pre-processing data and providing it to DU. RAP will also be participating in field work and quality control review of draft NWI data. A sole source contract was also developed with the St. Croix Watershed Research Station (SCWRS) to develop, test, and disseminate methods for landscape level wetland functional assessments using the updated NWI data. A project kick-off meeting was held on October 7, 2016 to coordinate various aspects of this project.

SMU has developed a draft technical procedures document to guide the NWI update for northwestern MN. Initial field work was conducted to develop and refine wetland photo-interpretation signatures for the project area. In addition, SMU has developed draft wetland inventory data for 10 quarter quadrangle tiles for initial review by the DNR.

RAP has been working on compiling and pre-processing data. RA has completed and delivered the following LiDAR derived layers for the NW NWI Study Area:

- Average Intensity of 1st Returns 3m
- DEM 3m
- Hillshade 3m
- HPI 3m
- Max Height of 1st Returns 3m
- Slope in Radians 3m
- TPI 3m
- Percent Canopy Cover 3m
- Hydro Break Lines for the Following Counties: Big Stone, Swift, Pope, Douglas
- 2 ft Contour Lines
- CTI 15m
- CTI 3m

RA is also currently working on creating the following layers

- % Hydric Soils Layer
- SDA (Stochastic Depressional Analysis) Model

Activity Status as of June 23, 2017:
SMU has completed draft data for 40 USGS quarter quads spread across the northwest project area as part of an effort to refine and review mapping procedures prior to full-scale map production. Subsequently, SMU has produced draft data for Traverse, Clay, Wilkin, and Stevens counties as well as for the western part of Marshall and Polk counties. Draft data are approximately 25% complete for the project area. SMU also conducted additional field work during the month of May to further refine the photo-interpretation guidelines for this region. The field work included visits to 110 additional sites.

The DNR has deployed the updated online review tool along with a user guide. The tool is being used by the DNR Resource Assessment Program (RAP) and the U.S. Fish and Wildlife Service (USFWS) to provide comments on the draft NWI data. Other project stakeholders are also being invited to use the tool to review and comment on the draft data. RAP and USFWS have reviewed draft NWI data for Traverse, Polk, and Marshall Counties. We also held a project status meeting in April with the project team for both the northwest and central update areas.

Activity Status as of January 31, 2018:
SMU has submitted draft data for a cumulative 54% of the project area. The DNR has provided review comments for about 39% of the submitted draft data (about 21% of the total project area). In addition, SMU has submitted an NWI update for the Koochiching pilot area. It is anticipated that approximately two counties of draft data will be delivered each month for the next several months.

Activity Status as of July 31, 2018:
SMU has submitted draft data for a cumulative 85% of the project area. The DNR has provided review comments for about 80% of the submitted draft data (about 68% of the total project area). SMU is on target to complete the project on time and within budget.

Activity Status as of January 31, 2019:
St. Mary's University completed wetland mapping for the northwest Minnesota project area (22,000 square miles). All draft data was finalized for this region and delivered to the DNR. Subsequently, SMU has edge-

matched all of the NWI data for the various project regions into a statewide seamless NWI layer and delivered this to the DNR. Additional watercourse features from southern MN project area were incorporated into the statewide data layer. The contract with SMU has been extended to address potential inconsistency issues across project boundaries. As part of this effort, SMU developed an online tool for stakeholder review of statewide NWI data. An issue tracking system was developed and several issues have already been resolved. Efforts to ensure consistency and accuracy are ongoing and weekly meetings are held to discuss progress and new issues as they arise.

The Minnesota DNR continues to provide ongoing project coordination and quality control oversight. During this reporting period, the DNR reviewed data for the northwest project area covering approximately 4,200 square miles. An accuracy assessment was performed on the northwest project area using ground validation data. The overall accuracy for wetland mapping is 93%. Wetland classification accuracy is 78%. The DNR also amended the contract, per the work program amendment, to extend the contract with St. Mary's University to include additional effort to create a seamless statewide dataset and to ensure consistency in wetland classifications across the various project phases. DNR staff reviewed approximately 26,800 square miles of the statewide seamless data layer. Project presentations were made at the Water Resources Conference (St. Paul), GIS/LIS Conference (Duluth), and Minnesota Association of Watershed Districts annual meeting (Alexandria). DNR updated the metadata and published the statewide NWI data to MN Geospatial Commons. The data have also been made available through an updated web map (DNR Wetland Finder).

