

Hydrology First:

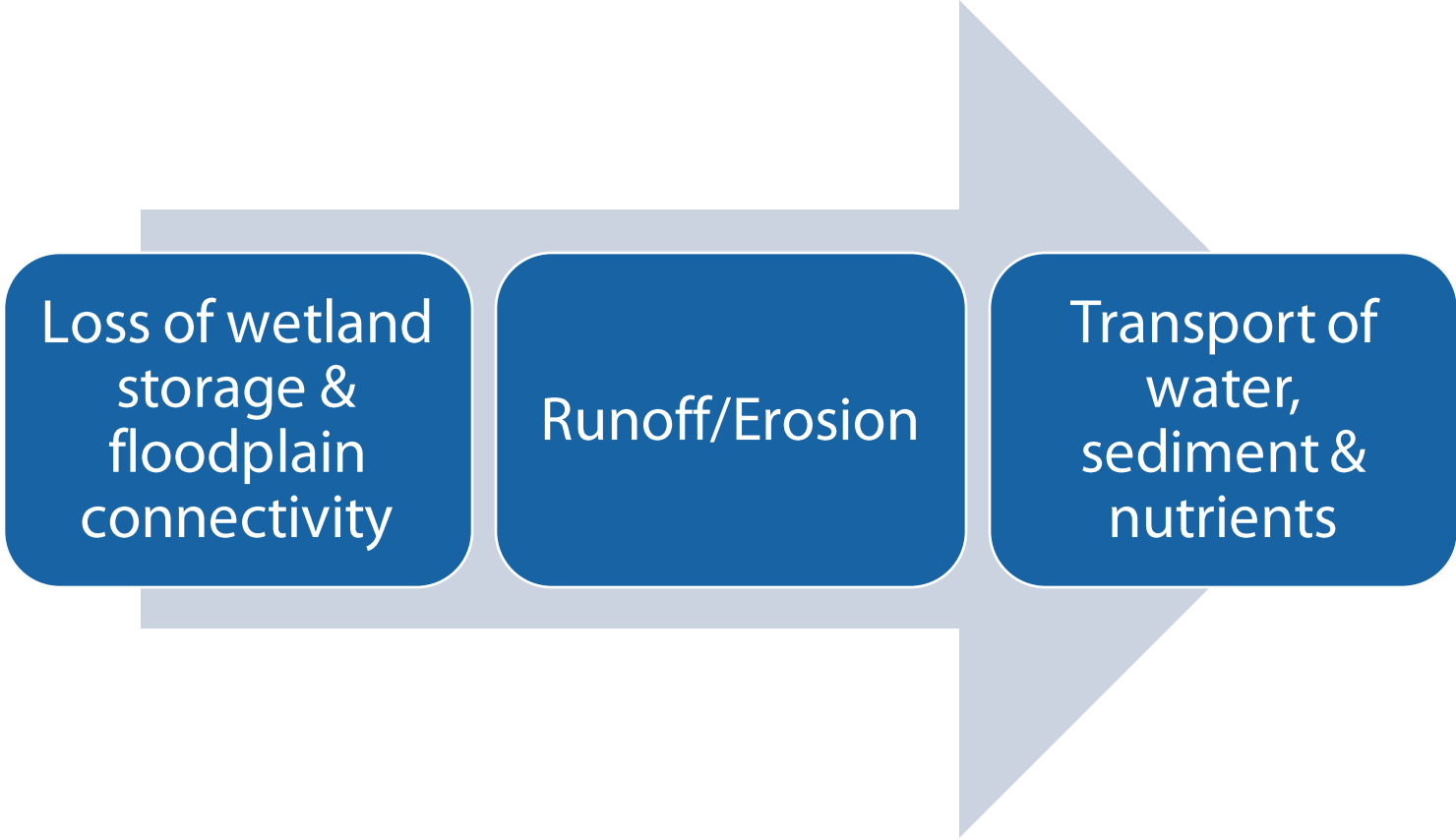
*Exploring New Approaches
to Runoff and Flood Risk
Management*



Kyle Magyera
Local Government
Outreach Specialist

Erin O'Brien
Policy Programs
Director





Loss of wetland
storage &
floodplain
connectivity

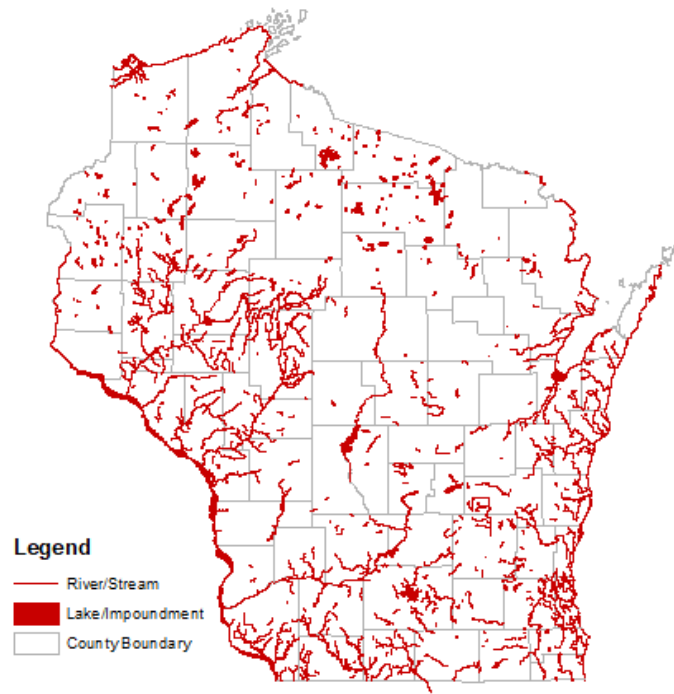
Runoff/Erosion

Transport of
water,
sediment &
nutrients



Degraded hydrology contributes to all of WI's water management problems:

- Surface water quality
- Groundwater quality
- Groundwater supply
- Flooding and flood damages
- Fish and wildlife habitat declines
- Others



