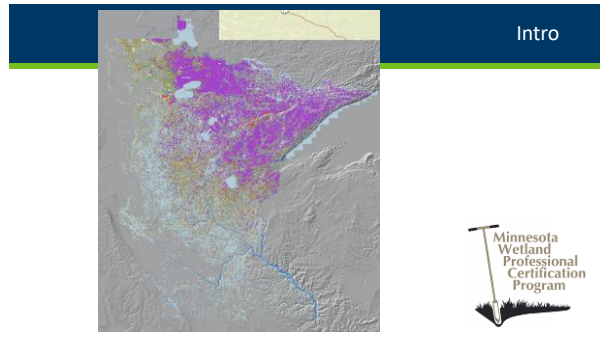




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2

Class Purpose

The purpose of the MWPCP Basic Delineation and Regulation Course is to teach the fundamental subjects of wetland delineation and regulation in Minnesota. The course takes a field-based, multi-disciplinary approach to wetland science and resource management for private and public sector professionals.

Subjects covered include a comprehensive study of the 3-parameter (hydrology, vegetation, soil) approach to wetland delineation, along with their indicators and tests; wetland classification systems; wetland functions; restoration and monitoring; and wetland regulatory programs in MN with an emphasis on the basic administration of the Wetland Conservation Act including Local Government Unit duties, Technical Evaluation Panel procedures, decision types, application procedures, wetland banking, and enforcement procedures.

3

MWPCP CORE CURRICULUM

- 1) **Wetland Conservation Act (WCA)** - MN Rule Chapter 8420 and underlying Statutes, Agency Guidance
- 2) **Purpose** - No net loss; increase quantity, quality & biological diversity; avoid, minimize, restore
- 3) **Scope** - What WCA Regulates & does NOT regulate
- 4) **Other Regulatory Programs** - Section 404 of the Clean Water Act, MN Public Waters Program, NCS Coordinator*
- 5) **Local Government Unit (LGU)** - Determining the LGU & LGU Duties
- 6) **Technical Evaluation Panel (TEP)** - TEP members, procedures, meetings, recommendations, and findings of fact
- 7) **Critical Delineation** - important WCA and delineation manual definitions
- 8) **Wetland Classification Systems** - Circular 39, Cowardin, Eggers & Reed, Hydrogeomorphic method
- 9) **Wetland Ecology & Functional Assessment** - Understanding wetland functions and values, assessment methods
- 10) **Wetland Delineation** - USACE 1987 Manual and Regional Supplements & guidance documents
 - a) **Vegetation** - Plant ID, plant communities, definition of a hydrophyte, National Wetland Plant List, plant indicator status, determining hydrophytic vegetation, problematic vegetation
 - b) **Soil** - Definition of hydric soil, key physical properties, textural divisions, Web Soil Survey, Field Indicators of Hydric Soils
 - c) **Hydrology** - Hydrology technical standard, hydrology indicators, antecedent precipitation, off-site aerial imagery review
- 1) **Application Procedures** - General WCA application requirements, determining a complete application, file management
- 2) **Noticing Requirements** - Notice of Application, Notice of Decision, timelines
- 3) **Boundary and Type Applications** - Required report components, site review
- 4) **No-Loss Criteria** - Activities with no permanent loss or impact to wetlands
- 5) **Exemption Standards** - Impacts to wetlands that do not require replacement
- 6) **Replacement plans** - Purpose & requirement, application requirements, approval conditions, special considerations, sequencing, replacement standards
- 7) **Wetland Banking** - Purpose, bank types, actions eligible for credit, establishing a wetland bank, restoration construction methods, certification and deposit of credits, replacement for public road projects, monitoring and corrective actions, withdrawals and transfers
- 8) **Enforcement & Appeals** - Enforcement procedures, Agency Roles in violations, restoration methods, voluntary restorations, appeal process



4

Basic Agenda

- | | |
|---|---|
| <p>Monday</p> <ul style="list-style-type: none"> 3 Parameters, Classification Systems, Wetland Functions, Regulatory Programs, Intro to Offsite Methods, Data Sheet Field Exercise <p>Tuesday</p> <ul style="list-style-type: none"> WCA 101, soil concepts, hydric soil indicators, soil texture lab, soil profile description field exercise <p>Wednesday</p> <ul style="list-style-type: none"> LGU Duties, Technical Evaluation Panel, WCA Application Procedures, Hydrology Indicators, Wetland Vegetation, Vegetation Field Plots | <p>Thursday</p> <ul style="list-style-type: none"> WCA Basic Decision Types, Replacement Plans, Wetland Banks & Monitoring, WCA Enforcement, Wetland Restoration, Small Group delineation Field Exercise <p>Friday</p> <ul style="list-style-type: none"> Offsite Hydrology Methods, Submitting Delineations, Course Summary & Quiz MWPCP Professional Exams |
|---|---|

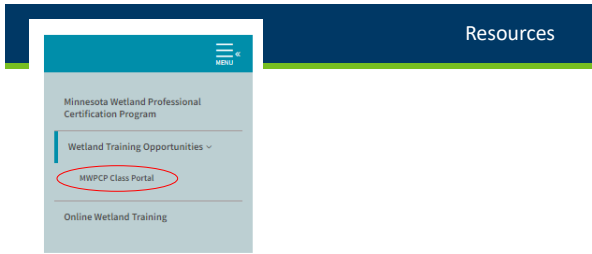
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Resources



• <https://bwsr.state.mn.us/wetland-training-opportunities>

6




MWPCP Class Portal

7

Pop Quiz




According to the 2019 Minnesota update of the National Wetland Inventory, how many acres of wetlands are in MN?

A) 6.3 million acres
 B) 10.5 million acres
C) 12.2 million acres
 D) 24.4 million acres



8

Science first, then apply policy

9

Three Parameters of a Wetland






m BOARD OF WATER AND SOIL RESOURCES

10

What is a Wetland?

Definition: Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions.





Hydrology + Vegetation + Soil = Wetland

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3 Parameters of a Wetland

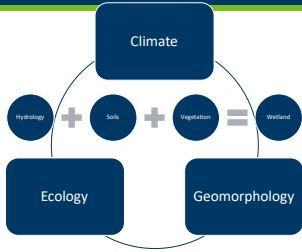
- 3 Parameters of a wetland
 - Hydrology- frequency and duration of movement of water through a landscape
 - Soil- organic and mineral surfaces which often exhibit characteristics that it has been in saturated conditions
 - Vegetation- plant community and prevalence of species that have made adaptations to live in saturated conditions



12

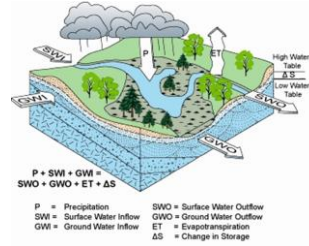
Key factors

- Climate
- Ecology
- Hydrology
- Geomorphology
- Soil
- Plant Communities
- Wetlands



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Hydrology



- Inputs
 - Precipitation
 - Surface water inflow
 - Groundwater inflow
- Outputs
 - Surface water outflow
 - Groundwater outflow
 - Evapotranspiration

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Wetland Hydrology

1987 Corps Manual: "The sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation."

Regional Supplements: "Wetland hydrology indicators are used in combination with hydric soil and hydrophytic vegetation to determine whether an area is wetland under the Corps manual."



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Hydrology Technical Standard

... "inundated or saturated by surface or ground water at a frequency and duration"

Technical standard if hydrology indicators not observed:

- 14 or more consecutive days of flooding or ponding;
- Water table 12 in. or less below soil surface;



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Hydrology Indicators



Evidence that there is continuing hydrology and confirms that an episode of inundation/saturation occurred recently.



Wetland hydrology indicators are divided into two categories:

- **Primary** – provide stand-alone evidence of a current or recent hydrologic event; and
- **Secondary** – provide evidence of recent hydrology when supported by one or more other hydrology indicators.

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Soil

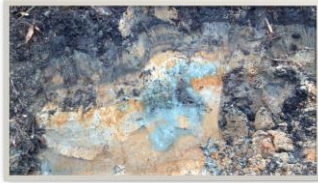
"...sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions"



18

Hydric Soil

- A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding **long enough** during the **growing season** to develop anaerobic conditions in the **upper part**.



19

Hydric Soil Indicators

Based on key physical properties: color & texture

And the depth & thickness where they are found



20

Vegetation

"...sufficient to support, and that under normal circumstances do support, a prevalence of **vegetation typically adapted to life in saturated soil conditions**"

Wetland Indicator Status	Definition
Obligate Wetland (OBL)	Almost always occur in wetlands
Facultative Wetland (FACW)	Usually occur in wetlands, but may occur in non-wetlands
Facultative (FAC)	Occur in wetlands and non-wetlands
Facultative Upland (FACU)	Usually occur in non-wetlands, but may in occur in wetlands
Obligate Upland (UPL)	Almost never occur in wetlands

https://wetland-plants.sec.usace.army.mil/nwpl_static/v34/home/home.html

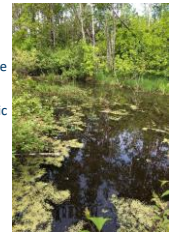
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Hydrophytes



Adaptations to saturated environment:

- morphological (multiple trunks, floating leaves)
- physiological (metabolic pathways)
- reproductive (floating seedlings)



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Dominance Tests

Methods to determine dominance of hydrophytic vegetation:

- Rapid test
- Dominance test (50/20)
- Prevalence Index
- Morphologic adaptations



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Rapid Test Example



Hydrophytic Vegetation?

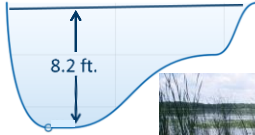
24

Limits of wetland (depth)- Deepwater Habitat

Important Considerations for Wetlands

- Must be capable of supporting rooted, emergent vegetation.
- Must have soil.

If the water is too deep or fast flowing, cannot support rooted vegetation and soil cannot form (unconsolidated bottom).



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Quiz

- What are the three parameters that define a wetland?



