Restoration & Monitoring

BOARD OF WATER AND SOIL RESOURCES

1

Overview

- General considerations for successful restoration
  - MN Restoration Guide
- Restoring natural hydrology
  - Hydrogeomorphology
    - Landscape position
    - Hydrology
    - hydraulics
- Restoration techniques
  - Filling ditches
  - Removing drain tile
  - Rerouting & pump removal
- Establishing vegetation
- Monitoring
  - Timelines
  - Roles and responsibilities
  - Interpreting hydrology and vegetation monitoring data

2

- Wetland Restoration

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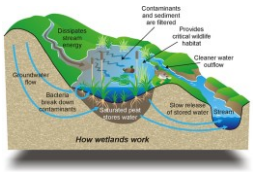
Why restore wetlands?

- Restore lost functions:
  - Wildlife habitat
  - Water Quality
  - Flood Attenuation



- Wetland Banking
- CRP/RIM
- Enforcement

4

Setting function-based restoration goals and performance standards.

Establishing Goals & Measurable Outcomes:

- Restore natural hydrology
- Reestablish native plant community to site
- Performance Standards (banking)- measurable attributes to determine if restoration goals are met

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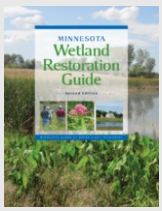
MN Wetland Restoration Guide

MN Wetland Restoration Guide:

- Planning
- Site Assessment
- Design and Construction
- Vegetation establishment
- Site Management & Monitoring



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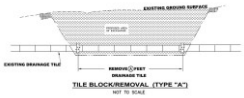
Technical Guidance Sheets

- Supplements to the MN Wetland Restoration Guide
- https://bwsr.state.mn.us/guidance-documents-tools-and-other-resources
  - Vegetation Establishment
  - Restoration Design and Construction
  - Managing Restoration Sites



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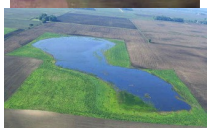
General considerations for wetland restoration

- Identifying and selecting projects
  - Restoration over creation
- Consider potential complications from degraded sites
- Adjacent land uses (present and future?)
  - Changes to adjacent landowners?
- Location of area ditches
  - Public or private?
  - Drainage Law?
- Understand soil conditions of site (permeability, chemistry)
- Water quality



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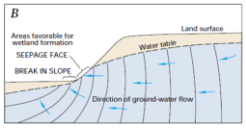
Hydrologic design considerations

Restoring natural hydrology:

- Hydrology
  - Precipitation, evapotranspiration, surface and groundwater inflow & outflow
- Hydraulics- how water flows
  - Unidirectional, bi-directional
- Landscape position
  - Surface shape
- Outlet structures
  - Location and size



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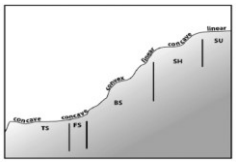
Landscape position

Understand the hydrogeomorphic position

- Landscape position
- Hydrology (inputs & outputs)
- Hydraulics (how water is moving)

Other considerations:

- Depth of basin
- Elevations (inlet, outlet)
- Microtopography



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Drainage Modifications

- Drainage Manipulation Strategies:
  - Ditches
  - Tile
  - Rerouting

- Restoration "reverses" modifications
- Don't over-engineer structures
  - **Restore natural hydrology**

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Ditches and Drain Tile

Ditch design considerations:

- Cross section area
- Depth
- Grade
- Outlet

Tile Design considerations:

- Tile size
- Depth
- Spacing grade
- Material
- Outlet

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Drainage Restoration Methods

- Filling ditches
- Removing tile
- Re-routing

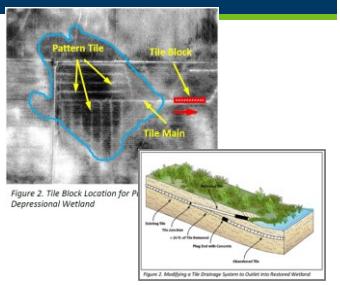

Figure 2. Tile Block Location for P… Depressional Wetland

Figure 2. Modifying a Tile Drainage System to Outlet into Restored Wetland

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Blocking and Filling Surface Ditches

Design Considerations:

- Ditch fill
  - Length
  - recontouring
- Ditch plugs for depressional, non-depressional, sloped wetlands
- Project boundaries/property lines

Blocking and Filling Surface Drainage Ditches Technical Guidance Document

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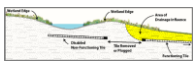
Blocking and Removing Subsurface Tile



- Design Considerations:
  - Tile block construction
  - Strategies to protect upstream land
  - Length, location, number of blocks (depressional vs sloped wetlands)
- Blocking Subsurface Drainage Tile Technical Guidance Document

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Rerouting Drainage Systems

- Rerouting Drainage Systems
  - Outletting incoming drainage directly into planned wetlands
  - Rerouting drainage to avoid planned wetlands
  - Removing/Relocating Pumps
- Design Considerations:
  - Wetland type, location, elevations, topography, adjacent land uses

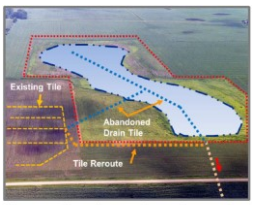

Figure 3. Drainage Tile Rerouted Around a Restored Wetland

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Outlets

Design Considerations:

- Location
- Elevation
- Size

Outletting Drainage Systems

- Types of outlet structures
  - Surface drainage
    - Rock riprap outfalls
    - Weir
      - Control elevation
  - Subsurface tile outlets
    - Several plastic pipe options
      - Consider perforated or non-perforated

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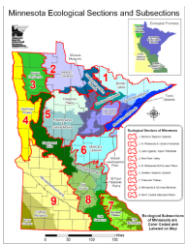
Vegetation establishment considerations

General strategies:

- Strategic site preparation
  - Planting elevation, water depth, soil type
  - Flooding frequency, duration
- Make landscape connections
- Match plant communities to site
- Restore and maintain plant diversity
  - Work with ecological variability
- Selecting seed mixes and plants
  - Species tolerance
- Manage Invasive species throughout entire site



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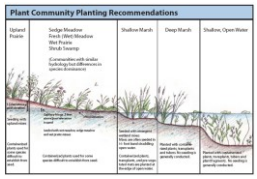
Developing a vegetation plan

- Consider topography and elevations to promote natural hydroperiods for plant species and communities
- Native Vegetation Establishment and Enhancement Guidelines
  - Comprehensive Guidebook



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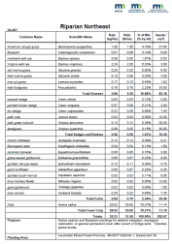
Selecting seed mixes and plants

- State Seed Mixes lists
- Grassland mixes (NW, SW, SE)
- Woodland mixes (S&W, Central, NE, NW)
- Wetland mixes (NE, South & West)



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Managing Restoration Sites

- Technical Guidance Documents:
  - Herbicide application
  - Prescribed burning
  - Mowing, grazing & haying
  - Water level management (flooding & drawdown)
  - Plant Care
  - Inspecting and maintaining outlet structures
  - Animal Control

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Wetland Bank Monitoring

BOARD OF WATER AND SOIL RESOURCES

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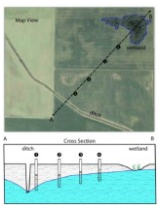
Overview of Wetland Bank Monitoring

- Monitoring process
  - Construction Certification
  - Duration of monitoring
  - Deposit of Credits
- Maintenance responsibilities
  - Monitoring reports
  - Timeline
  - Reports
- Corrective Actions



- Hydrology Monitoring
  - Performance standards
- Vegetation Monitoring
  - Performance standards

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General Monitoring roles once wetland bank is approved

LGU roles:

- certify construction
- certify credits for deposit
- review monitoring reports
- may require corrective actions as needed

Sponsor/landowner roles:

- Sponsor responsible for maintenance
- Submitting as-built documentation
- Submitting wetland credit deposit transaction form(s)
- Submitting monitoring reports
- Paying administrative fees

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Construction Certification

- LGU must certify the initial construction
  - Documentation:
    - as-built drawing
    - surveyed map
    - Delineation
    - seed tags
    - construction photos
- Site Visit with TEP
  - Recommend TEP Findings of Fact

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Monitoring Schedule

- Monitoring must begin no later than first full growing season after construction certification
- Must continue for at least 5 full growing seasons
- If unsuccessful, the LGU may extend the monitoring period (<5 additional years)
- Actual monitoring schedule may vary for different bank types (restoration vs preservation)

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Performance Standards

- Performance standard: observable or measurable physical (including hydrological), chemical and/or biological attributes that are used to determine if a compensatory mitigation project meets its objectives.

