

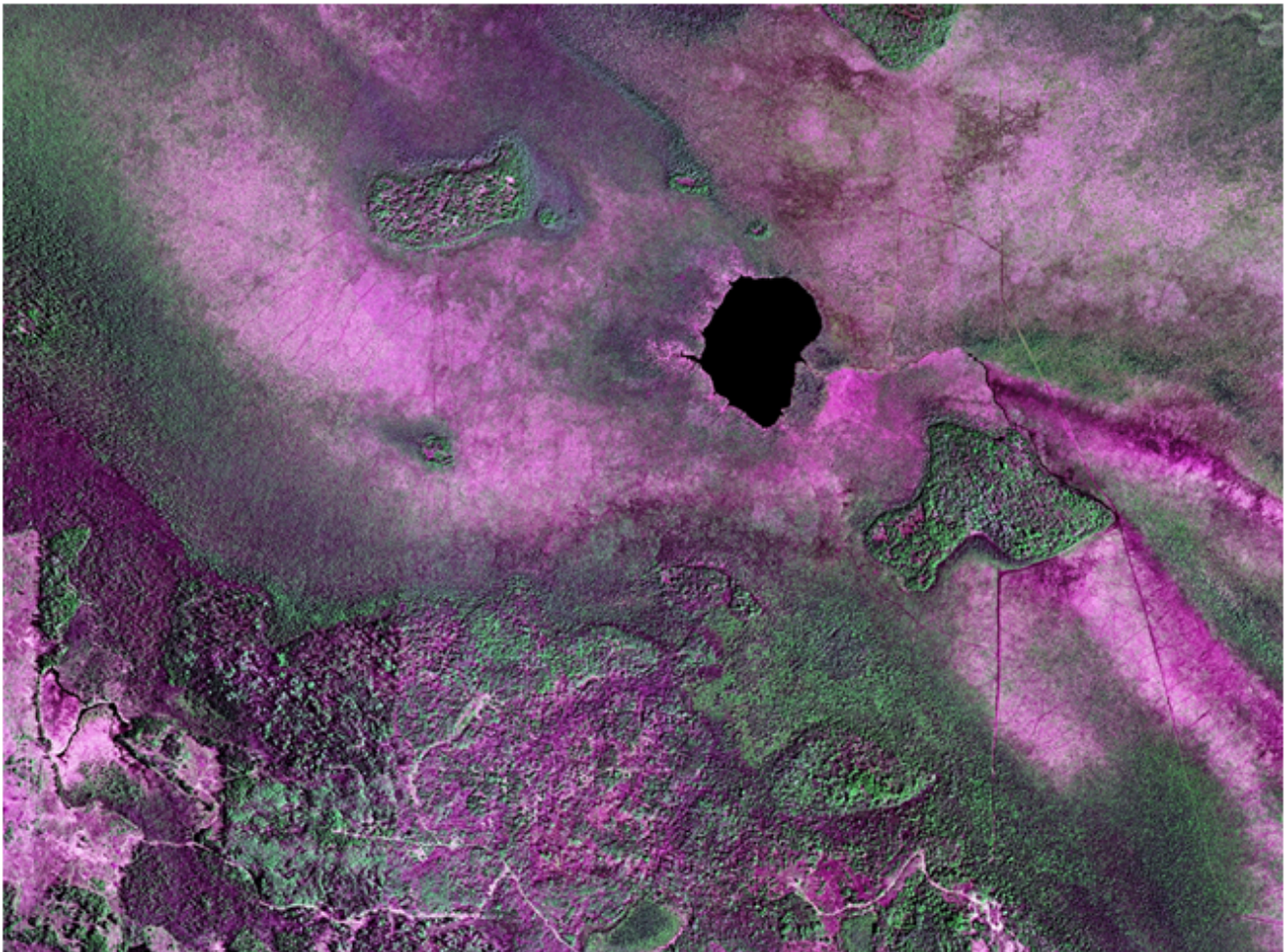
# ATTACHMENT F

Nomination for the Governor's Geospatial Commendation Award

## An Updated and Enhanced National Wetland Inventory for Minnesota

Project Duration: July 2008 – June 2019

[https://www.dnr.state.mn.us/eco/wetlands/nwi\\_proj.html](https://www.dnr.state.mn.us/eco/wetlands/nwi_proj.html)



**mn** DEPARTMENT OF  
NATURAL RESOURCES



# 1 INTRODUCTION

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## 1.1 WHY IT MATTERS

The National Wetland Inventory (NWI) updated for Minnesota is the most comprehensive and up-to-date inventory of wetlands and water ecosystems in the country. It is an important dataset for many natural resource planning and management efforts within Minnesota. These wetland data are used across all levels of government, as well as by private industry and non-profit organizations as an aid in wetland regulation and management, land use and conservation planning, environmental impact assessment, and natural resource inventories. Among other things, the NWI has been used to assess impacts of regulatory policy, identify flood storage, evaluate carbon storage potential and climate change impacts, and estimate waterfowl and amphibian population distribution.

The original NWI was completed in the mid-1980s, but over the decades, it had become considerably out-of-date. In addition, mapping technology has changed considerably. Updating the inventory was critical for continued support of wetland planning and management needs. With over two million polygons in the dataset, it is also one of the largest GIS datasets for Minnesota.

## 1.2 PROJECT DESCRIPTION

Under this project, the Environmental and Natural Resources Trust Fund provided \$7 million to the Minnesota Department of Natural Resources (DNR) to coordinate a collaborative effort and conduct a comprehensive, statewide update of the National Wetland Inventory for Minnesota. This effort included:

- Developing new methods for integrating lidar data into wetland mapping through the research efforts at the University of Minnesota, Remote Sensing and Geospatial Analysis Laboratory,
- Acquisition of new statewide, high-resolution digital stereo spring leaf-off aerial imagery to serve as the base imagery,
- Engaging federal, state, and local partners to enhance the imagery acquisition effort
- Creation of a suite of statewide lidar-derived topographic datasets to assist with wetland mapping,
- A complete re-mapping and classification of all wetlands in Minnesota larger than 0.5-acre in size,
- Engaging stakeholders to participate in the development and review of the updated wetland inventory,
- Engaging stakeholders in field visits designed to ensure accurate mapping and classification of wetlands,
- Enhancing the wetland inventory data with additional attributes, including alternative wetland classification systems, and attributes relating to wetland function, and
- Efficiently delivering data freely to various user groups through multiple means.

## 1.3 AWARD CRITERIA & PROJECT GOALS

This project meets multiple award criteria:

1. Yielded tangible benefits and exceptional results
2. Had a significant impact outside the home organization
3. Efficient investment in geospatial information that serve multiple purposes and users
4. Development of geospatial data as a public resource, widely available at reasonable cost
5. Use of GIS as an instrument for policy and decision-making

## 2 USES & BENEFITS

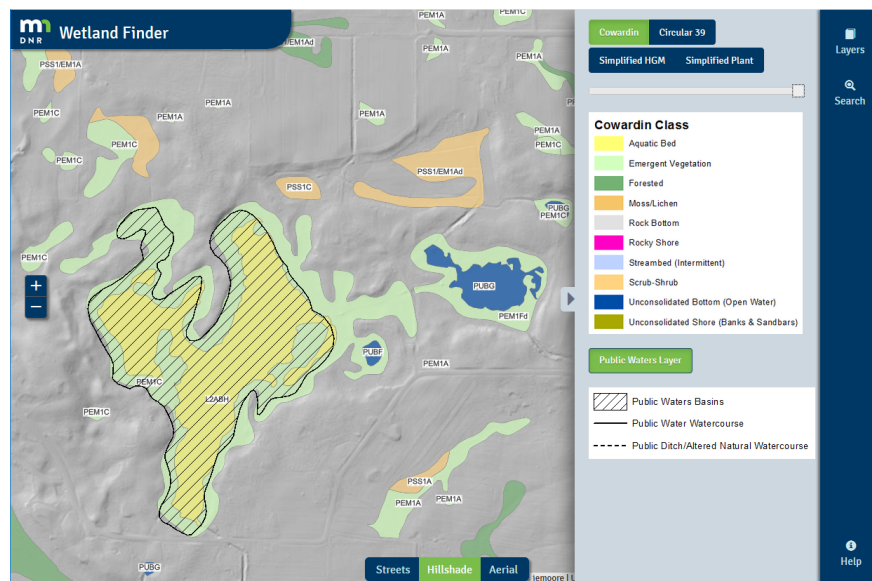
The following section illustrates some of the many applications and benefits of the NWI update project.

### 2.1 LAND USE AND DEVELOPMENT PLANNING

One of the most common wetland questions we get from landowners, developers, and real estate professionals is, “Are there wetlands on my property?” While the NWI isn’t a regulatory wetland determination, it is usually the first place to turn to begin to answer this question. Unsurprisingly, most of the people that ask this question aren’t GIS experts. The DNR developed the Wetland Finder application to meet the needs of these groups.