Final Report Summary:
During the final reporting period of this project St. Mary's University in collaboration with the DNR and the NWI technical advisory team reviewed the statewide dataset for accuracy and attribute consistency across project regions. Identified inconsistencies were corrected. Improvements were made to the water regime classification and landscape position as well as a number of other minor adjustments. This effort enhances the usefulness of the data for statewide applications.

The DNR finalized the NWI user guide (attachment C) and computed final summary statistics for the wetland data, computing area for the various wetland classification systems by both county and major watersheds. These summary statistics are provided in the appendix of the NWI user guide. The DNR also developed and printed a promotional wetland poster for distribution to local and state agency water/wetland resource personnel, educational institutions, conservation organizations, and the public.

ACTIVITY 2: Wetland Functional Assessment Demonstration & Training for Data Users
Description:
The updated NWI data are not only more current and spatially accurate than the original NWI, but they also include new attributes such as the hydro-geomorphic classification (HGM). These enhancements were included based on stakeholder requests and are intended to support wetland functional assessment. This activity includes a pilot demonstration to be conducted by the St. Croix Watershed Research Station (of the Science Museum of Minnesota) using the updated and enhanced National Wetland Inventory to assess the ecological functions of wetlands within a selected watershed in southern Minnesota. Various metrics will be derived from a combination of both the updated NWI data and lidar data, including, but not limited to; wetland surface area, mean depth, volume, watershed area, ratio of wetland area to watershed area, and ratio of wetland volume to watershed area. These metrics will be calculated for each wetland and summarized by HGM class. Correlations between these metrics and wetland hydrologic function will be developed through a combination of statistical analyses, modeling, and literature review. The procedures used for this analysis will be documented and presented to serve as guidance to natural resource managers for applications including flood analysis, water quality improvement, and wildlife habitat suitability assessment. This information will be disseminated through a combination of presentations and workshops.

Summary Budget Information for Activity 2:

ENRTF Budget: $256,350
Amount Spent: $255,060
Balance: $1,290

Outcome	Completion Date
1. *Conduct a pilot test using the new NWI data to assess wetland functions*	July 2018
2. *Publish a report on the procedures and results from the pilot test*	April 2019
3. *Present procedures and results from pilot test at four conferences or workshops*	June 2019

Activity Status as of January 31, 2017:
SCWRS has compiled and reviewed available data for the wetland functional assessment demonstration. In particular the availability of hydro-modified DEMs that are co-located with available updated NWI data in southern and east-central MN. The hydro-modified DEM is an important component of a potential wetland functional assessment because it can be used to analyze the flow paths and watersheds of wetlands. SCWRS has selected four pilot watershed areas for this part of the project; Yellow Medicine headwaters, Lake Wakanda, Madison Lake, and Browns Creek.

Activity Status as of June 23, 2017:
SCWRS has created a prototype procedure for the wetland functional assessment demonstration composed of ArcGIS and R functions/codes. The procedure identifies and delineates wetland depressions and their catchments (i.e., the direct drainage to the depression) as well as determines the network topological relationships between series of up- and downstream-connected depressions. Cumulative runoff into and out of each depression is determined based on depressional network topology, watershed runoff predicted from design storms, and each depression's storage volume. The functional assessment procedure was tested on the project's Yellow Medicine headwaters pilot watershed composed of approximately three HUC-12 subwatersheds. The pilot watershed consists of 1,100 wetland depressions aggregated into greater than fifty multi-depressional network watersheds.

