IAFSM
Illinois Association for Floodplain and Stormwater Management

The School Springs Mitigation and Restoration

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Hey and Associates, Inc.

McHenry County Conservation District

School Springs Mitigation and Restoration

- Site History and Planning
- Mitigation as Restoration Funding
- Stream Mitigation Framework
- Project Design and Permitting
- Project Implementation and Success

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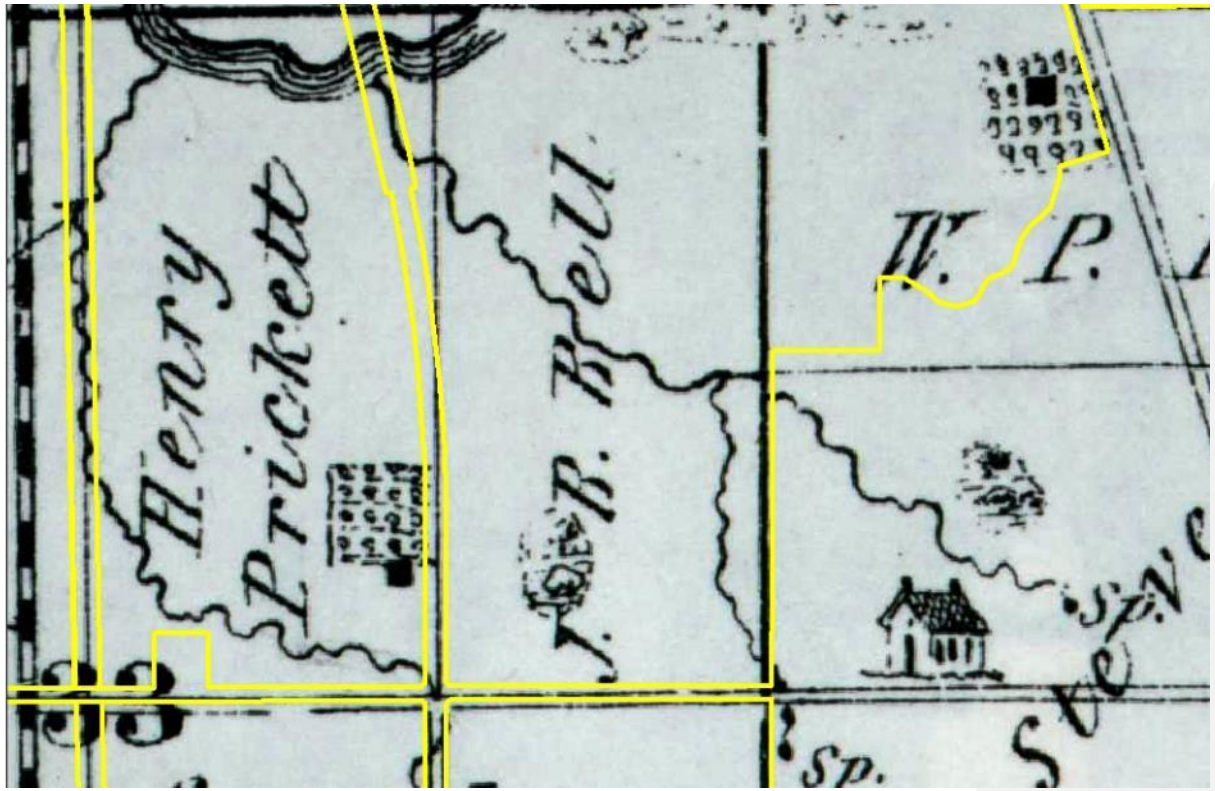
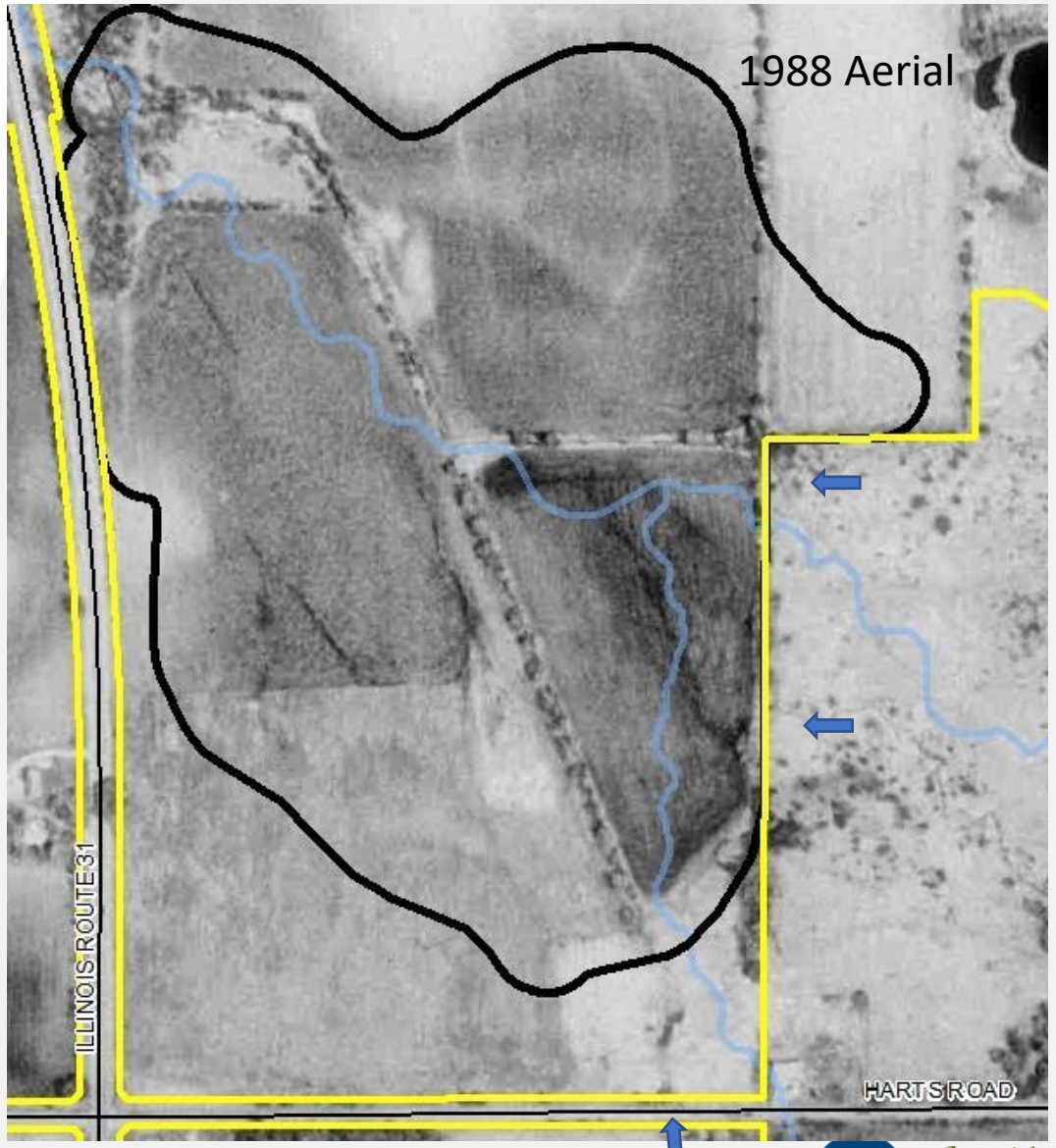
Site History and Planning