Examples:

- Vegetation
  - *"85% of the site is vegetated by planted species and/or regenerated species as per approved plan by end of 5th complete growing season."*
- Hydrology
  - *"Hydrology must meet wetland definition of 1987 Corps of Engineers Manual with saturation to the surface of the soil for at least 31 days of the growing season."*

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Monitoring Report

- Submitted following the first full growing season no later than 12/31
- Then submitted as per approved bank plan
- May include Form to Wetland Credit Deposit Transaction Form
- Contents of the report:
  - Project location map
  - Description of performance standards
  - Activities completed and planned
  - Hydrology measurements
  - Plant communities map
  - Color photographs
  - Other information specified from approved plan

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Vegetation

- Methods to monitor vegetation:
  - FQA
  - Mapping plant communities
  - Estimating invasive species
- Interpreting vegetation data
  - Indicator status (% FAC or wetter)
  - Composition (% native species richness)
  - Invasive cover (%)
  - Floristic Quality Assessment (index rating)

Table 1: Summary of Wetland Success Criteria for Phase I

Success Criteria	Phase I		
	Wet Meadow	Hardwood Swamp	Shallow Marsh
Duration			
Growing Seasons	5	4	5
Hydrology			
Hydrology (depth to water table)	Surface to -12"	Surface to -12"	+6" to -12"
Hydroperiod (duration within zone)	Meets duration	Meets duration	Meets duration
Vegetation			
Wetland Indicator (% FAC or wetter)	41/52 = 79%	39/51 = 76%	20/22 = 91%
Species Composition (Native Richness)	39/52 = 75%	39/51 = 76%	19/22 = 86%
Invasive Cover (% non-native)	2%	9%	2%
FQA/WFQA	20.2/26.7	20.0/21.4	16.9/19.7
Tree Coverage (trees per acre)	N/A	26.48	N/A

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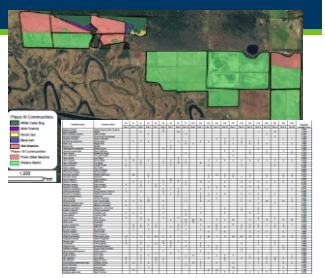
Interpreting Vegetation

- Vegetation measurements to consider:
  - Percent absolute cover of bare ground/open water
  - % relative cover of native, non-invasives
  - % relative cover of non-native, invasives
  - % relative cover of hydrophytes
  - Plant species richnesss



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Reviewing Monitoring Reports

A. Success Criteria Summary

Summary of Success Criteria Standards and Current Metrics for 2017.

Metric	Success Criteria	Measured Criteria	Success Criteria Met?	Comments
Hydrology – *Standards used for 2012 - 2016*				
Elevation	Water between 6 inches above and one foot below ground surface	Measured hydrology is between 6 inches above and one foot below ground surface	Yes	*Formal hydrology monitoring not required for 2017. Success based on direct site observations*
Duration	Majority of the growing season	Hydrology was within the desired range for the majority of the growing season	Yes	
Vegetation				
Diversity	Minimum of five native species	79 native species have been observed	Yes	Species diversity increased from 2016 to 2017
Composition	minimum two sedges and two grasses	Eight sedges and eight grasses have been identified	Yes	Species composition stable
Invasive species coverage	No more than 10% total cover	Total cover of invasive species is less than 10%, and has been effectively controlled.	Yes	Reed canary grass is less than 5% coverage.
Invasive species concentration	No single areas greater than one-quarter acre in size	Invasive species remain under control with no single area greater than one-quarter acre in size	Yes	Slight increase of along ditches, but sprayed again in fall 2017 to control

- Group exercise? (One report meets criteria, one parameter doesn't meet criteria)

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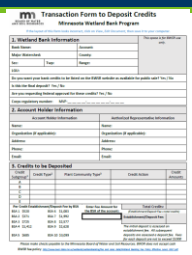
Credit Deposits

- Up to 15% of the credits are eligible for deposit after the certification of construction
- Remaining credits are eligible for deposit based on the credit release schedule and performance standards in the approved bank plan
- Subject to review by the LGU & TEP
- After certifying the credit for deposit, the LGU must forward to BWSR banking adminstrator


Transaction Form to Deposit Credits
Minnesota Wetland Bank Program

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Corrective Actions

- If, during the monitoring period, the LGU or TEP determine that a bank site does not meet the approved plan's specifications, the LGU must require corrective actions
- BWSR can freeze accounts by restricting deposits, withdrawals, transfers until the LGU determines the site is in compliance
- Noncompliance of bank sites is subject to enforcement procedures

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Review

- General considerations for successful restoration
  - Restoration over creation, degraded sites, adjacent land uses , soil conditions, water quality, other drainage features, landownership
- Restoring natural hydrology
  - Understand the landscape position, hydrology, hydraulics
- Establishing vegetation
  - Strategic site preparation, landscape connections, match plant communities to site, plant diversity, work with ecological variability, species tolerance, manage Invasive species
- Restoration techniques
  - Filling ditches, removing drain tile, rerouting & pump removal
- Performance Standards
  - Measurable attributes to determine if restoration goals are met
- Monitoring Reports
  - Hydrology monitoring
    - Monitoring wells
    - Interpreting data
  - Vegetation monitoring
    - Interpreting data
- Use available technical guidance!

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Wetland Banking

BOARD OF WATER AND SOIL RESOURCES

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Overview

- Purpose of Wetland Banking
- Types of Wetland Banks
- Actions Eligible for Credit
- Establishing a Wetland Bank
- Certification and deposit of credits
- Withdrawals and transfers
- Replacement for Public Road Projects

Banking-related topics covered in other sections:

- Restoration Construction Standards
- Monitoring and Corrective Actions

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- Wetland Bank Guidance and Information

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Purpose

What is Wetland Banking?

- WCA rule: "The purpose of the state **wetland banking** system is to provide a market-based structure that allows for replacement of unavoidable impacts with pre-established replacement wetlands."
- Federal Mitigation Rule definition (33 CFR 332.2): "A **mitigation bank** sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor."
- NRCS website: "**Wetland Mitigation Banking** is a form of Environmental Market trading where wetlands are developed to create marketable wetland credits (acres and function). These credits are sold to others as compensation for unavoidable wetland impacts."