Hydrology + Vegetation + Soil = Wetland

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Basic Overview of Wetland Delineation



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3-Parameter/ Indicator Approach

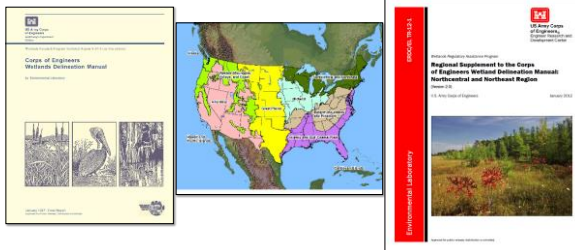
1. **Soils** –Longest term evidence, Historic conditions, may not reflect current condition.
2. **Hydrology** –Current condition, shortest term evidence but heavily influenced by recent climate conditions
3. **Vegetation** – Somewhere between



The 87 Manual requires 3 parameters because no one source typically gives the answer in all situations

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87 Manual and Regional Supplements



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Wetland Delineation Types

- Routine** – Qualitative Data
- Indicator based (veg, soil, hydro)
 - Representative sample points
 - Estimate and interpret data
 - 3-Types of delineations

- Comprehensive** – Quantitative Data
- Systematic sampling
 - Precise measurements

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Wetland Delineation Types

ROUTINE

- Level 1 - Onsite Inspection Unnecessary
- Level 2 - Onsite Inspection Necessary
- Level 3 - Combination of Levels 1 and 2



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Wetland Delineation Types

Routine Level 1

Use when exact wetland boundary not necessary

Proposed Shed



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Routine Level 1



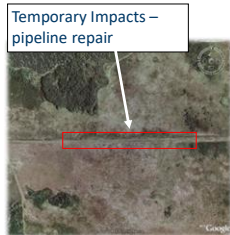
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Routine Level 1



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Routine Level 1 Examples



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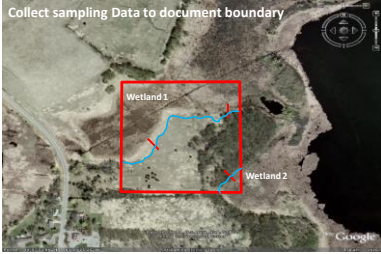
Wetland Delineation Types

Routine Level 2

- Use when an accurate boundary is critical
- Need a formal boundary approval
- Most used and focus of class

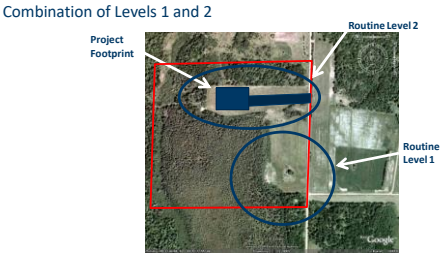
36

Routine 2



37

Routine Level 3



38

Routine Level 3



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Wetland Delineation Types

- Comprehensive Delineation Method**
- Complex, requiring rigorous documentation and coordination
 - Quantitative Measurements of:
 - Hydrology
 - Vegetation
 - Soils
 - Combine with other methods

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Comprehensive Delineation



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Routine Level 2 Process

1. Research data sources
 - Know site before visit
 - Saves time and effort
2. Field visit and data collection
 - Data collection
 - Preponderance of evidence
3. Delineate wetland boundary
 - Document indicators of wetland/non-wetland decision
 - Only after multiple informal observations

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Offsite Resources = Data Sources

- Aerial Photos (current and historic)
- Soil map (Web Soil Survey)
- Topographic\LiDAR
- NWI Map (updated)
- DNR Public Waters Map



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Routine Level 2 Process

- **Field Visit and Data Collection**
- Use preliminary map to make a plan
- Recon site and make informal observations and samples
- Make notes about general characteristics
 - Plant Communities
 - Topographic changes-Landscape position
 - Changes in soils
 - Precipitation conditions (wet-dry)
- Delineate Wetland Boundary

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45

Sample Points

1. Top section of data sheet
 - Documents sample location and landscape setting
 - Site conditions Wet-Dry
2. Vegetation
 - ID species to determine if plant community is hydrophytic
 - Record comments on changes in vegetation
3. Soil
 - Describe soil and determine if it is hydric
 - Record comments on changes in soil

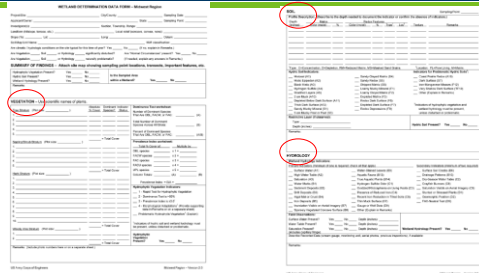
46

Sample Points

4. Topography
 - Record changes in topography
 - Abrupt
 - Gradual
 - Geomorphic position
5. Other notable remarks and observations
 - Basis for delineation line (sharp topo/veg break)
 - Hydrology inputs and outputs

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It's all about the documentation!



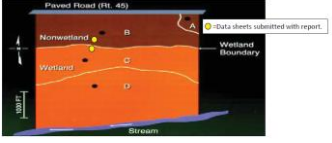
48

It's all about the documentation!

49

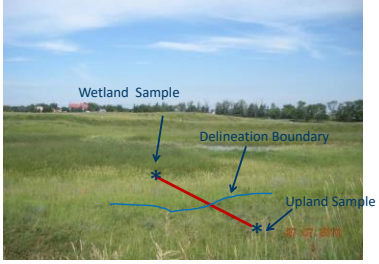
Sampling Location Should Be Representative

- Representative of soil changes (from upland to wetland)
- Representative of vegetation changes
- Representative of hydrology indicator changes
- Representative of landscape changes



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Routine Level 2 Sampling Transects



51

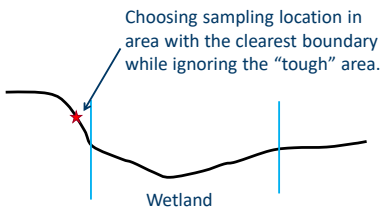
Sample location is important!

Good data collection cannot compensate for poor sampling location choices.



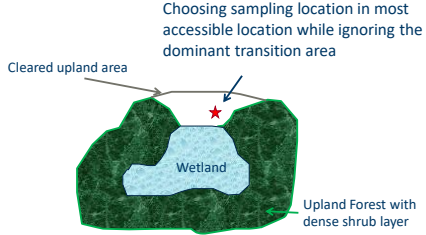
52

Common Errors – The “safe” approach



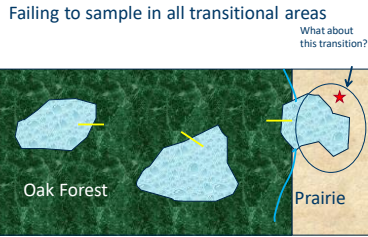
53

Common Errors – The “lazy” approach



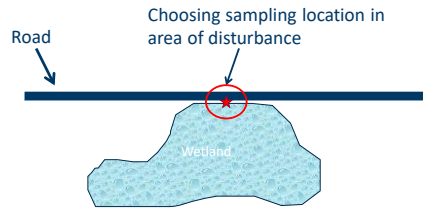
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Common Errors – The “anti-community” approach



55

Common Errors – The “disturbed” approach



56

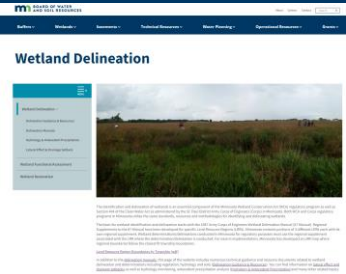
Make a Plan:

- Examining your offsite mapping before heading to the field.
- Do an initial site reconnaissance before settling on a sampling location.
- In tough areas, do “preliminary” sampling to help determine where you should do your “official” representative sampling (i.e. full data sheets).

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Guidance

[BWSR Wetland Delineation page](#)



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Critical Definitions for Wetland Delineation



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Critical Definitions

- Wetlands
- Growing Season
- Disturbed (Atypical Situations)
- Naturally Problematic (Problem Areas)
- Normal Environmental Conditions
- Normal Circumstances



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Definitions

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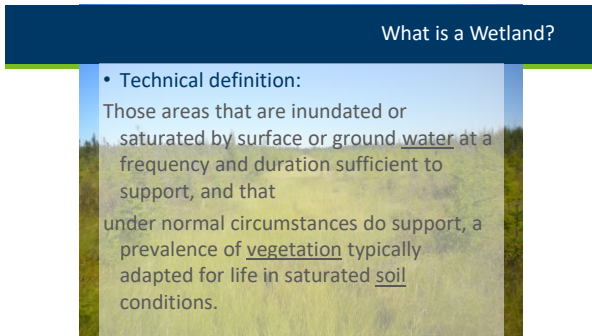


What is a Wetland?

“Wetlands are sometimes wet areas where people meet to argue.”

Greg Larson

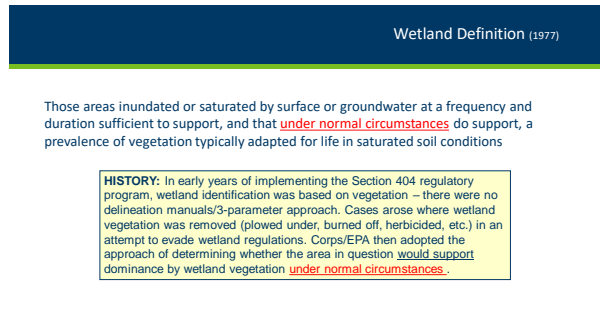
62



What is a Wetland?

• Technical definition:
Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

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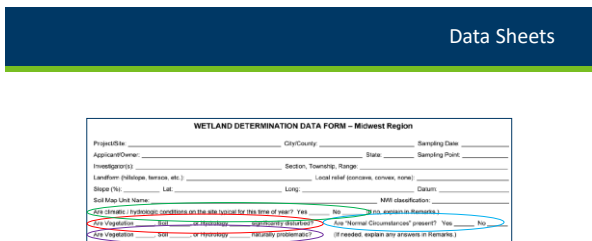


Wetland Definition (1977)

Those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions

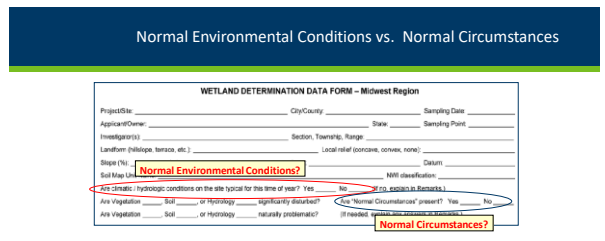
HISTORY: In early years of implementing the Section 404 regulatory program, wetland identification was based on vegetation – there were no delineation manuals/3-parameter approach. Cases arose where wetland vegetation was removed (plowed under, burned off, herbicided, etc.) in an attempt to evade wetland regulations. Corps/EPA then adopted the approach of determining whether the area in question would support dominance by wetland vegetation under normal circumstances.

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Data Sheets

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Normal Environmental Conditions vs. Normal Circumstances

66

Normal Environmental Conditions vs. Normal Circumstances

- **Short-term:** "normal environmental conditions" refers to the climatic conditions of the current year and growing season
- **Long-term:** "normal circumstances" refers to the multiple-year/decades-long condition of the site

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Normal Circumstances

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____
 Applicant/Owner: _____ State: _____ Sampling Point: _____
 Investigator(s): _____ Section, Township, Range: _____
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____
 Slope (%) _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ MNR Classification: _____

Are climatic/hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)
 Are "Normal Circumstances" present? Yes _____ No _____

If "Yes", data collection is based on current conditions.
 If "No", data collection is based on conditions that would exist in absence of recent disturbance(s).

