Wetland Functional GIS

The bad news:
"Between 1986 and 1997, the United States lost 644,000 acres of wetlands."
The good news:
"The estimated wetland loss rate is now 58,500 acres each year—this is an 80% reduction from the 1980s."

—Report to Congress on the Status and Trends of Wetlands in the Conterminous United States 1986-1997

An Introduction

Citing the Jan/Feb 2000 Minnesota Lakes Association. Newsletter, in 1991 Minnesota counties were granted permission and the authority to implement the state Wetland Conservation Act (WCA). This act requires that during times of development, all efforts to avoid or minimize impacts to a wetland must be made before a wetland replacement plan will or can be considered. It also states that any unavoidable filling of or draining of wetlands (that are not exempt) must be replaced. The WCA requires that in counties in which at least 80% of the pre-settlement wetlands are in-place, the replacement must be at least equal to 1:1. Counties with less than 80% in-place must replace their wetlands at a higher ratio.
Cass County, Minnesota, was part of a joint pilot project to streamline the wetland permit processing and was later granted funds to develop and implement a functional model for classifying wetlands. This model is now known as the Cass County Wetland Functional Assessment Model.

Defining a Wetland

Wetlands have been generally described as areas or ecosystems that depend on being either inundated or saturated by surface or ground water often or long enough to support a prevalence of vegetation that is typically adapted for life in conditions of saturated soils.

In Minnesota statutes, two wetland classification methods are referenced and applied to State rules. The first, published as U.S. Fish & Wildlife Service Circular 39, was used for the initial state wetland protection program which recognized eight types of wetland basins. The second, Cowardin System, provides a more detailed classification of wetland habitats and is used on the NWI maps and in Minnesota's original 1991 Wetland Conservation Act. This method required adding 2 new basin types, for a total of 10. Defining a wetland may also consider the values of a wetland. Values are usually subjective estimates of the quality, importance, merit and worth of a wetland. Wetlands in remote areas that do not directly benefit humans may have critical importance to the existence of other species. That is the reason why the Wetlands Functional Assessment Model needed to take into account 8 different wetland characteristics.

Cass County, MN, Wetland Ordinance

The Cass County, MN, Wetland Ordinance implements the Wetland Conservation Act (WCA) of 1991 by requiring persons proposing to impact a wetland to attempt to avoid the impact, minimize the impact, or replace any impacted area with another wetland of equal function and value. The WCA is administered by Cass County and is overseen by the Board of Water and Soil Resources (BWSR). Enforcement of the WCA is provided by the Department of Natural Resources (DNR) and the Cass County Environmental Services Department (ESD).

The purpose of the ordinance is 4-fold: 1) to achieve no net loss in the quantity, quality, and biological diversity of Minnesota's existing wetlands; 2) to increase the quantity, quality, and biological diversity of Minnesota's wetlands by restoring or enhancing diminished or drained wetlands; 3) to avoid direct or indirect impacts from activities that destroy or diminish the quantity, quality, and biological diversity of wetlands; and 4) to replace wetland values where avoidance of activity is not feasible and prudent.

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Geographic Information System Specialists
CONSULTANTS GIS PROGRAMMERS TECHNICIANS

Wetland Functional Assessment Model

Cass County, Minnesota, and other counties like it are experiencing a population explosion as people move into those counties with the lure of the lakes and natural beauty. Due to this sudden influx and the concern for the impact people have on natural systems, conflicts are rising over the development of the decreasing buildable lakeshore. The county and long-time residents are worried about the developments being a large threat to the quality of the water within the lakes.

To abate the residents' frustration with the wetland protection acts, in 1995 Cass County filed for and was granted General Permit 17, authority to administer the U.S. Army Corps of Engineers Wetland Regulation. Permit 17 provided for the empowerment of a local agency to decide mitigation factors and to grant use permits to individuals and agencies when wetland impacts are involved.