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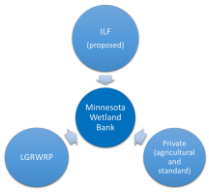
Bank types

- Private
  - Standard- Landowners establish bank on private land to mitigate impacts on non-ag or transportation projects
  - Agriculture- Credits can only be used for Ag projects
- In-lieu Fee (proposed)
  - Open to only government and NGOs, mitigation completed in advance, requires compensation planning framework
- Local Government Road Wetland Replacement Program
  - Replaces impacts resulting from local transportation projects



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Quick facts on ILF (as proposed)

Minnesota In-Lieu Fee Program

A program in which wetland replacement requirements are satisfied through payment of money to the board or a board-approved sponsor to develop replacement credits according to section 103G.2242, subdivision 12. (Minn Stat.)

In-lieu fee versus banking, major differences

- Mitigation is completed in advance with banking, after sale of credits with ILF
- Banking is for profit, ILF is open only to government and NGOs
- Corps is involved in finances with ILF, no involvement in banking
- ILF requires development of a compensation planning framework for program approval, banking does not

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Quick facts on Ag bank

Eligibility to USE the Ag Bank:

✓The wetland must be proposed to be drained for agricultural use.

✓The land must remain in agricultural use.

✓The wetland must be a farmed wetland (FW) or otherwise degraded wetland on existing agricultural land.

Differences with Standard Bank:

- Credits can only be used for Ag projects
- Flexibility on Vegetation Standards
- Expired CRP sites could be eligible "as-is"

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Local Government Road Wetland Replacement Program

- WCA exempts certain local road projects from State wetland replacement requirements
- BWSR is required to replace the associated wetland impacts so the local governments don't have to
- These wetland credits also satisfy Corps of Engineers' Section 404 permit requirements

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What projects Qualify?

- **Repair, rehabilitation, reconstruction** or **replacement** of **currently serviceable** existing State, City, County or Town public road.
  - Provided that:
    - Project **minimizes impacts**
    - **Plans are provided** to the LGU
- What doesn't qualify?
  - New roads
  - Roads expanded solely for additional capacity lanes

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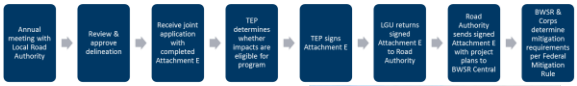
Reviewing Local Road Projects



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Joint Application Form


Joint Application Form for Activities Affecting Water Resources in Minnesota

For Local Road Projects:

- Parts 1-5; Attachments C and E
- May need Attachment D if there will be impacts that do not meet the Local Road Program eligibility requirements

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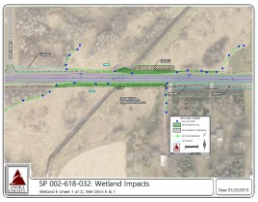
Application Requirements

Local Road Unit should provide TEP the following:

- Project plans depicting wetland boundaries
- Description of wetland impacts by type
- Information demonstrating wetland impact minimization
- Only one alternative is required



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Good Example

MnDOT's Road Design Manual (2000) also recommends turn and/or bypass lanes for rural undivided roadways with traffic volumes over 1,500 ADT and speed limits above 45 mph. Current road condition compared with required and proposed are laid out in the table below.

	Existing	Required	Proposed
Lane Width (ft)	12	11-12	12
Shoulder Width (ft)	0-6	8	8
In-Slope	1:4	1:4	1:4

This project is proposed to improve CSAH 18 to meet today's State Aid Standards and improve safety along the corridor.

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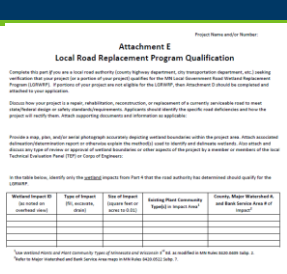
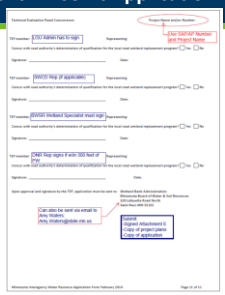
Attachment E – Joint Application


Attachment E
Local Road Replacement Program Qualification



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Actions Eligible for Credit

- Restoration of completely drained wetland
- Restoration of partially drained wetland
- Vegetative restoration of farmed wetlands
- Protection of wetland previously restored via conservation easements
- Wetland Creations
- Restoration and protection of Exceptional Natural Resource Value
- Preservation of wetlands
- Upland buffer areas

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Actions Eligible for Credit 8420.0526

Subpart	Action
2	Buffer
3	Restoration, Completely Drained or Filled
4	Restoration, Partially Drained or Filled
5	Vegetative Restoration of Farmed Wetland
6	Protection of Wetlands Previously Restored
7	Wetland Creation
8	ENRV
9	Preservation

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Establishing a Wetland Bank

State and Federal Review Process in Minnesota

- Draft Prospectus
  - State: Optional
  - Federal: Optional
- Prospectus
  - State: Optional
  - Federal: Required
- Mitigation Plan/Draft MBI
  - State and Federal: Required
- Final Mitigation Plan and MBI
  - Federal only and required

WCA	Corps
Draft Prospectus (optional)	Draft Prospectus (optional)
Prospectus (optional)	Prospectus (required)
Mitigation Plan (required)	Mitigation Plan (required)
Easement Acquisition	Final Mitigation Plan (required)

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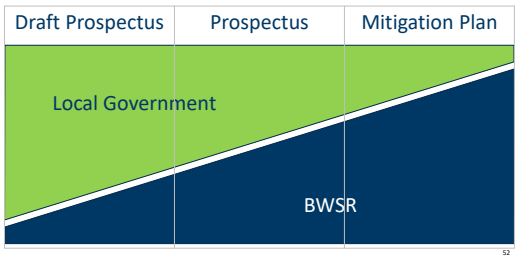
Roles in Establishing a Wetland Bank



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Draft Prospectus

- Optional
- No decision required
- Help sponsors
- Complex or difficult projects
- Minimal investment

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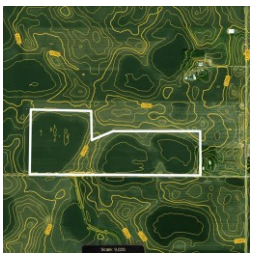
Draft Prospectus

- Basic project information
- Easement questionnaire
- Basic Features
- Why is it a good bank project
- Constraints
- Existing wetlands



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Draft Prospectus

- BWSR provides “Discussion Items”
- WS uses discussion items at TEP meeting
- TEP writes Findings based on discussion
- Sponsor receives TEP findings and decides what to do

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Wetland Mitigation Proposal
Prospectus

Prospectus

- Required by Corps
- No decision required
- Baseline Information
- Justify Credit Actions
- Justify Credit Allocation
- General Concept Plans

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Prospectus

- Crediting
- Topographic Information
- Wetland Determination
- Title Opinion
- Site Hydrology Information

WCA Wetland Bank Credit Allocation Table

Map ID	Credit Action [2]	Acres [3]	Credit Allocation			
			Minimum Credit [4]		Maximum Credit [5]	
			% Credit	Credit Amount	% Credit	Credit Amount
1	Subp 4 A/Rehabilitation	21.4	75	16.0500	100	21.4000
2	Subp 4 A/Rehabilitation	14.7	75	11.1600	100	14.3200
3	Subp 4 B/Rehabilitation	3.3	25	0.8133	50	1.6266
4	Subp 4 B/Rehabilitation	1.7	25	0.4307	50	0.8614
5	Subp 4 B/Rehabilitation	1.2	25	0.3068	50	0.6136
6	Subp 2/Upland Buffer	0.8	10	0.0774	25	0.1934
7	Subp 2/Upland Buffer	17.6	10	1.7648	25	4.4121
8A	Subp 2/Upland Buffer	2.2	10	0.2162	25	0.5405
8B	Subp 2/Upland Buffer	1.7	10	0.1728	25	0.4831
9	Earthen Embankment	0.5	0	-	0	-
	TOTAL EASEMENT SIZE	67.6	TOTAL:	32.0820	TOTAL:	46.529%