1872 Atlas





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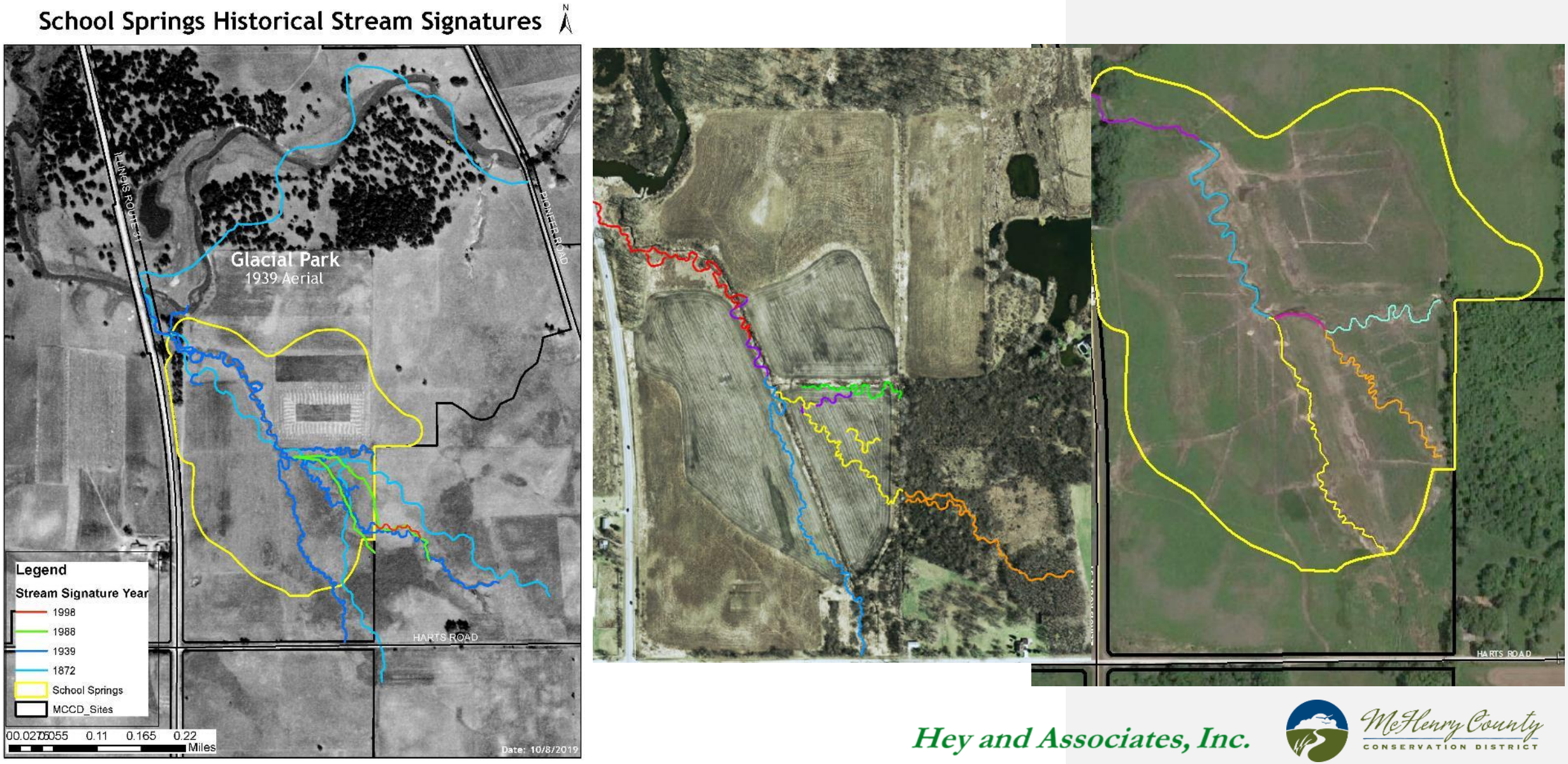
Site History and Planning



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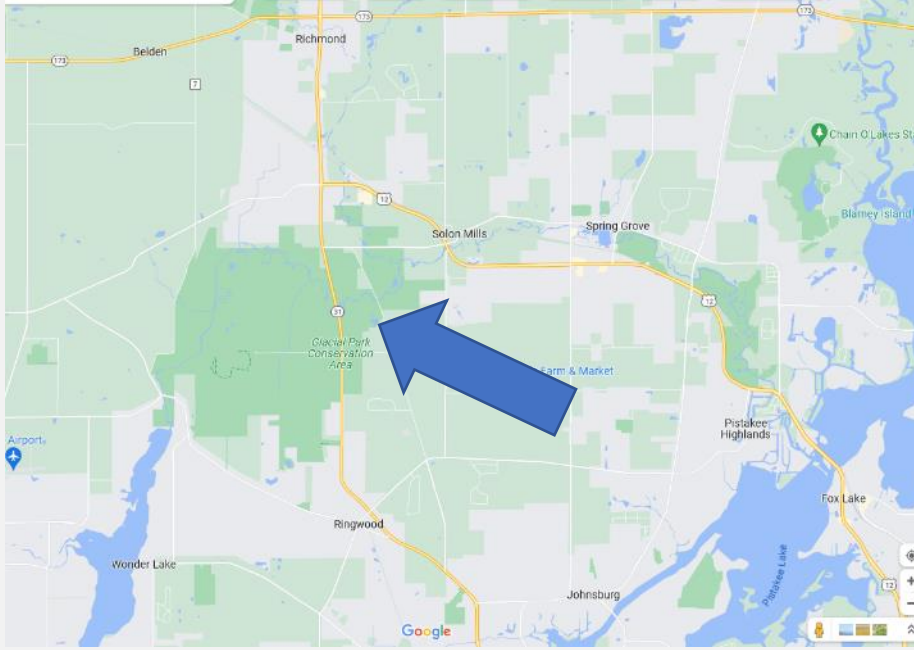
Pre-Project Conditions