Wetland Finder provides a simple method for the non-GIS user to view the updated National Wetland Inventory (NWI) data. People use this application to check location, how many, and what types of wetlands are present in a given area. Users can search the map for a specific address and view wetland data from the NWI as well as public waters from the Public Waters Inventory (PWI). Users can choose to display the data according to any of four different wetland classifications and they can click on any wetland to get additional information. The information window provides links to regulatory contacts including the local government unit (LGU) contact list for the Wetland Conservation Act as well as to DNR area hydrologists for questions about public waters.

- Doug Norris, Wetland Program Coordinator, Minnesota DNR



Screenshot of the Wetland Finder application

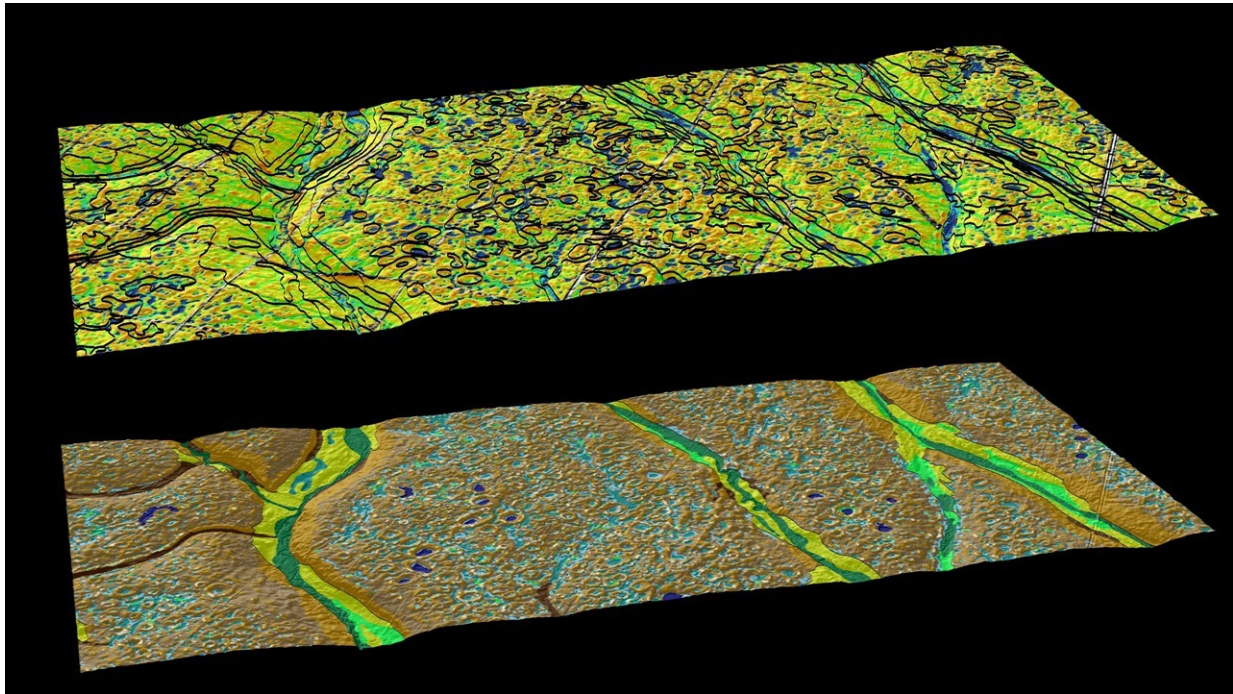


## 2.2 UPDATING THE SOIL SURVEY

The Natural Resources Conservation Service (NRCS) creates and maintains soil survey data that include detailed maps of soil units along with descriptions and tables of soil properties. Soil surveys are used by farmers, real estate agents, land use planners, engineers and others who need information about soil resources. Soils form over time under the influence of parent material, climate, topography, and biological activity. These are some of the same forces involved in the formation of wetlands. Therefore, it's not surprising that there is considerable correlation between the presence or absence of wetlands and the presence or absence of certain soil types.

Soil Scientists have found the new enhancements to the NWI and associated classifications critical in developing strategies for identifying, classifying and sampling wet soils. This data has also been beneficial in modeling efforts to develop consistent and repeatable soil survey information.

- Danielle Evans, MLRA Soils GIS Specialist, NRCS



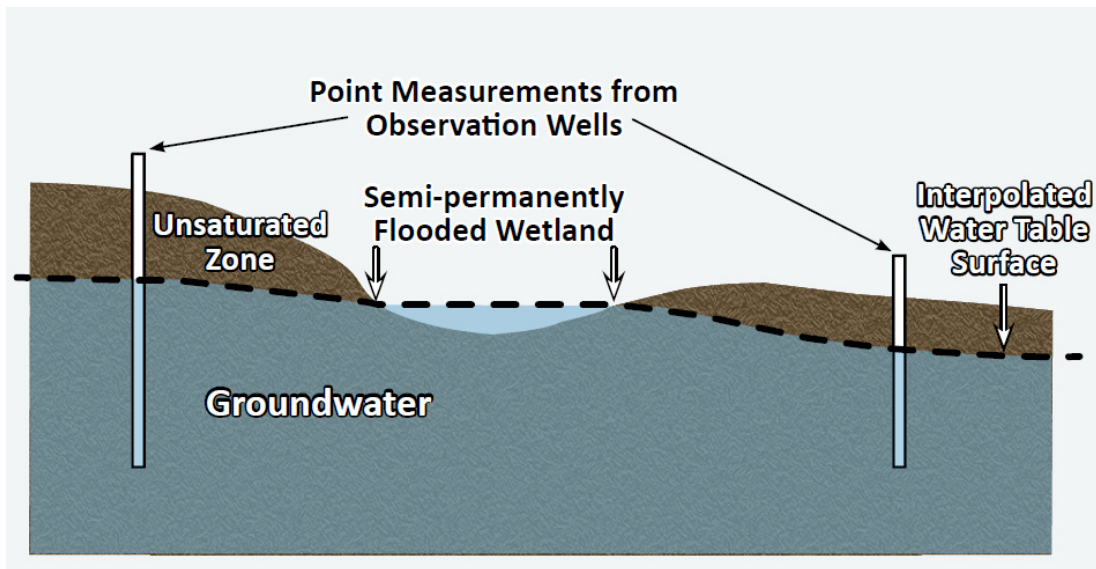
Oblique view of updated soils maps

## 2.3 MAPPING GROUNDWATER

The water table is defined as the surface below which sediment is saturated with groundwater. Water table elevation and depth to water table are important considerations in construction projects and land use programs. The groundwater portion of the County Geologic Atlas uses selected wetlands from the NWI as an input for water-table elevation maps. The wetlands extracted from the NWI are important for filling data gaps from other sources. Wetlands that are flooded semi-permanently to permanently are usually closely connected to the water table.

The NWI provides information on the size and location of wetlands as well as information on water regime. The County Geologic Atlas extracts the shoreline for these wetland features and combines with other sources such as measured water-table elevations from the DNR's groundwater monitoring well network. Water-table elevations in between these input data are interpolated using GIS.

- Todd Peterson, Hydrogeologist, Minnesota DNR



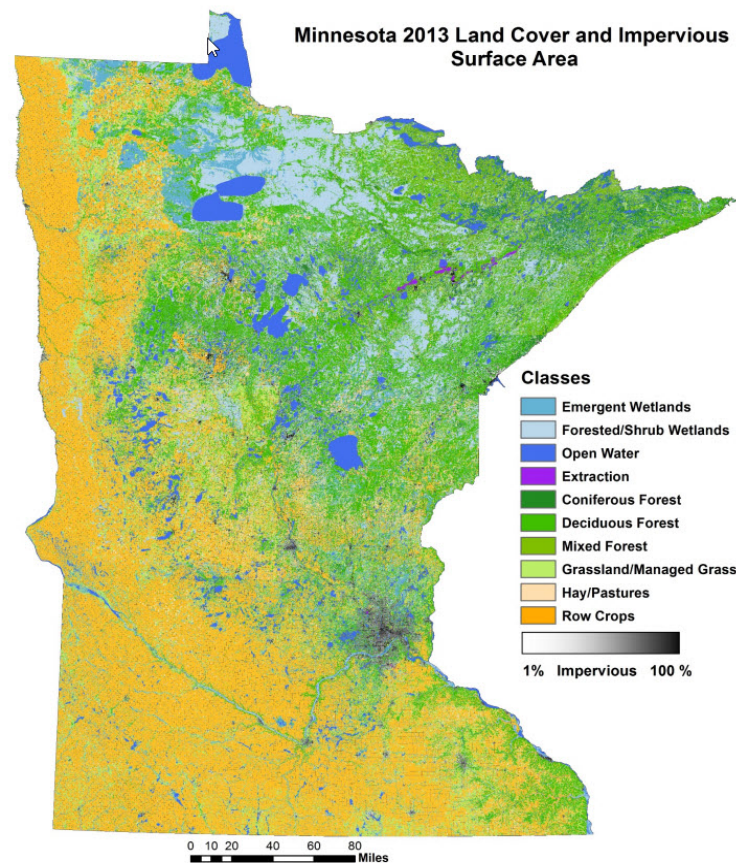
Schematic diagram of water table interpolation

## 2.4 DEVELOPING LAND COVER MAPS

Land cover data play an important role in many land planning and natural resource management programs, but keeping these data up-to-date and accurate can be a challenge. Wetlands and water comprise about 25% of all area in Minnesota. Wetlands are also known to be somewhat difficult to accurately map and classify using purely conventional remote sensing techniques.