57

Roles for reviewing prospectus

TEP/LGU Roles:

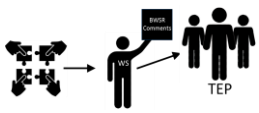
- Verify previous comments addressed
- Verify sponsor adequately described the site
- Review wetland delineation or determination
- Review crop history (if necessary)
- Provide LOCAL perspective on project and eligibility

BWSR Role:

- Evaluate easement issues
- Vegetation, Engineering, and Bank Coordinator comments included
- Statewide consistency
- Technical answers and interpretations
- Coordination with Corps

58

- Comments become more direct
- Baseline information must justify credit actions and allocations
- Some credit actions require more information
- Project takes shape but detailed plans not required
- Balance information needs versus sponsor’s cost



59


Wetland Mitigation Proposal
Mitigation Plan (Full Application)

Mitigation Plan

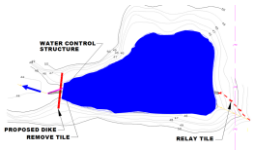
- Document of record
- Required for both programs
- LGU Decision Required
- Section 15.99 time limits!
- Attached to Corps’ MBI

60

Mitigation Plan

Required:

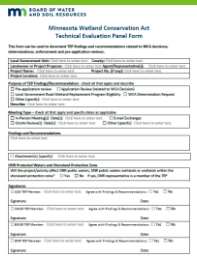
- Detailed vegetation plans
- Detailed construction plans
- Detailed monitoring plans
- Performance standards
- Credit release schedule



61

TEP Review

- Verify Corps has completed Prospectus phase
- Verify Prospectus information carried forward and comments addressed
- Verify Baseline Information is complete and adequate
- Wetland delineation approval
- Review detailed plans to your comfort level

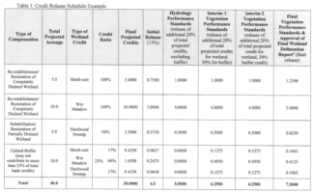


62

"Plans are nice but performance releases credits." J. Overland

Mitigation Plan

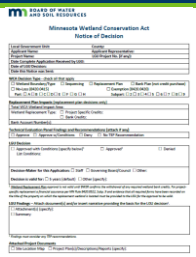
- Monitoring plan must relate to performance standards
- Performance standards must relate to credit releases
- The Mitigation Plan is the basis for implementation, credit releases, and allowable actions into the future
- DOCUMENTATION IS CRITICAL



63

Mitigation Plan Decision

- Track 15.99 time limits, extensions needed
- Most Mitigation Plans will require some revision
- Make final decision in accordance with section 15.99
- Clearly identify and retain approved Mitigation Plan
- When possible the WCA and Corps approved plans should be the same



64

Easement Acquisition

GENERAL PROCESS INFORMATION

- Easement acquisition is typically initiated after mitigation plan approval
- Easement acquisition does not have to be completed prior to construction
- The process is managed at BWSR by Easement Section Staff, not Wetland Specialists
- It is the responsibility of the sponsor/landowner to initiate the easement acquisition process

65

LGU role in Easement Acquisition

- Help the sponsor find the "Conservation Easement Acquisition Overview for Private Wetland Banks"
- BWSR easement staff will take it from there

66

Easement Acquisition

The significant steps in the easement acquisition process include:

1. **Sponsor** submits initial $1,000 Easement Acquisition Fee **to BWSR** along with application
2. **BWSR** performs a preliminary review of ownership information to identify potential issues
3. **Sponsor provides** DRAFT Certificate of Survey in required format **for BWSR review & comment**
4. **BWSR provides** sponsor with instructions to obtain Title Commitment
5. **Sponsor (landowner) provides** Title Commitment **to BWSR** for State Attorney General (AG) review & comment
6. **BWSR prepares** Conservation Easement document to be signed by landowner
7. **Landowner signs Easement and returns to BWSR** with $2,400 Easement Acquisition Fee balance
8. **BWSR sends** instructions to record the Easement and issue a Title Insurance Policy
9. **BWSR notifies sponsor** that easement acquisition process is complete

67

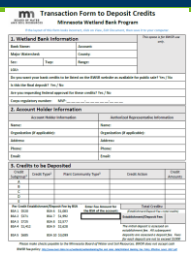
Construction Certification

- LGU must certify the initial construction
  - Documentation:
    - as-built drawing
    - surveyed map
    - Delineation
    - seed tags
    - construction photos
- Site Visit with TEP
  - Recommend TEP Findings of Fact

68

Credit Deposits

- Up to 15% of the credits are eligible for deposit after the certification of construction
- Remaining credits are eligible for deposit based on the credit release schedule and performance standards in the approved bank plan
- Subject to review by the LGU & TEP
- After certifying the credit for deposit, the LGU must forward to BWSR banking administrator



69

Credit Withdrawal and Transfer

- Submitted as part of Replacement Plan to LGU with jurisdiction of impact site
- Reviewed and approved by the LGU with TEP input
- Processed and entered into official ledger by BWSR
- BWSR coordinates approved transactions with Corps

70

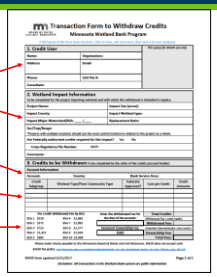
Credit Transactions

Help us improve transaction processing efficiency.

Make sure all requested information is provided

Make sure account information is provided and each column is filled out

Don't worry about fees – BWSR will handle that



71

Credit Transactions

Transaction forms cannot be processed without required signatures

When processing transactions we need LGU name and contact. Typed or printed information makes it easier to figure out

72

Review

- Types of Wetland Banks
  - Standard
    - Private and Agriculture
  - In Lieu of Fee (proposed)
  - Local Road Program
- Replacement for Public Road Projects
  - Repair, rehabilitate, reconstruction of currently serviceable roads
- Actions Eligible for Credit
  - Restoration of drained wetlands, vegetation restoration, protection, ENRV, Preservation, upland buffer
- Establishing a Wetland Bank
  - Draft Prospectus
  - Prospectus
  - Mitigation Plan
- LGU and TEP procedures for banking
  - Construction Certification, deposit of credits, withdrawal of credits

73

Aerial Photo Interpretation

BOARD OF WATER AND SOIL RESOURCES

74

Overview

Expert, I helped write the guidance.

What is the off-site method?

75

Overview

Easy

76

Overview

A Little Harder

77

Overview

Harder Still

78

Overview

What the ?

79

Overview

Inherent difficulty with wetlands on ag. land:

- They often lack a natural plant community
- Their soils are disturbed by cultivation
- Their hydrology is often altered either directly (ditches, tile, diversion) or indirectly (tilling patterns, evaporation and transpiration from exposed soils and intensive cropping).

80

Overview

'87 Manual Definitions:
- Normal Circumstances
- Atypical area
- Problem area

Midwest and NC/NE require aerial review per Chapter 5:
- "Agricultural lands"
- "Wetlands that periodically lack indicators of wetland hydrology"

81

Overview

"Findings suggest that aerial image interpretation provides a useful, but conservative approach to identifying areas of wetland hydrology…"

82

Guidance

US Army Corps of Engineers ®
St. Paul District

Minnesota Board of Water & Soil Resources

July 1, 2016

Guidance for Offsite Hydrology/Wetland Determinations

This document replaces all previous Minnesota Board of Water and Soil Resources (BWSR) and St Paul District Corps of Engineers (District) endorsed versions of guidance concerning wetland mapping conventions

83

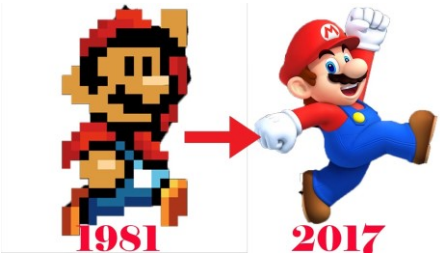
Guidance

- Always use all* imagery in putting the pieces together, and place greatest reliance on more recent years; they tend to best reflect current conditions.