In 1996, Cass County, Minnesota, assembled an interagency task force to build a wetland evaluation GIS. The team included members from the county's SWCD and Land Department, the DNR, BWSR, NRCS, US Army Corps of Engineers, USFS, Ten Mile Lake Association, U of M Duluth, Leech Lake Band of Ojibwe, and Pro-West & Associates, Inc. (PWA). PWA was responsible for collecting existing spatial data, supervising the creation of new data and integrating the data into a consistent format. PWA also built an automated mapping feature for ArcView.

Each member of the task force valued different parameters of wetlands. So together, they agreed to build an index of values based on eight different characteristics so that mitigation recommendations can be determined. Each subcommittee was given a characteristic and was asked to establish criteria to rate wetland types as either highly functional (3 points), moderately functional (2 points), or not functional (1 point) for that characteristic. The sum of those values was used to determine the replacement ratio of the wetland(s). This resulting data serves as a guide to the county's long-range plans to protect the local water resources. Plus, this model serves as the technical basis for the Cass County Wetland Ordinance.

The Cass County Wetland Ordinance strives to achieve no net loss in the quantity, quality and biological diversity of Minnesota's wetlands by restoring or enhancing diminished or drained wetlands.

"A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the soil surface."

National Research Council

Wetland Characteristics

Uniqueness: This is determined by calculating the total acres of each wetland type. The type with the smallest acreage received the highest score.

Fisheries Habitat: This is based on the wetland's proximity to trout or cisco waters.

Wildlife: Hydrologically isolated PEMs and PFOs within 50' of a river—considered types that provide critical wildlife habitat—were the highest scorers.

Rare & Endangered Species: This was found by using the county's biological survey data & the National Heritage database of known occurrences of rare and endangered species.

Cultural Resources: This was found by using criteria from the Leech Lake Band of Ojibwe, Mississippi Headwaters Board, US Forest Service and others.

Surface Water Quality: This was based on the wetland's proximity to a protected lake or river.

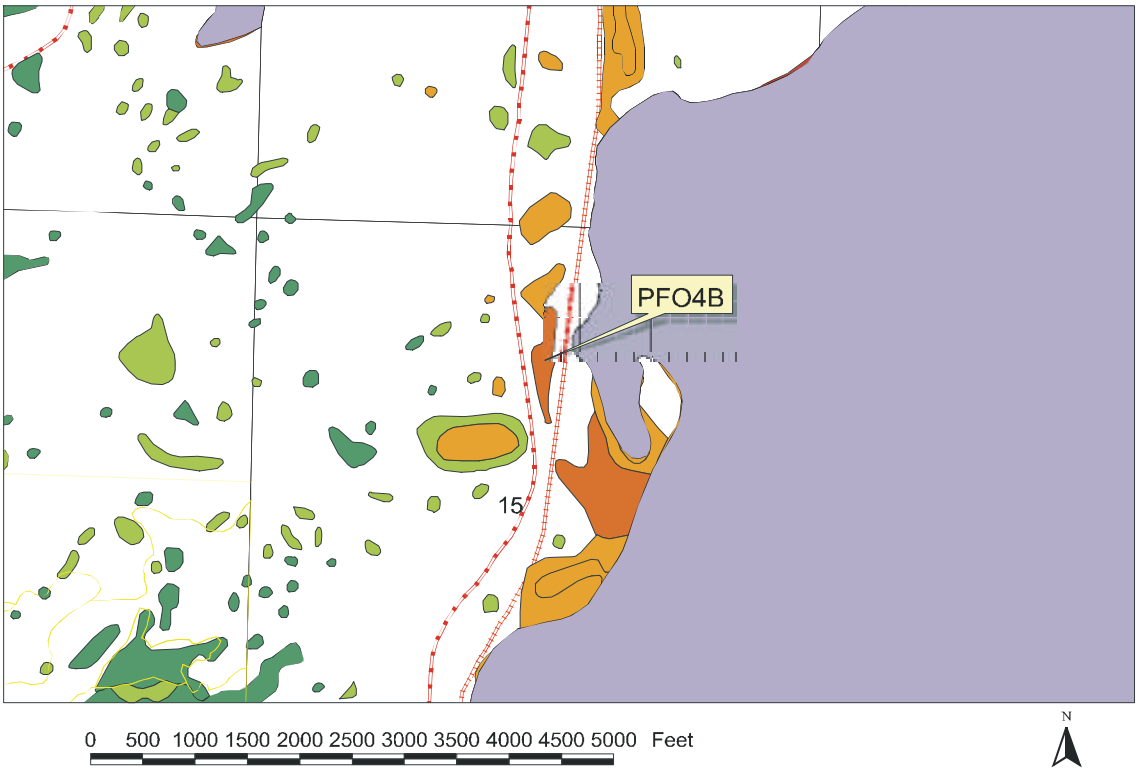
Groundwater Quality: Soil permeability and sensitivity to groundwater recharge were used to rate this characteristic.