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Normal Circumstances Key

1. Soils, vegetation and hydrology are undisturbed.....**NC**
1. Physical alteration(s) to soils, vegetation and/or hydrology has occurred.....2
 2. Physical alteration(s) to soils, vegetation and/or hydrology is minor, i.e., insufficient to remove or obscure field indicators...
.....**Normal Circumstances**
 2. Physical alteration(s) to soils, vegetation and/or hydrology is more than minor ("significantly disturbed" is checked on datasheet).....3

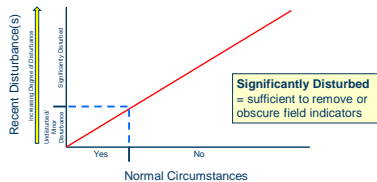
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Normal Circumstances Key

3. Physical alteration(s) is legally established, maintained and represents the long-term condition of the site; OR is a newly-authorized physical alteration (e.g., a permitted fill, new concrete dam).....**Normal Circumstances**
3. Physical alteration(s) is due to:
 - a. an unauthorized or illegal activity;
 - b. done with intent of evading wetland regulations;
 - c. total or partial clearing of vegetation, or selective removal of veg
 - d. presence of a crop, tree farm, improved pasture, managed veg
 - e. destruction of hydric soil field indicators by cultivation, deep ripping, etc.;
 - f. irrigation or pumping of surface or groundwater for agriculture;
 - g. a major natural event (e.g., a river changes course).....**NOT Normal Circumstances**

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Relationship of Normal Circumstances and Recent Disturbance(s)



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Normal Circumstances

- The full range of **pristine to highly disturbed** conditions may constitute the normal circumstances
- The **long-term condition** of a site including any authorized or other legal alterations, such as highways, dams, and other relatively permanent infrastructure and development
- The **extent, duration** and **relative permanence** of the physical alteration(s) are key
- **Maintenance** is a factor – if a physical alteration (e.g., ditch system) is **abandoned** and wetlands reestablish, the NC is wetlands
- The conditions indicated by the soils and hydrology normally present on a site, in cases where the vegetation has been altered or removed

Extent and Relative Permanence Test

72

Not Normal Circumstances



Recent, unauthorized fill that buried natural vegetation and native soils, and altered hydrology

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Normal Circumstances - Hydrology



Example A: Ditch legally constructed in 1950s and maintained since = ditch is established as **Normal Circumstances**. Partially drained is the normal circumstance for hydrology.

Example B: Ditch constructed last year; unauthorized side casting of fill materials in wetlands = **NOT Normal Circumstances**

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Normal Circumstances



Authorized wetland fill meets the "extent and relative permanence test" -- establishes a **new Normal Circumstance**

3. Physical alteration(s) is legally established, maintained and represents the long-term condition of the site; **OR** is a newly-authorized physical alteration (e.g., a permitted fill, new concrete dam).....**Normal Circumstances**

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Normal Circumstances – Soils

- **Normal plowing** (e.g., 8- to 9-inch depth) is not considered a "significant" disturbance to soils if does not remove or obscure field indicators of hydric soils
 - Examples: A1, A12
 - However, other field indicators (e.g., F8, some S indicators (sandy) would be obscured or difficult to determine
- "Deep ripping" or other methods that disturb and mix soil layers at depths greater than normal plowing are **NOT Normal Circumstances**

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Normal Circumstances - Vegetation

Removal of natural vegetation and replacement with a planted crop = **NOT Normal Circumstances**

IGNORE the planted crop for purposes of the hydrophytic vegetation determination



When natural vegetation has been removed, focus on soils and hydrology. If a site has wetland hydrology and hydric soils, it would support dominance by hydrophytes **under normal circumstances**.

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Normal Circumstances - Vegetation

- Removing, manicuring, planting, cropping, or other means of altering vegetation that is more than minor = **NOT Normal Circumstances**



Overgrazed to the extent that alteration of vegetation is more than minor -- including the extreme case shown above where vegetation has been removed = **NOT Normal Circumstances**

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Normal Circumstances - Vegetation



Sample Point – vegetation not disturbed to the extent that dominant species cannot be accurately identified

Light grazing of a sedge meadow – minor disturbance of natural vegetation = **Normal Circumstances**

Example of an **unimproved** pasture = no interseeding, planting, etc.

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Normal Circumstances - Vegetation

What about moderate grazing sufficient to result in a shift of the plant community to species more tolerant of grazing ("increasers") at the expense of other plant species ("decreasers") (see Table 10 in Midwest Supplement for examples). Most cases: **NOT Normal Circumstances**. Follow Midwest Supplement guidance.



KEY:
 1 Light Grazing - Sedge Meadow
 2 Moderate Grazing
 3 Overgrazed - Exposed Soils

80

Normal Circumstances - Vegetation



Natural vegetation removed and replaced by manipulated/manicured vegetation (seeding, mowing, fertilizing, selective herbicide applications) = **NOT Normal Circumstances**

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Problem Areas and Normal Circumstances

• **EXAMPLE:** Vernal pools are naturally dry outside of the first few weeks of the growing season = **Normal Circumstances**



Vernal Pool, Late Summer

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Problem Areas and Normal Circumstances

Project/Site _____	City/County _____	State _____	Sampling Date _____
Applicant/Owner _____	Section, Township, Range _____	Sampling Point _____	
Tract(s) _____	Local relief (positive, convex, none) _____		
Slope (%) _____	Lat. _____	Long. _____	Datum _____
Soil Map Unit Name _____	NMT classification _____		
Are climatic / hydrologic conditions on the site typical for the time of year? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If no, explain in Remarks.)			
Are vegetation / soil _____ or hydrology _____ significantly disturbed?		Are "Normal Circumstances" present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Are vegetation / soil _____ or hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)			



Prairie pothole wetland in a drought year

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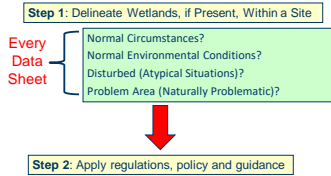
Normal Circumstances?



Not Normal Circumstances: removal of natural vegetation

84

Two-Step Process



85

Why do we care about Growing Season?

Growing season dates are needed to:

- Evaluate and interpret certain wetland hydrology indicators
- Analyze recorded data to determine if wetland hydrology criterion is met



86

Indicators of Start of the Growing Season

1. Soil temperature at 12 inches is 41° F. or higher

Use a compost thermometer for each site

[Research & Outreach Centers | College of Food, Agricultural and Natural Resource Sciences \(umn.edu\)](https://www.mda.state.mn.us/protecting/soilprotection/soiltemp)

<https://www.mda.state.mn.us/protecting/soilprotection/soiltemp>

2. "Green-up" indicator



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Growing Season

Green-up indicators 2 to 3 weeks earlier than safe planting period for agricultural crops

=

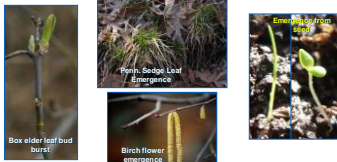
Observations of inundation/saturation 2 to 3 weeks earlier in the "wet" season for wetland hydrology determinations



88

"Green-Up" Indicator for Start of Growing Season

Two or more species of non-evergreen plants show active growth in a wetland or surrounding area with similar elevation and aspect

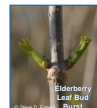


89

"Green-Up" Indicator (cont.)

Record supporting information on data sheet

- Include the species observed, their abundance and location relative to the potential wetland, and type of biological activity observed
- Recommend photo documentation



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Start of Growing Season



April site visit:
Two species of non-evergreen plants – reed canary grass and lake sedge – have new, green, aerial leaf/stem growth
Meets the “green-up” indicator for the start of the growing season

91

End of Growing Season

- woody deciduous species lose their leaves
- and/or
- the last herbaceous plants cease flowering, and their leaves die back



92

Disturbed (Atypical Situations)



- ▶ One or more parameters altered or absent due to recent human activities or natural event

Filling, artificial drainage, stream channelization, levee construction, mowing, cropping, plowing, logging, change in river course, high-capacity groundwater well pumping, tree farms, etc.

93

Degree of Disturbance(s)

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Job: _____ City/County: _____ State: _____ Sampling Date: _____
 Applicant/Owner: _____ Section, Township, Range: _____
 Invertebrate(s): _____ Local relief (concave, convex, none): _____
 Landform (hillside, terrace, etc.): _____ Slope (%): _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ AHS description: _____
 Are climatic/hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (if no, explain in Remarks.)
 Are Vegetation _____ Soil _____ or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____
 Are Vegetation _____ Soil _____ or Hydrology _____ naturally problematic? (if needed, explain any areas in Remarks.)

Significantly Disturbed = sufficient to remove or obscure field indicators

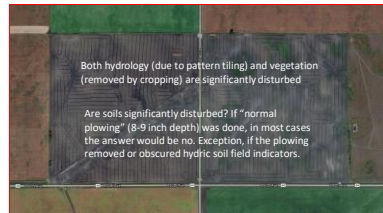
94

Disturbed (Atypical)



95

Disturbed (Atypical)



96

Problem Areas (Naturally Problematic)



- ▶ One or more parameters are absent due to normal seasonal or annual variability, or permanently due to the nature of the soils or plant species
 - Seasonal wetlands
 - Prairie potholes
 - Red clay parent materials
 - FACU-dominated wetlands
 - Inter-dunal swales

97

Problem Areas

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____
 Applicant/Owner: _____ State: _____ Sampling Point: _____
 Investigator(s): _____ Section, Township, Range: _____
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____
 Slope (%): _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ MNR Classification: _____
 Are climatic/hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)
 Are Vegetation, Soil, or Hydrology naturally problematic? Are 'Normal Circumstances' present? Yes _____ No _____
 (If needed, explain any anomalies in Remarks.)

98

Seasonal Wetlands



99

Problem Areas



Wetlands dominated by non-hydrophytic species like white pine, a Facultative Upland species

100

Chapter 5- Difficult Wetland Situations

- Atypical situations
 - Agricultural Land (NE/NC, Midwest)
 - Silviculture (NC/NE)
- Problem areas
 - Problematic vegetation
 - Problematic soil
 - Seasonal hydrology
- Procedural problems
 - Wetland/non-wetland mosaics



101

Wetland Classification Systems

Minnesota Wetland Professional Certification Program

mi BOARD OF WATER AND SOIL RESOURCES

102

Wetland Classification Systems in MN

- Circular 39
- Cowardin et al.
- Eggers & Reed
- Hydrogeomorphic Method

103

Why Classify Wetlands?

- To establish a consistent organizational structure for:
 - Understanding functions
 - Inventory/mapping
 - Scientific study and tracking
 - Regulation

- Most systems use
 - Vegetation (emergent or forested?)
 - Hydrology (standing water or saturation?)
 - Water depth (6 inches or 3 feet?)
- Some use
 - hydrology source (surface or groundwater fed)
 - geomorphic position (position on the landscape).

104

Wetland Classification Systems

105

Circular 39

Developed in 1956 for wildlife habitat (waterfowl)

Used in Minnesota Wetland Conservation Act

Based on hydrology and vegetation
let's also apply landscape position

106

Type 1

Seasonally flooded basins

Landscape position: depressional basins, floodplains

Hydrology: Seasonally Flooded, dry for much of growing season

Vegetation: Highly Variable plant communities

107

Type 2

Inland fresh meadow

Landscape position: depressions, lake fringes

Hydrology: saturated, without standing water for most of the growing season

Vegetation: grasses, sedges, rushes, or broadleaf plants

108

Type 3

Inland shallow marshes
 Landscape position: lake fringe, seep areas of on irrigated land
 Hydrology: flooded up to 6" in depth
 Vegetation: Grasses, bulrushes, cattails, arrowhead



109

Type 4

Deep marsh
 Landscape position: shallow basins, lake fringe
 Hydrology: 6" to 3' of near permanent surface water with open water components
 Vegetation: Cattails, reeds, spike rush, bulrushes, pondweeds, duckweeds, water lilies, wild rice



110

Type 5

Inland open water
 Landscape position: shallow basins, lake fringe
 Hydrology: <8.2' (2.5m) deep
 Vegetation: pondweeds, water milfoils, fringed by emergent vegetation



111

Type 6

Shrub swamps
 Landscape position: sloped, along river and lake fringes
 Hydrology: Saturation with seasonal shallow inundation
 Vegetation: Shrub swamps dominated with willow, dogwood and alder as well as grasses/forbs.