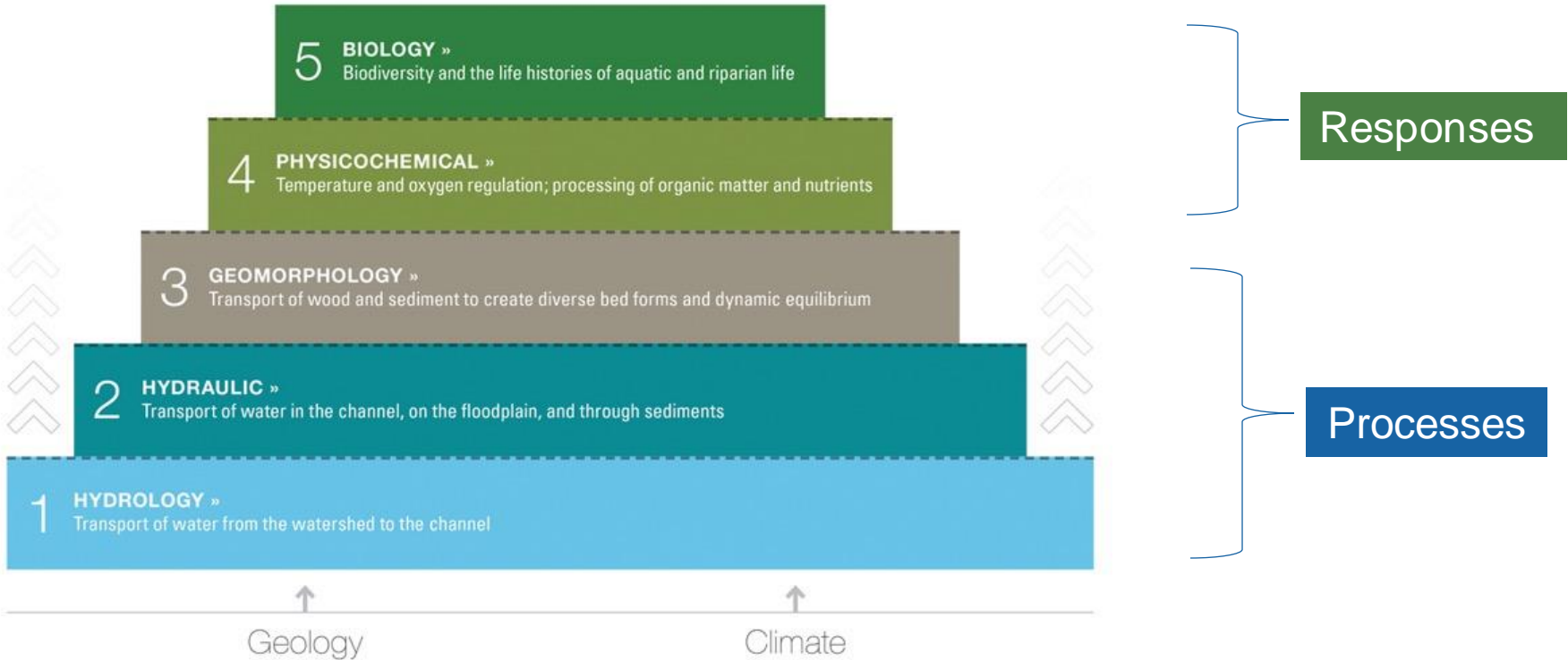
Benefits of watershed-scale hydrologic assessment & restoration



- No “one size fits all” problems or solutions
- Can be low-cost, low-tech, and highly effective
- Voluntary/community driven
- Can be strategic/targeted
- Compatible with current land uses
- **Enables multi-objective work**
- **Addresses root causes of water management problems**



Stream Functions Pyramid



(Harman et al. 2012 - *A Function-Based Framework for Stream Assessment and Restoration Projects*)

Natural Flood Management



— NFM —

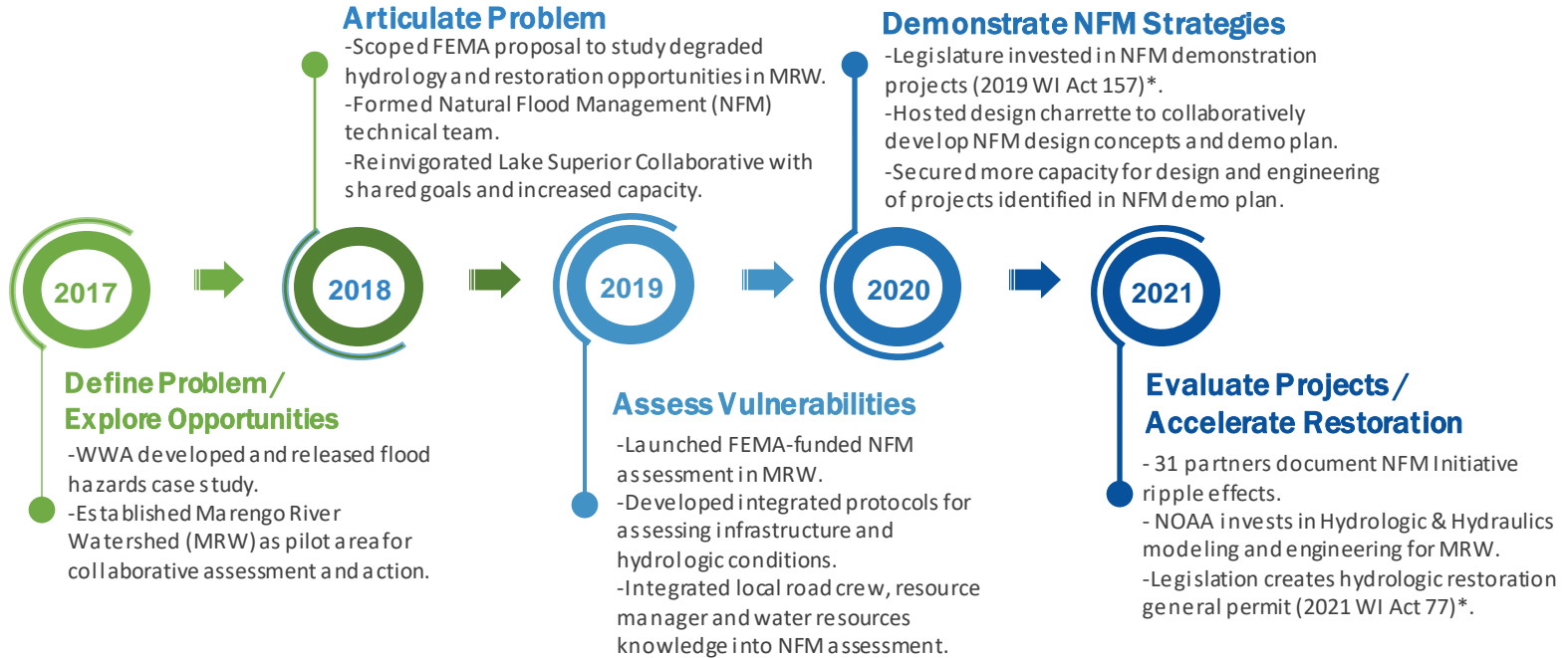
- Reconnect channels, floodplains, wetlands
- Work with and mimic hydrologic processes
- Combine with structural approaches
- Mitigate erosion hazards