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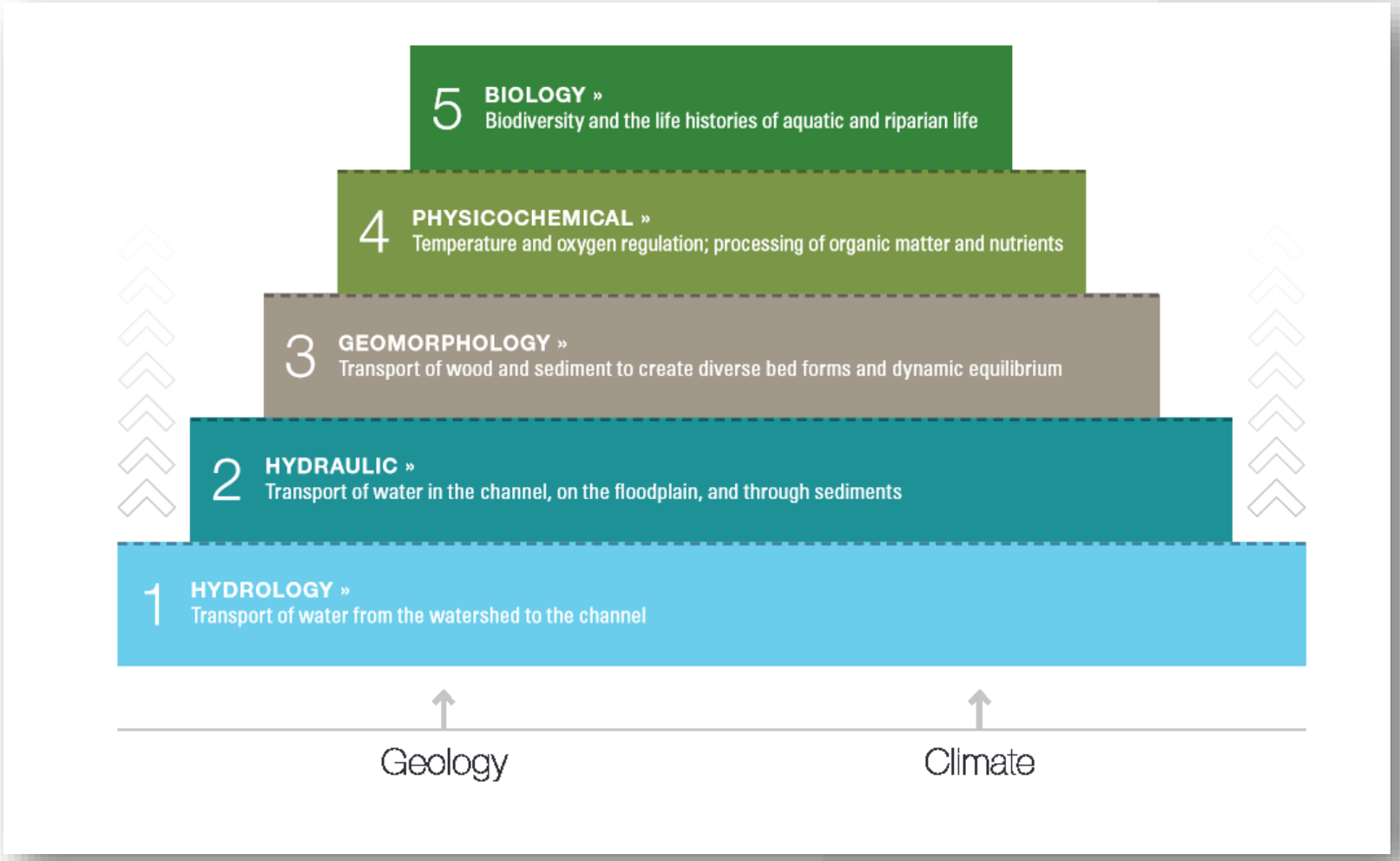
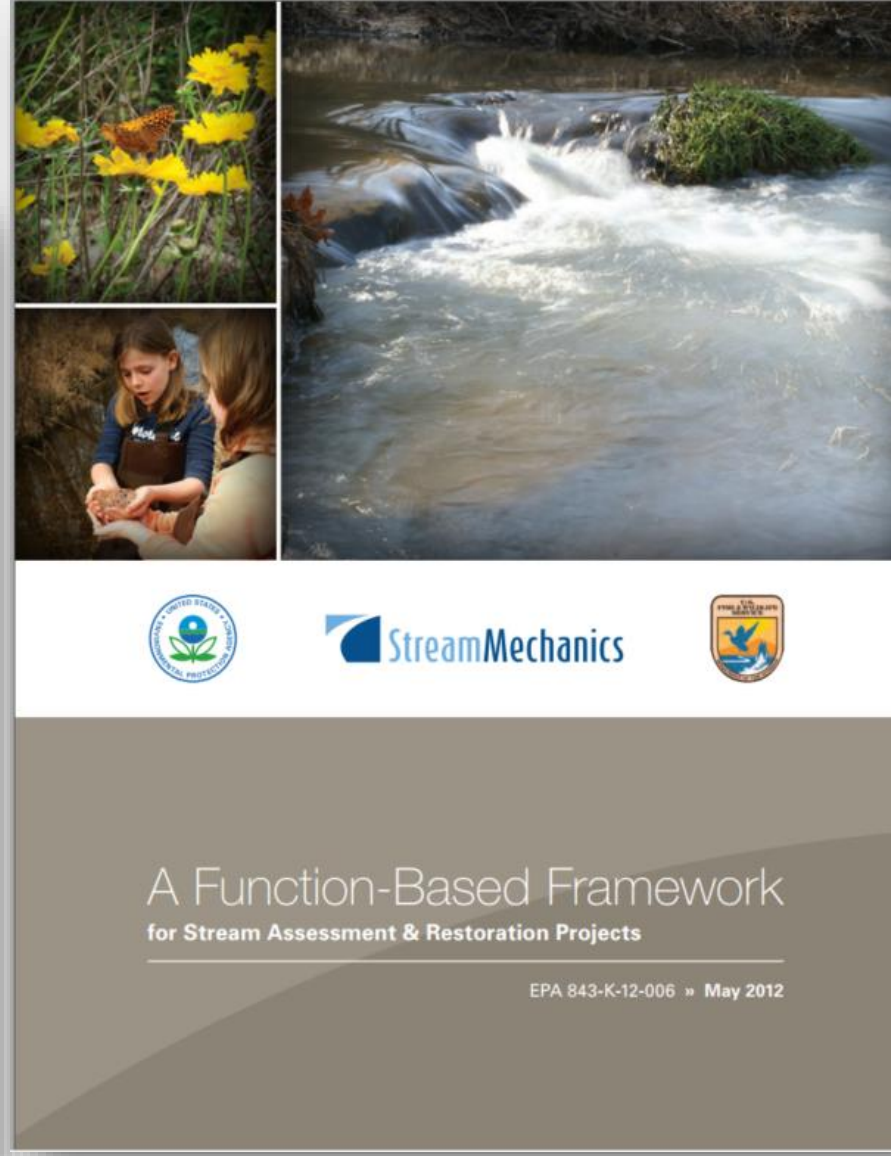
Stream Mitigation Framework





A Function-Based Framework for Stream Assessment & Restoration Projects, EPA 843-K-12-006

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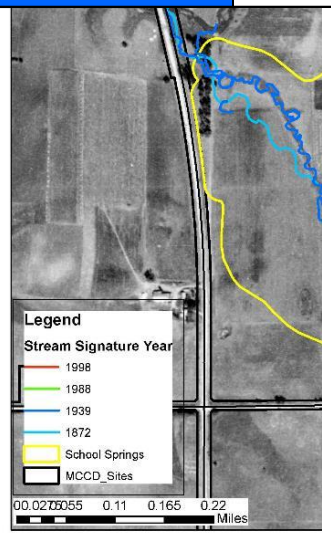
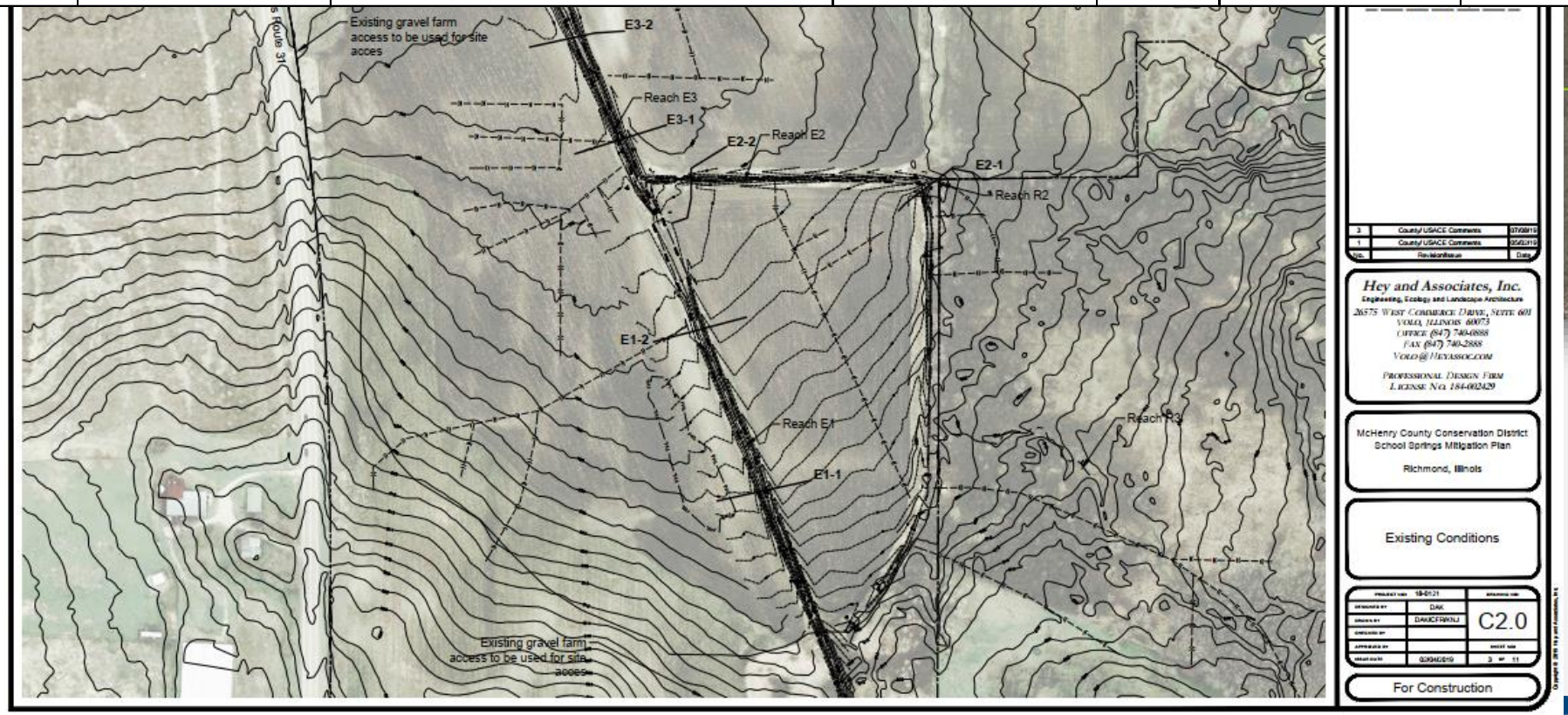
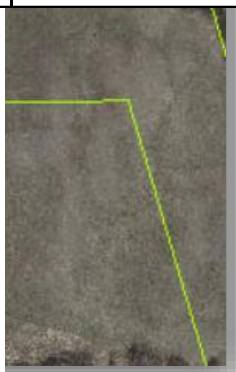
Stream Mitigation Framework