From 2011 to 2013, the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory conducted a project funded by Minnesota's Environment and Natural Resources Trust Fund to update the statewide land cover. The update was based on Landsat satellite imagery, the statewide lidar, and additional datasets such as the NWI. This new statewide land cover map was necessary because the previous map was completed in 2000, which meant that natural resource managers and other stakeholders had gone thirteen years without updated and comprehensive knowledge of how Minnesota was changing. The updated NWI was foundational to the accuracy of this important land cover product. Accurately classifying wetlands using geospatial data is a challenging task, which was substantially improved by incorporating the updated NWI. We estimate that the accuracy of the wetland class in our statewide land cover update improved by at least 20% using the new NWI compared to using the other datasets alone. This resulted in a product that is far better and more usable as a tool to manage Minnesota's natural resources.

- Dr. Joe Knight, Professor and Director of Remote Sensing Laboratory, University of Minnesota



Overview of the updated land cover data for Minnesota



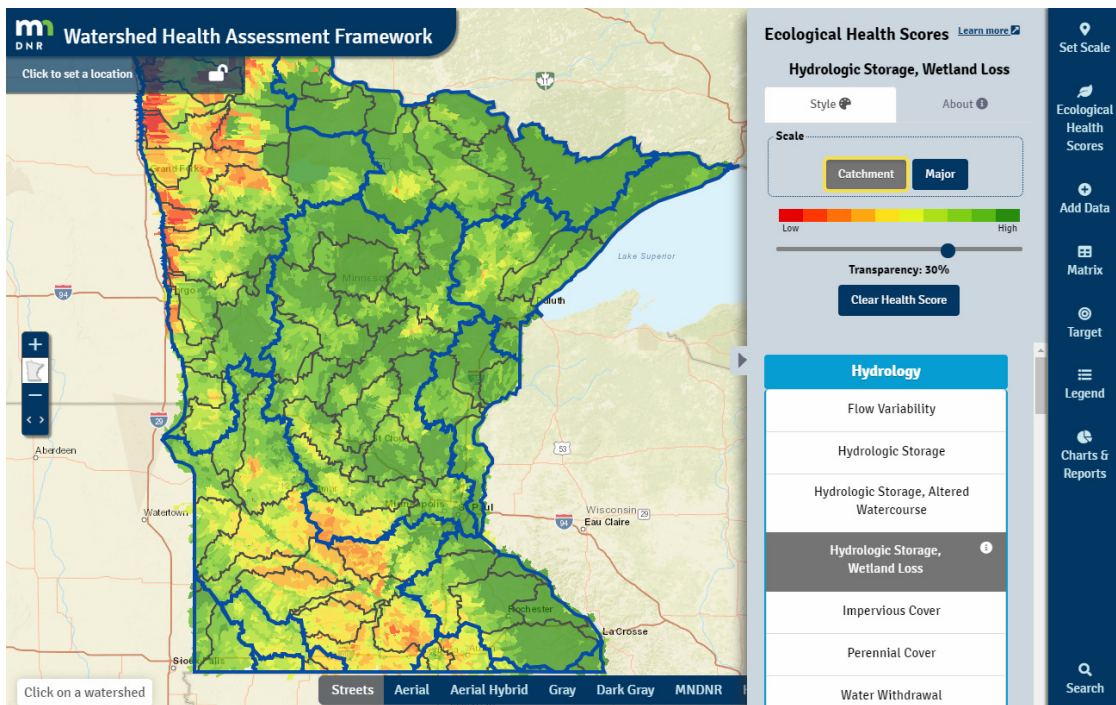
## 2.5 WATERSHED HEALTH ASSESSMENT

The Minnesota DNR developed a web application known as the Watershed Health Assessment Framework (WHAF) to help promote greater understanding of the factors affecting watershed health and to foster innovative ideas to improve the health and resilience of natural and human communities. WHAF uses a five-component framework to allow users to understand and evaluate watershed health. These components include biology, hydrology, geomorphology, connectivity, and water quality. The NWI data are used as part of the watershed hydrology health scoring.

The NWI data play a key role in calculating several watershed health scores available in the WHAF tool. The *loss of hydrologic storage* health score is comprised of two metrics; loss of wetlands and watercourse alteration. The loss of hydrologic storage potential due to the loss of wetlands is computed by subtracting current wetland extent (as defined by the NWI) from an estimate of historic wetland extent derived from hydric soils (from a combination of SSURGO and STATSGO databases). The wetland loss metric is combined with a metric for the percent of watercourses that have been altered. The watershed health score is provided to help watershed stakeholders identify areas to focus on restoring natural hydrology through both wetland and stream restoration programs.

In addition, the *terrestrial habitat quality* and *terrestrial habitat connectivity* scores also use the NWI data. These metrics are calculated from a model of likely habitat for sensitive wildlife species from each region of the state. The NWI data is a key input used to better identify wetland-dependent habitat needs.

- Ben Gosack, Senior Natural Resources Specialist, Minnesota DNR



Screenshot of the wetland loss metric for the Watershed Health Assessment Framework

## 2.6 WETLAND RESTORATION PRIORITIZATION

Minnesota has lost about half of its original 22 million acres of wetlands since 1850. Many of these wetlands were drained to support agricultural production, while others have been lost to other activities including urban development, mining, and road construction. Historically, wetlands were viewed as an impediment to development, but in recent decades, we have come to appreciate the many benefits they provide including flood reduction, water quality improvement, and wildlife habitat. Subsequently, federal, state, and local agencies as well as non-profit conservation organizations have expended considerable resources to restore wetlands. Careful planning is required to ensure that wetland restoration projects meet program objectives and are cost-effective.

Restoration programs frequently seek to identify multiple restoration opportunities in a targeted area. The NWI is a useful resource to identify potential restoration sites and evaluate their feasibility. The Natural Resources Research Institute (NRRI) developed an online decision support system that uses the NWI and other GIS layers to evaluate ecological stresses and potential wetland restoration benefits ([www.mnwetlandrestore.org](http://www.mnwetlandrestore.org)). As a part of this effort, the NRRI developed a statewide wetland probability model to identify all lands that are likely to be or to have been wetlands. The new NWI data are used to separate out existing wetlands from potentially restorable wetlands.

- Lucinda Johnson, Associate Director, Natural Resources Research Institute



Photo of blue flag iris in a wet meadow type wetland

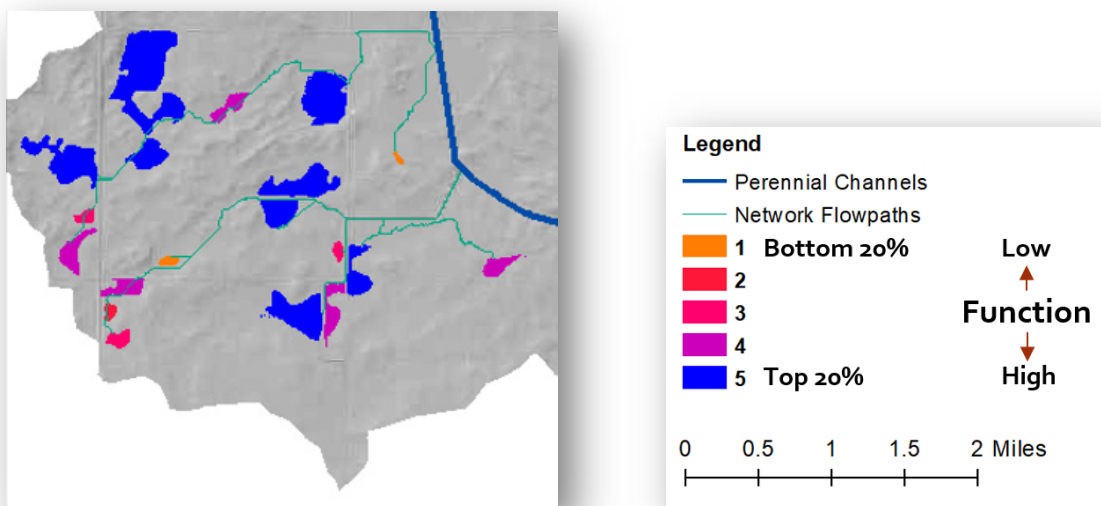


## 2.7 FLOOD STORAGE ANALYSIS

Floods are one of the most common types of disasters in Minnesota. Flooding from heavy rain or snowmelt events causes significant damage and the frequency of such events appears to be increasing. Wetlands can play a vital role in mitigating such damage. Depressional wetlands can temporarily store runoff and slowly release it over time, reducing flood peaks.