Rebuilding the landscape's natural capacity to store and manage water



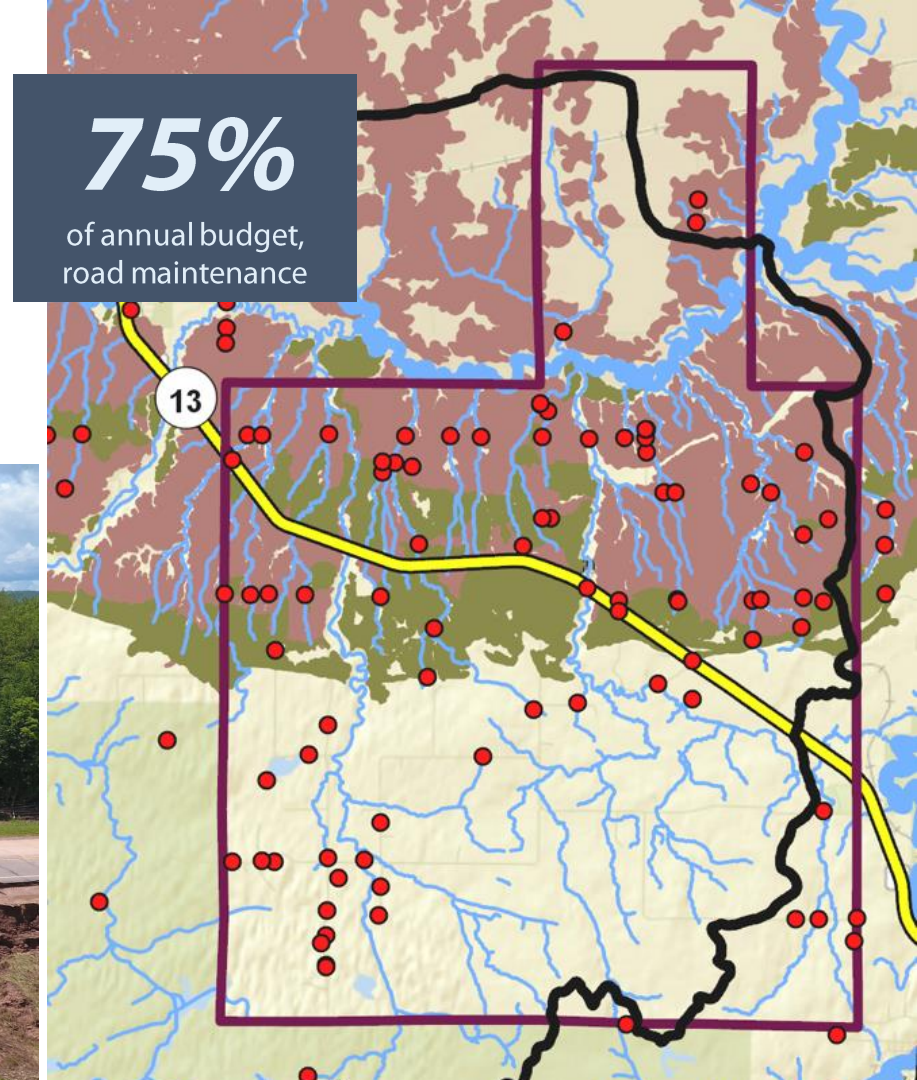
Lake Superior Basin Natural Flood Management Initiatives