LEVEL AND CATEGORY	PARAMETER	MEASUREMENT METHOD	MEASUREMENT DESCRIPTION	EXISTING CONDITION OF REFERENCE REACHES		EXISTING CONDITION OF EXISTING REACHES		PREDICTED POST-RESTORATION CONDITION (PROPOSED REACHES)	
				VALUE	RATING	VALUE	RATING	VALUE	RATING
1. Hydrology	Channel Forming Discharge (CFD)	Calculate CFD	Hydrologic Model 1-yr and 2-yr peak discharge (Q)	R1largely contains ±100-yr event, R2/3 1.5-yr	Functioning	Existing channel largely contains ±100-yr event	Not functioning	P1 1.5-yr Q = 15.5 cfs P2 1.5-yr Q = 17.0 cfs P3 1.5-yr Q = 15.8 cfs P4 1.5-yr Q = 54.6 cfs	Functioning
	Precipitation Runoff/ Relationship	Calculate RCN	Calculate subbasin RCN using TR-55 methods	All subbasins (1-6) 80 On-site subbasins (3-6) 79	Functioning	All subbasins (1-6) 80 On-site subbasins (3-6) 79	Functioning	All subbasins (1-6) 80 On-site subbasins (3-6) 77	Functioning (improved)
		Hydrologic Model Condition	Hydrologic Model 100-yr Peak Discharge (Q)	N/A	Functioning	100-yr Q = 428 cfs	Functioning	100-yr Q = 416 cfs	Functioning (improved)







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Stream Mitigation Framework

LEVEL AND CATEGORY	PARAMETER	MEASUREMENT METHOD	MEASUREMENT DESCRIPTION	EXISTING CONDITION OF REFERENCE REACHES		EXISTING CONDITION OF EXISTING REACHES		PREDICTED POST-RESTORATION CONDITION (PROPOSED REACHES)	
				VALUE	RATING	VALUE	RATING	VALUE	RATING
2. Hydraulic	Floodplain Connectivity	Hydraulic Model Conditions (Stage vs. Discharge)	HEC-RAS Hydraulic Model Very incised: channel carries the 100-yr discharge Not incised: channel carries the bankfull discharge	R1 Bankfull Event = ±100-yr R2 Bankfull Event = ±1-yr R3 Bankfull Event = ±1-yr	Varies (R1 Not Functioning R2/3 Functioning)	Bankfull Event = ±100-yr	Not functioning	Bankfull Event = ±1.5-yr	Functioning
		Bank Height Ratio (BHR)	BHR=LBH/dmbkf LBD = Low Bank Height dmbkf = bankfull depth	R1 Average = 1.1 R2 Average = 0.6 R3 Approximate = 0.6	Varies (R1 Not Functioning R2/3 Functioning	E1 Average = 0.9 E2 Average = 0.6 E3 Average = 0.9	Not functioning	P1 Average = 1.1 P2 Average = 0.9 P3 Average = 1.2 P4 Average = 0.9	Functioning
		Entrenchment Ratio (ER)	ER = flood prone width/bankfull width flood prone width = width of channel at 2x bankfull depth bankfull width = width of channel at bankfull depth	Existing overbanks are relatively flat.	Varies (R1 Not Functioning R2/3 Functioning)	±1	Not functioning	P1 Average = 5.7 P2 Average = 4.3 P3 Average = 5.3 P4 Average = 5.5	Functioning
	Flow Dynamics	Hydraulic Model Conditions: Stream Power (2-yr)	HEC-RAS Hydraulic Model	R1 Average = 4.7 lbs/ft s R2 Average = 0.5 lbs/ft s R3 Approximate = 0.5 lbs/ft s	Functioning	E1 Average = 3.3 lbs/ft s E2 Average = 6.9 lbs/ft s E3 Average = 1.7 lbs/ft s	Functioning	P1 Average = 4.7 lbs/ft s P2 Average = 5.0 lbs/ft s P3 Average = 6.6 lbs/ft s P4 Average = 3.0 lbs/ft s	Functioning (improved)
		Hydraulic Model Conditions: Bankfull Velocity	HEC-RAS Hydraulic Model	R1 Average = 4.9 ft/s R2 Average = 0.4 ft/s R3 Approximate = 0.5 ft/s	Functioning	E1 Average = 3.0 ft/s E2 Average = 2.7 ft/s E3 Average = 1.9 ft/s	Functioning	P1 Average = 3.3 ft/s P2 Average = 3.4 ft/s P3 Average = 4.0 ft/s P4 Average = 3.6 ft/s	Functioning
		Hydraulic Model Conditions: Bed Shear Stress (2-yr)	HEC-RAS Hydraulic Model	R1 Average = 1.1 lbs/sqft R2 Average = 1.1 lbs/sqft R3 Approximate = 1.1 lbs/sqft	Functioning	E1 Average = 0.9 lbs/sqft E2 Average = 1.9 lbs/sqft E3 Average = 1.0 lbs/sqft	Functioning	P1 Average = 1.1 lbs/sqft P2 Average = 1.1 lbs/sqft P3 Average = 1.4 lbs/sqft P4 Average = 0.8 lbs/sqft	Functioning (improved)
	Groundwater/ Surface Water Exchange	Install Bank Piezometers	Field Measurements	N/A	Functioning	N/A	Functioning	To be assessed post-construction.	Anticipated: functioning (improved)