The St. Croix Watershed Research Station (SCWRS) has combined the NWI data with high-resolution elevation data from lidar to evaluate the runoff storage capacity of wetlands on a watershed wide basis. The overall effectiveness of flood storage for wetlands for a given watershed depends on not only wetland size (area, depth, and volume), but also their hydrologic connections with each other. Researchers at SCWRS modeled wetland connectivity networks for a set of study watersheds comprising over 2 million acres in Southern Minnesota. They calculated available storage volume, direct drainage area for wetlands, and then simulated each wetland's fill-and-spill response to runoff for various design storms. The results from this can be used to estimate the existing flood storage capacity for wetlands as well as to help identify areas that could use additional flood storage capacity.

- Jason Ulrich, Assistant Scientist, St. Croix Watershed Research Station



Relative flood storage ranking of wetlands

## 2.8 WILDLIFE HABITAT SURVEYS

There are numerous state and federal programs, as well as non-profit conservation organizations, dedicated to protecting wildlife and wildlife habitat. The NWI data have been frequently used for assessing habitat and population health of wetland dependent species. One example of this type of use is in designing duck surveys. These surveys provide essential information for waterfowl managers.

Wildlife research biologists Hannah Specht and Todd Arnold from the University of Minnesota, in collaboration with Ducks Unlimited and the USFWS, have used the NWI to identify characteristics of wetlands that correspond to whether they're used by waterfowl. Their research relied on developing correlations between waterfowl observations and basin-specific habitat characteristics including wetland size, edge complexity, water regime, and adjacent land cover. The wetland variables were derived from the NWI. Wetland size is positively correlated to duck abundance. The degree of edge complexity (the ratio of the wetland perimeter to the perimeter of a circle with the same area) is correlated to the amount of shallow water habitat used by dabbling ducks. Dabbling ducks also show a preference for seasonally flooded wetlands during certain times. As a result, wetland management efforts for waterfowl can be focused on wetlands most likely to be occupied.

- Dr. Hannah Specht, Postdoc at University of Montana, PhD in Conservation Sciences, University of Minnesota



Photo of mixed flock of ducks in a wetland

## 3 ANCILLARY BENEFITS

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### 3.1 AERIAL IMAGERY USES

Spring leaf-off imagery is the preferred base imagery for wetland mapping because it provides a better view of ground conditions beneath the vegetative canopy and it corresponds with seasonally high water tables, making wetlands easier to identify. As part of the NWI update, this project acquired high-resolution, 4-band, spring leaf-off imagery for the entire state of Minnesota. The ENRTF was used to fund a baseline resolution of 1/2 –meter resolution imagery. The imagery acquisition team reached out to dozens of potential partners interested in buying up to 0.3-meter (1-foot) resolution imagery.

This was the first statewide spring leaf-off imagery acquisition in Minnesota since the 1991 black and white imagery. Imagery were acquired between 2009 and 2014. All the imagery was made freely available through the MnGeo imagery service ([https://www.mngeo.state.mn.us/chouse/wms/geo\\_image\\_server.html](https://www.mngeo.state.mn.us/chouse/wms/geo_image_server.html)). The spring aerial imagery acquired through this program averaged 1.23 million image requests per month from July 2017 through February 2019, showcasing the high value of this dataset.

#### 3.1.1 Watershed Restoration and Protection Strategy

The Minnesota Pollution Control Agency helped fund the acquisition of higher resolution imagery for northeastern Minnesota. The MPCA used this imagery to help develop a Watershed Restoration and Protection Strategy (WRAPS) by identifying pollution sources and other stressors such as feedlots adjacent to streams and lakes.

- Jesse Anderson, Research Scientist, MPCA

#### 3.1.2 Digital Surface Modeling for Land Change Analysis

The Minnesota DNR Division of Forestry received a US Forest Service Landscape Scale Restoration (LSR) grant to develop an innovative technique for mapping land cover change using stereo imagery to develop digital surface models (DSMs) and looking for changes over time. The imagery acquired by the NWI is a unique dataset in that it provides statewide stereo coverage at 0.5-meter resolution or better. The stereo imagery data from the NWI project will be used by this LSR project as well as an associated Great Lakes Restoration Initiative (GLRI) project to create a statewide multi-temporal DSM and fill in gaps where satellite stereo and fall color stereo aerial coverage hasn't been acquired yet.

- Dr. Jennifer Corcoran, Remote Sensing Program Consultant, Minnesota DNR

### 3.2 PEOPLE TRAINED

#### 3.2.1 St. Mary's University of Minnesota – academic apprenticeship

GeoSpatial Services (GSS) is a project center within Saint Mary's University of Minnesota that integrates professional services and academic apprenticeships in the areas of natural resource assessment, geographic analysis, and contemporary digital mapping. This integration employs the technical and problem-solving skills of full-time staff, fosters practical work experience, and provides non-traditional education for students. The NWI Update project for Minnesota provided 26 students with the opportunity to learn about geospatial technologies and geographic data production in a mentored business environment. Students who participated on this project developed unique and marketable technical software skills and professional experience in a consulting business



setting, while earning money to support their education. They also gained a significant appreciation for the diverse natural resources of Minnesota. Out of the many students that worked on the MN NWI project and at the time of writing this document, we know that nine have gone on to professional careers in the geospatial industry and five have registered for advanced degrees in geographic information science. This apprenticeship truly has been a springboard for their transition into professional life.

### 3.2.2 University of Minnesota – graduate research assistantship

The NWI project was extraordinarily important to the development of students and staff at the University of Minnesota. These include three doctoral students (Jennifer Corcoran, Lian Rampi, Keith Pelletier), six Master's students (Courtney Blouzdis, Josh Dunsmoor, James Klassen, Bryan Tolcser, Margaret Voth, Yan Wang) and one research staff (Trent Erickson). In addition, twelve undergraduate students participated in the project as field sampling crewmembers, which gave them skills important to their career development. The project provided the data and methods for eight peer-reviewed journal articles and numerous conference presentations. The graduate students supported have gone on to make important contributions to the geospatial field based on the knowledge and experience gained through their participation in the NWI project, including one holding a postdoctoral fellowship at NASA JPL and others landing successful careers at the MN DNR, environmental consulting firms, and geospatial non-profit organizations.

## 4 DATA DISSEMINATION

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The NWI is available electronically in two basic forms: (1) the data can be viewed through easy-to-use online wetland map applications; or (2) the GIS data can be downloaded and used by desktop GIS software. The data can be downloaded from the Minnesota Geospatial Commons or the USFWS Wetland Mapper. The Minnesota DNR and the U.S. Fish and Wildlife Service both maintain online wetland mapping applications.

For links to download data and online maps, see the DNR wetlands maps web page:

<https://www.dnr.state.mn.us/wetlands/maps.html>

The spring imagery acquired under this project is also being shared through the MnGeo web service.

Other web mapping applications are also using these data including the Watershed Health Assessment Framework from the DNR and the Wetland Restoration Prioritization Tool from the Natural Resources Research Institute.

### 4.1 PUBLICATIONS AND CONFERENCE PRESENTATIONS

The information developed through this project was widely shared through local and national conference presentations, workshops, peer-reviewed journals, book chapters, and other publications. The information dissemination benefits not only potential users of the data, but also other professionals engaged in related wetland and natural resources mapping efforts. Publications generated by the Minnesota NWI update have been cited in 231 other publications to-date. Wetland mapping methods developed during this project are also being used in many mapping efforts in other states and countries.

#### 4.1.1 Publications

Kloiber, S.M., Macleod, R.D., and Wang, G. (2018) An automated procedure for extending the NWI classification system for wetland functional assessment in Minnesota, United States. In “Wetland and Stream Rapid Assessments: Development, Validation, and Application”, Ralph Tiner Ed. Chapter 2.2.5.