Timeline of Key Activities in the Marengo Valley NFM Pilot



Town of Ashland

- Almost every culvert washed out
- Lean budget, dependent on loans



Marengo River Watershed

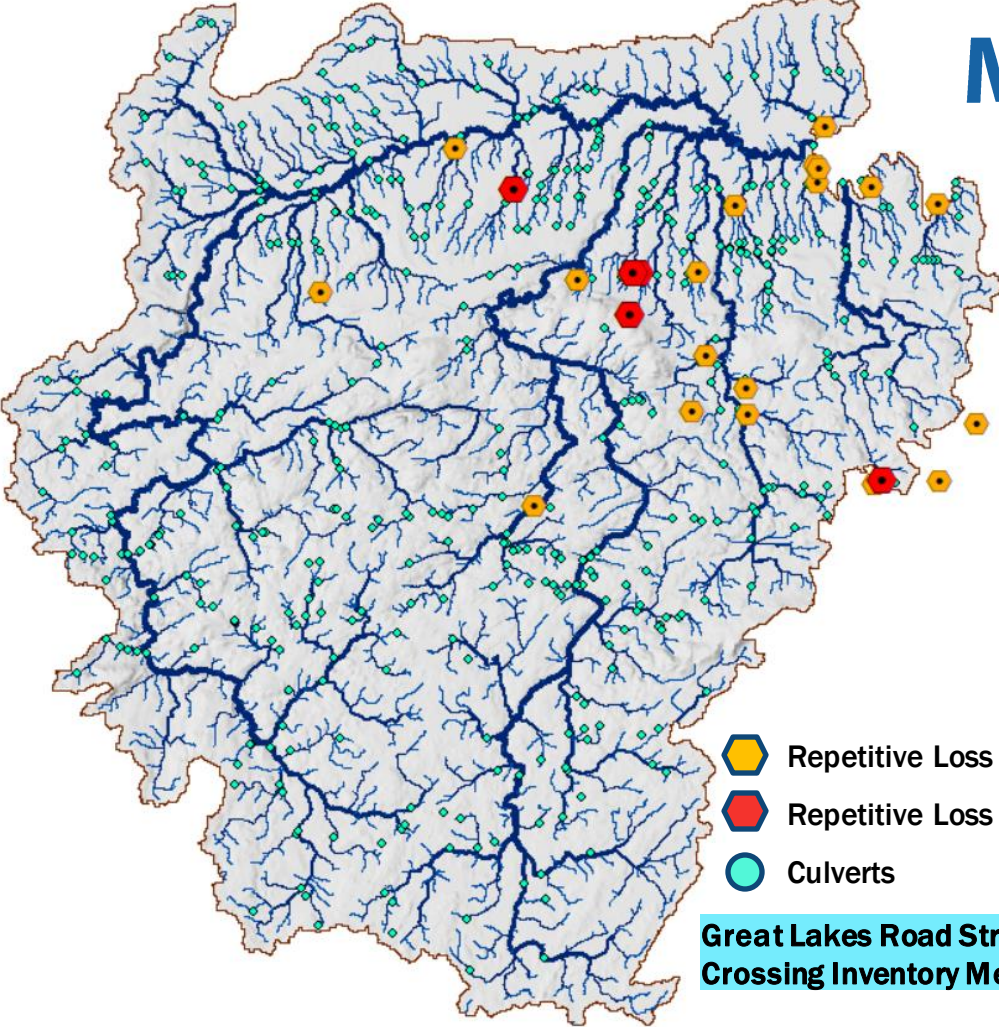





FEMA Advance Assistance

2019 WI Act 157

9-Key Element, LWRM plans

Lake Superior Collaborative



-  Repetitive Loss (x2)
-  Repetitive Loss (x3)
-  Culverts

Great Lakes Road Stream Crossing Inventory Method



Gullying → Wetland Drainage





Loss of Storage

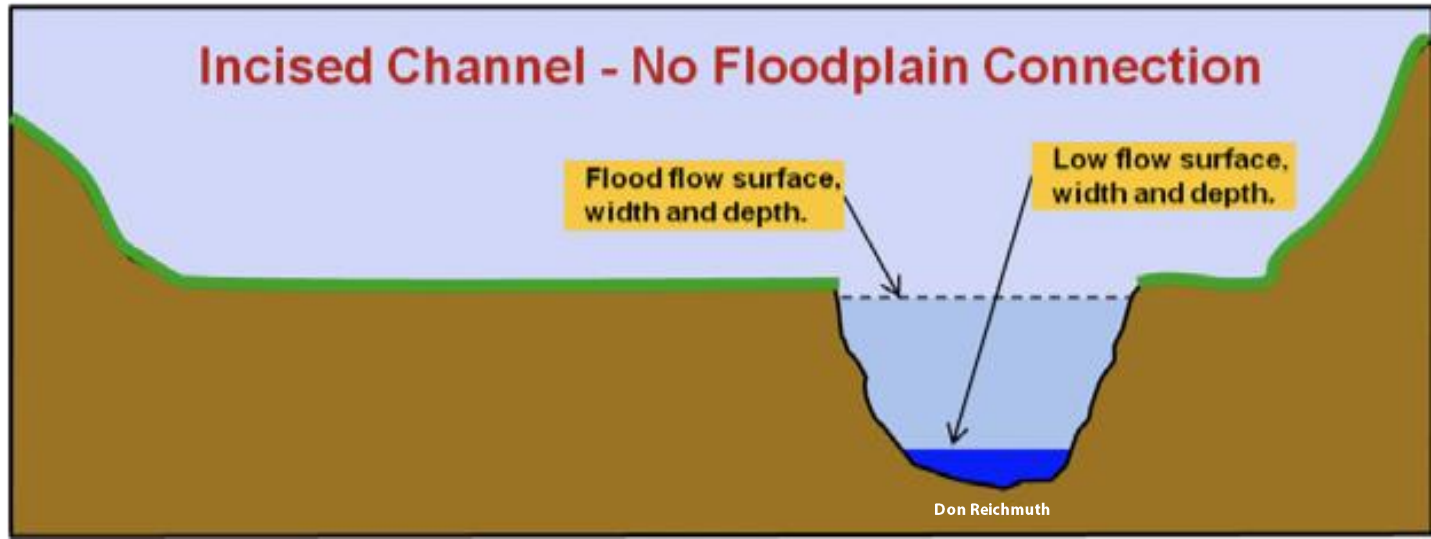
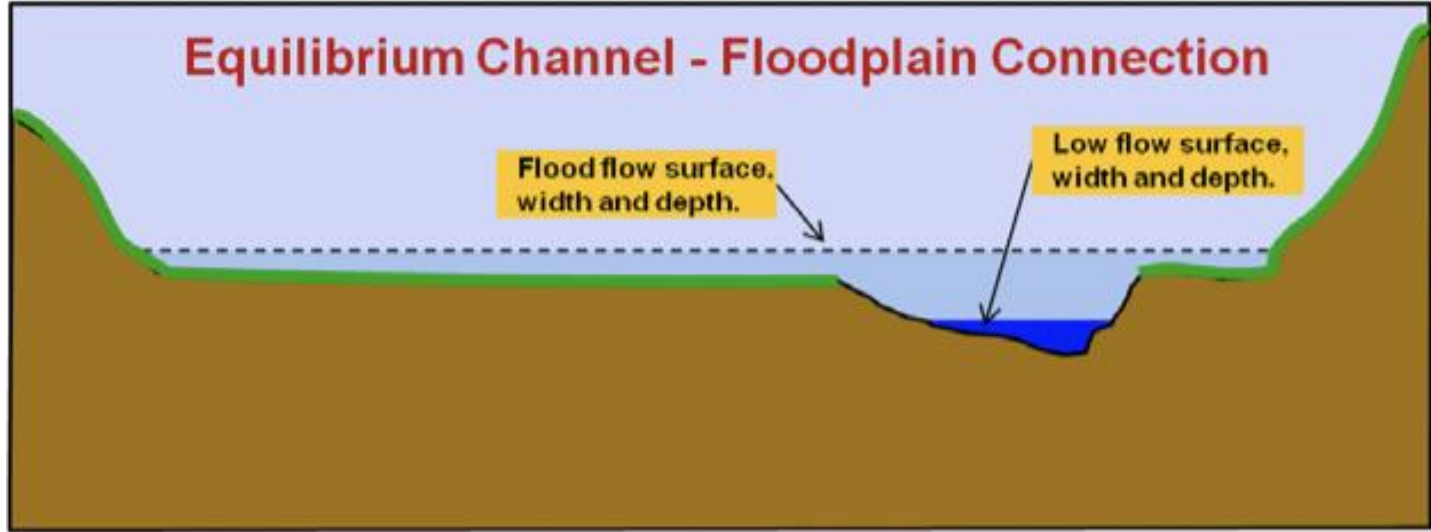
Disconnected Floodplains



- ❑ Incised meadows & hollows
- ❑ Channels where they should **not** be
- ❑ Channels act like agricultural ditches



Hydrologic Disconnections



Incised Channels

floodplain
swamp

Drainage



Fluvial Erosion Hazards (FEH)



Gullies



Incision



Headcuts



FEMA Advance Assistance: Where is loss of wetland storage and floodplain disconnection occurring because of FEHs?