*Use only high quality/good resolution slides. Much better to focus on image quality than normalcy of antecedent conditions.

84

The evolution of aerial photo review



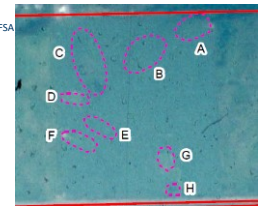
85

Guidance

Moving away from FSA images 1979 – 2000

Using more recent and clearer images: 5 normal years

1997 FSA



2010 MnGEO

86

Guidance

Vigor and stress responses to wetland conditions

87

Evaluating Images

Signatures:

- CS: Crop stress
- DO: Drowned Out
- NC: Not cropped
- SW: Standing water
- NV: Normal vegetative cover
- NSS: No soil wetness
- AP: Altered pattern
- SS: Soil wetness signature
- CS/DO… (can have multiple, use the /)

Wetland Signatures are a positive "hit"

88

Evaluating Images

Crop Stress (CS)

89

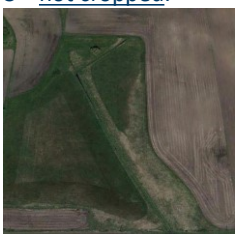
Evaluating Images

Drowned Out (DO)

90

Evaluating Images

NC – not cropped.




91

Evaluating Images

Standing Water (SW)

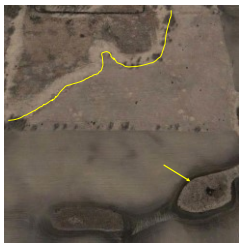

92

AP – altered pattern


93

Evaluating Images

WS – wetland signature.




94

Evaluating Images

Normal Vegetative Cover (NV) or No Soil Wetness (NSS)

95

Evaluating Images

Soil Wetness Signature-SS

- In Bare soil images, dark, or wet-appearing photo tone from early growing season
- May even include some standing water
- Note the drift lines around the edge of the basin

96

What signature(s) do you see?

Crop Stress (CS)	
Drowned Out (DO)	
Not Cropped (NC)	
Standing Water (SW)	
Altered Pattern (AP)	
Wetland Signature (WS)	

97

Evaluating Images

Spring 2010

Summer 2010

Light versus dark is relative

Calibrate your eye!

98

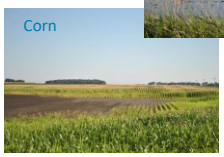
Variables

Vegetation Tolerance

Hydrophytic Veg.

Soybeans

Corn



99

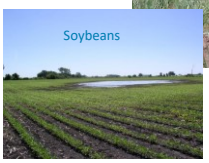
Variables

Stem Density

Alfalfa

Corn

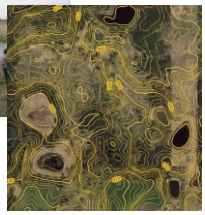
Soybeans

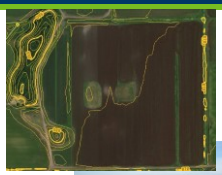


100

Variables

Topography

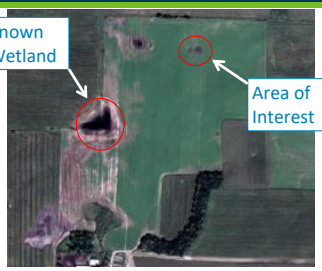




101

Variables

Reference Areas



102

Variables

Deep Peat Soils

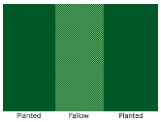
103

Variables

Iron Chlorosis

Winter Freeze

Business Decisions



104

Photo interpretation

- Interpretation conundrum scale:

"I will apply the guidance using a minimum of 5 normal years"

"I only see signatures in wet years!"

"I only see signatures in dry years!"

"Nothing to see here, it's all upland!"

"I see everything as wetland!"

Everything looks green.

Utilize the signatures in the joint guidance.

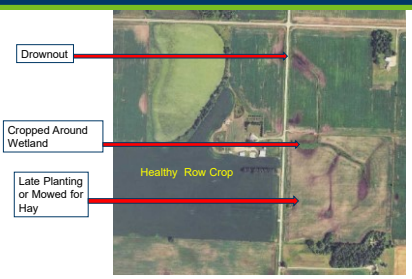
Look for the subtle patterns of color variation.

105

Wet Signatures

106

Wet Signatures



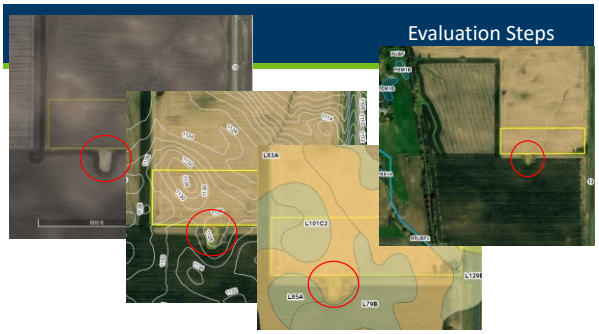
107

Evaluation Steps

- Assign identifying labels:

108

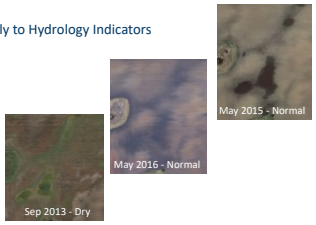
Evaluation Steps



109

Aerial photo review

- Note aerial review conclusion on corresponding data sheets, where possible, to aid with regulatory review.
- Signatures on aerials correspond directly to Hydrology Indicators
  - B7 – Inundation Visible on Aerial Imagery
  - C9 – Saturation Visible on Aerial Imagery
  - D1 – Stunted or Stressed Plants



110

Overview

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches):
Water Table Present? Yes ____ No ____ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches):

Wetland Hydrology Present? Yes ____ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
June 2016 Google Image shows inundation during normal antecedent precip.

Remarks:

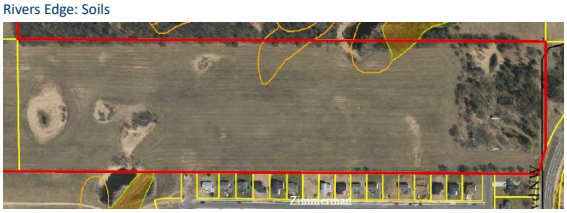
111

Example

112

Example

Rivers Edge: Soils



113

Example

Rivers Edge: NWI

114

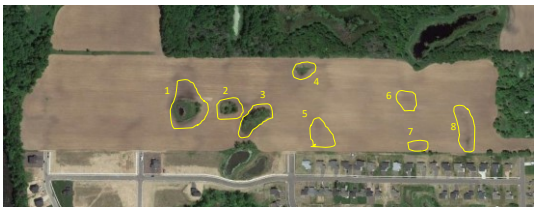
Example

Rivers Edge

115

Example

Rivers Edge 2017



116

Example

Rivers Edge 2015

117

Example

Rivers Edge 2011

118

Example

Rivers Edge 2010

119

Example

Rivers Edge 2008

120

Example

Rivers Edge 2006

121

Example

Rivers Edge 2004

122

Let's do the math.