Kloiber, S.M., Macleod, R.D., Smith, A.J., Knight, J.F., and Huberty, B.J. (2015) A semi-automated, multi-source data fusion update of a wetland inventory for east-central Minnesota, USA. *Wetlands*. 35(2): 335-348. (22 citations)

Knight, J., Corcoran, J. Rampi, L., Pelletier, K. 2015. Theory and Applications of Object-Based Image Analysis and Emerging Methods in Wetland Mapping. In Tiner, R., Lang, M., Klemas, V. *Remote Sensing of Wetlands: Applications and Advances*. CRC Press, 2015.

Corcoran, J., Knight, J., Pelletier, K., Rampi, L., Wang, Y. 2015. The Effects of Point or Polygon Based Training Data on RandomForest Classification Accuracy of Wetlands. *Remote Sensing, Special Issue: Towards Remote Long-Term Monitoring of Wetland Landscapes*. *Remote Sensing*. 2015(7), DOI: 10.3390/rs70404002.

Rampi, L.P., Knight, J.F., and Pelletier, K.C. (2014) Wetland mapping in the Upper Midwest United States: an object-based approach integrating lidar and imagery data. *Photogrammetric Engineering and Remote Sensing*, 80(5): 439-449. (28 citations)

Rampi, L.P., Knight, J.F., and Lenhart, C.F. (2014) Comparison of flow direction algorithms in the application of the CTI for mapping wetlands in Minnesota. *Wetlands*, 34(3): 513-525. (16 citations)

Knight, J.F., B. Tolcser, J. Corcoran, and L. Rampi. (2013) The effects of data selection and thematic detail on the accuracy of high spatial resolution wetland classifications. *Photogrammetric Engineering and Remote Sensing*, 79(7): 613-623. (22 citations)

Rampi, Lian Pamela. (2013). Evaluating state-of-the-art remotely sensed data and methods for mapping wetlands in Minnesota. Retrieved from the University of Minnesota Digital Conservancy, <http://hdl.handle.net/11299/162515>.

Corcoran, Jennifer Marie. (2013). Integrating data from several remotely sensed platforms to accurately map wetlands. Retrieved from the University of Minnesota Digital Conservancy, <http://hdl.handle.net/11299/152862>.

Corcoran, J.M., Knight, J.F., and Gallant, A.L. (2013) Influence of Multi-Source and Multi-Temporal Remotely Sensed and Ancillary Data on the Accuracy of Random Forest Classification of Wetlands in Northern Minnesota. *Remote Sensing*, 5(7): 3212-3238. (87 citations)

Corcoran, J.M, Knight, J.F., B. Brisco, S. Kaya, A. Cull, K. Murhnaghan. (2011) The integration of optical, topographic, and radar data for wetland mapping in northern Minnesota. *Canadian Journal of Remote Sensing*, 27(5): 564-582. (56 citations)

#### 4.1.2 Presentations

Kloiber, S.M. and Ulrich, J. (2018) Wetland Functional Assessment Using Minnesota’s New and Improved Wetland Inventory. Minnesota Water Resources Conference. St. Paul, MN.

Kloiber, S.M. (2018) Using Minnesota’s New and Improved Wetland Inventory for Geospatial Analysis. 28th Annual Conference of the Minnesota GIS/LIS Consortium. Duluth, MN.

Kloiber, S.M. (2015) An Improved National Wetland Inventory for Southern Minnesota. 25th Annual Conference of the Minnesota GIS/LIS Consortium. Duluth, MN.

Kloiber, S.M. (2013) Assessing Wetland Quantity Changes for Minnesota from 2006 to 2011. The 2013 Society of Wetland Scientists Annual Meeting. Duluth, MN.

Macleod, R.M. and Kloiber, S.M. (2013) Automating a Hydrogeomorphic (HGM) Classification for the National Wetlands. 23rd Annual Conference of the Minnesota GIS/LIS Consortium. Rochester, MN.

Rampi, L. and Knight, J. (2013) Wetland mapping in Minnesota: An object-based approach to integrate lidar and multispectral imagery. 23rd Annual Conference of the Minnesota GIS/LIS Consortium. Rochester, MN.

Corcoran, J.M.; Knight, J.F.; (2013). "Mapping and Monitoring Wetland Ecosystems More Accurately by Integrating Data from Several Remotely Sensed Platforms". American Association of Geographers, Los Angeles, CA.

Kloiber, S.M. (2012) A Case Study of Quality Assurance for GIS Data Development Using the National Wetland Inventory. 22nd Annual Conference of the Minnesota GIS/LIS Consortium. St. Cloud, MN.

Cialek, C., Kloiber, S.M., Jenkins, P., Wencil, R., and Bloomquist, J. (2012). Panel on New Aerial Imagery in Minnesota Progress Reports; Visioning a Long-Term Statewide Program. 22nd Annual Conference of the Minnesota GIS/LIS Consortium. St. Cloud, MN.

Corcoran, J. and Knight, J. (2012) The Influence of Multi-Platform, Multi-Frequency, and Multi-Temporal Remote Sensing and Field Reference Data Quality on the Accuracy of Decision Tree Classification of Wetlands. 22<sup>nd</sup> Annual Conference of the Minnesota GIS/LIS Consortium. St. Cloud, MN.

Corcoran, J.M.; Knight, J.F.; (2012). "Incorporating Data from Several Remotely Sensed Platforms to Map Current and Potentially Restorable Wetlands", INTECOL International Wetlands Conference, Orlando, FL.

Corcoran, J.M.; Knight, J.F. (2012). "Integration is Modernization: On Incorporating Data from Several Remotely Sensed Platforms to Accurately Map Current and Potential Wetlands", American Society for Photogrammetry and Remote Sensing, Sacramento, CA.

Cialek, C., Kloiber, S.M., Jenkins, P., Brandt, D. and Wencil, R. (2011). Panel on Aerial Imagery in Minnesota – Continued Progress, Improved Collaboration. 21st Annual Conference of the Minnesota GIS/LIS Consortium. St. Cloud, MN.

Kloiber, S.M. (2011). A Sneak Preview of the National Wetland Inventory Update. 21st Annual Conference of the Minnesota GIS/LIS Consortium. St. Cloud, MN.

Kloiber, S.M. (2010) Mapping the Probability of Wetland Occurrence with LiDAR. 20th Annual Conference of the Minnesota GIS/LIS Consortium. Duluth, MN.

Corcoran, J.M.; Knight, J.F. (2011). "Data Integration of Fully Polarimetric Synthetic Aperture Radar (SAR), Optical Imagery & Topographic Data for Wetland Mapping", American Society for Photogrammetry and Remote Sensing, Milwaukee, WI.

Corcoran, J. and Knight, J. (2010). "Synthetic Aperture Radar (SAR) Polarimetry for Wetland Mapping and Change Detection". RADARSAT-2 Annual Workshop, Montreal, QC.

Corcoran, J. and Knight, J. (2010) Synthetic Aperture Radar (SAR) for Wetland Mapping and Change Detection. 20<sup>th</sup> Annual Conference of the Minnesota GIS/LIS Consortium. Duluth, MN.



## 5 PEOPLE & PARTNERS

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### 5.1 FUNDING PARTNERS

Major funding for the update of the NWI in Minnesota came from the Minnesota Environmental and Natural Resources Trust Fund (ENTRF) as recommended by the Legislative and Citizen Commission on Minnesota Resources (LCCMR). The ENTRF provided \$7,150,000 for this effort over a period of 10 years. Numerous partners made financial contributions totaling over \$1 million (Table). Most of these partner contributions were directed toward enhancing the spring imagery acquisition.

<b>Funding Source and Use of Funds</b>	<b>Funding Timeframe</b>	<b>\$ Amount</b>
MN Environmental & Natural Resources Trust Fund – Imagery Acquisition, Methods Development, Defining User Requirements, Wetlands Mapping, Quality Control, Demonstration, and Outreach	FY09 through FY19	\$7,150,000
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
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	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

## 5.2 PARTICIPANTS

There were about 100 people from a dozen different organizations directly involved with the NWI update.

### 5.2.1 Project Coordination (DNR)

The project was coordinated by the DNR Division of Ecological and Water Resources. Ann Pierce was the executive sponsor, Doug Norris was the business sponsor, Steve Kloiber was the project manager, and Andrea Bergman was the technical data steward. Coordinating a project this large over such a long period was a significant challenge. In the end, the project was brought in on schedule and within budget.

### 5.2.2 Technical advisory committee (multiple agencies)

A technical advisory committee was formed from federal, state, and local partners to provide guidance on the project.