Adapting FEH & River Process Corridor assessment methods

<https://extension.umass.edu/riversmart/>



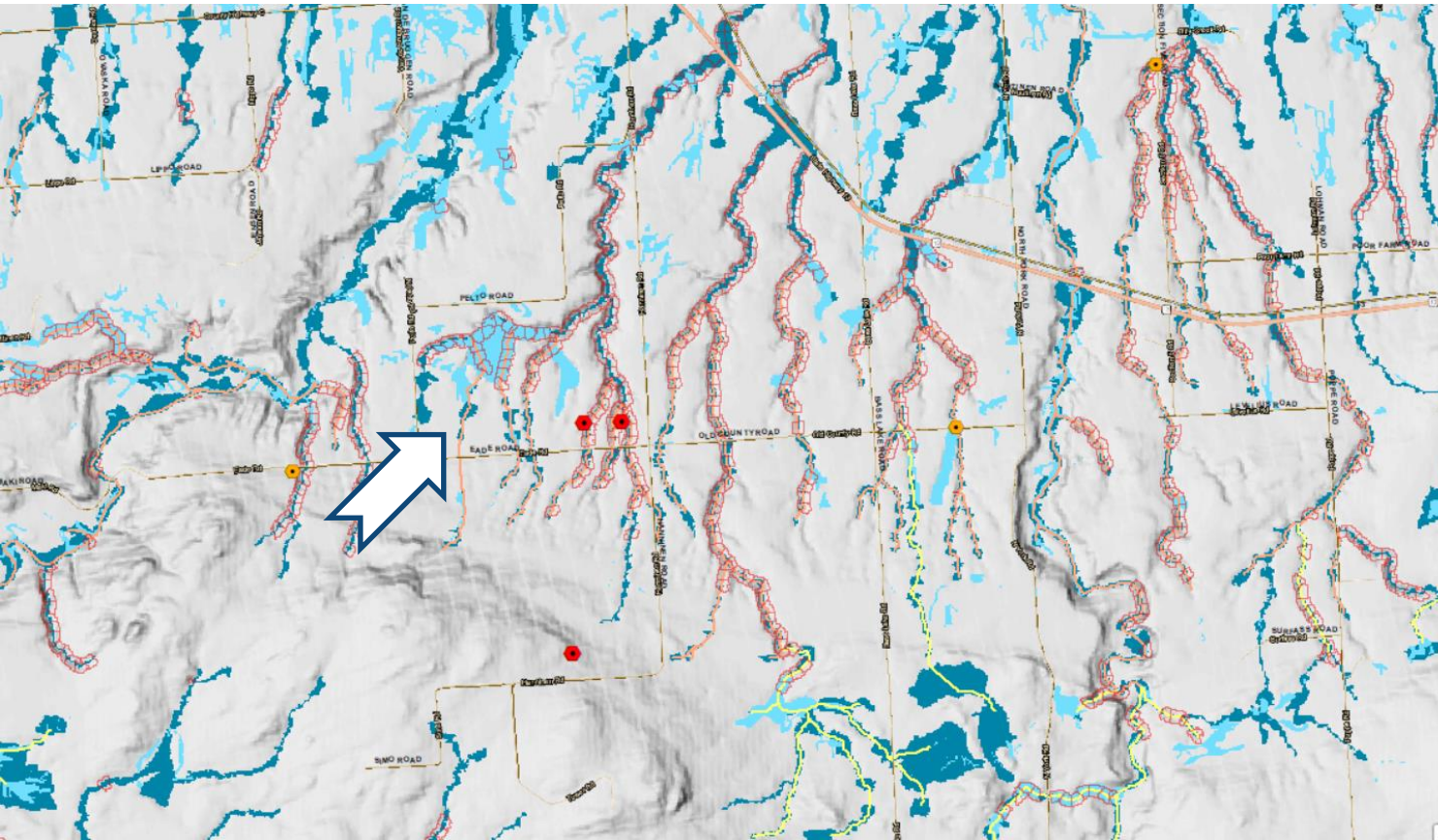
Risk of Erosion





Specific Stream Power (W/m^2)	0-60	60-300	>300
Valley Confinement	>10	6-10	<6
Increase (%) in Confinement by Infrastructure	<10	10-25	>25
LEVEL OF RISK	LOW	MODERATE	HIGH

Risk of Aggradation (Deposition)

Specific Stream Power (W/m^2)	>300	60-300	0-60
Number of slope decreases > 5%	0	1	≥ 2
Number of > 3 rd order confluences	0	1	>1
Number of road crossings	0	1-2	>2
LEVEL OF RISK	LOW	MODERATE	HIGH

Headwaters Sensitivity



-  **HAND**
-  **PRWs**
-  **Wetlands**
-  **steep valleys**

(gw) wave-planed topography

(sg) hummocky stream sediment overlain by silty material

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Flow

Risks:

- Headcuts & incision
- Drainage network extension
- Loss of headwater wetlands
- Mass wasting

