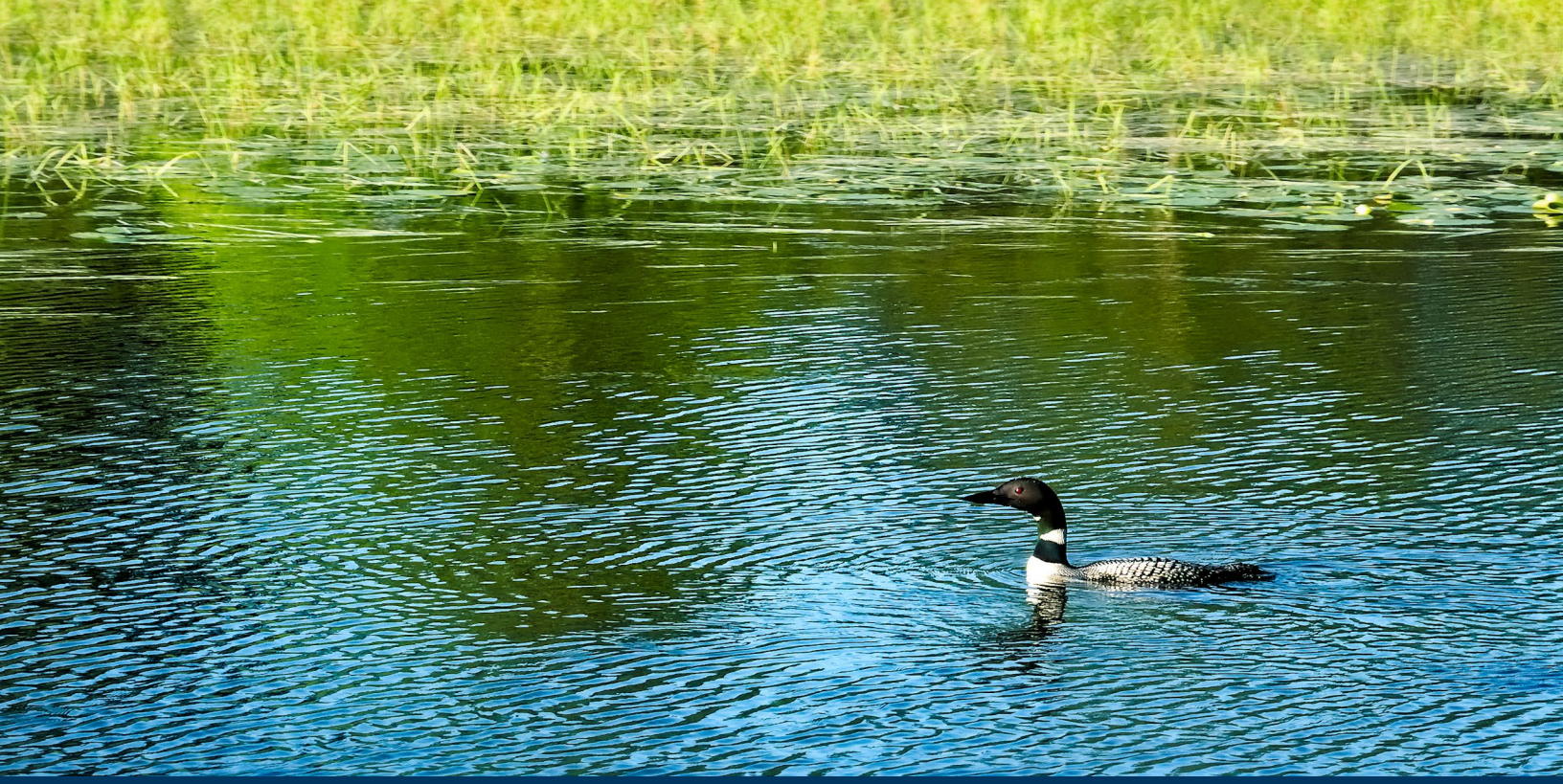

Minnesota Wetland Inventory and Wetland Finder

State of Minnesota — Minnesota IT Services

CATEGORY:
Data Management, Analytics & Visualization

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INITIATION DATE:
July 2008

END DATE:
June 2019

MINNESOTA IT SERVICES

Executive Summary

The National Wetland Inventory (NWI) update for Minnesota is the most comprehensive and up-to-date inventory of wetlands and water ecosystems in the country. It is an extremely important dataset for many natural resource planning and management efforts within Minnesota.