Stream Mitigation Framework

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3 – Geomorphology	Bank Migration/ Lateral Stability	Meander Width Ratio (MWR)	MWR = belt width/bankfull width belt width = distance from the apex of one meander bend to the next meander bend, measured perpendicular to the fall line of the valley bankfull width = width of channel at bankfull depth	R1 = 0.24 R2 = 0.13 R3 Approximate = 0.15	Functioning	E1 = 0 E2 = 0 E3 = 0	Not functioning	P1 = 2.80 P2 = 2.13 P3 = 3.97 P4 = 1.07	Functioning
		Bank Erosion Hazard Index (BEHI)	Field Assessment	R1 Low R2 Moderate R3 Moderate	Functioning	Low	Not functioning	To be assessed post-construction.	Anticipated: functioning
		Cross Section Assessment	Field Observation	Minimal bank migration	Functioning At-Risk	Minimal to no bank migration	Not functioning	To be monitored post-construction.	Anticipated: functioning
		Bank Pins	Field Measurements	Minimal bank migration	Functioning At-Risk	Minimal to no bank migration	Not functioning	To be assessed post-construction.	Anticipated: functioning
	Riparian Vegetation	Buffer Width	Estimate using aerial imagery, design to improve	R1 = 45 ft R2 = 150+ ft R3 = 150+ ft	Functioning	E1 = ±0 ft E2 = ±0 ft E3 = ±0 ft	Not functioning	P1 = 150+ ft P2 = 150+ ft P3 = 150+ ft P4 = 150+ ft	Functioning
		Buffer Composition (Mean C and FQAI)	Field Survey	Mean C = 2.53 FQAI = 23.77 (MCCD Non Ag Area Survey 8/14/18)	Functioning	Mean C = 1.11 FQAI = 9.53 (MCCD Ag Area Survey 8/14/18)	Functioning	Mean C = FQAI = To be assessed using final MCCD planting plan.	Functioning (improved)
		NRCS Visual Assessment Protocol	Estimate using aerial imagery, design to improve	Fair	Functioning	Poor	Not functioning	Good/Excellent	Functioning
	Bed Form Diversity	Percentage Riffle/Pool	Non-existent in existing conditions, design in regards to hydraulics and downstream reach conditions	R1 = 4.5 Riffles/100LF R2 = 4.6 Riffles/100LF R3 = 4.6 Riffles/100LF	Functioning	E1 = 0 E2 = 0 E3 = 0	Not functioning	P1 = ±4.5 Riffles/100LF P2 = ±4.5 Riffles/100LF P3 = ±4.5 Riffles/100LF P4 = ±4.5 Riffles/100LF	Functioning
		Pool to Pool Spacing	Non-existent in existing conditions, design in regards to hydraulics and downstream reach conditions	R1 = 4.5 Pools/100LF R2 = 4.6 Pools/100LF R3 = 4.6 Pools/100LF	Functioning	E1 = 0 E2 = 0 E3 = 0	Not functioning	P1 = ±4.5 Pools/100LF P2 = ±4.5 Pools/100LF P3 = ±4.5 Pools/100LF P4 = ±4.5 Pools/100LF	Functioning
		Depth Variability	Non-existent in existing conditions, design in regards to hydraulics and downstream reach conditions	R1 = ±1 R2 = ±1.2 R3 = ±1.2	Functioning At-Risk	E1 = 0 E2 = 0 E3 = 0	Not functioning	P1 = 1.5+ P2 = 1.5+ P3 = 1.5+ P4 = 1.5+	Functioning
	Bed Material Characterization	Size Class Pebble Count Analyzer	Qualitative summary to include existing bed material as present on site, located by MCCD. Design of proposed channel location will resume use of existing bed material.	Varying size bed material, riffle structures formed	Functioning	Relatively homogeneous bed material, as compared to reference reaches.	Functioning At-Risk	Varying size bed material will be incorporated into channels.	Functioning (improved)

Stream Mitigation Framework

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4 – Physiochemical	Water Quality	Temperature	Field Measurements	N/A (assumed good per observation)	Functioning	N/A (assumed good per observation)	Functioning	To be monitored post-construction.	Functioning (maintain)
		Dissolved Oxygen	Field Measurements	N/A (assumed good per observation)	Functioning	N/A (assumed good per observation)	Functioning	To be monitored post-construction.	Functioning (maintain)

Stream Mitigation Framework

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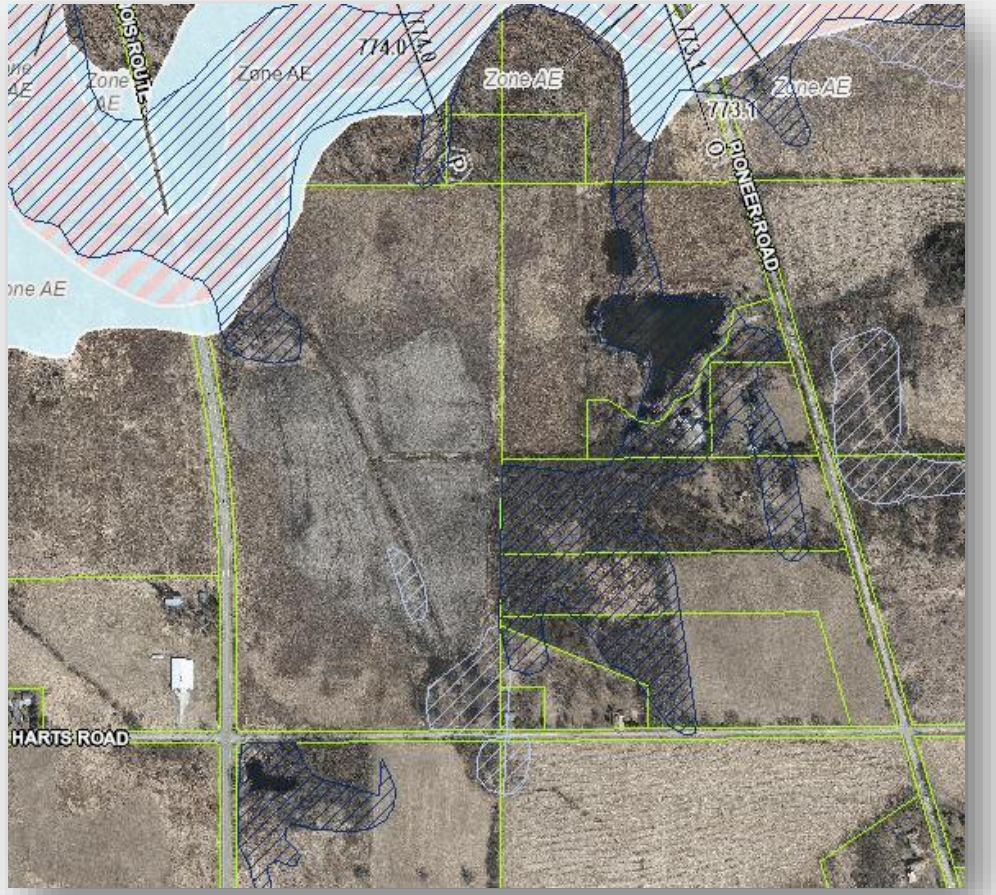
				VALUE	RATING	VALUE	RATING	VALUE	RATING
5 – Biology	Riparian Vegetation	Buffer Composition (Mean C and FQAI)	Field Survey	Mean C = 2.53 FQAI = 23.77 (MCCD Non Ag Area Survey 8/14/18)	Functioning	Mean C = 1.11 FQAI = 9.53 (MCCD Ag Area Survey 8/14/18)	Functioning	Mean C = FQAI = To be assessed by MCCD Survey post-construction.	Functioning (improved)
	Aquatic Macrophyte Communities	Biological Indices (Mean C and FQAI)	Field Survey	Mean C = 0.00 FQAI = 0.00 (MCCD Area 1 Macrophyte Survey 7/31/18)	Not functioning	Mean C = 1.75 FQAI = 4.95 (MCCD Area 2 Macrophyte Survey 7/31/18)	Functioning	Mean C = FQAI = To be assessed by MCCD Survey post-construction.	Functioning (improved)
	Benthic Macroinvertebrate Communities	Biological Indices (MBI)	Field Survey	N/A	N/A	Average MBI = 4.15 (MCCD Macroinvertebrate Survey 5/31/2018)	Functioning	MBI = To be assessed by MCCD Survey post-construction.	Functioning (improved)
	Fish Communities	Biological Indices (IBI)	Field Survey	N/A	N/A	IBI = 9 (MCCD Fish Survey 6/13/2017)	Functioning	IBI = To be assessed by MCCD Survey post-construction.	Functioning (improved)

Project Design and Permitting

- Hydraulic Stability
- Hydrologic Impact
- Sediment Movement
- Regulatory Requirements