Activity Status as of January 31, 2018:
SCWRS has continued development of a set of GIS tools and procedures to quantify wetland hydrologic and water quality function at individual-wetland to watershed scales. The pilot study area has been expanded to comprise several larger watersheds including all of the Lac qui Parle, Yellow Medicine and Le Sueur (HUC-8) watersheds and parts of the Blue Earth and Watonwan watersheds. The expanded study area is composed of approximately 20,000 NWI delineated wetlands, their respective drainage areas and their network connectivity with up- and downstream wetlands. Currently, analyses are underway to statistically mine this greatly expanded dataset to develop additional relationships between NWI wetland type and hydrologic and water quality function.

Activity Status as of July 31, 2018:
SCWRS expanded upon the previous data analysis by expanding it from the original four pilot areas to nearly the entire extent of hydrologically conditioned lidar DEMs in southern Minnesota. This expanded study area allows examination of a vastly larger (and variable) set of wetlands and soil, climate and landscape conditions to gain a better understanding of wetland function across Minnesota. Analysis results include the computation of wetland storage volumes, direct drainage areas and up/downstream neighbors for all NWI polygons within the study area. In addition, the fill-and-spill responses to 2yr/24hr and 10yr/24hr design storms have also been calculated.

Note: An outstanding invoice was received for work performed in fiscal year 2018 that has not been processed yet. This will be reflected in the next semi-annual status report.

Activity Status as of January 31, 2019:

The SCWRS completed analyses for wetland flood storage and connectivity, providing individual to watershed-scale estimates of permanent and temporary storages from a set of design storms (1, 2, 5, 10, 25, 50, and 100 yr/24 hr) across the project study of over 2 million acres in Southern Minnesota. Provisional wetland metrics for surface hydrologic and water quality functions were developed using results from wetland storage and connectivity analyses resulting in normalized metric scores based on relative ranking at different watershed scales (e.g., Hydrologic Unit Code [HUC] 12 and 8). Current results were presented at the 2018 MN Water Resources Conference.

Final Report Summary:
The SCWRS submitted a final report (attachment D) summarizing the wetland functional assessment demonstration project. The previous water quality and water quantity functional assessment procedures were documented and the analysis was expanded to also include groundwater function and wildlife habitat function (i.e. dabbling duck habitat).

V. DISSEMINATION:
Description:
Wetland maps and related data developed by this project will be disseminated through web-based data distribution hubs and online viewing through web mapping applications. The primary data access website for the State of Minnesota is the Minnesota Geospatial Commons. The primary online mapping application for viewing the data will be Minnesota NWI Viewer. Furthermore, the data are likely to be picked up and served by other sites and applications beyond the ones listed here. Publicity for this effort will include presentations at professional conferences as well as publication in selected newsletters and journals. Conference presentations will include at least two of the following venues; the Minnesota Water Resources Conference, the Minnesota GIS/LIS Conference, the Annual Minnesota Wetlands Conference, and the Conference of the Minnesota Association of Watershed Districts.

Status as of January 31, 2017:
The updated NWI data for the northeast was added to a web service and a web application with the previously completed project areas for east-central and southern MN. This web application provides easy access to the data for non-expert users (http://www.dnr.state.mn.us/eco/wetlands/map.html).

Status as of June 23, 2017:
Potential reviewers from DNR and BWSR field offices have been invited to participate in the review of the draft NWI data. We will also be coordinating with these staff for a broader effort to engage local reviewers.

Status as of January 31, 2018:
We have reached out to numerous local data users to engage them in reviewing the draft data. We have contacted county GIS coordinators and SWCD wetland specialists in Clay, Douglas, Grant, Pope, Stevens, and Wilkins counties.

Status as of July 31, 2018:
We have continued to engage local project stakeholders to review the draft data using our web-based review tool. We are working on a communications plan for the final rollout of the NWI update and are planning to present at professional water resource and GIS conferences this fall.

Status as of January 31, 2019:
Presentations on the NWI were given at the Minnesota Water Resources Conference (St. Paul), the Minnesota GIS/LIS Conference (Duluth), and the Minnesota Association of Watershed Districts annual meeting (Alexandria). The DNR also launched an updated web-map application called Wetland Finder that provides an easy way for non-GIS professional to view the NWI data.