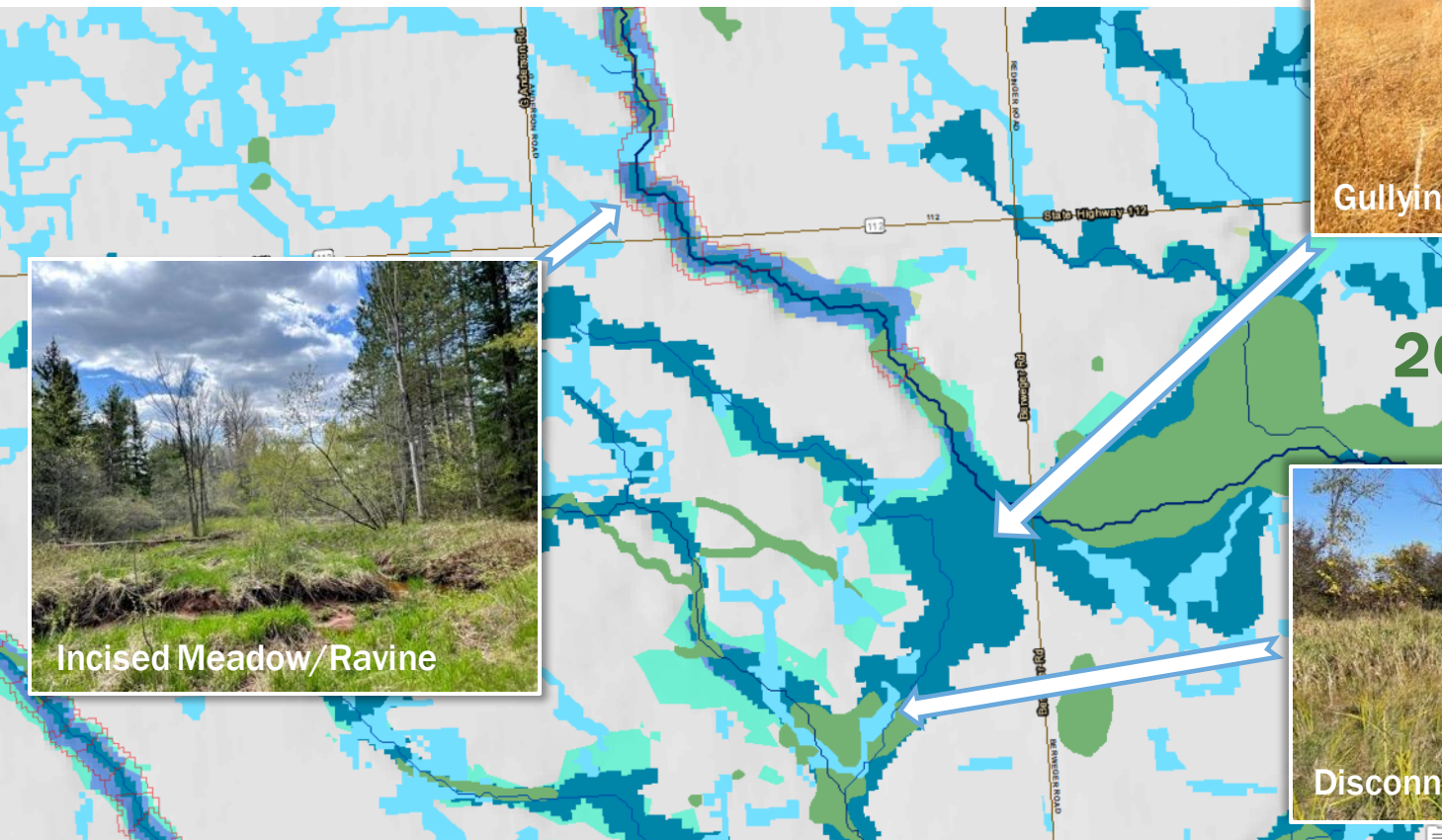
2019 WI Act 157



(1) FLOOD RISK REDUCTION PILOT PROJECT. ...the department of natural resources shall allocate \$150,000 from the appropriation under s. 20.370 (6) (dq) to Ashland County to design, implement, and evaluate not more than three demonstration projects ***that test natural flood risk reduction practices in that county.***

Co-Authors: Representatives Beth Meyers, Jim Steineke, and John Nygren, and Senators Janet Bewley, Jerry Petrowski.

NFM Demonstration



Gullying



Incised Meadow/Ravine

2019 WI Act 157



Disconnected meadow (sediment)

NFM Toolbox



Think beyond the culvert

- ✓ Channel design
- ✓ Headcut control
- ✓ Grade stabilization
- ✓ Flow dispersal
- ✓ Water level fluctuation
- ✓ Debris & ditch management
- ✓ On-farm & forestry practices
- ✓ Beaver management
- ✓ Stream simulation structures



Marengo Valley NFM Strategy






Tactic #1: Reduce flow velocities & sediment loads

Tactic #3: Replace culvert to restore natural flows & sediment transport

Tactic #2: Revitalize farm; reconnect floodplains

Tactic #4: Preserve & increase storage in degraded wetlands

Tactic #5: Regenerate stream-wetland corridor

-  ravine stabilization
-  floodplain reconnection
-  road-stream-crossing
-  wetland restoration
-  wetland restoration

0 1,000 2,000 4,000 Feet

 Mapped Wetlands

 Culverts

 Marengo Watershed Boundary

Tactic #1 Ravine NFM

Goal: Reduce flow velocities & sediment loads

Mimic woody debris accumulation,

Build riffles and pools,

Force flows onto historic floodplain surface,
repair incised channel, restore wet meadow

Observe hydrologic response to combo of practices:

- Post-assisted log structures (PALS)
- Root wads, log jams, bioengineering
- Beaver dam analogs (BDAs)
- Rock riffle/vortex weirs