Field Data Sheet Reference:

Wetland Hydrology from Aerial Imagery - Recording Form

Proj. Name: Rivers Edge Date: 7/21/2021 County: Anoka

Reviewer: BLM Location (Sec, Twsp, Rng):

Review Summary Table

Image Date (earliest)	Image Source	Climatic Condition	Image Interpretation Area(s) 1	2	3	4	5	6	7	8
6/25/2017	Google Earth	Normal	NC	NC	NC	NC	NV	NV	NV	NV
2016	Google Earth	Wet	NC	NC	NC	NC	NV	NV	NV	NC
2015	Google Earth	Dry	NC	NC	NC	NC	NV	NV	NV	NC
2011	Google Earth	Wet	NC	NC	NC	NC	NV	NV	NV	NC
2010	Google Earth	Normal	WS	WS	WS	WS	NV	NV	WS	WS
2009	Google Earth	Dry	NC	NC	NC	NC	CS	CS	CS	CS
2008	Google Earth	Normal	NC	NC	NC	NC	NC	NC	NC	NC
2006	Google Earth	Normal	NC	NC	NC	NC	NC	NC	NC	NC
2004	Google Earth	Normal	NC	NC	NC	NC	NV	NV	CS	NC
2003	Google Earth	Normal	SW	NC	NC	NC	NV	NV	CS	SW

Number of Normal Years	6	6	6	6	6	6	6	6	
Normal Years with Wet Signature	6	6	6	6	2	2	5	5	
Percent Normal with Wet Signature	100	100	100	100	33.333	33.333	83.333	83.333	

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Document

Hydric Soils present[1]	Identified on NWI or other wetland map[2]	Percent with wet signatures from Exhibit 1	Field verification required[3]	Wetland?
Yes	Yes	>50%	No	Yes
Yes	Yes	30-50%	No	Yes
Yes	Yes	<30%	Yes	Yes, if other hydrology indicators present
Yes	No	>50%	No	Yes
Yes	No	30-50%	Yes	Yes, if other hydrology indicators present
Yes	No	<30%	No	No
No	Yes	>50%	No	Yes
No	Yes	30-50%	No	Yes
No	Yes	<30%	No	No
No	No	>50%	Yes	Yes, if other hydrology indicators present
No	No	30-50%	Yes	Yes, if other hydrology indicators present
No	No	<30%	No	No

Area	Hydric Soils Present	Identified on NWI or other wetland map	Percent with wet signatures from Exhibit 1	Other hydrology indicators present	Wetland?
1	No	Yes	100	NA	Yes
2	No	Yes	100	NA	Yes
3	No	Yes	100	NA	Yes
4	No	Yes	100	NA	Yes
5	No	No	33	No	No
6	No	No	33	No	No
7	No	No	83	NA	Yes
8	No	No	83	NA	Yes

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Example

Final Example: Rivers Edge

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Other uses

Level 1 Delineations

Delineation Method	Review of offsite mapping resources	Site Visit	Sampling Approach	Complete Field Data Forms	Field Staking of Wetland Boundaries
Routine Level 1	Yes	Sometimes	Offsite	No	No
Routine Level 2	Yes	Yes	Onsite, qualitative	Yes	Yes
Comprehensive	Yes	Yes	Onsite, quantitative	Yes	Yes

WCA Application Type Examples	*Commonly Used* Delineation Method
Temporary impact under No-Loss	Routine Level 1
Banking application: pre-application scoping	Routine Level 1
Banking application: full application	Routine Level 2
Road Program Wetland Impact Documentation—Road project through a large continuous wetland	Routine Level 1
Road Program Wetland Impact Documentation—Scattered wetlands within construction corridor	Routine Level 2
Replacement plan	Routine Level 2
Enforcement actions	Routine Level 2 or Comprehensive
Wetland boundary approval (no project application)	Routine Level 2
Agricultural exemption determination (8420.0420, Subpart 2A)	Routine Level 1

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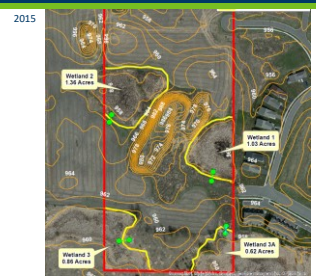
Other uses

Level 1 Delineations

127

Incidental

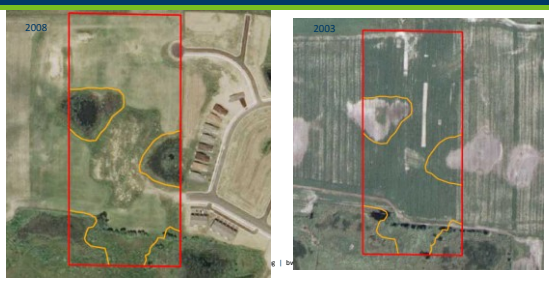


128

Incidental

129

Incidental



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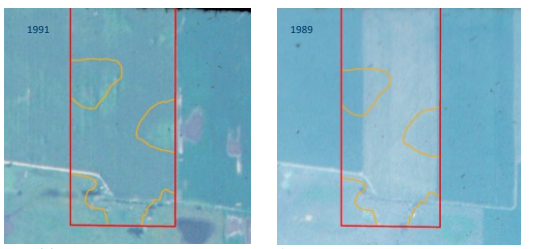
Incidental



131

Incidental

132

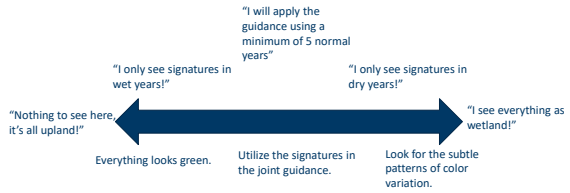
Final Point

- Except for Level 1 delineations, the results of aerial imagery review are not necessarily the final determination.
- Other data to support conclusions.
- Results do not override site specific data (Level 2, etc).

133

Photo interpetation

- Interpretation scale conundrum:



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Submitting Wetland Delineations

BOARD OF WATER AND SOIL RESOURCES

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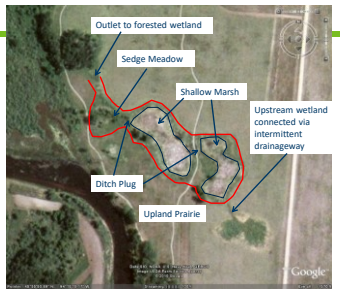

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Wetland Delineation Reports

- Field Notes
- Basic Report Components
- Report Contents
- Field Review
- Non-Routine Wetland Delineations

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Guidance

Delineation Method	Review of offsite mapping resources	Site Visit	Sampling Approach	Complete Field Data Forms	Field Staking of Wetland Boundaries
Routine Level 1	Yes	Sometimes	Offsite	No	No
Routine Level 2	Yes	Yes	Onsite, qualitative	Yes	Yes
Comprehensive	Yes	Yes	Onsite, quantitative	Yes	Yes

WCA Application Type Examples	*Commonly Used* Delineation Method
Temporary impact under No-Loss	Routine Level 1
Banking application: pre-application scoping	Routine Level 1
Banking application: full application	Routine Level 2
Road Program Wetland Impact Documentation—Road project through a large continuous wetland	Routine Level 1
Road Program Wetland Impact Documentation—Scattered wetlands within construction corridor	Routine Level 2
Replacement plan	Routine Level 2
Enforcement actions	Routine Level 2 or Comprehensive
Wetland boundary approval (no project application)	Routine Level 2
Agricultural exemption determination (8420.0420, Subpart 2A)	Routine Level 1

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Take Good Field Notes

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What to Record

- Plant communities
  - Describe and sketch on aerial photograph
- Landscape settings
  - Topographic changes from wetland to upland
    - Gradual, abrupt?
- Vegetation
  - Dominant veg
  - changes from wetland to upland
- Soil
  - Changes from wetland to upland
  - Textures, Colors
- Hydrology indicators
  - Changes from wetland to upland

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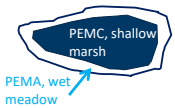
What to Record

- Wetland type
  (Circular 39, Cowardin, Eggers & Reed)
- General site description
  - Buildings, ditches, culverts, etc…
- Field conditions
  - Raining, temperature, drought, etc.