Final Report Summary:
The DNR posted the final statewide updated NWI data to the Minnesota Geospatial Commons and updated the data in the Wetland Finder application on May 31, 2019. The DNR issued a press release on June 3, 2019 announcing the availability of the statewide NWI. The DNR also included social media posts regarding this release. The story was picked up by several media outlets (attachment E). A copy of the data was also provided to the USFWS to post on the federal Wetland Mapper website.

The DNR developed a web application to support ongoing stewardship of the NWI data. The web application provides a simple and consistent method for state and local wetland professionals to submit change requests to the DNR. DNR plans to incorporate these user requests into annual updates of the NWI.

The DNR also developed a NWI User Guide and Summary Statistics (attachment C). This guide provides a brief overview of the potential uses, limitations, access and technical aspects of the Minnesota Wetland Inventory. This guide also provides summary statistics of wetland types by county and major watershed. Printed copies were provided to BWSR to distribute to local Soil and Water Conservation Districts and BWSR wetland specialists. The DNR will distribute copies to DNR area hydrologists and others. In addition, the DNR developed and printed 1000 copies of a map poster. These are being sent to potential NWI users including SWCDs and local government units. Finally, the project was nominated for and received the Governor's Geospatial Commendation (attachment F).

VI. PROJECT BUDGET SUMMARY:
A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	$ 1,482,000	(1) MNIT project manager at 0.65 FTE for 2-years; ($200,000) (2) A service level agreement with DNR Resource Assessment Office for data processing, field work, quality assurance, and other support; ($177,000) (3) A sole source contract with the St. Croix Watershed Research Station for a wetland functional assessment demo; ($225,000) (4) A competitive bid contract for wetland mapping services; ($880,000)
Equipment/Tools/Supplies:	$ 2,002	
Travel Expenses in MN:	$ 3,600	
Other: DNR Direct and Necessary Support*	$ 12,398	
TOTAL ENRTF BUDGET:	**$1,500,000**	

* Direct and Necessary expenses include both Department Support Services (Human Resources, IT Support, Safety, Financial Support, Communications Support, Planning Support, and Procurement Support). Department Support Services are described in the agency Service Level Agreement, and 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, single source contract activity with an associated cost of $602,000 has not been assessed Direct and Necessary costs. In addition, itemized costs captured in our proposal budget include Departmental Financial Support ($12,398) that is necessary to accomplishing funded programs/projects.

Explanation of Use of Classified Staff: The DNR contracts for project management services for this project through MN.IT Services. The MN.IT project manager was originally hired as an unclassified DNR employee. This position was reorganized to MN.IT Services under a statewide consolidation of IT services and is now a classified employee. The project management responsibilities of this position have been funded by the ENRTF program at a rate of 0.65 FTE. There is currently no other source of funding for managing the NWI project and once the project is complete the agency will secure other funds and re-assign this position to other responsibilities.

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

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 0.65 FTE for 2-years (1.3 FTE) through a service level agreement with MNIT

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 7 FTE for two years (14 FTE)

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
	$0	$0	
State			
In-kind contribution from DNR wetland program coordinator	$10,000	$7,000	Project coordination and planning
TOTAL OTHER FUNDS:	**$10,000**	**$7,000**	

VII. PROJECT STRATEGY:

A. Project Partners: The St. Croix Watershed Research Station (SCWRS) is a partner on this project with responsibility for conducting the wetland functional assessment demonstration using the updated NWI data. An amount of $250,000 from this grant will be directed to the SCWRS for this effort. In addition, other state and federal agency partners support this project in a variety of capacities. These partners include the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, the Minnesota Board of Water and Soil Resources, the U.S. Fish and Wildlife Service, and the Minnesota Dept. of Administration's Geographic Information Office.

B. Project Impact and Long-term Strategy:

This is the sixth phase of a multi-phase project to update the NWI for the entire state of Minnesota. The original estimated total budget for the project is $7.5 million. With this appropriation, the total amount received from ENTRF to date will be $7,150,000. Upon completion of this phase, our progress will be 100% completion for all tasks.