Joe Knight (UMN)	Susanne Maeder (MnGeo)
Brian Huberty (USFWS)	Nancy Read (MMCD)
Doug Norris (DNR)	Steve Eggers (USACE)
Less Lemm (BWSR)	Mark Gernes (MPCA)
Ken Powell (BWSR)	Rob Sip (MDA)

### 5.2.3 Methods development and field validation (University of Minnesota)

The Remote Sensing and Geospatial Analysis Laboratory at the University of Minnesota provided key services including research and development of wetland mapping methods. The results from this effort included technical reports to the DNR, peer-reviewed publications on remote sensing of wetlands, and multiple local and national technical presentations. The principal investigator for the UMN was Dr. Joe Knight. Research was carried out by graduate students including Bryan Tolser, Dr. Jennifer Corcoran, Dr. Lian Rampi, and Josh Dunsmoor. In addition, the UMN also acquired an independent set of field validation data that was used to assess the data quality of the final NWI product.

#### UMN NWI Field Interns

Sheena Ahrar	Aaron Job
Matthew Billings	Wolf Ruhmann
Jaime Borotz	Mickey Rush
Vanessa Borotz	Steven Sovinski
Heidi Eaves	Cody Venier
Brandon Hull	Kia Yang

### 5.2.4 Data processing & QA/QC (DNR Resource Assessment Program)

The DNR Forestry Resource Assessment Program (RAP) in Grand Rapids provided support for this project including compiling and pre-processing data as well as field and in-office quality control review of wetland classification data. RAP developed several derived data products from lidar including; slope, topographic position index, compound topographic index, max height of first return, return intensity, and hillshade. These data along with other ancillary data on soils were provided to the mapping contractors as part of the input for their work. Draft NWI data were reviewed by RAP and comments provided to the mapping contractors.

### **DNR Resource Assessment NWI Project Staff**

Molly Shoberg	Dr. Jennifer Corcoran
Tyler Kaebisch	Dennis Kepler
Dr. Scott Hillard	Mike Hoppus
Bonnie Delare	Tim Anun
	Dr. Ram Deo

#### **5.2.5 Production mapping (Ducks Unlimited and St. Mary's University)**

While project coordination, methods development, data pre-processing, and QA/QC are all important, the core of the project is to map and classify wetlands for the entire state of Minnesota, one of the most wetland-rich areas of the country. This work was conducted by two competitively bid contracted organizations: Ducks Unlimited and Geospatial Services of St. Mary's University of Minnesota. Their work involved dozens of people from project managers, geospatial analysts, senior photo-interpreters, and numerous student workers.

#### **Ducks Unlimited**

Robb Macleod	Anna Wahl	Erica Smith	Christy Kelly
Gang Wang	Lucian Murphy	Adam Brzak	Martina Schneider
Aaron Smith	Leah Harrison	Matthew Burud	James Steward
Rob Paige	Mitchell Diltz	Matthew Girbach	Bill Bond
Alek Kreiger	Sean Wylie	Brandon Baird	Danielle Forsyth
Mat Halliday	Ashley Suiter	Jordan Duft	Jes Skillman
Emily Doerner	Caitlin Boon	Kristin Bahleda	Mike Mitchell
Jack McDonald	Brian Kearns	Teresa Pilon	Nick Smith

#### **Geospatial Services of St. Mary's University of Minnesota**

Andy Robertson	Keith Bollinger	Hannah Hutchins	Reed Fry
Dave Rokus	Jensen Connor	Christine Wiggins	Darren Omoth
Chad Richtman	Joey Nadeau	Amanda Momeni	Matt Hogan
Kathy Allen	Rick Debbout	Zack Ansell	Nick Shelquist
Jeff Knopf	Matt Anderson	Peter McColl	Zach Loechler
Kevin Stark	Kyle Good	Katie Ethen	Toan Tran
John Anderson	Derrick Sailer	Conner Morgan	James Loken
Roger Meyer	Jena Happ	Klaus Friedli	Eric Lindquist
Nick Lemcke	Seth Webinger	Christine Neumann	



### 5.2.6 Field visit participants

The project was conducted in phases, divided up by geographic region. Each region included initial fieldwork to develop site-specific photo-interpretation guidance, collect training data, and familiarize the staff involved in mapping with the landforms and wetland types. We invited other project stakeholders to join these field visits. Some of these additional stakeholder participants are listed below.

- Brian Huberty (USFWS) – east-central, south, northeast
- Mark Gernes (MPCA) – east-central
- Kane Radel (BWSR) – south MN
- Clint Little (DNR) – northeast MN
- John Jereczek (DNR) – northeast MN
- Daryl Weirzbinski (USACE) - northeast
- Tom Hollenhorst (EPA) – northeast
- Ralph Tiner (USFWS) – special hydrogeomorphic workshop



Photos of field visit participants for the NWI

### 5.2.7 Draft data review outside participants

As part of the NWI project, we developed an application to share the draft data with project stakeholders. We invited stakeholders to review and comment on the draft data using this web mapping application. By inviting stakeholders to review the draft data, we were able to leverage their knowledge of local conditions to catch potential errors early enough in the process to incorporate corrections before the full public release of the data. The process we followed was when a new block of draft data was posted we would send email invitations to county wetland specialists. Reviewers that had registered accounts for the draft data review tool are listed below.

#### Registered Users for the NWI Draft Data Review Tool

Colleen Allen	Matthew Danzl	Beth Hippert	Darren Newville
Mike Becker	Phil Doll	Steven Hofstad	Tyler Orgon
Nicole Bernd	Craig Erickson	Jared House	Joe Pallardy
Robert Bohland	Kelly Erickson	Brian Huberty	Jon Peterson
Joseph Brennan	Danielle Evans	Travis Janson	Donald Prom
Mitch Brinks	Brianna Forcier	John Kostreba	Nancy Read
Jamin Carlson	Lynn Foss	Dane Lynch	Becky Sovde
Lance Chisholm	Mark Gernes	Bryan Malone	Josh Stromlund
Ryan Clark	Rusty Griffin	Tyler Marthal	David Thill
Ed Clem	Dan Haasken	Jeremy Maul	Doug Thom
Kelly Condiff	Aaron Habermehl	Helen McLennan	Kevin Trappe
Jim Dahl	Jerome Haggemiller	Mark McNamara	Teresa Wickeham
Maranda Dahl	Tanya Hanson	Peter Mead	Nathan Williams
Thomas Daniels	Dillon Hayes	Aaron Neubert	Scott Zwick

### 5.2.8 Functional assessment demo & outreach (St. Croix Watershed Research Station)

The updated NWI data are not only more current and accurate than the original NWI, but they also include new attributes like the hydrogeomorphic classification (HGM). These enhancements will support additional uses such as wetland functional assessment. However, given that this type of information is new to Minnesota wetland scientists, there is little experience and knowledge regarding the use of HGM to conduct landscape-level wetland functional assessments. The St. Croix Watershed Research Station (SCWRS) lead an effort to demonstrate some of the potential uses of the enhanced NWI data. Key project staff for SCWRS in this effort included Jim Almendinger and Jason Ulrich.

### 5.2.9 Application Development and Data Distribution

MNIT Services at DNR also provided support for the NWI project. Application development for a data review tool was provided by Craig Perreault. Application development for the Wetland Finder was provided by Jeremy Moore and Jessica Schultz. Mike Tronrud created the tile cached web services (both the NWI data and the spring imagery). Zeb Thomas assisted with data management and publication to the MN Geospatial Commons.

### 5.2.10 Imagery Acquisition Workgroup (MnGeo, MNDOT, DNR)

The spring leaf-off imagery acquisition for the NWI project presented a significant opportunity to leverage this imagery for multiple users and multiple benefits. We developed an imagery acquisition workgroup to help lead this aspect of the project. The DNR collaborated with MnGeo to help administer and coordinate the imagery acquisition. Chris Cialek was the point person for MnGeo, overseeing communications between the DNR, local

partners, and imagery vendors. Nancy Rader and Jim Krummrie provided support for administration and quality control. Pete Jenkins of MNDOT was also part of the imagery acquisition workgroup. MNDOT staff also helped coordinate positional accuracy testing of the imagery deliverables.

## 6 LETTERS OF SUPPORT

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The following organizations have provided letters of support for this nomination:

- US Fish and Wildlife Service (Brian Huberty, NWI Coordinator)
- Minnesota Board of Water and Soil Resources (Ken Powell, WCA Operations Coordinator)
- Minnesota Pollution Control Agency (Katrina Kessler, Assistant Commissioner)
- University of Minnesota Remote Sensing and Geospatial Analysis Laboratory (Dr. Joe Knight, Professor)
- Ducks Unlimited (Nick Wiley, Chief Conservation Officer)
- St. Mary's University of Minnesota (Andrew Robertson, Executive Director, Geospatial Services)
- Mille Lacs County Environmental Resources (Dillon Hayes, Environmental Resources Manager)
- Shakopee Mdewakanton Sioux Community (Ferin Davis, Lead Environmental Scientist)

*March 1, 2010*

Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee:

The Minnesota Department of Natural Resources has been and continues to be a leader for mapping Minnesota's wetlands in partnership with local governments, NGO's, tribes and federal agencies. I am writing this letter in support of the nomination of the Minnesota Department of Natural Resources (DNR) for the Governor's Commendation Award for the development and public release of an updated, upgraded and enhanced wetland inventory for Minnesota. Ten years and about ten million dollars were invested to better define the dynamic and geospatial state of wetlands throughout Minnesota.