112

Type 7

Wooded swamps
 Landscape position: mineral flats, sloped
 Hydrology: saturated with seasonal inundation for short periods
 Vegetation: Forested, often dominated with tamarack, black ash, spruce, red maple, balsam fir, cedar



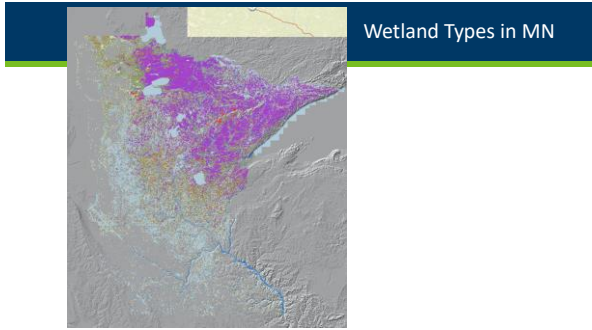
113

Type 8

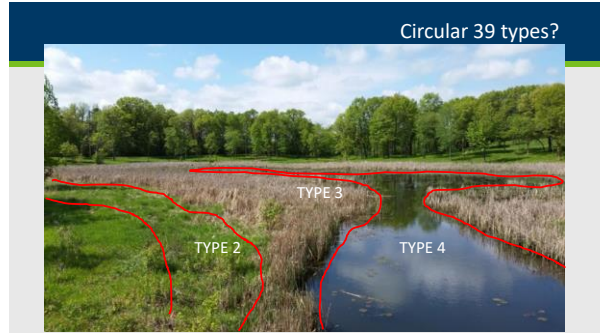
Bogs
 Landscape Position: organic flats, lake fringe
 Hydrology: permanently saturated
 Vegetation: Herbaceous strata dominated by sphagnum moss, leatherleaf, Labrador tea, sedges, black spruce and tamarack trees



114



115



116

Cowardin Classification System

- Created in 1979
- Includes wetlands and other aquatic habitats (streams, lakes, etc.)
- Used for NWI maps
- Nationwide system

117

Cowardin System

Hierarchy uses symbols to describe System, Class, plant community, hydrology and modifiers

Examples of common symbols:

Systems:
P = Palustrine, L = Lacustrine, R = Riverine

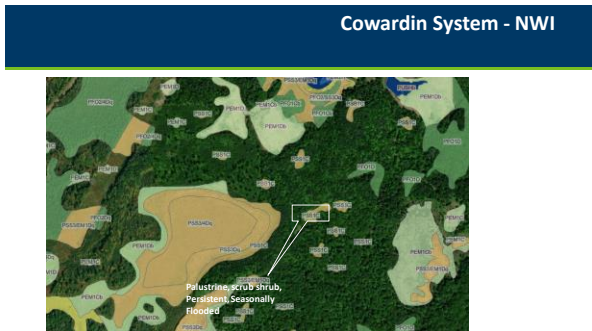
Palustrine Classes:
EM = Emergent, SS = Scrub shrub, FO = Forested

Plant Community:
EM: Persistent=1, Non persistent=2
SS & FO: Broad-leaved deciduous=1, Needle-leave deciduous= 2, Broad-leaved evergreen=3, Needle-leaved evergreen=4

Water regime modifiers:
C = Seasonally flooded, A = Temporarily Flooded, B = Seasonally Saturated
D = Continuously Saturated F=semi-permanently flooded, H=permanently flooded

Special Modifiers:
b = Beaver, d = Partially Drained/Ditched, f = Farmed, x = Excavated

118

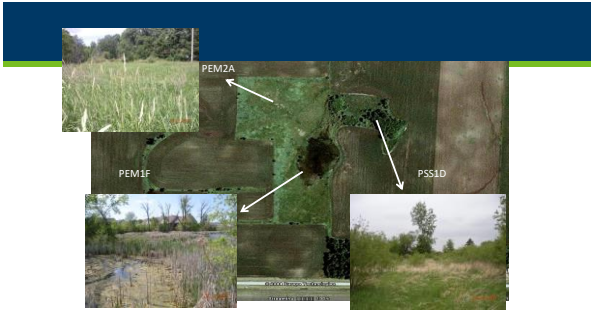


119

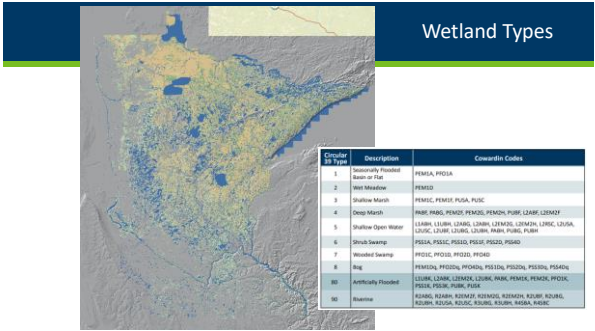
WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

MODIFIERS			
Water Regime	Plant Community	Special Modifiers	Water Quality
1 C A B D F H	1 EM SS FO	b d f x	1 1 2 3 4

120



121

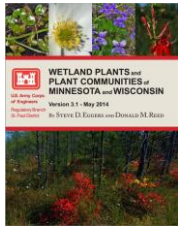


122

Eggers & Reed Classification System

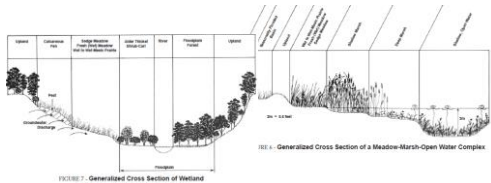
Primarily based on plant communities, but includes "typical" associated hydrologic regimes

- Shallow, Open Water
- Deep Marsh
- Shallow Marsh
- Sedge Meadow
- Fresh (Wet) Meadow
- Wet/Wet-Mesic Prairie
- Calcareous Fen
- Open Bog/Coniferous Bog
- Shrub-Carr/Alder Thicket
- Hardwood Swamp/Coniferous Swamp
- Floodplain Forest
- Seasonally Flooded Basin



123

Eggers & Reed Classification System



124

Shallow, Open Water

Hydrology: **permanently inundated**, Water depths less than 8.2 feet (2.5 meters)

Vegetation: Dominated by submergent, floating and floating-leaved species



125

Deep Marshes

Hydrology: **semi-permanently inundated** by 6 inches to 3 feet or more of water during the growing season

Vegetation: Dominated by herbaceous emergent, submergent, floating and floating-leaved species



126

Shallow Marshes

Hydrology: Soils saturated to the surface to inundated up to 6 inches of water for a significant portion of most growing seasons

Vegetation: Wild rice, reed canary grass and bur reed



127

Fresh (Wet) Meadows

Hydrology: Water table often drop below 12 inches after early portion of growing season

Vegetation: Dominated by grasses, such as reed canary grass and redtop, and/or forbs such as giant goldenrod and marsh aster



128

Sedge Meadows

Hydrology: Saturated soils most of the growing season.

Vegetation: Dominated by sedges, primarily *Carex*, but also woolgrass and other sedge family members, Canada blue-joint grass may be subdominant, can have floating mat (Sedge Mat) when fringing deeper hydrologic regimes



129

Wet to Wet-Mesic Prairies

• **Hydrology:** Saturated soils most of the growing season

• **Vegetation:** Dominated by native prairie grasses, often with a rich diversity of hydrophytic prairie forbs such as Prairie cord-grass, big bluestem, gayfeather, green bulrush, mountain mint, sawtooth sunflower, New England aster, white lady-slipper, etc.



130

Seasonally Flooded Basins

Hydrology: seasonally flooded, Typically ponded for a few weeks early in the growing season then drying out

Vegetation: Mudflats left by receding water are colonized by annuals



Condition shown is in May -- cropped corn field. By mid- to late growing season, annual species such as wild millet (FACW) and smartweeds (FACW-OBL) would dominate

131

Shrub-Carr and Alder Thickets

Hydrology: saturated to seasonally flooded

Vegetation: Native willows, dogwoods and/or alders dominate. Disturbed sites may have non-native glossy buckthorn.



132

Hardwood and Coniferous Swamps

Hydrology: saturated, may be seasonally inundated

Vegetation: Black Ash, Tamarack/Black Spruce, no continuous sphagnum moss



133

Calcareous Fens



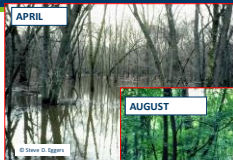
- Hydrology: upwelling groundwater discharge continuously saturates organic soils, Specific soil and water chemistry (CaCo)
- Vegetation: Rarest wetland type in MN. Supports disproportionate number of T & E species: sterile sedge, beaked spikerush, hardstem bulrush, Grass of Parnassus, Kalm's lobelia, white lady-slipper, Riddell's goldenrod

134

Floodplain Forests

Hydrology: seasonally inundated, relatively well-drained for most of the growing season

Vegetation: silver maple, American elm, river birch, green ash, black willow, box elder, eastern cottonwood



135

Open and Coniferous Bogs

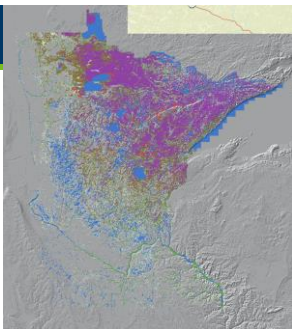
Hydrology: saturated, with acidic, peat soils low in nutrients

Vegetation: tamarack, black spruce, continuous mat of *Sphagnum* moss, bog sedge, wire-grass sedge, cottongrass, leatherleaf, labrador tea and unique flora not found in any other habitat. Many orchid species.



136

Wetland Types



137

Eggers & Reed?



138

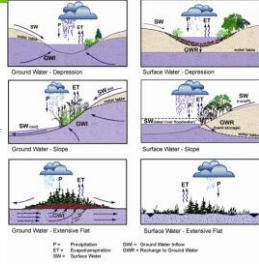
Hydrogeomorphic Method

Assesses functional conditions of a specific wetland referenced to data collected from wetlands across a range of physical conditions

- Developed by Brinson (1993), modified by Smith et al. (1995)
- Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the NRCS (2008 NRCS Technical Note No. 190-8-76)

Established Classes based on geomorphic, hydrology and hydraulic functions of palustrine wetlands

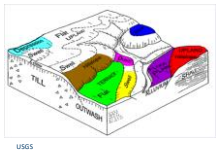
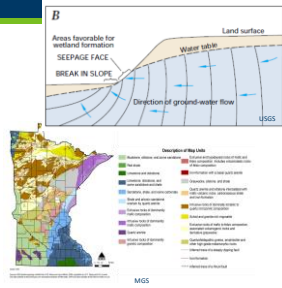
- RIVERINE, DEPRESSIONAL, SLOPE, MINERAL SOIL FLATS, ORGANIC SOIL FLATS, ESTUARINE FRINGE, LACUSTRINE FRINGE



139

Parameters of HGM

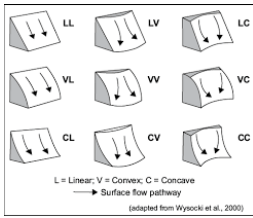
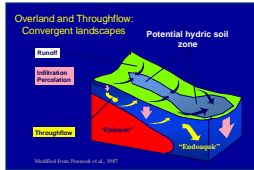
- Geomorphology- **landscape position**
- Hydrology- **water source** and output
- Hydraulics- **hydrodynamics**