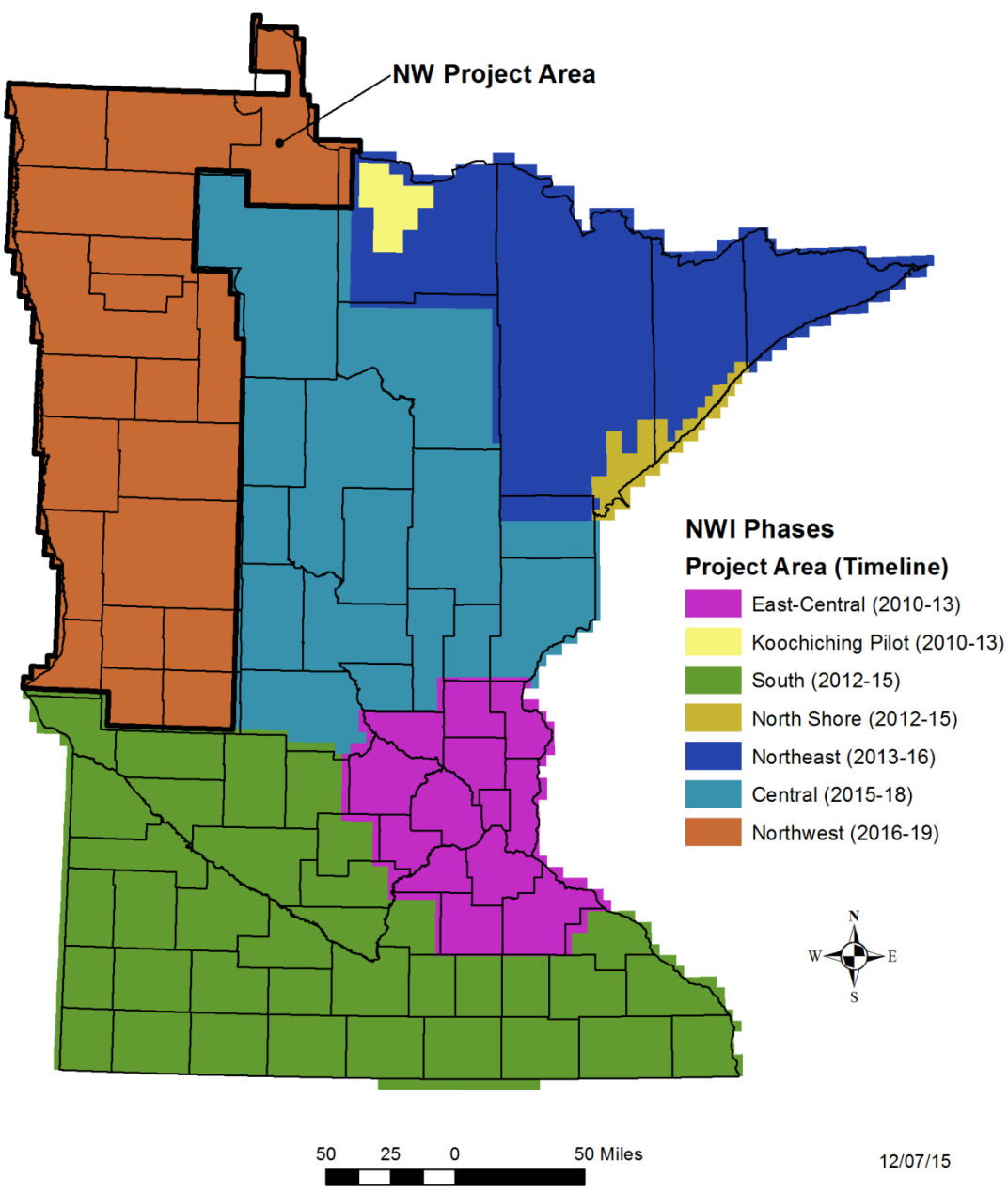
C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
ENRTF – Imagery, Methods, Standards	FY09-11	$550,000
ENRTF – Imagery, Wetland Mapping (east-central), Methods	FY11-14	$1,100,000
ENRTF – Imagery, Wetlands Mapping (southern)	FY13-15	$1,500,000
ENRTF – Imagery, Wetlands Mapping (northeast)	FY14-16	$1,000,000
ENRTF – Imagery, Wetlands Mapping (central)	FY16-18	$1,500,000
USGS/NGA – Imagery	FY10	$25,000
St. Louis County – Imagery	FY10	$24,999
MPCA Clean Water Legacy – Imagery	FY10	$111,000
DNR – Heritage Enhancement Fund – Imagery	FY10	$181,064