Tactic #2. On-Farm NFM

Regenerate stream- wetland corridor

Improve soil health &
prevent crop damages

Increase flows & flood
pulses to wetlands

Restore hydrology

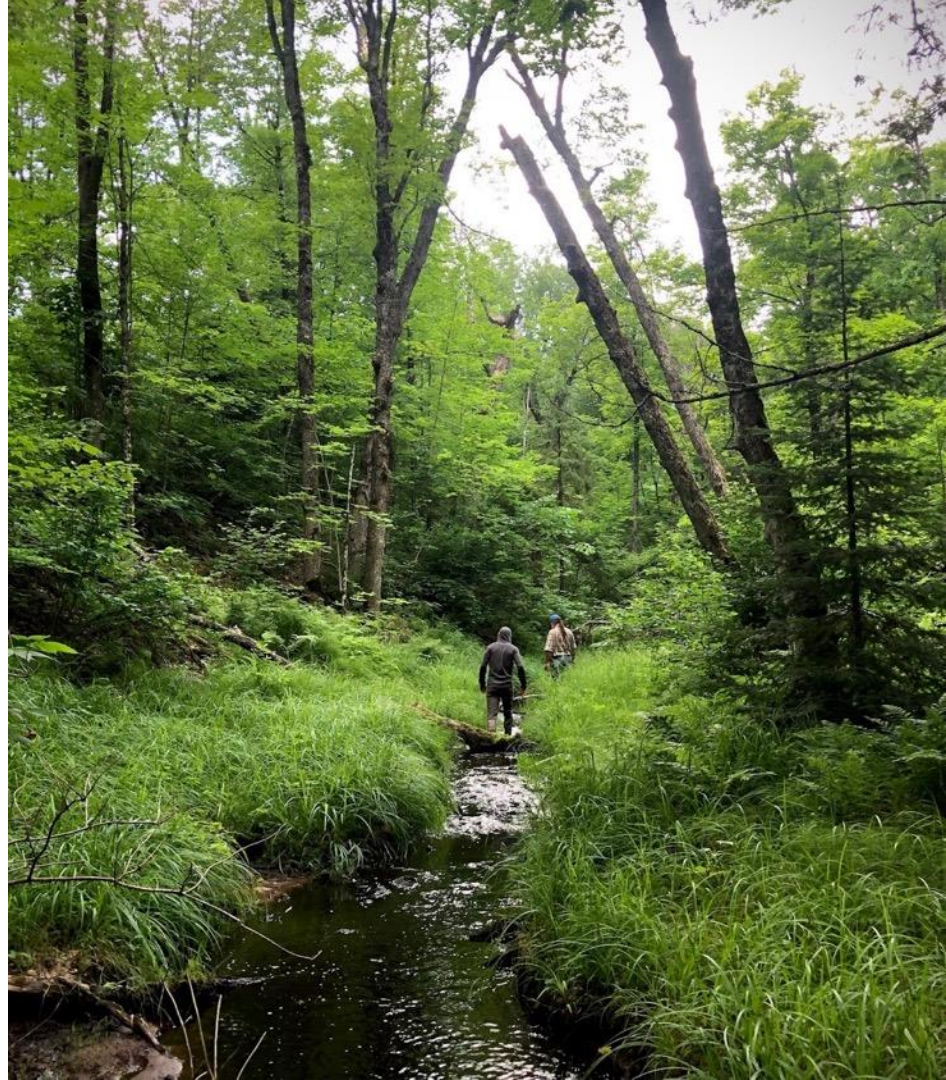
Include protective measures
to manage uncertainty



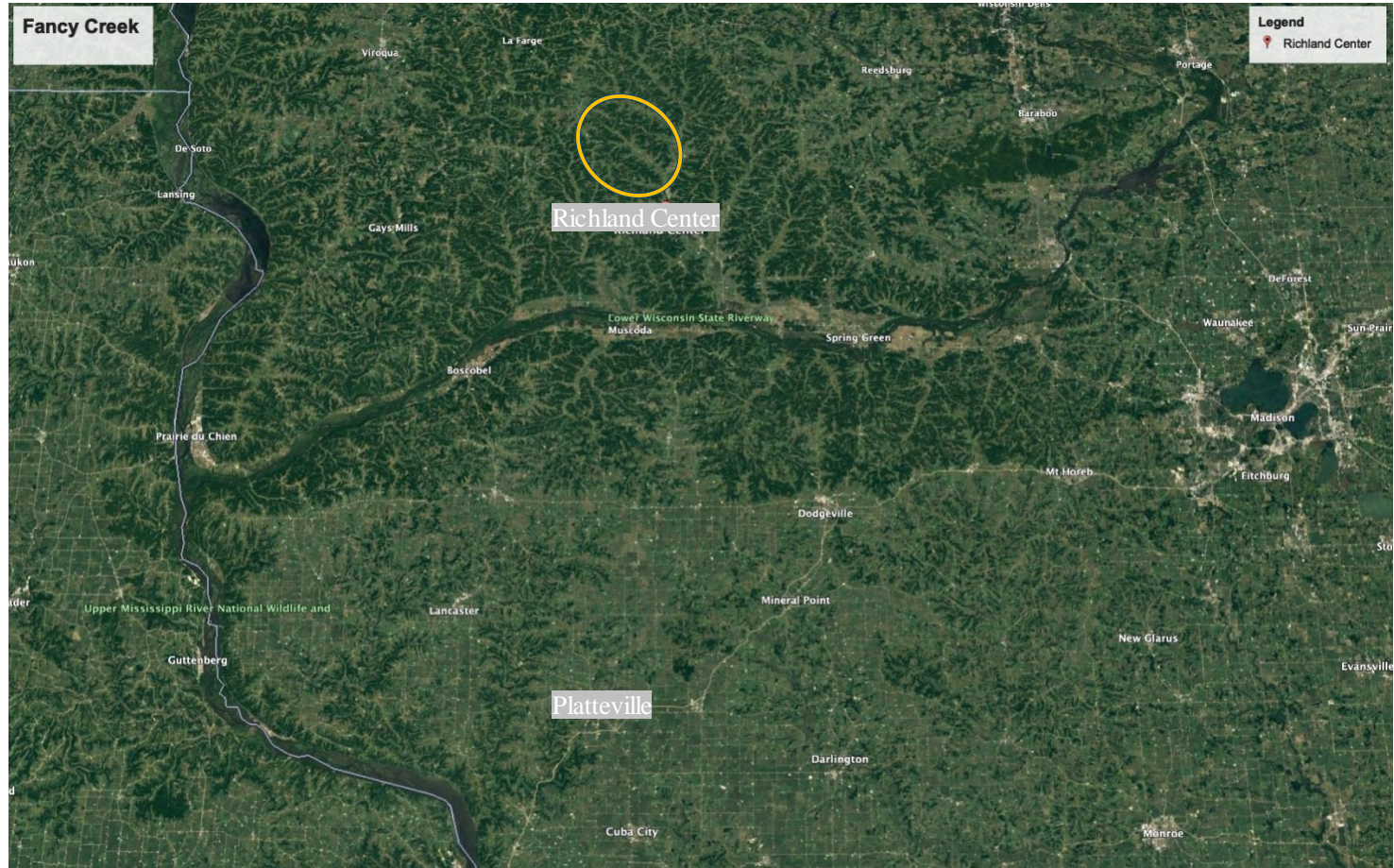
The Journey

- ✓ Design charrette
- ✓ NR 151, cattle, & managed grazing
- ✓ Zone AE floodplain & HEC-RAS
- ✓ Temporary v. permanent treatments
- ✓ Large woody debris
- ✓ Hydrologic variability & uncertainty
- ✓ Metrics for success?
- ✓ Professional/volunteer crews?