140

Landscape Position- surface shape

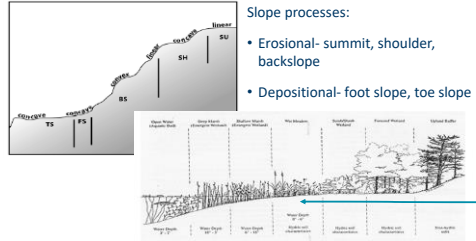
- Convex- surface curves outward
- Concave- surface curves inward
- Linear- flat, one dimensional surface



141

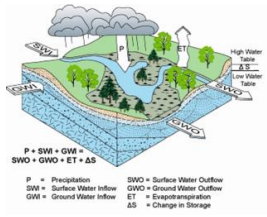
Landscape Position- slope processes

- Landscape position:
- Summit
 - Shoulder
 - Backslope
 - Foot slope
 - Toe slope



142

Hydrology



- Inputs
 - Precipitation
 - Surface water inflow
 - Groundwater inflow
- Outputs
 - Surface water outflow
 - Groundwater outflow
 - Evapotranspiration

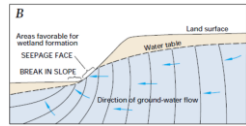
$$P + SWI + GIW = SWO + GWO + ET + \Delta S$$

P = Precipitation
 SWI = Surface Water Inflow
 GIW = Ground Water Inflow
 SWO = Surface Water Outflow
 GWO = Ground Water Outflow
 ET = Evapotranspiration
 ΔS = Change in Storage

BWSR Wetland Section | www.bwsr.state.mn.us/wetlands

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Hydraulics- how water moves



- Uni-directional
- Bi-directional
 - Estuarine and lacustrine fringe



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HGM Classes



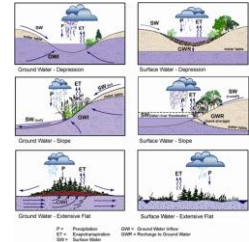
- RIVERINE
- DEPRESSIONAL
- SLOPE
- MINERAL SOIL FLATS
- ORGANIC SOIL FLATS
- ESTUARINE FRINGE
- LACUSTRINE FRINGE



145

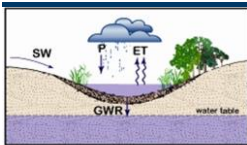
HGM Subclasses

- Influenced by:
 - Groundwater input
 - Surface water input
 - Hydrology Outputs
 - Surface
 - Ground



146

Depressional- surface



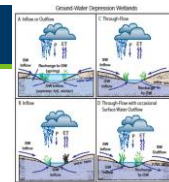
Surface Water - Depression



- Landscape position- concave, foot slope/toe slope, closed contours
- Hydraulics- unidirectional
- Water source- surface flow and precipitation, seasonal
- Outputs- Evapotranspiration, groundwater recharge

147

Depressional- groundwater



Depressional- groundwater

- Landscape position- concave, foot and toe slopes, closed contours
- Hydraulics- unidirectional
- Water source- groundwater and precipitation, seasonal
- Outputs- Evapotranspiration, groundwater recharge, intermittent overland flow

148

Mineral Soil Flats



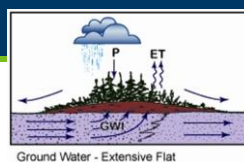
Surface Water - Extensive Flat



- Landscape position- relic land bottoms and floodplains, intergrades to multiple other classes (sloped, riverine, lacustrine)
- Hydraulics- vertical groundwater fluctuations
- Water source- precipitation, no groundwater interaction
- Outputs- evapotranspiration, saturated "seepage" flow

149

Organic Soil Flats



Ground Water - Extensive Flat



Organic Soil Flats

- Landscape position- summit (interfluvial) broad "plateau" between drainage systems, depressions filled with organics, vertical accretion of organics
- Hydraulics- precipitation, unidirectional groundwater
- Water source- precipitation, groundwater
- Outputs- saturated overland seepage, evapotranspiration

150

Riverine

- Landscape position- floodplains and riparian corridors, often intergrade to sloped or depressional
- Hydraulics- unidirectional, surface overbank flow, groundwater, interflow (both surface and ground) from adjacent uplands
- Water source- precipitation, groundwater
- Outputs- overland surface flow (perennial flow not required), evapotranspiration



151

Lacustrine Fringe

- Landscape position- adjacent to lakes, toe slope, often intergrade to sloped
- Hydraulics- bidirectional (inflow from adjacent uplands and lake)
- Water source- precipitation, groundwater
- Outputs- return flow to lake, saturated surface seepage, evapotranspiration



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Estuarine Fringe

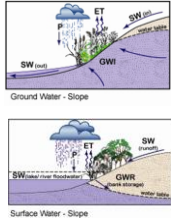
- Landscape position- along coasts and estuaries, often intergrade to riverine
- Hydraulics- bidirectional (tidal flow)
- Water source- surface via frequent tidal flooding, precipitation
- Outputs- tidal exchange, saturated overland flow, evapotranspiration



153

Sloped

- Landscape position- linear or convex, predominately found at foot and toe slope and shoulder slope, often intergrades to other classes (mineral flat, riverine, depression)
- Hydraulics- unidirectional
- Water source- groundwater, surface runoff, precipitation
- Outputs- evapotranspiration, surface flow, groundwater recharge

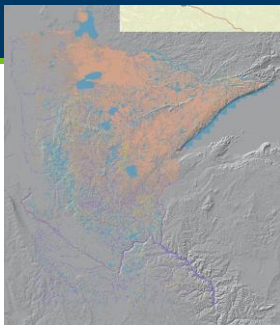


154

HGM Class (subclass)	Hydrology Inputs	Hydrology Outputs	Hydraulics
RIVERINE	surface flow precipitation groundwater	surface flow evapotranspiration	bidirectional (both surface and ground)
DEPRESSIONAL- surface	surface flow precipitation	groundwater recharge evapotranspiration	unidirectional
DEPRESSIONAL- ground	groundwater precipitation	intermittent surface flow evapotranspiration groundwater recharge	unidirectional
SLOPED- surface	surface flow precipitation	surface flow evapotranspiration groundwater recharge	unidirectional
SLOPED- ground	groundwater surface water precipitation	surface flow evapotranspiration	unidirectional
MINERAL SOIL FLATS	precipitation intermittent surface flow	evapotranspiration intermittent surface flow	unidirectional
ORGANIC SOIL FLATS	groundwater precipitation	intermittent surface flow Evapotranspiration	unidirectional
ESTUARINE FRINGE	surface flow tidal exchange precipitation	tidal exchange surface flow Evapotranspiration	bidirectional
LACUSTRINE FRINGE	surface flow groundwater precipitation	return flow to lake surface flow evapotranspiration	bidirectional

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Wetland Types



[HGM Classification System](#)
[Dichotomous Key](#)

156

HGM?



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Wetland Classification Systems in Minnesota

Circular 39

- Based on hydrology and vegetation

Cowardin

- Based on hierarchy system, class, veg, water regime, special modifiers

Eggers & Reed

- Based on plant communities & "typical" associated hydrologic regimes

Hydrogeomorphic Method

- Based on landscape position, water source, hydraulics



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Wetland Functions

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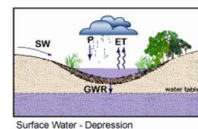
Overview

- Wetland Functions
- Wetland Values

- Hydrogeomorphic Method
- Functional Assessments



- MN Routine Assessment Method (MNRAM)
- Floristic Quality Assessment (FQA)



160

Wetland Functions & Values

Wetland Functions: in scientific assessments means natural processes

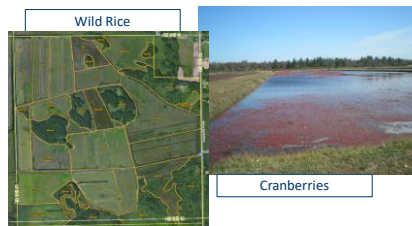
Wetland Value: wetland goods and services providing monetary or social welfare benefit.



161

Values

Food Production



162

Values

More than a billion people make a living from wetlands across the world.

- Fishing
- Eco-tourism
- Farming
- Drinking water



Source: www.worldwildlife.org
Photos: www.ramsar.org

163

Values

Recreation, Aesthetics, Education



164

Values

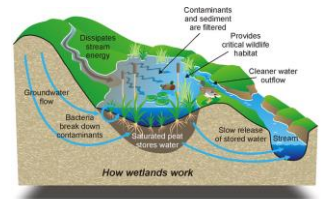
Hunting, Fishing, Bird watching, photography



165

Wetland Functions

- Act as a natural "filter" to maintain water quality
- Facilitates infiltration recharging groundwater
- Stabilize base flow
- Decreases fluid velocity during high flow events which decreases turbidity
- Storm water retention (i.e. storage)
- Provides habitat
- Shoreline protection



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Functions

Water Quality



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Functions

Floodwater Retention

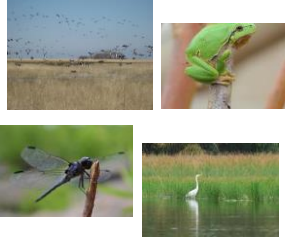


168

Functions

Habitat

- Many insects, reptiles and amphibians rely on wetlands to complete their life cycle.
- Some mammals are semi-aquatic: beavers, muskrat, mink, otters.
- Many birds feed and nest in wetlands.
- Fish rely on wetlands for breeding, feeding and shelter.



169

Functions

Sediment Trap



170

Functions

Groundwater Recharge



171

Functions

Carbon Storage

Although wetlands only account for 5-8% of earth's terrestrial landscape they may provide carbon sinks of about 300 to 700 billion tons of carbon. Peatland wetlands make up the majority of carbon sinks.



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Functional Assessment Methods

- MN Routine Assessment Method (MnRAM)
 - Numeric model for assessing wetland functions and some values
- Floristic Quality Assessment
 - Vegetation based ecological condition assessment method

Comprehensive General Guidance

for Minnesota Routine Assessment Method (MnRAM) Evaluating Wetland Function, Version 3.4 (beta)

9/15/2010



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MnRAM (MN Routine Assessment Method)

- Developed by interagency work group shortly after WCA passed.
 - Refined in 2010
- Assessment tool that uses numeric model to rank both Functions and values
- BWSR no longer supports Access database version
- Excel version 3.2 and text version using the Comprehensive Guidance Document for explanations, definitions and ranking formulas for each function

174

Method

Determine vegetative diversity and integrity:

- List plant communities of each wetland
- Dominant vegetation
- Cover class

Date	Wetland name / ID	Wetland name / ID	Wetland name / ID	Wetland name / ID
Special Features (see 3.2.2.1.1.1)				
Community Number and associated community plant species (see 3.2.2.1.1.1.1)	30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100	101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130	131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160	161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200
Community Type (see 3.2.2.1.1.1.1)				
Community Description (see 3.2.2.1.1.1.1)				
Dominant Vegetation / Cover Class				
Substrate				
Hydroperiod				
Hydroperiod Vegetation / Cover Class				
Community ID (MNR 3.2.2.1.1.1.1)				

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Method

Assign rating based on series of questions for each wetland using Comprehensive Guidance