Wetlands provides clean water, flood storage, recreation opportunities such as hunting and fishing, food as in wild rice, carbon storage as well as habitat for a multitude of fish and wildlife species. Wetlands help define the landscape of our state as well as being a component of our infrastructure.

As the National Wetlands Inventory (NWI) Coordinator for the U.S. Fish & Wildlife Service, I can attest to their value with a couple of examples. Wetland maps are critical for habitat assessment and landscape management across all ownerships and across North America. Wetland maps document where they lie across the state as well as their type, and condition. They are essential for proper conservation management.

The original NWI was based on 1970's and 1980's aerial photography. In this digital age, much has changed not only with wetlands but also with the digital approach to map wetlands. End users are now demanding more current and accurate delineations. The new method led by the DNR for the new Minnesota National Wetland Inventory (MN NWI) map has provided much more accurate estimates of wetland type, function and location that would be impossible to derive by any other means.

The use of original NWI and new MN NWI wetland maps span all sectors across Minnesota. The Minnesota Department of Transportation uses them for highway planning, airport management and the proposed North Star high speed rail corridor. The Minnesota Army National Guard Base at Camp Ripley uses wetland maps for training exercises and for conservation management. Tribes across the state use wetland maps for hunting and fishing as well as for wild rice management. Individual citizens are also frequent users of wetland maps for hunting, fishing, home development and private land conservation.

Given the scale and demands of this project to map such dynamic features which are constantly changing, the outcomes will provide the citizens of Minnesota a clearer picture of where our wetland features reside across the landscape. It is my pleasure to nominate the Minnesota Department of Natural Resources to receive the Governor's Geospatial Commendation.

Sincerely,

A handwritten signature in black ink, reading "Brian Huberty". The signature is fluid and cursive, with the first name "Brian" and last name "Huberty" clearly distinguishable.

Brian Huberty, National Wetland Inventory Coordinator  
U.S. Fish & Wildlife Service, Midwest Region  
5600 American Blvd; Suite 990  
Bloomington, MN 55437  
[brian\\_huberty@fws.gov](mailto:brian_huberty@fws.gov)  
612-713-5332





April 17, 2019

Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee:

I am writing this letter in support of the nomination of the Minnesota DNR for a Governor's Commendation Award for the development and public release of an updated and enhanced wetland inventory for Minnesota.

I am the Wetland Conservation Act Operations Coordinator for the Minnesota Board of Water and Soil Resources (BWSR). The Wetland Conservation Act (WCA) is the state's most comprehensive wetland regulatory program that affects every county and municipality. Being able to identify and classify wetlands is absolutely essential to implementing the WCA and conserving wetlands for the important functions they provide such as protecting water quality, storing floodwaters, providing wildlife habitat and many others.

A national effort to map wetlands in the 1980's (the National Wetland Inventory or NWI) appeared to provide a solid dataset for wetland conservation planning and regulatory implementation. However, it soon became apparent that there were significant inaccuracies and inconsistencies in the mapping data due to lack of technology and policy-influenced data collection methods adopted at the time. In addition, the mapping data became dated and less useful with the passage of time.

DNR's successful update and enhancement to wetland mapping provides a valuable resource for implementation of the WCA and wetland conservation in general. Landowners, regulators, natural resource planners, developers, farmers and many others who interact with wetlands and the wetland regulatory program now have an accurate and reliable resource to identify wetlands on the landscape. Wetland mapping data is now used in many aspects of the WCA program where it was missing prior to DNR's update. Landowners can now rely on this mapping resource to reasonably approximate the extent of regulated wetland resources on their property as they contemplate land use changes and associated regulatory implications. The updated wetland inventory is a reliable resource for regulatory staff to use in evaluating land use applications from their desktop, thereby improving the timing and efficiency of regulatory review. BWSR is also using this data to develop watershed-based plans to prioritize wetland restorations. The DNR's incorporation of new hydrogeomorphic descriptors adapted for Minnesota provides a new and improved way of evaluating wetland functions.

The Minnesota DNR should be recognized for their diligent and highly professional work to develop this important wetland mapping data, and I support them receiving the Governor's GIS Award.

Sincerely,

A handwritten signature in black ink, appearing to read "Ken Powell". The signature is fluid and cursive, with a large initial "K" and a stylized "P".

Ken Powell  
WCA Operations Coordinator

CC: Doug Norris, DNR

*Equal Opportunity Employer*

May 3, 2019

Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Dan Ross:

I am writing in support of nominating the Minnesota Department of Natural Resources (DNR) for a Governor's Geospatial Commendation for their leadership updating and enhancing Minnesota's National Wetland Inventory (NWI). Completion of this project to map and inventory Minnesota's surface waters including wetlands, lakes, larger streams, and rivers, took over 10 years and 8 million dollars to complete. This effort also included significant in-kind time from well over 100 partners and collaborators.

In its final form, Minnesota's NWI is one of the largest geospatial datasets in the state, including some 2.2 million polygon features spread across Minnesota. Project completion required the acquisition of high resolution recent spring leaf-off color infra-red and true color base imagery. This data is now publically available through the Minnesota Geospatial Commons.

Dozens of planning, permitting, monitoring, and research staff within the Minnesota Pollution Control Agency routinely use the leaf-off base imagery and the NWI data to support many parts of our agency work. Having current coverage and enhanced wetland classification and functional assessment attributes has improved efficiency and outcomes in agency activities and decisions; three examples are highlighted below.

- Total maximum daily load modeling uses wetland extent data to help determine water quality pollutant load allocations.
- Surface water monitoring staff rely on the NWI to support surveys to provide estimates of wetland quality across Minnesota. This improves our understanding of how the condition or health of wetland water quality affects stream and lake quality.
- Staff in the Section 401 Water Quality certification program regularly rely on accurate NWI data to inform and facilitate regulatory decisions on projects proposing to dredge or fill Minnesota waters.

Dan Ross  
Page 2  
May 3, 2019

Thank you for the opportunity to show support for this recently completed comprehensive geospatial project. If you have any questions or need additional details feel free to contact Mark Gernes in our Surface Water Monitoring Section at [mark.gernes@state.mn.us](mailto:mark.gernes@state.mn.us) or via phone at 651-757-2387.

Sincerely,



Katrina Kessler  
Assistant Commissioner

KK/PA/MG:vs

*Twin Cities Campus*

*Department of Forest Resources*

*College of Food, Agricultural and  
Natural Resource Sciences*

*115 Green Hall  
1530 Cleveland Ave. N  
St. Paul, MN 55108-6112  
612-624-3400  
Fax: 612-625-5212*

May 16, 2019

Mr. Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee members:

I write to express my enthusiastic support for the nomination of the Minnesota Department of Natural Resources (DNR) for the Governor's Commendation Award for the updated and enhanced Minnesota wetlands inventory. The University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory (RSGAL) was an early partner in the Minnesota National Wetlands Inventory (NWI) project. We conducted the methods development research that contributed to the successful wetland mapping done by contractors. We further performed the field sampling that created the validation products used to assess the accuracy of the new NWI.

A primary part of the mission of the University of Minnesota is educating future leaders. The NWI project supported the education of several Master's students, doctoral students, and research staff, who are named in the nomination letter. These former students and staff are now working in positions throughout Minnesota, including in state agencies, environmental consulting firms, geospatial services companies, and in academia. Working on the NWI project greatly influenced the careers of numerous people, who are now making important contributions to the state.

A second part of the University's mission is research. The new NWI has been an important piece of many additional research projects in the RSGAL. For example, in 2011 we were funded by Minnesota's Environment and Natural Resources Trust Fund to update the statewide land cover. This update of the previous layer from 2000 resulted in new data products that provide natural resource managers and other stakeholders with much-needed information about the current land cover of the state, and how it has changed. Such information is critical for management and conservation of our natural resources, among many other uses. The updated NWI was foundational to the accuracy of this important land cover product. Including the new NWI resulted in a product that is much better and more usable than it would have been without the NWI.

A third part of our University mission is extension. We are tasked with transferring knowledge and methods to the public. Since wetlands are such vital pieces of our statewide landscapes – providing benefits like wildlife habitat, recreation, food and water sources, flood mitigation, and carbon sequestration – it is important that we have the tools and information necessary to communicate about them with the public. The NWI project has given us both updated information about Minnesota's wetlands and an easy-to-use tool, the Wetland Finder, with which to improve our extension mission.