Minnesota IT Services (MNIT) application development and geospatial (GIS) staff partnered with the Department of Natural Resources (DNR) and many other organizations on a series of projects aimed at updating and modernizing the NWI inventory. The DNR, with funding from the Environmental and Natural Resources Trust Fund, began the statewide update of the NWI in 2008, with massive efforts to collect and prepare statewide aerial data. A high level of collaboration was necessary for success. The original NWI was completed in the mid-1980s, but over the decades, it became considerably out-of-date. In addition, mapping technology has changed considerably. Updating the inventory was critical for continued support of wetland planning and management.

Project oversight, coordination, and quality control were provided by the DNR, with the map production work handled through vendors. Other organizations provided mapping services for all sections of Minnesota.

In 2018-2019, MNIT staff partnered with the DNR on two key wetland tools. The Wetland Inventory Review and Changes tool, originally built in 2015, was updated with new web app technology in 2018. The Wetland Finder Web App was built by MNIT staff in 2019. These project teams provided application development, GIS data management support, tile caching, data publication, data stewardship, and data management.

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 capacity, evaluate carbon storage potential and climate change impacts, and estimate waterfowl and amphibian population distribution.

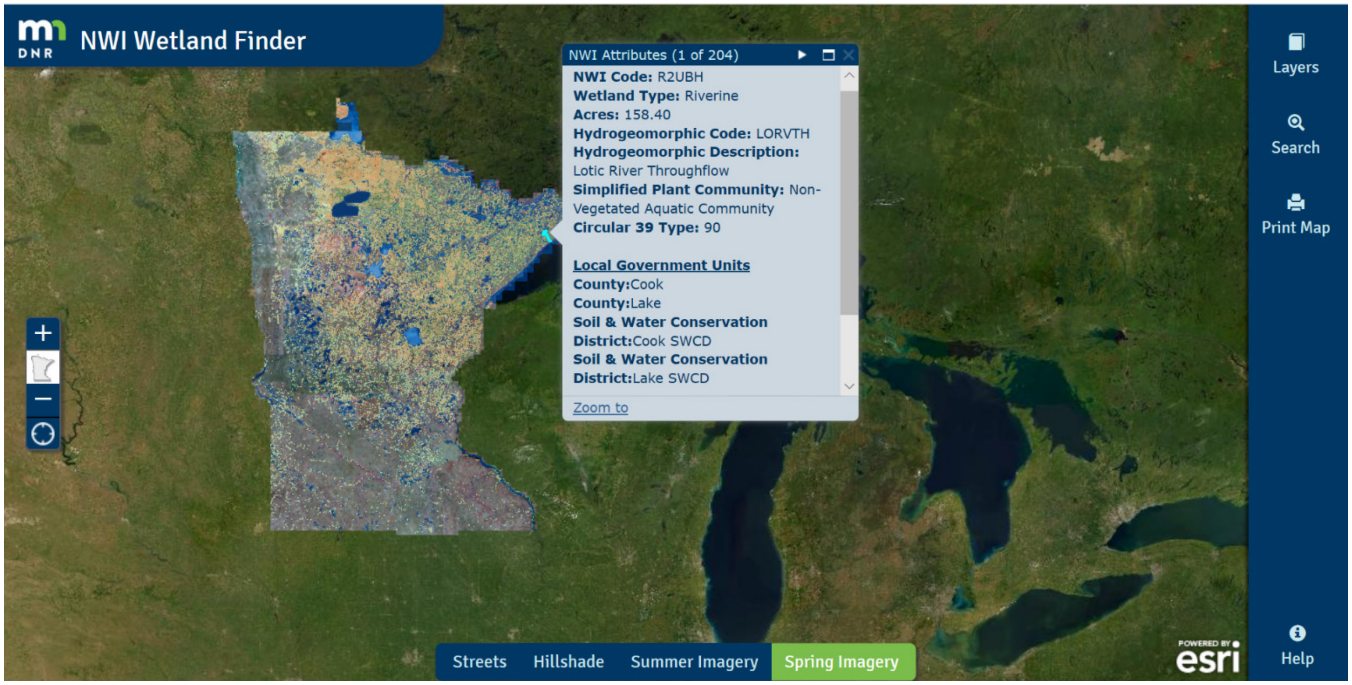
With over two million polygons in the dataset, it is also one of the largest Geographic Information System (GIS) datasets for Minnesota. The wetland inventory has been remapped using GIS technology, including lidar and high-resolution aerial imagery, making it the most comprehensive, current, and accurate wetland inventory in the country.