Funding Source and Use of Funds	Funding Timeframe	$ Amount
DNR/NOAA – Coastal Zone Program – Imagery	FY10	$24,227
USGS/NGA – Imagery	FY11	$75,000
Metropolitan Council – Imagery	FY11	$65,750
Metropolitan Mosquito Control District – Imagery	FY11	$7,000
McLeod County – Imagery	FY12	$24,000
Sibley County – Imagery	FY12	$29,000
Murray County – Imagery	FY12	$35,000
US Fish and Wildlife Service – Wetland Mapping (North Shore)	FY13-14	$75,000
Carlton County – Imagery	FY14	$23,475
Camp Ripley – Imagery	FY14	$8,898
Itasca County – Imagery	FY14	$86,841
Clay County – Imagery	FY14	$31,091
Wilkin County – Imagery	FY14	$23,266
Mille Lacs County – Imagery	FY14	$13,769
White Earth Reservation – Imagery	FY14	$34,231
Fond du Lac Reservation – Imagery	FY14	$3,000
Beltrami County – Imagery	FY15	$54,499
Polk County – Imagery	FY15	$59,863

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

IX. VISUAL COMPONENT or MAP(S):



X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than January 31, 2017, July 31, 2017, January 31, 2018, July 31, 2018 and January 31, 2019. 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

ATTACHMENT A

Project Title: Completing National Wetland Inventory Update for Minnesota
Legal Citation: *M.L. 2016, Chp. 186, Sec. 2, Subd. 03e*
Project Manager: *Steve Kloiber*
Organization: Minnesota DNR
M.L. 2016 ENRTF Appropriation: $ 1,500,000
Project Length and Completion Date: *3 Years, June 30, 2019*
Date of Final Report: *October 31, 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
BUDGET ITEM	***Updating Wetland Maps***			***Functional Assessment Demo***				
Professional/Technical/Service Contracts								
Project Manager; Service Level Agreement with MNIT for 0.65FTE for 2 years (78% salary, 22% benefits)& Programmer SLA for 0.17FTE	$92,204	$90,179	$2,025	$31,350	$30,060	$1,290	$123,554	$3,315
Contract for Wetland Mapping Service - St. Mary's University of MN through competitive bid contract	$985,000	$984,500	$500				$985,000	$500
Service Level Agreement with DNR Resource Assessment Office for data processing and quality assurance support	$147,000	$147,000	$0				$147,000	$0
Sole Source Contract with St. Croix Watershed Research Station for wetland functional assessment demo& outreach				$225,000	$225,000	$0	$225,000	$0
DNR graphical design and desktop publishing support	$6,600	$4,950	$1,650				$6,600	$1,650
Equipment/Tools/Supplies								
Software maintenance for quality control review	$803	$803	$0				$803	$0
Printing guidebook and promotional wall map	$5,287	$3,402	$1,885				$5,287	$1,885
Travel expenses in Minnesota								
In-state mileage, travel expenses, and conference registration	$250	$250	$0				$250	$0
Other								
DNR's direct and necessary costs cover HR Support ($0), Safety Support ($0), Financial Support ($12,398), Communication Support ($0), IT Support ($0), Planning Support ($0), Procurement Support ($0), and division and regional program management ($0) that are necessary to accomplishing funded programs/projects.	$6,506	$2,915	$3,591				$6,506	$3,591
COLUMN TOTAL	$1,243,650	$1,234,000	$9,650	$256,350	$255,060	$1,290	$1,500,000	$10,940