Flood Attenuation: Wetlands needed to store flood water earned the highest scores.

This example wetland was previously mapped and coded by the National Wetlands Inventory (NWI) and was given a code relating to the NWI's standards. This wetland has been rated using the Wetland Functional Model via all eight characteristics, and has been assigned a value of 21. This value corresponds to a predetermined index for a replacement ratio of 4:1. This means that for every acre of wetlands drained, the owner must create 4 acres of new wetland. However, in Cass County, MN, this high value also means that the wetland must be reviewed by a technical panel to meet other requirements.

CASS COUNTY ENVIRONMENTAL SERVICES

Wetland Data Sheet



Wetland Location Section: 15 Twp: 140 Range: 28 Wetland Size in Acres: 3.68

Wetland Types Circular 39: 7 NWI: PFO4B

FACTOR	SCORE	COMMENTS
Uniqueness :	3	Unique Wetland
Fisheries Habitat:	3	High Probability Fish Habitat Impact
Wildlife Habitat Protection:	2	May Provide Quality Wildlife Habitat
Rare and Endangered Species Protection:	3	High Probability of Rare Species
Cultural Resource Protection:	3	High Probability of Cult. Res. Site
Surface Water Quality Protection:	3	High Surface Water Impact
Groundwater Sensitivity:	3	High Sensitivity for Ground Water
Flood Attenuation:	1	FEMA CLASS C
TOTAL SCORE:	21	(Requires Technical Panel Review)

REPLACEMENT RATIO 4:1

Wetland Scores

8 - 10	17 - 19
11 - 13	20 - 21
14 - 16	22 - 28

"A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part."

National Research Council

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The National Wetlands Inventory

The U.S. Fish and Wildlife Service's National Wetlands Inventory Center (NWI) produces information about the status, extent and characteristics of the U.S.'s wetlands, waters, and rivers with a measurable area. This information is used by local, state and federal agencies as well as private residents. The Emergency Wetland Resources Act of 1986 states that the wetlands of the U.S. are to be mapped and that the USF&WS produce a wetlands digital database for the U.S. So far, approximately 90% of the lower 48 states is mapped and about 40% is digitized. Another requirement is that the NWI produce reports every decade on the status of the U.S. wetlands. Although the U.S. as a whole has not been able to meet the goal of no net loss of wetlands, substantial progress has been made in the reduction of the rate of loss. The NWI summary of wetlands that were mapped from 1982—1993, based on aerial photography, approximates that 10.6 million acres of wetlands currently exist in Minnesota alone.

PWA Wetland Model Specialist

Rose M. Erickson
GIS Specialist, Computer Programmer

Education
Bachelor of Science—*Computer Science: Computer Information Systems,* Bemidji State University

Experience
Ms. Erickson has extensive experience in designing databases and writing programs to assist with natural resource management. She joined the staff of PWA in 1993 to write *ForestView by PWA*. Since then, she has developed forest management applications for paper companies and county governments, built customized ArcView extensions for wetland and upland classification and written a variety of information management programs to assist PWA clients.

Pro-West & Associates, Inc. has been providing GIS and information/technology integration services since 1987, and has become one of the largest GIS firms in the upper Midwest. PWA is also a dealer for ESRI® (Environmental Systems Research Institute) software applications such as ArcGIS™, ArcView® and its extensions, ArcIMS™, and PC ARC/INFO®.

PWA employs a staff of twenty consultants, programmers and technicians, and is located one mile north of Walker, Minnesota, in the Leech Lake area.