The NWI data are available electronically in two forms: online wetland map applications, and a download for use with desktop GIS software. The Minnesota DNR and the U.S. Fish and Wildlife Service both maintain online wetland mapping applications as well as provide download access to the GIS data. The data are also available on the Minnesota Geospatial Commons website.

EXEMPLAR

Although the data collection took place over the last decade, the technology was created in 2018-2019 to make use of state-of-the-art data storage and the online data delivery mechanism for all Minnesota wetland data. The **Minnesota NWI Wetland Finder** makes data easy to access and enables anyone to select an area and print maps of local wetlands from a web browser.

This project coupled modern remote sensing data collection with data storage and delivery through an online web application. The web application provides base map layer options of streets, hillshade terrain relief, spring satellite imagery, summer satellite imagery. It is searchable by pin drop location, street address, or public land survey identifiers.



This statewide collaborative 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.
- Acquiring 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.
- Creating 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 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.
- Delivering data efficiently and freely to various user groups through multiple means.

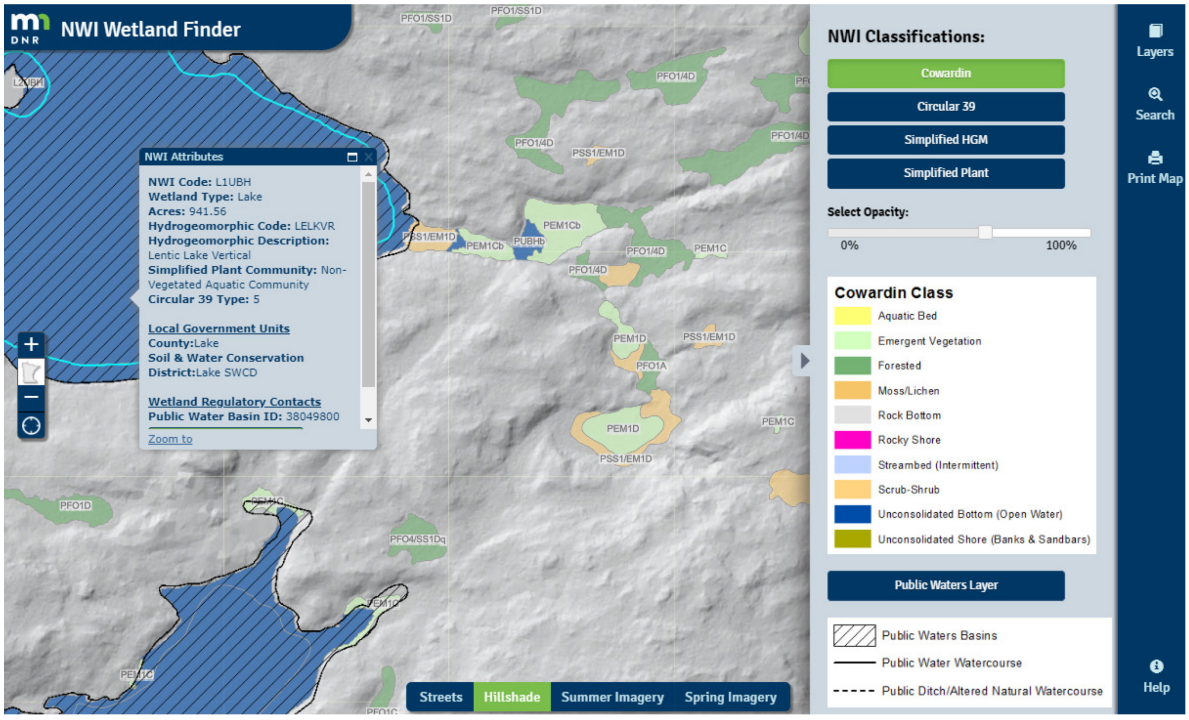
CONCEPT

The original mid-1980s NWI dataset was, like many mapping projects, treated like a one-time investment, but environmental features like wetlands are not static. There was no plan at the time to maintain and update these data. After 30 years, the data had become dated and inaccurate. This project greatly improved the accuracy of a dataset used for making planning and regulatory decisions, and incorporated modern application and data management technologies. Reduced errors of omission and commission save time and money for both government regulatory programs and permit applicants.

MNIT's involvement in all efforts included IT project management, GIS developers, business analysts, database architecture and development, data stewardship, application development, programming, security review, documentation, user guides, ongoing and final data validation and QA/QC, and design and programming of reports. MNIT staff provide ongoing technical and data management support.