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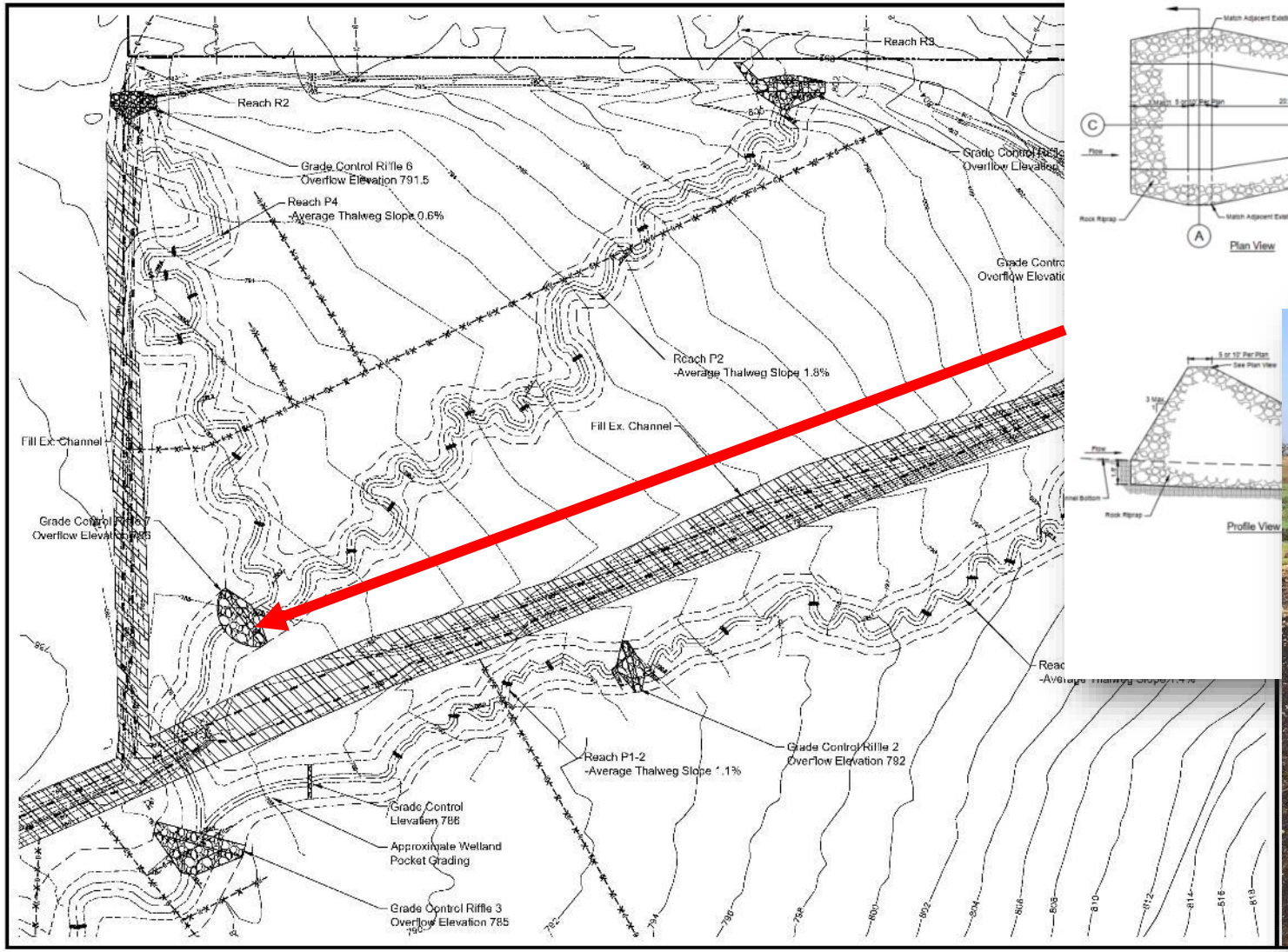