- MnRAM Comprehensive General Guidance
- MnRAM Guidance on Selected Questions

Question Description	User	Rating
1. Name of the Wetland		
2. Wetland ID		
3. Wetland Name		
4. Wetland Type		
5. Wetland Description		
6. Wetland Location		
7. Wetland Size		
8. Wetland Age		
9. Wetland Condition		
10. Wetland Management		
11. Wetland Use		
12. Wetland Value		
13. Wetland Risk		
14. Wetland Potential		
15. Wetland Resilience		
16. Wetland Sustainability		
17. Wetland Health		
18. Wetland Integrity		
19. Wetland Function		
20. Wetland Services		
21. Wetland Benefits		
22. Wetland Costs		
23. Wetland Trade-offs		
24. Wetland Decision-making		
25. Wetland Implementation		
26. Wetland Monitoring		
27. Wetland Evaluation		
28. Wetland Reporting		
29. Wetland Communication		
30. Wetland Collaboration		
31. Wetland Leadership		
32. Wetland Innovation		
33. Wetland Adaptation		
34. Wetland Resilience		
35. Wetland Sustainability		
36. Wetland Health		
37. Wetland Integrity		
38. Wetland Function		
39. Wetland Services		
40. Wetland Benefits		
41. Wetland Costs		
42. Wetland Trade-offs		
43. Wetland Decision-making		
44. Wetland Implementation		
45. Wetland Monitoring		
46. Wetland Evaluation		
47. Wetland Reporting		
48. Wetland Communication		
49. Wetland Collaboration		
50. Wetland Leadership		
51. Wetland Innovation		
52. Wetland Adaptation		
53. Wetland Resilience		
54. Wetland Sustainability		
55. Wetland Health		
56. Wetland Integrity		
57. Wetland Function		
58. Wetland Services		
59. Wetland Benefits		
60. Wetland Costs		
61. Wetland Trade-offs		
62. Wetland Decision-making		
63. Wetland Implementation		
64. Wetland Monitoring		
65. Wetland Evaluation		
66. Wetland Reporting		
67. Wetland Communication		
68. Wetland Collaboration		
69. Wetland Leadership		
70. Wetland Innovation		
71. Wetland Adaptation		
72. Wetland Resilience		
73. Wetland Sustainability		
74. Wetland Health		
75. Wetland Integrity		
76. Wetland Function		
77. Wetland Services		
78. Wetland Benefits		
79. Wetland Costs		
80. Wetland Trade-offs		
81. Wetland Decision-making		
82. Wetland Implementation		
83. Wetland Monitoring		
84. Wetland Evaluation		
85. Wetland Reporting		
86. Wetland Communication		
87. Wetland Collaboration		
88. Wetland Leadership		
89. Wetland Innovation		
90. Wetland Adaptation		
91. Wetland Resilience		
92. Wetland Sustainability		
93. Wetland Health		
94. Wetland Integrity		
95. Wetland Function		
96. Wetland Services		
97. Wetland Benefits		
98. Wetland Costs		
99. Wetland Trade-offs		
100. Wetland Decision-making		

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Method

Functional index score
Outcome Numeric ranking:

- Exceptional
- High
- Medium
- Low

Function Name	Rating	Weight	Priority
Vegetative Diversity Integrity	0-5	1	1
Hydrology - Characteristics	0-5	1	1
Flood Attenuation	0-5	1	1
Water Quality - Dissolved	0-5	1	1
Water Quality - Sediment	0-5	1	1
Shoreline Protection	N/A	N/A	N/A
Characteristic Wildlife Habitat Structure	0-5	1	1
Maintenance of Characteristic Fish Habitat	0-5	1	1
Maintenance of Characteristic Amphibian Habitat	0-5	1	1
Aesthetics Recreation Education Culture	0-5	1	1
Commercial use	0-5	1	1
Special Features Listing	0-5	1	1
Global Climate Change	0-5	1	1
Global Climate Change - Functional Index	0-5	1	1
Global Climate Change - Potential	0-5	1	1
Stormwater Sediment (not active)	0-5	1	1

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Wetland Management Classification

Functional index score can then be used to classify management

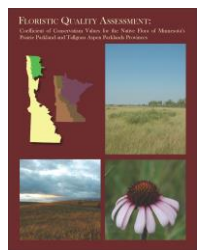
- Wetland Management Classification System
- Results are **classification recommendations**:
 - Preserve, Manage 1, Manage 2, Manage 3



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Floristic Quality Assessment

- Vegetation condition assessment to measure the quality of a native plant community
- Developed by the MN Pollution Control Agency
 - 2007, Statewide C-values
 - Efforts to regionalize C-values underway
- Intended to complement functional assessments such as MnRAM



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FQA Key Concepts

- Key concepts:
 - Species conservatism- tolerance to degradation
 - Coefficients of Conservatism (C-value)
 - Floristic Quality Index
 - Species richness and mean C-values
- Sampling methods
 - Rapid FQA
 - Full Method



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FQA Key Concepts

- Coefficients of Conservatism
 - Numeric rating of an individual species fidelity in relationship to disturbance
- C-values range from 0-10
 - 0= most tolerant, found in wide variety of plant communities
 - 10= least tolerant, found in narrow range of plant communities
- Non-native species = 0
 - Reed Canary Grass (introduced) C=0
 - Ostrich Fern (FAC, NCNE) C=5
 - Pink lady slipper C=9



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Sampling Methods Overview

- FQA Sampling Protocol:
 - Map Assessment Area
 - Determine Plant community types
 - Conduct timed meander (rapid) or plot-based sampling
 - Conduct shoreland sampling (if necessary)
 - Make Areal cover estimations
 - Calculations
- Full FQA -Plot-based sampling
- Rapid FQA- Timed meander rules
 - Areal cover in cover classes for each species



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Sampling Methods

- Determining the Assessment Area
- Define plant communities
 - Eggers & Reed
 - MN DNR Native Plant Communities Classification Guide
 - Laurentian Mixed Forest, Eastern Broadleaf Forest, Prairie Parkland and Tallgrass Aspen Parklands



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Metrics

- Variables:
- Number of species = Species Richness
 - Mean C-value
 - Mean C-value (weighted) (wC)
 - $wC = \sum pC$
- Floristic Quality Index
 - Integral measurement of FQA
 - $FQI = \bar{C}\sqrt{S}$
 - mean C value
 - S= number of species (i.e. species richness)
 - Both stand alone indices
 - Greater the FQI, the closer the condition is to a natural state

184

Review

- Functions- natural processes
 - Water quality, flood retention, habitat, groundwater recharge, carbon storage
- Values- provide monetary or social welfare benefit
 - Wild rice, recreation, education, aesthetics, fishing
- HGM- landscape position, hydrology, hydraulics
 - Depressional, sloped, riverine, mineral flats, organic flats, lacustrine and estuarine fringe
- MNRAM- Numeric model for assessing wetland functions and some values
- FQA- Vegetation based ecological condition assessment method

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Wetland Functional Assessment

BWSR Wetland Section | www.bwsr.state.mn.us/wetlands

186






Wetland Regulatory/Compliance Programs in Minnesota




187

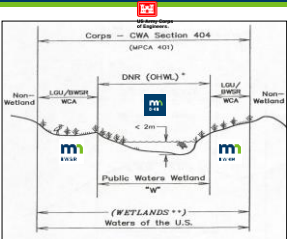
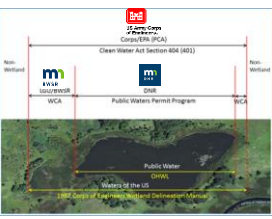
Programs

- Minnesota Wetland Conservation Act (WCA)
- Public Waters Work Permit Program (PWPPP)
- Section 404 of the Clean Water Act (404)
- Section 401 of the Clean Water Act (401)
- Swampbuster provisions of the Food Security Act (FSA)

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Jurisdiction

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Wetland Conservation Act (WCA)

Overview




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Wetland Conservation Act

- **Regulates:** draining, filling, some excavation
- **Administered by:** Local Government Units, SWCDs, Watershed Districts
- **Oversight by:** MN Board of Water and Soil Resources
- **Authorities:** M.S. 103A, 103B, 103G; M.R. Chapter 8420
- **Jurisdictional boundary:** 1987 Corps of Engineers Wetland Delineation Manual
- **Review standards:** Avoid, minimize, replace (sequencing)
- **Enforcement:** DNR Conservation Officers; cease & desist, restoration orders
- **Application:** Joint Application Form for Activities Affecting Water Resources in Minnesota

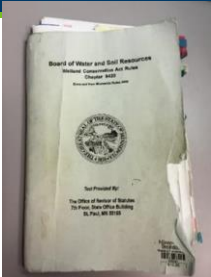




191

What is it?

- Series of laws passed in 1991
- Major component – wetland regulatory provisions, Minnesota Rules Chapter 8420.
- Regulatory provisions implemented under temporary rules in 1991 and permanent rules in 1993.



192

Purpose?

- Maintain and *increase* the quantity, quality and biological diversity of Minnesota's wetlands. (QQB)
- *Avoid* wetland impacts from activities that negatively effect quantity, quality and biological diversity.
- *Replace* wetland values where avoidance is not feasible and prudent.
- The sequence of avoid, minimize and then replace for wetland impacts is referred to as **Sequencing** in WCA rules.

193

What does WCA regulate?

- **Wetland Impacts** are defined in WCA rule.
- **Wetlands** are identified and their boundaries determined by 87 Manual.
- Two exceptions:
 - Incidental wetlands
 - Wetland areas of DNR public waters and public waters wetlands unless regulatory jurisdiction waived by DNR to WCA.

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Incidental Wetlands

- Wetlands created in naturally non-wetland areas not on purpose.



Temporary puddles



Stormwater ponds



Sewage treatment wetlands



Roadside ditch in upland



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Implementation Structure

- Local Government Units (LGUs) are primarily responsible for implementing WCA.
- BWSR provides oversight and assistance to LGUs. BWSR implements certain limited provisions of WCA.
- DNR has an enforcement role in WCA.

196

Implementation by LGUs

- LGU can be:
 - County, City/Town
 - Township (in certain 7-county metro areas only)
 - Watershed district, management organization or commission
 - State agency on state owned or administered lands
- For projects that require a Permit to Mine under state law, DNR's Division of Lands and Minerals administers the provisions of the WCA under their Permit

197

Applications and Decisions

- In general, applicants demonstrate through their application submittal that they are compliant with WCA.
- An LGU's decision to approve, deny or approve with conditions is saying if the project complies with WCA or not.
- An LGU can take the WCA decision process and fold it into a permit that they issue for a project. This is optional, but common among watershed districts and counties that issue permits for various other things.
- In general, LGUs can have more restrictive local requirements, but not less restrictive requirements.

198

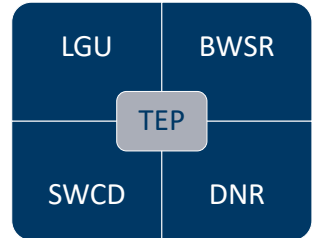
WCA Decision Types and Application Requirements

Decision Type	Application Requirement
Wetland Boundary/Type	Application required
Exemption or No-Loss Provision	Application not required (unless LGU has more restrictive local requirement)
Replacement Plan	Application required
Banking Plan	Application required

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Technical Evaluation Panel

- Plays a key role in implementation.
- Representative from LGU, SWCD, BWSR and DNR (if project effects public waters and/or in shoreland zone).
- Primary role is to advise LGU on decisions. Some decisions depend on TEP recommendation/concurrence.
- TEPs often advise landowners/applicants during pre and post application reviews.



200

Key Roles in WCA Implementation

- **LGU** – make WCA decisions, leads Technical Evaluation Panel
- **SWCD** – serve on TEP, write restoration plans for violation orders
- **BWSR** – serve on TEP, hear appeals, administer wetland bank, oversee and train LGUs.
- **DNR** – serve enforcement orders and coordinate/collaborate with TEP, LGU and SWCD on enforcement process.