It is rare, in my experience, to participate in a project that involves such a large number of participants, from so many different agencies and groups, over a period as long as eleven-years. That breadth has allowed the NWI project to touch many lives, all over the state. The NWI project was an extraordinary partnership, bringing together wetlands scientists, natural resource managers, non-government stakeholders, and the public. The project and its resulting data products have had significant and long-lasting benefits to Minnesota. Therefore, the NWI project has my unreserved recommendation for the Governor's Commendation Award. Please do not hesitate to contact me if I can be of further assistance to your deliberations.

Sincerely,

A handwritten signature in black ink, appearing to read 'Joe Knight', with a long horizontal flourish extending to the right.

Joseph Knight  
Associate Professor and Director  
Remote Sensing and Geospatial Analysis Laboratory



One Waterfowl Way  
Memphis, TN 38120-2351  
(901) 758-3825 fax (901) 758-3850  
www.ducks.org

May 1, 2019

**President**  
Rogers S. Hoyt, Jr.  
Victoria, Texas

**Chairman of the Board**  
Paul R. Bonderson, Jr.  
Sunol, California

**Chief Executive Officer**  
H. Dale Hall  
Memphis, Tennessee

**Dan Ross**  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

**Dear Governor's Geospatial Commendation Awards Committee:**

I am writing this letter in support of the nomination of the Minnesota Department of Natural Resources (DNR) for the Governor's Commendation Award for the development and public release of "An Updated and Enhanced National Wetlands Inventory for Minnesota".

Ducks Unlimited prides itself on being a science-based organization and utilizing the best possible information to "fill the skies with waterfowl today, tomorrow and forever". While our mission is focused on wetland conservation, our work restoring, enhancing and protecting wetlands supplies many other benefits for other wildlife and humans. To do this work, DU needs accurate and timely geospatial information on the location, type and trends of wetlands throughout North America. Unfortunately, most of the US Fish and Wildlife Service's National Wetlands Inventory (NWI) is 30 years old, including the original NWI for Minnesota.

This project was a significant undertaking (lasting 11 years with 100 staff and costing over 7 million) and exemplary geospatial activity (over 40 undergraduate, graduate and post graduate students trained; seven peer-reviewed papers, and 13 presentations; consistent, state-wide, detailed wetlands delineation with three different classification systems for users). It has already yielded tangible benefits for Ducks Unlimited as we plan for future restoration efforts. The project also met five of the eight goals of the commendation.

Ducks Unlimited is in a unique position to support this nomination as we were involved in the creation of the data and are current and future users of the data. The results of this work will support efforts to continue our landscape planning efforts and on-the-ground habitat conservation work. The Minnesota DNR was a pleasure to work with on the project and were highly professional throughout. The way the project incorporated the research aspect with the University of Minnesota and the local and regional stakeholder in the quality control was an outstanding way to leverage expertise and generate support for the resulting products.

I fully endorse the nomination of the Minnesota DNR's "An Updated and Enhanced National Wetlands Inventory for Minnesota" for the Governor's Geospatial Commendation.

Sincerely,



Nick Wiley  
Chief Conservation Officer



March 18, 2019

Mr. Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee:

I write to you today in support of the nomination of the Minnesota Department of Natural Resources (DNR) for the Governor's Commendation Award for the development and public release of an updated, upgraded and enhanced wetland inventory for Minnesota. The completion and release of this data has been a multi-year public-private partnership initiative that has resulted in the creation of a critical spatial database for land use and habitat management in our state.

GeoSpatial Services is a project center within Saint Mary's University of Minnesota. Our mission is to provide experiential learning opportunities and 'real-world' work experience for our students. In order to provide these opportunities, we work with our nationwide partners on wetland inventory, spatial data analysis and watershed planning. As one of the contractors involved in the National Wetland Inventory update for Minnesota, we recognize the incredible value that this data represents for resource and habitat management, land use planning and decision support statewide.

We incorporate updated National Wetland Inventory data in most of the planning and resource management projects that we participate in with our partners. For many parts of the U.S., the wetland inventory is out of date and unsuitable for the types of analyses that we complete. Recent NWI updates such as the one in Minnesota provide improved accuracy and temporal consistency, which leads to enhanced decision support. In a recent example, GeoSpatial Services completed a spatial analysis highlighting the impact of proposed changes to the Waters of the U.S. Rule (WOTUS) under the Clean Water Act. Three watersheds were chosen for this analysis nationwide based on having current wetland data, and the Cottonwood River Watershed in Southwestern Minnesota was part of that showcase. This important project shed significant light on the impacts of the changes to the clean water rule. Minnesota was front and center in the process because of the new statewide, enhanced wetland inventory.



This is only one example of the value that an updated wetland inventory provides to the agencies and citizens of Minnesota. These data also support: improved project screening by state and federal agencies; more comprehensive and informed land use planning decisions (e.g., One Watershed One Plan initiatives); improved insight into habitat changes and focal areas for resource management; and, increased confidence for stakeholder engagement. It is for these reasons and many more that I strongly support the nomination of the Minnesota Department of Natural Resources for the Governor's GeoSpatial Commendation Award. Please do not hesitate to reach out if you require further information.

Sincerely,

A handwritten signature in black ink, appearing to read 'Andrew Robertson'.

Andrew Robertson  
Executive Director, GeoSpatial Services  
Saint Mary's University of Minnesota  
700 Terrace Heights, #7  
Winona MN 55987  
aroberts@smumn.edu  
507-457-8746



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**Dillon Hayes**  
*Environmental Resources Manager  
Administrative Services Office  
dillon.hayes@millelacs.mn.gov*

April 18, 2019

Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee,

I am writing this letter in support of the nomination of the Minnesota DNR for a Governor's Commendation Award for the development and public release of an updated and enhanced wetland inventory for Minnesota.

I serve as the Local Government Unit representative for the administration of the Wetland Conservation Act (WCA) in Mille Lacs County. Being able to identify and classify wetlands is absolutely essential to implementing the WCA, and the ability to do so with greater certainty from my desktop is one of the ways in which the WCA can be implemented locally with greater efficiency.

A national effort to map wetlands in the 1980's (the National Wetland Inventory or NWI) appeared to provide a solid dataset for wetland conservation planning and regulatory implementation. However, it soon became apparent that there were significant inaccuracies and inconsistencies in the mapping data due to lack of technology and policy-influenced data collection methods adopted at the time. In addition, the mapping data became dated and less useful with the passage of time.

The DNR's successful update and enhancement to wetland mapping provides a valuable resource for implementation of the WCA and wetland conservation in general. The updated wetland inventory is a reliable resource for regulatory staff to use in evaluating land use applications from their desktop, thereby improving the timing and efficiency of regulatory review. Mille Lacs County is also using this data to influence the development of both local and watershed-based plans to prioritize efforts to protect and restore water resources.

The Minnesota DNR should be recognized for their diligent and highly professional work to develop this important wetland mapping data, and I support them receiving the Governor's GIS Award.

Sincerely,

Dillon Hayes  
Environmental Resources Manager





# SHAKOPEE MDEWAKANTON SIOUX COMMUNITY

2330 Sioux Trail NW • Prior Lake, Minnesota 55372  
Tribal Office: 952.445.8900 • Fax: 952.233.4256

CHARLES R. VIG  
Chairman

KEITH B. ANDERSON  
Vice-Chairman

REBECCA CROOKS-STRATTON  
Secretary/Treasurer

May 14, 2019

Dan Ross  
Minnesota Chief Geospatial Information Officer  
Minnesota Geospatial Information Office  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Dear Governor's Geospatial Commendation Awards Committee,

I am writing this letter in support of the nomination of the Minnesota Department of Natural Resources (MNDNR) for a Governor's Commendation Award for the development and public release of an updated and enhanced wetland inventory for Minnesota.

I am the Lead Environmental Scientist for the Shakopee Mdewakanton Sioux Community (SMSC) Land and Natural Resources Department located in Scott County, Minnesota. I am primarily responsible for the maintenance and restoration of natural resources throughout the Community. An updated and enhanced wetland inventory in our region is an essential resource the SMSC will use for wetland conservation and planning purposes. The Community plans to utilize the MNDNR's new National Wetland Inventory data to update SMSC's current local wetland inventory and prioritize areas to assess and determine wetland conditions based on ecological and cultural values through hydrogeomorphic mapping methods and field site assessments. With this information the SMSC will be able to create watershed-level plans to conserve and restore wetlands and other surface and subsurface water resources.

Again, I wish to express my complete support of the MNDNR's nomination for the Governor's Commendation Award. The development and execution of this vital inventory will be utilized by many to protect, enhance and restore wetland resources.

Sincerely,

Ferin Davis  
Lead Environmental Scientist  
2330 Sioux Trail NW  
Prior Lake, MN 55372  
(952) 496-6183