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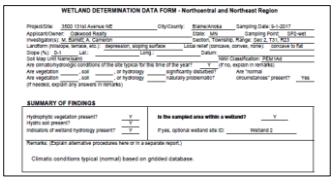
Notes on Field Notes (cont.)

- Note taking skills improve with experience as you figure out what is important and what is not
- Take time to organize, refine, and augment field notes immediately following your field visit.
- Label and organize photos so you know where you took them and what they are intended to show.


WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SUMMARY OF FINDINGS

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Marking Wetland Boundaries

- Mark with:
  - Flags, lath, whatever works.
  - Will vary depending on situation.
- Locate via GPS or land survey methods (find out local requirements).
- Wetland boundaries m… a…

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Guidance

St. Paul District REGULATORY
US Army Corps of Engineers®

Minnesota Board of Water & Soil Resources

March 4, 2015

Guidance for Submittal of Delineation Reports to the St. Paul District Army Corps of Engineers and Wetland Conservation Act Local Governmental Units in Minnesota, Version 2.0

Introduction – Purpose and Background of 2015 Guidance

This guidance provides specific standards and expectations for conducting wetland delineations and submitting wetland delineation reports for regulatory purposes in Minnesota. It supplements and emphasizes information in the 1987 *Corps of Engineers Wetland Delineation Manual* (Manual) and applicable regional supplements. In 1996, the Corps of Engineers (the Corps), St. Paul District Regulatory Branch issued *Guidelines for Submitting Wetland Delineations to the St. Paul District Corps of Engineers and Local Units of Government in the State of Minnesota* jointly with the Minnesota Board of Water and Soil Resources (BWSR). Significant improvements to the application of the science behind wetland and

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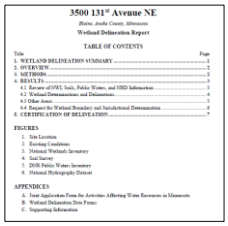
Typical Report Format

- **Introduction**
- **Methods**
- **Results**
- **Discussion (optional)**
- **Figures**
- **Field Data Forms**



3500 131st Avenue NE

Blaine, Anoka County, Minnesota

Wetland Delineation Report

TABLE OF CONTENTS

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Introduction

- Who did you do this for?
  - Developer, public entity
- Where is the project
  - General location and size of project area
  - General description of plant communities: Wooded, meadow, urban etc…
- Why are you doing it?
  - Identify wetlands on potential development site
  - Identify wetlands in road corridor
- When did you do it?

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Methods

- **Level 1 or 2?**
- **Off site aerial review?**
- **Monitoring data?**
- **Reference wetlands?**
- **Problem area or atypical procedures?**

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RESULTS and Discussion

Describe wetlands AND uplands

- Wetland Type – Circular 39, Cowardin, Eggers & Reed
- Dominant Vegetation for each community/type

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Text Examples

Wetland Type &Vegetation:

"Wetland 1 is a Type 3 (PEMC/F) with an interior shallow marsh community surrounded by a fringe of wet meadow.

Dominant vegetation in the shallow marsh includes broadleaf cattail, and water plantain.

The wet meadow fringe include reed canary grass, with a few scattered willow shrubs."

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Text Examples

Soils:

"Soils in the wetland consisted of a deep layer of organic sapric material overlying fine sand consistent with the mapped soil unit. Indicator A1 (histosol) was observed in the wetland.

Adjacent upland soils lacked the organic surface layer and consisted of high chroma loamy fine sand over sand. No hydric soil indicators were observed in the upland."

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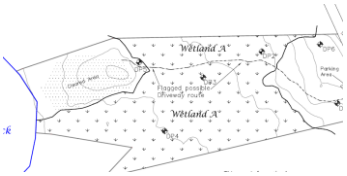
Report Components – Figures

1. Site Location
2. National Wetland Inventory (NWI)*
3. Soils
4. Public Waters Inventory (PWI)*
5. Wetland Boundary Map

*often combined



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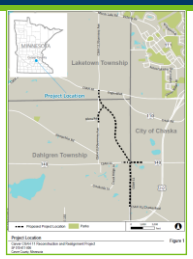
Report Components – Maps | Site Location



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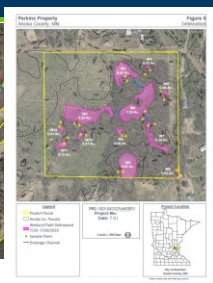
Identify all aquatic resources



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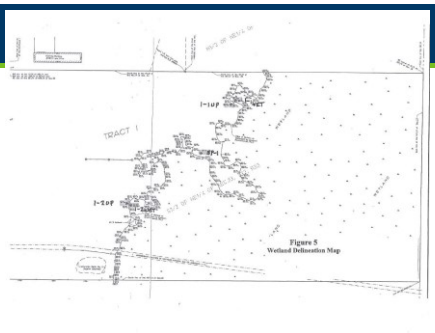
Reports



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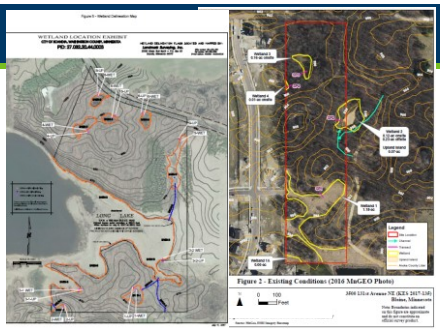

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Data Forms

- Completely filled out
- Correspond to sample locations indicated on a map
- Remember that sample locations should be representative
- Not needed if doing a Routine Level 1
- Do a complete job, but keep in mind that these are field assessments, not a scientific study, spend a reasonable amount of time.

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Field Review

Who should conduct site review?

- At least 1 member of TEP
- LGU may request assistance from TEP (SWCD and BWSR) or other tech. prof.
- Corps invited/coordination
- Delineator invited (but does not need to be present)

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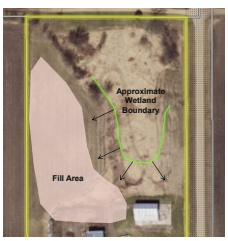
Non-Routine Wetland Delineations

- Informal Delineations
- Landowner wanted to fill an area mapped as non-hydric soil
- Site visit to estimate and stake wetland boundary



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Class Summary

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

BWSR Wetland

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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-Parameter/ Indicator Approach

1. **Soils** –Historic conditions, may not reflect current condition.
2. **Hydrology** –Current condition, 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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Land Resource Regions

- **Regions dictate which indicators are used and how they are used**

a) The indicator descriptions in this guide are abbreviated versions of the full descriptions found the Regional Supplements to the Corps of Engineers Wetland Delineation Manual (Great Plains, North-Central/North-East, Midwest). Users are encouraged to reference the full descriptions and user notes found in those documents.

b) An indicator is applicable statewide unless otherwise indicated below the indicator description.