201

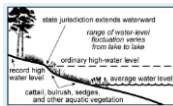
Public Waters Work Permit Program (PWPPP)

Overview

202

Public Waters Permit Program

- **Regulates:** changes to "course, current or cross-section"
- **Administered by:** DNR – Area Hydrologists
- **Authorities:** M.S. 103G; M.R. Chapter 6115
- **Jurisdictional boundary:** "Ordinary High Water Level"
- **Review standards:** Public interest; reasonable/practical, Riparian rights, Availability of feasible & prudent alternatives, Compensatory mitigation
- **Appeals:** Contested case hearing
- **Enforcement:** DNR Conservation Officers; cease & desist, restoration orders
- **Application:** on-line via "MPARS"



203

Purpose

To conserve and utilize the water resources of the state in the best interest of its people.



204

What is a Public Water?

Waters that are (paraphrased and shortened from statute):

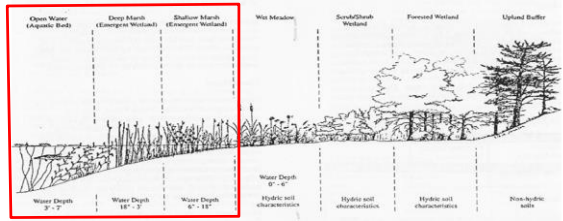
- Assigned a shoreland management classification; navigable waters; lakes; for a designated mgmt. purpose (trout and game lakes); designated as scientific and natural areas; located within and totally surrounded by publicly owned lands; state or federal govt. holds title to any of the beds or shores, with publicly-owned and controlled access; natural and altered watercourses with a total drainage area greater than two square miles; trout streams; and **public waters wetlands**.



205

What is a Public Water Wetland?

- All types 3, 4, and 5 wetlands that are ten or more acres in size in unincorporated areas or 2.5 or more acres in incorporated areas.



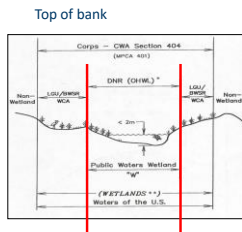
206

Watercourses and Wetlands



207

Public Watercourses



208

Delineation of Public Waters/Public Waters Wetlands

- PWWPP does not use the same criteria and delineation methods as WCA (or any other programs we will discuss in this class).
- Uses the **Ordinary High Water Level (OHWL)** to define boundaries.
- OHWL is an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

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OHWL vs Wetland Boundary

- Wetlands** are transitional lands between *terrestrial* (living/growing on/in land/soil) and *aquatic* systems (living/growing on/in water). Wetland boundary is upper limit of hydric soils, wetland hydrology and hydrophytic vegetation.
- Public waters** includes wetlands, but their boundaries are the upper limit of where high water has left evidence on the landscape, often this is the point where there is predominantly aquatic vegetation.



210

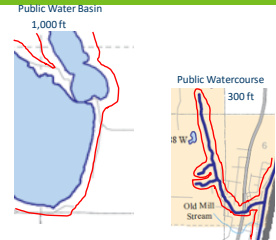
OHWL vs Wetland Boundary

	Wetland Delineation	OHWL
Boundary Type	Line representing change from where all 3 parameters are present to where one or more parameters is absent.	Elevation representing where high water has left evidence on the landscape.
Key Factors	Hydrophytic vegetation, hydric soils and wetland hydrology	Evidence on landscape
Determination	Applicants/consultants make determination, regulatory agencies review and approve.	DNR makes determination

211

What is shoreland?

- DNR definition:
 - 1,000 ft from the OHWL of a public water basin or the shoreland area defined in local ordinance, which can be more restrictive
 - 300 ft from the OHWL of a public watercourse or the shoreland area defined in local ordinance, which can be more restrictive



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Standards (example)

Filling Public Waters

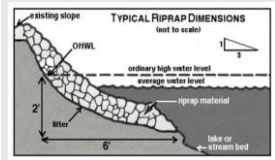
- **Standards** - Minimize encroachment, must be clean fill, must consider alternatives, must have erosion control, be consistent with floodplain/shoreland ordinance, etc.
- **Prohibitions** – in fish spawning areas, for veg control, to construct roadways (except public roads under certain circumstances), for disposal of materials, etc.



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PW and applications

- No Permit Required – sand beach blankets (under certain conditions), riprap, in a watercourse with 5 sq. mile or less drainage area (under certain conditions), etc.
- Check with the LGU on WCA implications!



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Permit Application Process

- Apply through Minnesota Permit Application Reporting System (MPARS), an online permit system.
- DNR has schedule of application fees.
- Application is noticed to city, SWCD, watershed district and BWSR.

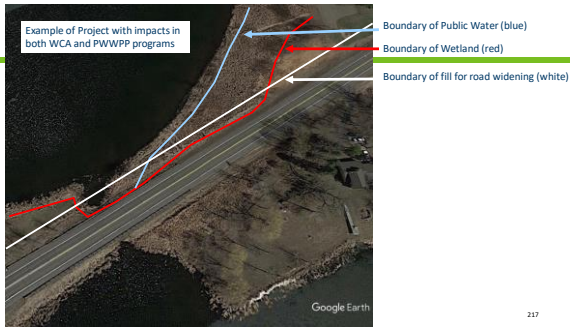


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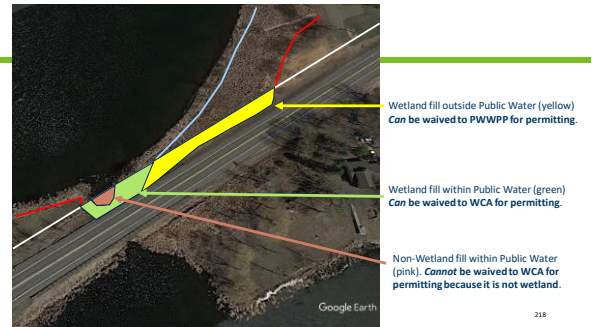
Waiving Jurisdiction between WCA and PWPP

- Jurisdiction between the two programs can be waived from one program to the other if a project impacts wetland areas both within and outside of public waters. But only for wetland areas, not deepwater habitats and watercourses.

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218

Program Element	WCA	PWWPP
Basis of Authority	Mn Rules Chapter 8420 and associated statutes	Mn Rules Chapter 6115 and associated statutes
Regulated Waters	Wetlands except incidental and wetland areas of Public Waters (unless waived)	Public Waters and Public Waters Wetlands (which includes deepwater habitats, streams and wetlands)
Jurisdictional Boundaries	Wetland Delineation per 87 Manual	DHWL
Regulated Actions	Fill, drain, excavate (semi-perm. Flooded areas of type 3, 4, 5)	Changes in course, current or cross-section
Program Administration	LGU implementation, BWSR oversight, DNR enforcement	DNR implementation
Type of Approvals	WCA decisions	Permit authorizations
Applying for Approval	WCA application or request for decision	MNPARS online application

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Section 404 Clean Water Act (in MN)

Overview

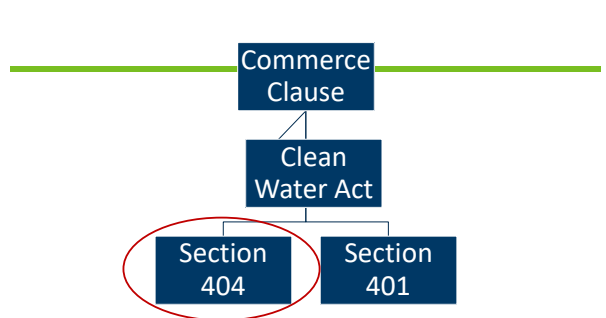
BOARD OF WATER AND SOIL RESOURCES

220

Clean Water Act Section 404

- Regulates:** Discharges of dredged or fill material, including redeposit
- Administered by:** U.S. Army Corps of Engineers – St. Paul District
- Authorities:** 33 U.S.C. §1251; 33 CFR Parts 320-332; 40 CFR Part 230
- Jurisdictional boundary:** 1987 Corps of Engineers Wetland Delineation Manual
- Review Standards:** Sequencing, public interest, adequate compensatory mitigation
- Appeals:** COE administrative appeal
- Enforcement:** COE and USEPA; administrative orders
- Application:** Joint Application Form for Activities Affecting Water Resources in Minnesota

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Corps

- Also implements [Section 10 of the Rivers and Harbors Act \(1899\)](#).
- This is separate from 404 program.

Program	Waters Regulated	Scope of Regulation
Section 10 Rivers & Harbors Act	Navigable Waters	Obstructions and alterations.
Section 404 Clean Water Act	WOTUS (which includes navigable waters)	Discharges of dredged or fill material

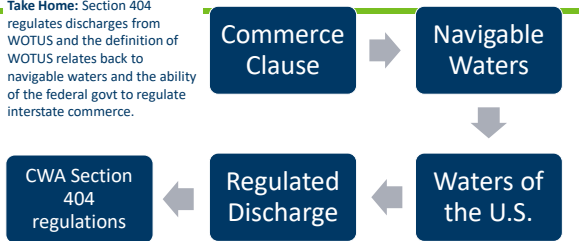
223

Scope of Jurisdiction

- CWA regulation includes non-navigable waters (including wetlands) and associated activities to protect and promote commerce on navigable waters. These are [Waters of the U.S. \(WOTUS\)](#).
- WOTUS is a case-by-case determination referred to as a **Jurisdictional Determination or JD**.

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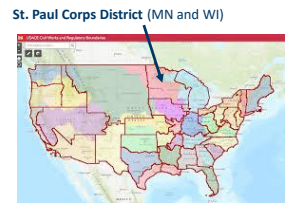
Take Home: Section 404 regulates discharges from WOTUS and the definition of WOTUS relates back to navigable waters and the ability of the federal govt to regulate interstate commerce.



225

Corps Program Administration

- Regulatory authority delegated to 36 separate Districts.
- Each District sets their own policies and establishes their own permitting system to implement 404 within broad national guidance.



226

404 Jurisdiction Trigger

Must be a “discharge” of dredged or fill material into WOTUS.



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Basic Permitting Structure

Two basic forms of permits.

- **Individual Permit (IP)**—for discharges with potentially significant impacts.
- **General Permit (GP)** – for categories of activities where discharges have minimal impacts. Can be issued on a [nationwide](#), [regional](#) or [state](#) basis.

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IPs vs GPs

Individual Permits have longer review times, different noticing procedures and receive more scrutiny than **General Permit** authorizations.

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General Permits (GP)

- Authorizes landowners to proceed with a project without the more time-consuming need to obtain standard individual permits in advance.
- Corps is confirming that activity is eligible for the GP.
- ~97% of permit activities authorized by general permits.