The Wetland Finder provides a simple method for a non-GIS user to view the updated National Wetland Inventory (NWI) data. The online web Wetland Finder meets accessibility guidelines for online maps. People can use this application to get a quick initial view of the how many and what types of wetlands are present in each area. Users can search the map by location, address, and public land survey. Data is displayed from the NWI and the DNR's Public Waters Inventory (PWI).

The application offers basemap options, and layer controls for four separate symbology classification schemes, opacity adjustments, a toggle layer for public waters, and a link to a user guide.



Users can choose to display the data according to any of four different wetland classifications or they can click on any wetland and get additional attribute information. The attribute pop-up window also provides links to

wetland 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.

The authoritative data source is a PostgreSQL database created and maintained by MNIT. A dedicated server provides data storage.

The Wetland Finder application IT costs of $12,000 were related to staff hours for the project.

The Wetland Inventory web map application was developed to provide easy access to the wetland inventory data for Minnesota users without access to or knowledge of GIS software. The GIS data is available to GIS users through download and web services via the Minnesota Geospatial Commons, but for the non-GIS user (or for quick and simple access), we propose to develop a public-facing web mapping application. There are three main wetland regulatory programs in Minnesota: Public Waters Work Permit Program, the Minnesota Wetland Conservation Act, and the Federal Clean Water Act Section 404 Permit Program. These programs have different jurisdictions that sometimes overlap, and they are administered by different agencies. The Minnesota Wetland Finder provides the appropriate agency contact information for the specific wetland selected on the map.

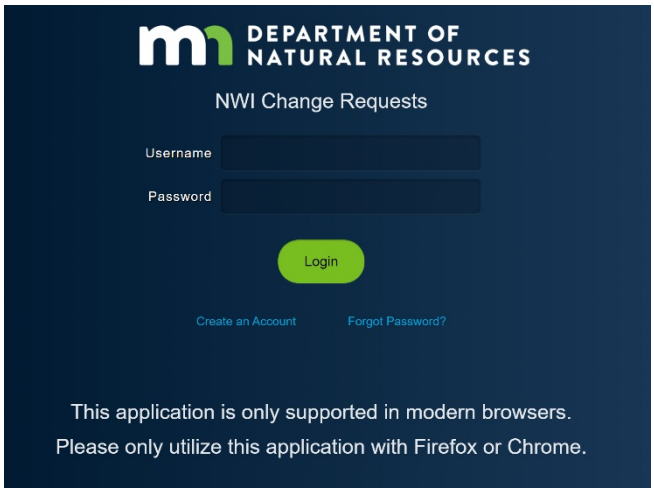
The basic data structure for the NWI is a GIS polygon data layer with an associated attribute table with one attribute record for every polygon. The file geodatabase version provided through the Minnesota Geospatial Commons also includes a series of extended attribute tables that can be joined to the primary attribute table based on a key field.