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Land Resource Regions

- **Regions dictate which indicators are used and how they are used**

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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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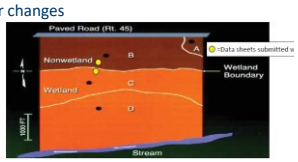
Sampling Location Should Be Representative

- 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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Critical Definitions

- Wetlands
- Growing Season
- Atypical Situations
- Problem Areas
- Normal Circumstances

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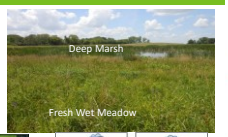
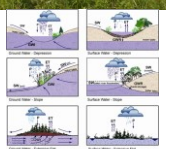
Wetland Classification Systems in MN

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





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Wetland Functions & Values

Wetland Functions: in scientific assessments means natural processes

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

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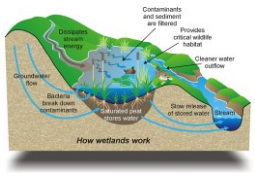
Wetland Functions

- 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



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

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Functional Assessment Methods

- MN Routine Assessment Method (MNRAM)
  - Numeric model for assessing wetland functions and some values

Comprehensive General Guidance

for

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

9/15/2010

- Floristic Quality Assessment
  - Vegetation based ecological condition assessment method

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

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Research Data Sources

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

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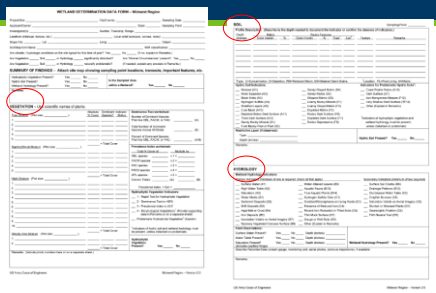
It's all about the documentation!



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MN Wetland Regulatory Programs

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

DEPARTMENT OF NATURAL RESOURCES

Communities and Local Government

US Army Corps of Engineers®

BOARD OF WATER AND SOIL RESOURCES

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Soil

- Basics of Soil
  - Soil formation
  - Landscape positior
- Soil Properties
  - Texture
  - Color
- Hydric soil develop
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All
  - Fine
  - Sandy
- Common soil indicators

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Field Indicators of Hydric Soils

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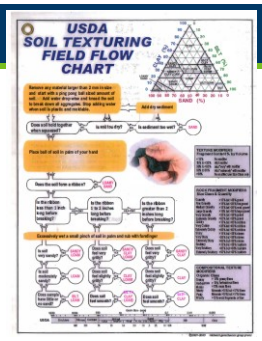
USDA SOIL TEXTURING FIELD FLOW CHART



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Web Soil Survey

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
C02B	Rushville loamy sand, Rainy till phase, 0 to 3 percent slopes	31.8	25.3%
C103B	Brainerd sandy loam, 1 to 4 percent slopes	13.0	10.3%
C104B	Brainerd-Flak complex, 4 to 8 percent slopes	13.3	10.6%
C106A	Nokay-Pinnish complex, 0 to 2 percent slopes	56.3	44.8%
W	Water	11.3	9.0%
Totals for Area of Interest		125.7	100.0%

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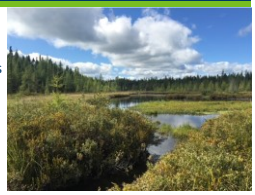
Hydrology

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

- Technical standard of 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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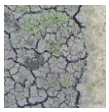
Hydrology Indicator Groups

Group A – direct observation of *water*



Group B – evidence of *flooding/ponding*

Group C – evidence of *current or recent saturation.*

Group D – *Landscape and veg. characteristics* that indicate contemporary wetland conditions.

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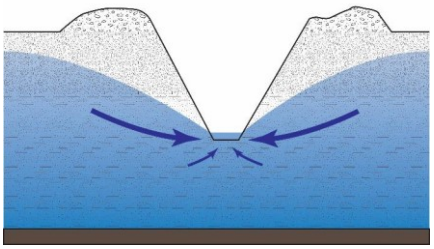
How do drains work?



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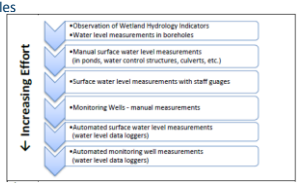
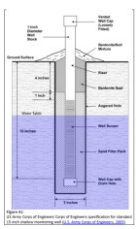
Methods to monitor hydrology

- Observation of indicators
- Staff gauges
- Open boreholes



Monitoring wells



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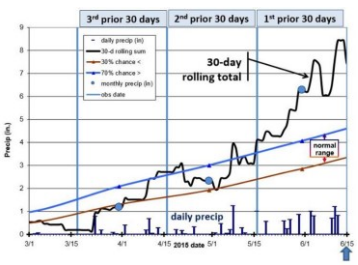
Antecedent Precipitation

To better interpret the data collected or observation made in the proper context.



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Overview of Wetland Vegetation

- Hydrophytic Vegetation Definition
  - Define Hydrophyte
  - What makes a plant a hydrophyte
  - Determine why matters
- Hydrophytic Vegetation Indicators
  - Field indicators
  - Indicator status
  - Dominance
- Determining Hydrophytic Plant Community
  - Rapids Test
  - 50/20 Rule
  - Prevalence Index

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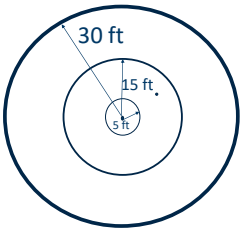
Vegetation Sampling



5 ft Herbaceous; 15 ft Shrub/Sapling; 30 ft Tree

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Determining Hydrophytic Vegetation

The procedure for using hydrophytic vegetation indicators is as follows:

1. Apply Indicator 1 (Rapid Test for Hydrophytic Vegetation).
2. Apply Indicator 2 (Dominance Test).
3. Apply Indicator 3 (Prevalence Index). This and the following step assume that at least one indicator of hydric soil and one primary or two secondary indicators of wetland hydrology are present.
4. Apply Indicator 4 (Morphological Adaptations).

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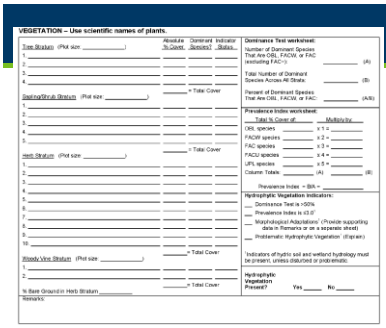
Hydrophytic Veg.


VEGETATION – Use scientific names of plants.

Dominance Test worksheet:

Prevalence Index worksheet:

Hydrophytic Vegetation Indicators:

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Overview of Wetland Restoration

- General considerations for successful restoration
  - MN Restoration Guide
- Restoring natural hydrology
  - Hydrogeomorphology
    - Landscape position
    - Hydrology
    - hydraulics
- Restoration techniques
  - Filling ditches
  - Removing drain tile
  - Rerouting & pump removal
- Establishing vegetation
- Monitoring
  - Timelines
  - Roles and responsibilities
  - Interpreting hydrology and vegetation monitoring data

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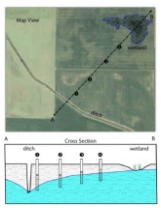
Overview of Wetland Bank Monitoring

- Monitoring process
  - Construction Certification
  - Duration of monitoring
  - Deposit of Credits
- Maintenance responsibilities
  - Monitoring reports
  - Timeline
  - Reports
- Corrective Actions



- Hydrology Monitoring
  - Performance standards
- Vegetation Monitoring
  - Performance standards

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Wetland Delineation Reports

- Field Notes
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- Report Contents
- Field Review
- Non-Routine Wetland Delineations

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Final Thoughts?

- Questions (last chance!)

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