Next phase: ASFPM collaboration



Fancy Creek Watershed





Fancy Creek Floodplain



**Straightened, incised
channel acts like a ditch**

Historic channel and disconnected wet meadow



NFM Goals

- ❑ Restore flow to the pre-ditched reaches and reconnect floodplain,
- ❑ Explore effective floodplain reconnection techniques,
- ❑ Demonstrate that floodplain reconnection can solve problems
- ❑ Improve water quality, habitat.



Benefits of Watershed-Scale NFM

- ❑ Increase technical support for flood prone communities
- ❑ Improve data availability/reliability
- ❑ Inform local policies and priorities
- ❑ Help communities compete for pre- and post-disaster aids
- ❑ Reduce flood risks and damages
- ❑ Achieve many co-benefits



Next Step: collaboration with the Association of State Floodplain Managers



Slow the Flow Team



LAKE SUPERIOR COLLABORATIVE



Wisconsin Wetlands ASSOCIATION



United States Department of Agriculture

Natural Resources Conservation Service



Mary Griggs Burke Center for Freshwater Innovation NORTHLAND COLLEGE



What supports are available to help Wisconsin communities engage in watershed-scale hydrologic assessment and restoration?





Examining the status of Hydrologic Assessment and Hydrologic Restoration in Wisconsin

An evaluation of barriers, needs, and opportunities

Anders Shropshire & Amber Saylor Mase
Evaluation Specialists
Natural Resources Institute
UW-Madison Division of Extension

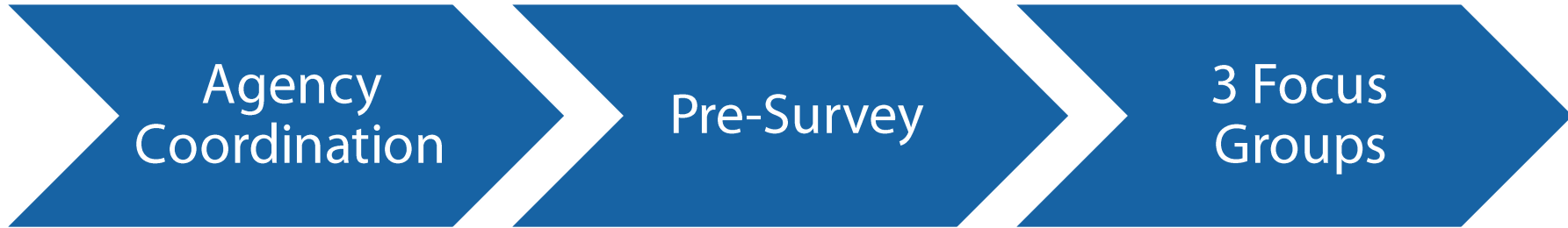


wetland icon created by Dan Hetteix from the Noun Project

Funded by:



Methods



WDNR*
DATCP*
WGNHS
WI Land + Water

On-line questionnaire
sent in November 2020

- On-line
- 2 hours each
- Held in Dec/Jan



**Focus Group #1:
Technical Experts**



**Focus Group #2:
State Program Managers**



**Focus Group #3:
Local Implementers**

Total participants = 33

- Academic
- County Land Conservation Depts
- WI Dept. of Agriculture, Trade, & Consumer Protection
- WI Dept. of Natural Resources
 - WI Dept. of Transportation
 - WI Emergency Management
- WI Geologic & Natural History Survey
 - WI Land + Water
- UW Extension Educators



Barriers to watershed-scale/ hydrology-focused work:

- Data
- Decision-support tools
- Design/engineering capacity
- Funding prioritizes site-specific/short-term projects



**Wisconsin does not have the
structural frameworks in
place to support watershed
scale hydrologic assessment
and restoration
(...yet)**



Building the policy/program supports for HA/HA - Pilot Projects -

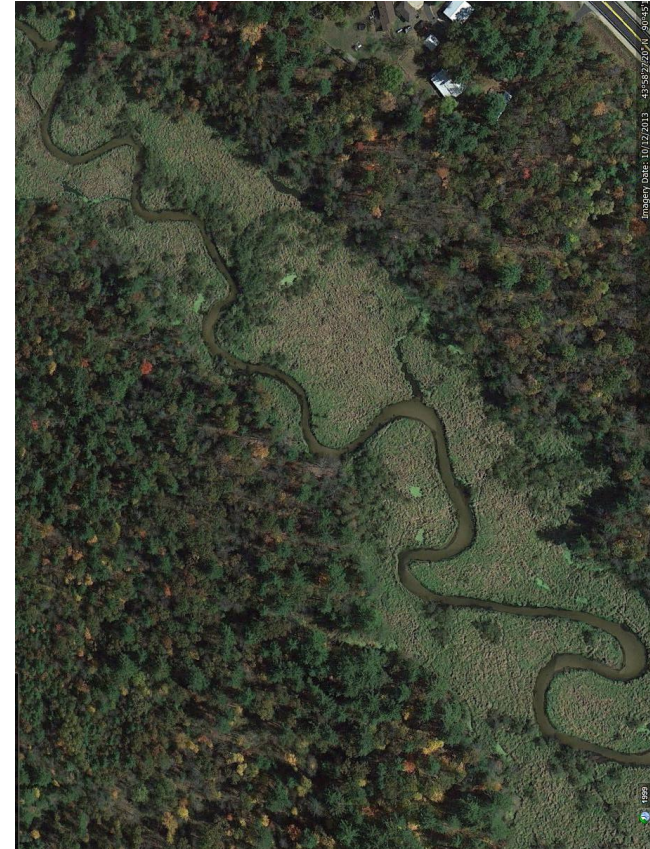
1. NFM in Marengo River Watershed
2. Little Plover River Watershed Enhancement Project (*and beyond*)
3. Fancy Creek floodplain restoration



Building the policy/program supports for HA/HA

- Improving Permit Efficiencies -

- New General Permit for Hydrologic Restoration (*2021 WI Act 77*)
- Will encourage/enable projects that reestablish storage, connectivity, processes.
- Should address multiple barriers to restoration work in/near sensitive waters.



Building the policy/program supports for HA/HR

- Enabling Cost Share & Tech Support -

- DATCP Grant: Ensure wetland practices are eligible for state cost share and grants
- Training for ag engineers & counties.
- Technical roundtables at WI Land + Water conference



Building the policy/program supports for HA/HR

- Goals/Next Steps -

- Establish new funding streams or align existing funding
- Support additional pilot project(s) in flood prone communities
- Collaborate on baseline data development initiatives
- Continue soliciting input to better understand and help address local support needs



Questions/Discussion?

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