The principal classification attribute for the NWI uses a complex alphanumeric code to describe wetland types. These wetland types are described by supporting documentation such as “The Classification of Wetland and Deepwater Habitats” by Cowardin et al. (1979), which describes a hierarchy of wetland types. Wetland types at each level of this hierarchy are given coded values and linked into a single field. This system is further described later in this guide.

The uses of coded values makes for concise map labels, but it presents issues for the casual data user. Users who are unfamiliar with these codes will have difficulty understanding the data and will need to rely on outside references to look-up the full description of the various wetland types.

The state’s version of the data provide associated look-up tables that split these codes into separate fields for each component. Full text description is provided for each part. These tables can be joined to the base table using the key field [ATTRIBUTE]. This structure makes querying the data simpler and more robust.

The DNR Ecological and Water Resources Division is responsible for oversight and administration of this data. The NWI also features a web-based change request application for registered users, including wetland specialists from Soil and Water Conservation Districts, Watershed Districts, DNR Area Hydrologists, and other local governments. They can request changes or report updates online. This application has the same features, search functions and layer controls as the other applications.



A data governance structure is in place for data stewards to review the record of change requests and apply accepted changes to the dataset. Ongoing data stewardship informs registered users of changes to the data and reinforces the importance of the work.

SIGNIFICANCE

Minnesota has 12.2 million acres of wetlands, the second most in the lower 48 states after Florida! The goal of the NWI is to map all wetlands and deep-water habitats (lakes and rivers) larger than-0.5 acre in area. The NWI data has many uses including assessing potential impacts from proposed development projects, estimating flood storage capacity, mapping waterfowl and amphibian habitat, and evaluating carbon storage potential.

Stakeholder groups include local, state, and federal governments; watershed districts, wetland specialists, academics, and local citizens to name a few. The beneficiaries are Minnesotans who will see the result of responsibly managed wetlands.

This initiative falls under the Minnesota IT Services' Five Year Strategy for partnering with agencies to use technology to connect Minnesotans and provide better online government services with systems that are accessible and usable by everyone. This initiative follows the MNIT strategy to:

- Implement data management strategies that help agencies to manage data as a strategic information asset.
- Advance investment in IT for modern mission-critical IT systems and services.
- Plan for future of technology in Minnesota to ensure our state can succeed in the digital economy by ensuring state agencies have cost-effective solutions to meet and manage their technology needs, while planning for the future and life cycle of technology in the state.
- Ensure that technology is accessible and easy to use for business partners and for all Minnesotans by requiring user-focused technology that makes dealing with government easier, simpler and better for the people of our state, including people with disabilities.

This initiative fits into the larger picture by addressing four of NASCIO's State CIO Top Ten Priorities:

- (2) Digital Government, by providing the state's digitized wetland polygons via an online map application.
- (5) Customer Relationship Management, by providing online wetland maps to local units of government and citizens.
- (7) Legacy Modernization, by using modern remote sensing aerial-collected data to update Minnesota wetland data from paper maps of the mid-1980s and serving it via a new online web application.
- (8) Data Management and Analytics, by consolidating wetland data collections into a single centralized, authoritative database.

IMPACT

The immediate impact of this initiative is that the extensive amount of high-resolution data is readily searchable and available. With modern data architecture and applications in place, MNIT and their DNR partners are poised for the future.

Long-term, having current, accurate data provides a holistic picture of the wetlands that can minimize development impacts, and maximize preservation.

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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. 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.

Future generations of Minnesotans will benefit from our wetland preservation and restoration efforts today, and by the technology to support data-driven decisions for the state.