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General Permits

- Issue Regional General Permits (RGPs) in addition to or to substitute for NWP.
- GPs may include mitigation threshold.
- GPs may include pre-construction notification (PCN) requirements.
- General Permit include:
 - Minor discharges
 - Piers and docks
 - Utility
 - Transportation
 - Wildlife ponds

231

Nationwide Permits (NWP)

- A form of general permit issued nationally every 5 years.
- Each Corps District has broad discretion as to how they utilize NWPs. They can:
 - Adopt some or all NWPs for use in their district; or
 - Add their own regional conditions to some or all NWPs.
 - Cannot exceed ½ acre of impact

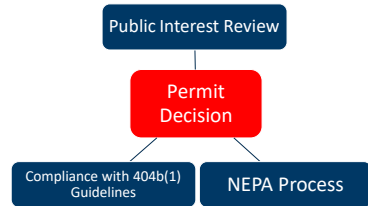
232

Types of Nationwide Permits (NWP)

- Residential Development
- Commercial Development
- Agricultural Activities
- Recreation Facility
- Stormwater Management Facility
- Mining Activities
- Land and Water-Based Renewable Energy Generation Facility

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Corps Permit Decision Criteria



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Decision Element	Type	Critical Elements
Public Interest Review	Substantive criteria for making a decision.	Project need, practicable alternatives and extent/permanence of effects.
404b(1) Guidelines	Substantive criteria for making a decision.	Practicable alternatives, minimization of potential harm, significant degradation to aquatic system, Federal mitigation rule.
NEPA	Procedural requirement, public disclosure and factors that must be considered in decision making.	EIS/EA, consultation with other agencies, consideration of effects on the human environment, alternatives, mitigation.

235

404b(1) Guidelines Requirements for Regulated Projects/Activities

- Must not be practicable alternatives that are less damaging
For example: *Alternative that is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.*
- Cannot result in significant degradation of the aquatic ecosystem
- Must minimize potential harm to the aquatic ecosystem
- Must be sufficient information to make a reasonable judgment on compliance.

236

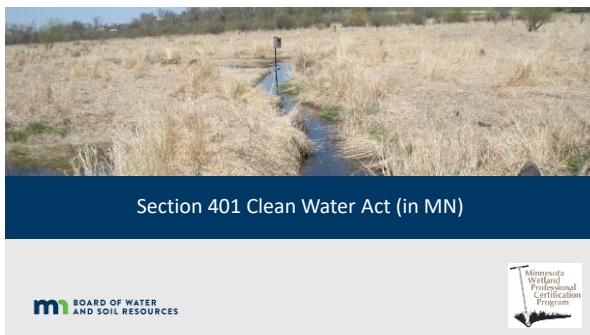
Other Important 404 Considerations in MN

- **Endangered Species Act**
 - Corps must consult with U.S. Fish and Wildlife Service regarding affects on federally-threatened and endangered species by proposed permit actions.
- **National Historic Preservation & Preservation of Historical and Archeological Data Acts**
 - Corps must consider affects of permit actions on significant historical or archeological resources. Consultation with State Historic Preservation Office (SHPO) and tribes.

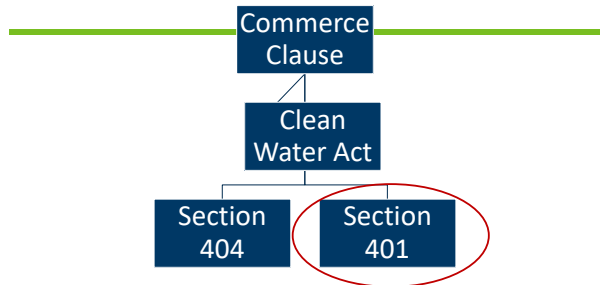
237

Program Element	WCA	404
Basis of Authority	State statutes and rule (Mn Rules Chapter 8420)	Clean Water Act
Regulated Waters	Wetlands except incidental and wetland areas of Public Waters (unless waived)	Waters of the U.S. (WOTUS)
Regulated Actions	Fill, drain, excavate (semi-perm. Flooded areas of type 3, 4, 5)	Discharges of dredged or fill material
Program Administration	LGU implementation, BWSR oversight, DNR enforcement	Corps Districts implement, EPA oversight
Type of Approvals	WCA decisions	Permit authorizations via IPs, GPs, NWPs
Applying for Approval	WCA application or request for decision	Pre-Construction Notification (PCN) for GPs/NWPs, Application for IP
Mitigation for Impacts	Replacement	Compensatory Mitigation

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Program Basics

- A federal permit may not be issued without a certification from the state that the discharge complies with state water quality standards pursuant to Section 401 of the Clean Water Act.
- In Minnesota, the Minnesota Pollution Control Agency (MPCA) is responsible for adopting state water quality standards and issuing Section 401 certifications.

241

Regulatory Scope

- Requires a federal action (permit, license, etc.). If none, then not applicable.

$$\boxed{\text{No 404 Permit Required}} = \boxed{\text{No 401 Certification Required}}$$

242

Program Administration

- All General Permits in MN have been certified by MPCA.
- Reviews all Corps Individual Permits (IP's)
- Provides Individual Certification for "high risk" projects (mining operations, dam removal, large bridges, large pipeline and transmission lines)

243

Outstanding Resource Values Waters

- Waters designated as such for their "exceptional characteristics".
- Two Types of ORVWs:
 - **Restricted** – activities are restricted as necessary to preserve the existing water quality and to maintain and protect the exceptional characteristics.
 - **Prohibited** - prohibits activities that result in a net increase in loading or other causes of degradation.

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Program Element	WCA	404	401
Basis of Authority	State statutes and rule (Mn Rules Chapter 8420)	Clean Water Act	Clean Water Act
Regulated Waters	Wetlands except incidental and wetland areas of Public Waters (unless waived)	Waters of the U.S. (WOTUS)	Waters of the State
Regulated Actions	Fill, drain, excavate (semi-perm. Flooded areas of type 3, 4, 5)	Discharges of dredged or fill material	Discharges of dredged or fill material
Program Administration	LGU implementation, BWSR oversight, DNR enforcement	Corps Districts implement, EPA oversight	MPCA implements
Type of Approvals	WCA decisions	Permit authorizations via IPs, GPs, NWP's	Water Quality Certifications
Applying for Approval	WCA application or request for decision	Pre-Construction Notification (PCN) for GPs/NWP's, Application for IP	Application for IP
Mitigation for Impacts	Replacement	Compensatory Mitigation	Mitigation

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Food Security Act (Wetland Conservation Provisions)




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Program Basics

- The U.S. Dept of Agriculture (USDA) via the 1985 Food Security Act provides benefits (loans, assistance payments, insurance premium subsidies, etc.) to producers of agricultural crop commodities. Typically referred to as the “Farm Program”.
- The program is modified and re-authorized periodically by congress. This is typically referred to as the “Farm Bill”.

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Agency Roles (related to wetland conservation provisions)

- **Natural Resource Conservation Service (NRCS):**
 - Makes technical determinations by assigning labels to farm fields that are significant in determining compliance with wetland conservation provisions.
 - Provides technical assistance to producers to assist in wetland conservation compliance.
- **Farm Service Agency (FSA):**
 - determines whether production/planting occurred on converted wetland and if producer is in compliance with wetland conservation provisions.

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Wetland Conservation Provisions of Food Security Act

Producers must complete form AD-1026 certifying they will not:

- Plant or produce an agricultural commodity on a converted wetland; or
- Convert a wetland with the intent to make production of an agricultural commodity possible.

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How Does NRCS Evaluate Compliance?

Primarily through Certified Wetland Determination (CWD).

Involves identifying wetlands and then assigning a label that has implications for compliance. For example, if producer drains a wetland for crop production, that would result in a label change that could result in producer being ineligible.

CWD does not relate to WCA jurisdiction!

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Program Element	WCA	404	Wetland Conservation Provisions of Food Security Act
Basis of Authority	State statutes and rule (Mn Rules Chapter 8420)	Clean Water Act	Food Security Act
“Regulated” Waters	Wetlands except incidental and wetland areas of Public Waters (unless waived)	Waters of the U.S. (WOTUS)	All wetlands
“Regulated” Actions	Fill, drain, excavate (semi-perm. Flooded areas of type 3, 4, 5)	Discharges of dredged or fill material	Draining, dredging, filling, leveling, or otherwise manipulating to make crop production possible.
Program Administration	LGU implementation, BWSR oversight, DNR enforcement	Corps Districts implement, EPA oversight	Farm Service Agency, technical determinations by NRCS
Type of Approvals	WCA decisions	Permit authorizations via IPs, GPs, NWPs	Eligible to receive benefits
Applying for Approval	WCA application or request for decision	PCN	Form 1026
Mitigation for Impacts	Replacement	Compensatory Mitigation	Mitigation

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How many jurisdictions?



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BWSR page for more info

- [Wetland Regulations in MN](#)

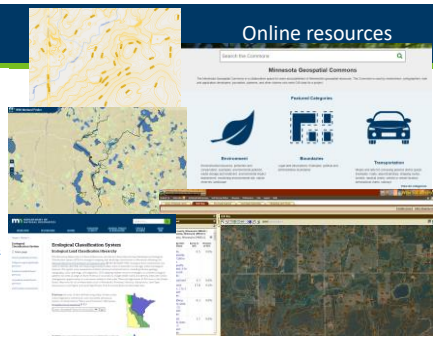


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Online resources

Available resources:

- [MN Geospatial Commons](#)
- [MN Topo](#)
- [NRCS Web Soil Survey](#)
- [MN NWI](#)
- [MN DNR Ecological Classification System](#)
- [MN Natural Resource Atlas](#)
- [MN Historic Aerial Photographs Online](#)
- [EnviroAtlas](#)



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Good Aerial Photos Are Essential

- [Google Earth](#)
- MN Geospatial Information Office
<http://www.mngeo.state.mn.us/>
- County Land Explorers



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NRCS Soils Map

Show potential wetlands based on the presence of hydric soils and symbols.



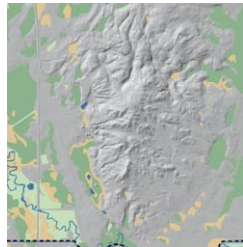
Web Soil Survey
<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

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Topographic maps



<http://arcgis.dnr.state.mn.us/maps/mntopo/>



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NWI

- [NWI Wetland Finder: Minnesota Department of Natural Resources \(state.mn.us\)](#)



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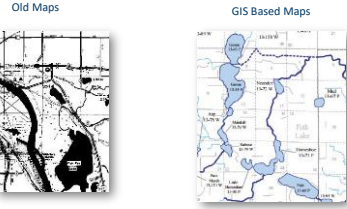
National Wetland Inventory



<https://www.fws.gov/wetlands/data/Mapper.html>

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DNR PUBLIC WATERS MAP

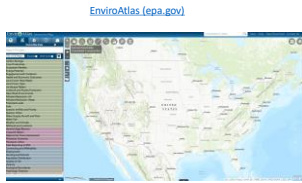


http://www.dnr.state.mn.us/waters/watergmt_section/pwi/maps.html
<https://gisdata.mn.gov/dataset/water-mn-public-waters>

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EnviroAtlas Interactive Map

- Nationwide interactive map utilizes diverse datasets
- Layers include:
 - Landcover
 - Soils
 - Hydrology
 - Weather & Climate
 - Ecological boundaries
 - Species at risk and priority



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Results = preliminary wetland map with possible transect locations and areas to investigate.



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Top of the Data Sheet Exercise

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site _____ City/County _____ Sampling Date _____
 Applicant/Owner: _____ State: _____ Sampling Point: _____
 Investigator(s) _____ Section, Township, Range _____
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____
 Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ NWI classification: _____
 Are climatic / hydrologic conditions on the site typical for the time of year? Yes _____ No _____ (if no, explain in Remarks.)
 Are Vegetation _____ Soil _____ or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____
 Are Vegetation _____ Soil _____ or Hydrology _____ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____	Is the Sampled Area within a Wetland? Yes _____ No _____
Hyptic Soil Present? Yes _____ No _____	
Wetland Hydrology Present? Yes _____ No _____	

Remarks: _____

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