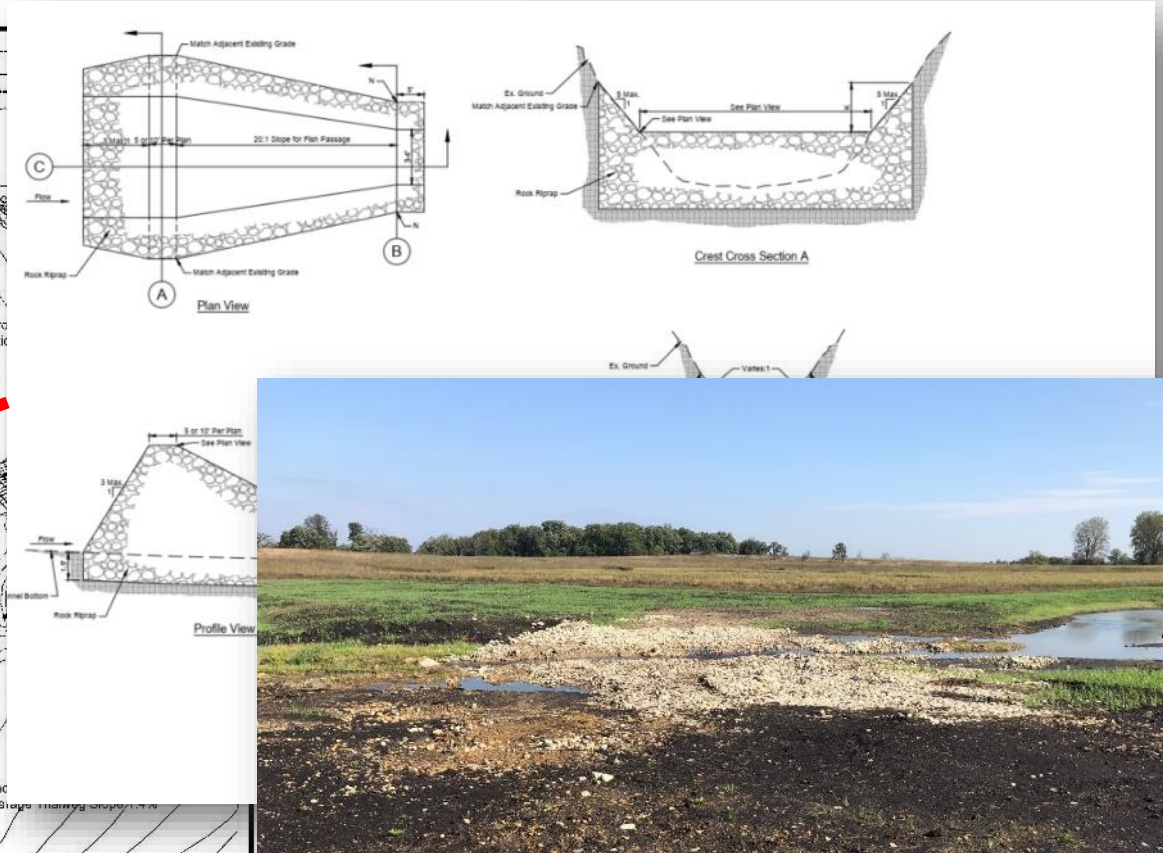

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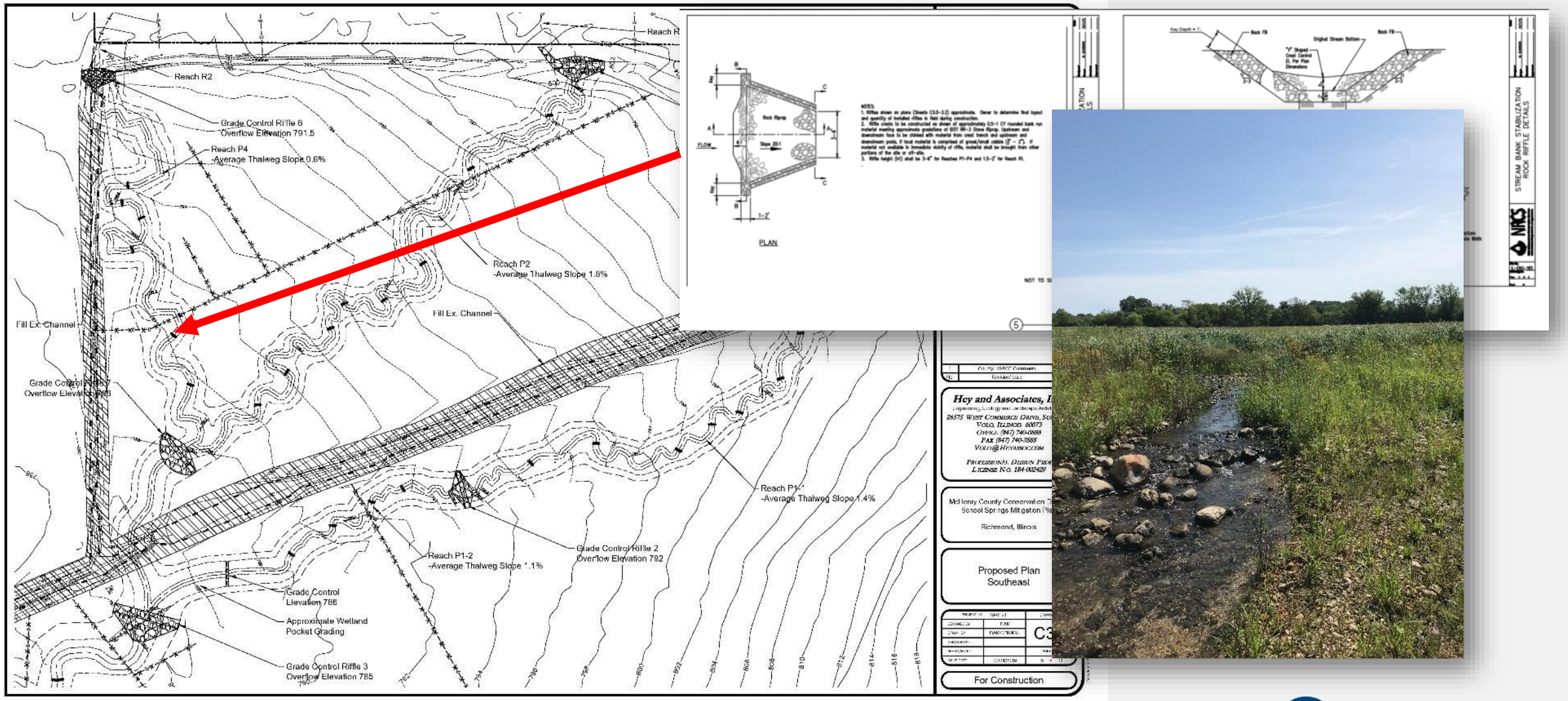

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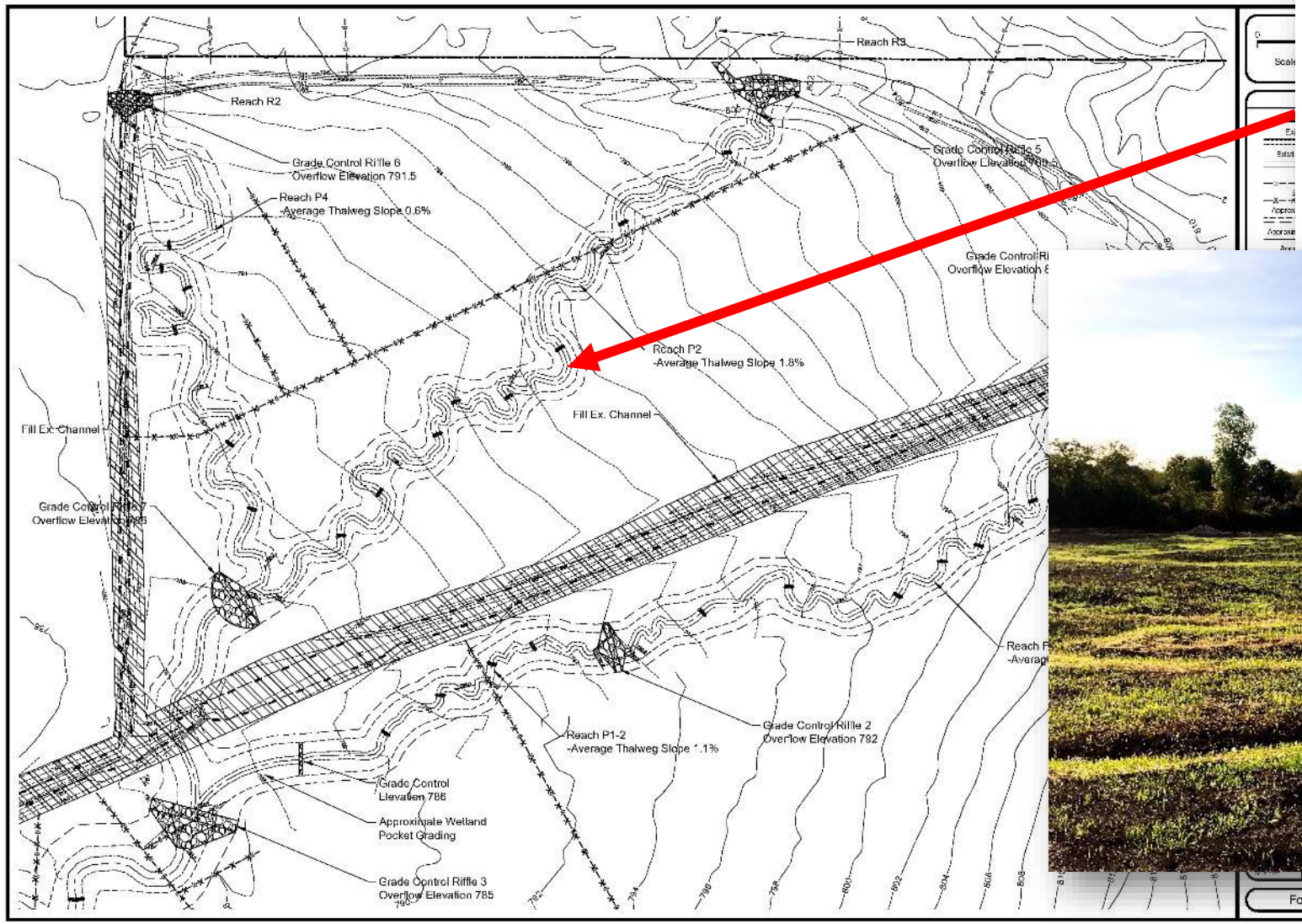

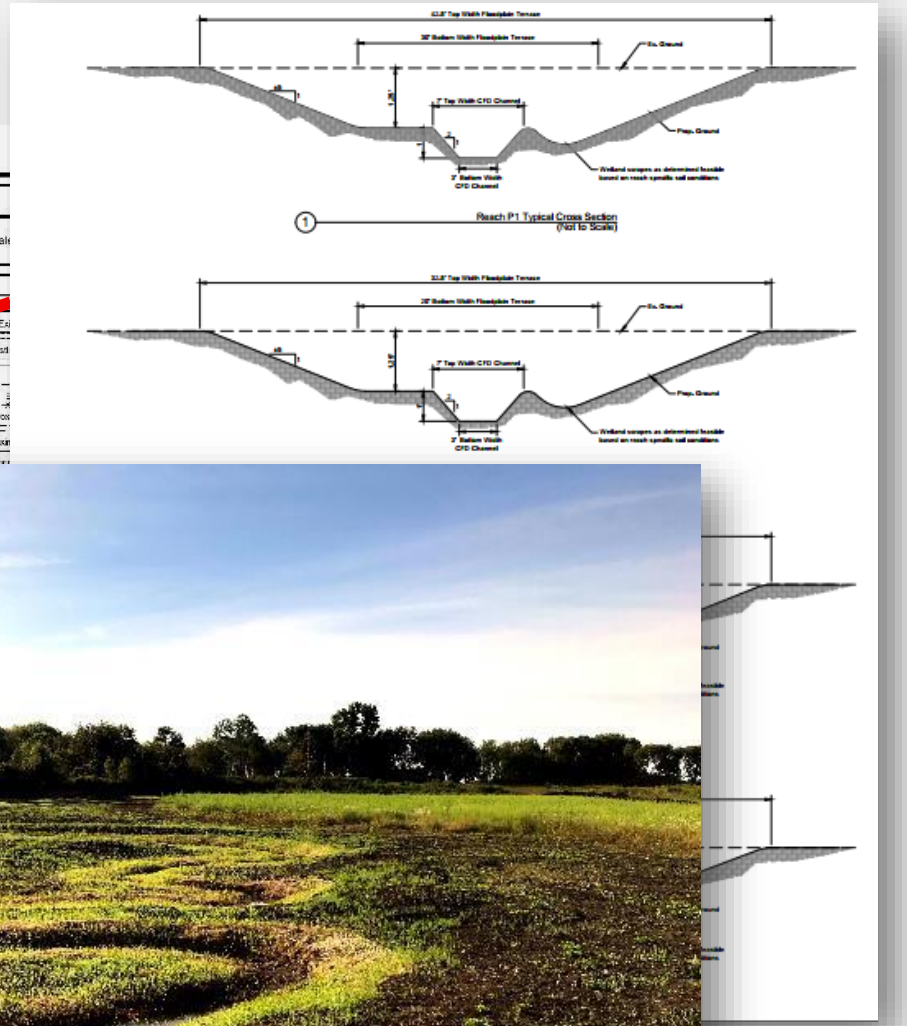

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Project Implementation

Erosion Control:
- Phasing
- Vegetated Site
- Channel basins

Floodplain Construction
- Flagging

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Project Implementation

Erosion Control:

- Phasing
- Vegetated Site
- Channel basins

Dewatering Channel basin

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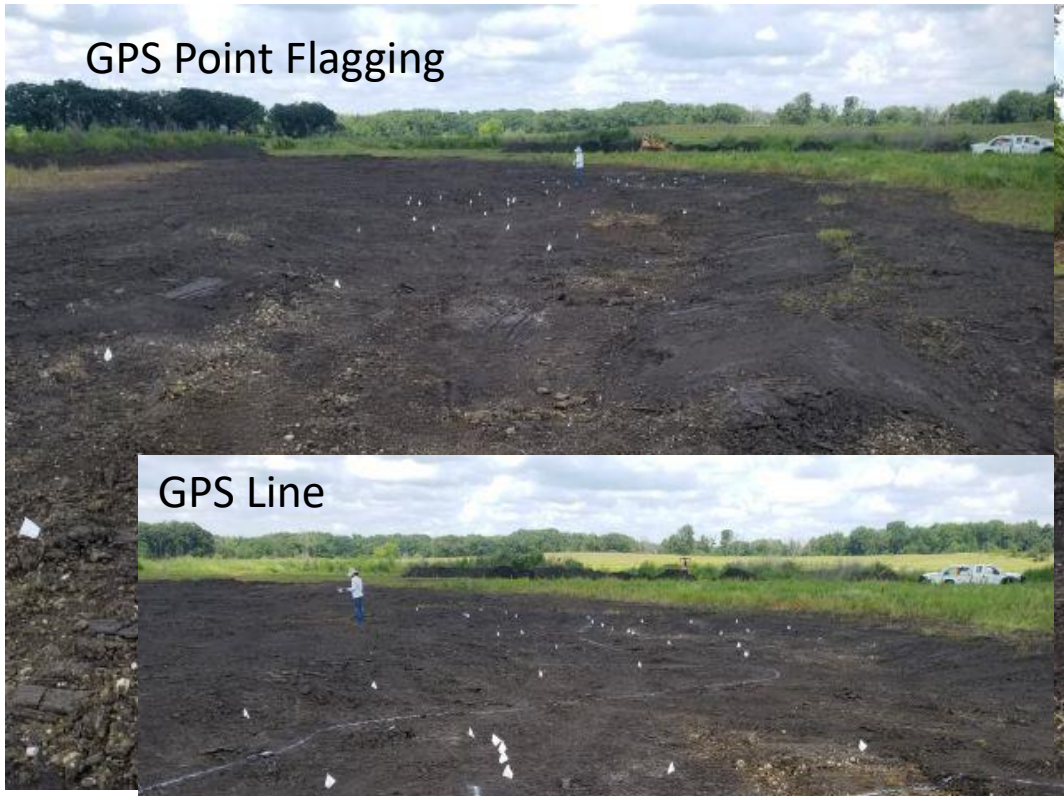
Project Implementation



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Project Implementation

Seed, E-mat, Stockpiles

Water reintroduction

Floodplain

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Project Implementation

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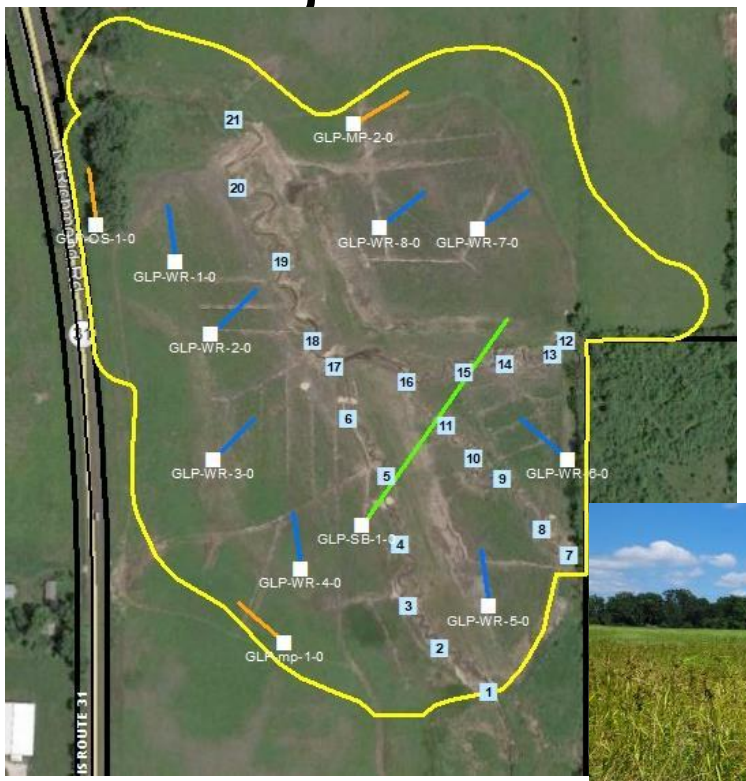
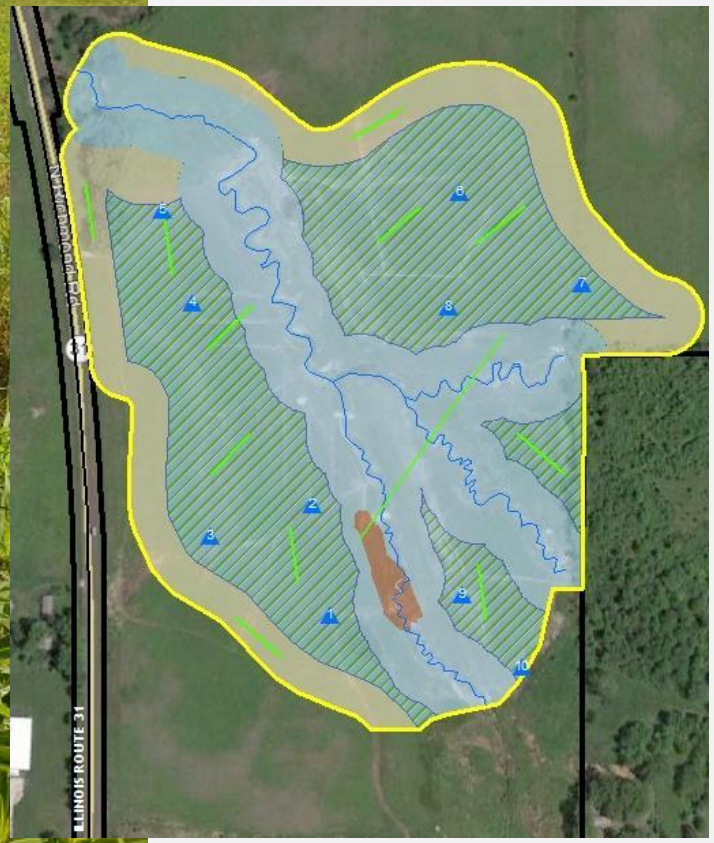
Project Successes!





https://www.mccdistrict.org/learn___experience/behind_the_scenic_views/wetland_and_stream_mitigation_bank.php

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Project Successes!

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Questions?

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