Adaptive Management: From Pilot to Permit

Erin Houghton, Watershed Programs Manager
NEW Water: the brand of Green Bay Metropolitan Sewerage District

NEW Water
The brand of the Green Bay Metropolitan Sewerage District

NEW Water: Green Bay Metropolitan Sewerage District

- Waste Water Treatment Facility (WWTF) since 1931
  - Treat 38 million gallons a day
    - Green Bay Facility (30mgd)
    - De Pere Facility (8mgd)
- Whole Effluent Toxicity (WET) testing
  - Test quality and toxicity of our effluent annually
- Nationally recognized, multiple award-winning effluent
  - 16 years straight of compliance
- 5-member Board of Commissioners

Environmental Trends Overtime

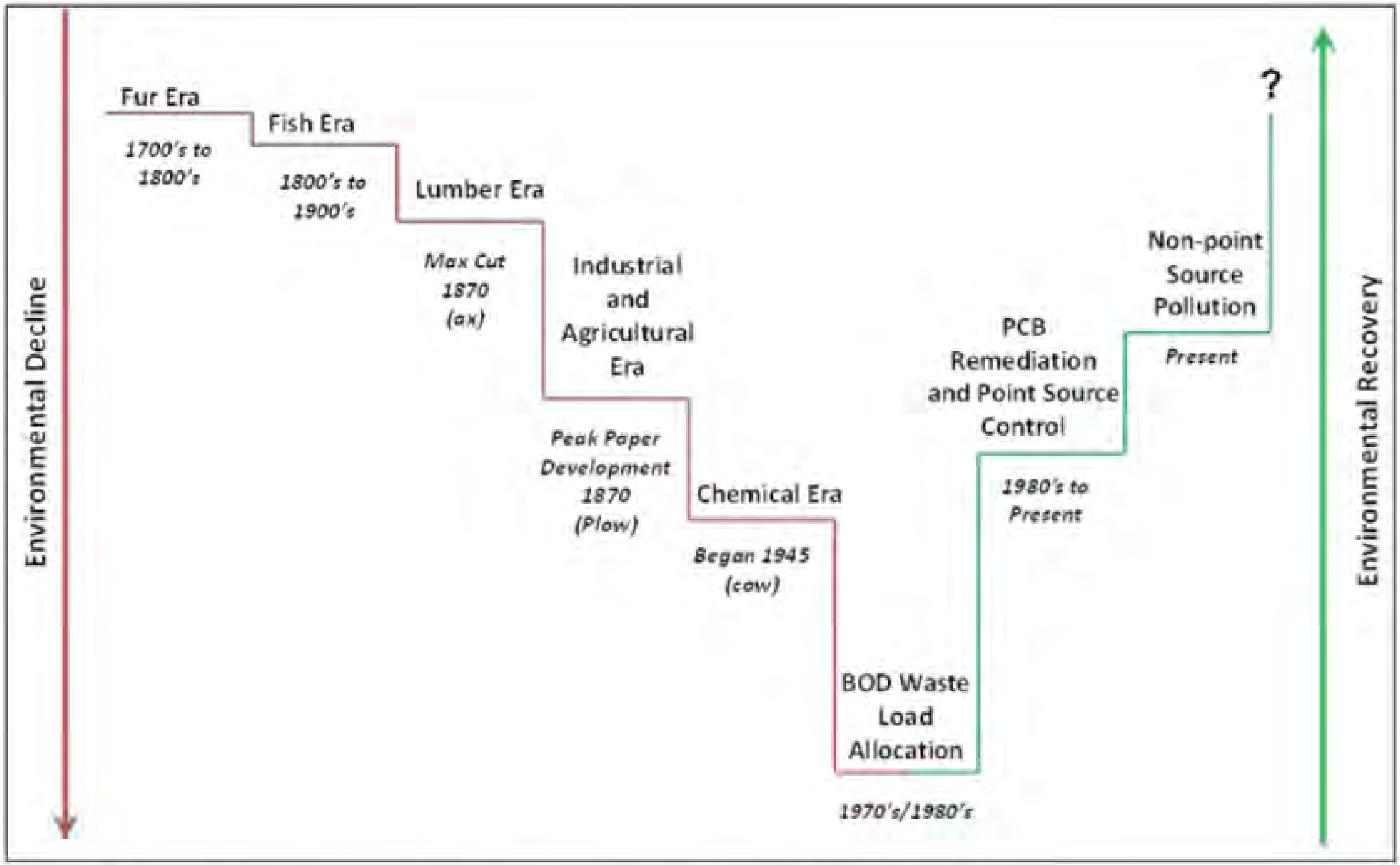
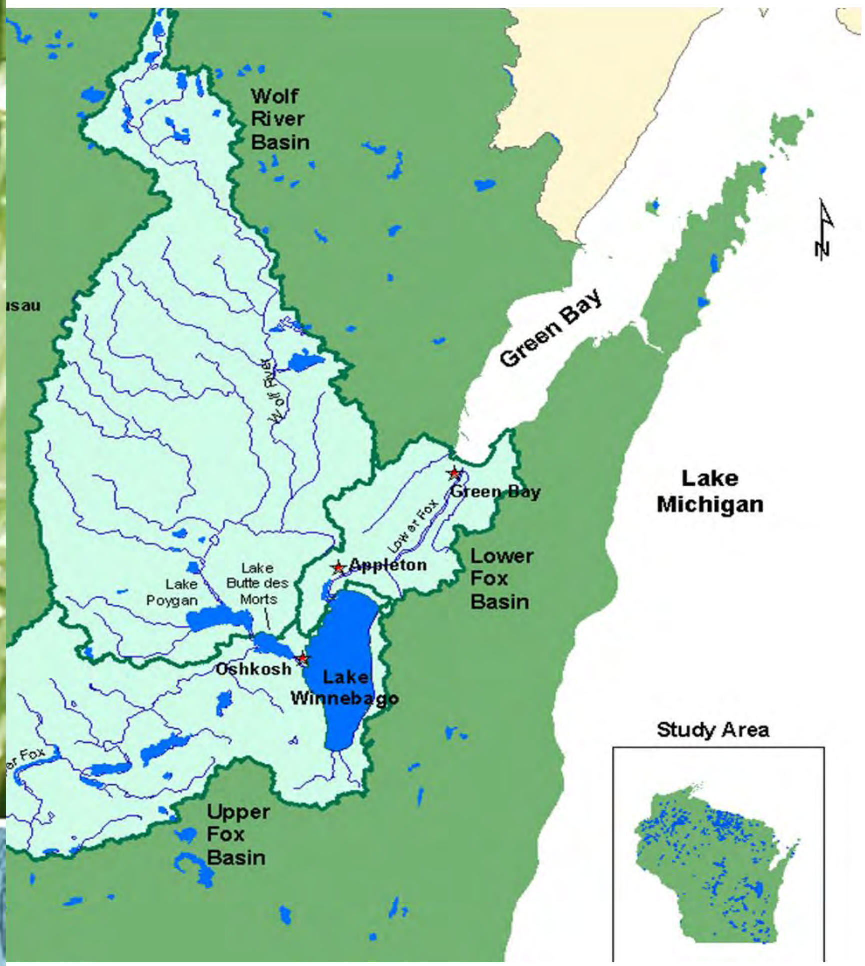
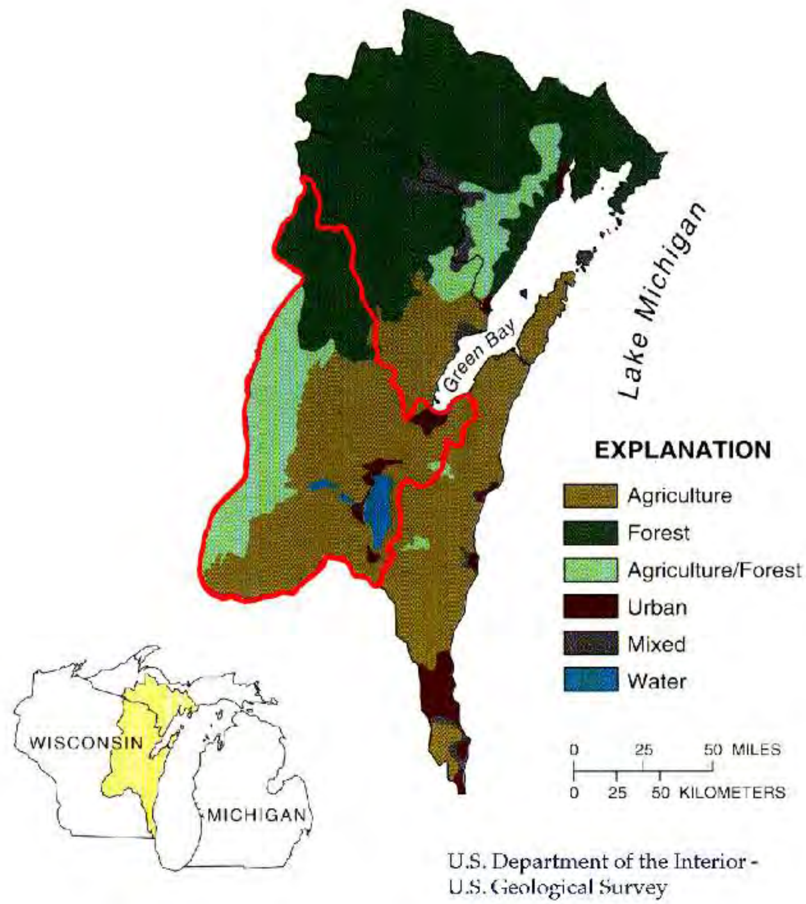


Figure 3: Timeline of environmental degradation and recovery in the Lower Fox River/Green Bay AOC. **State of the Bay Report, 2014**

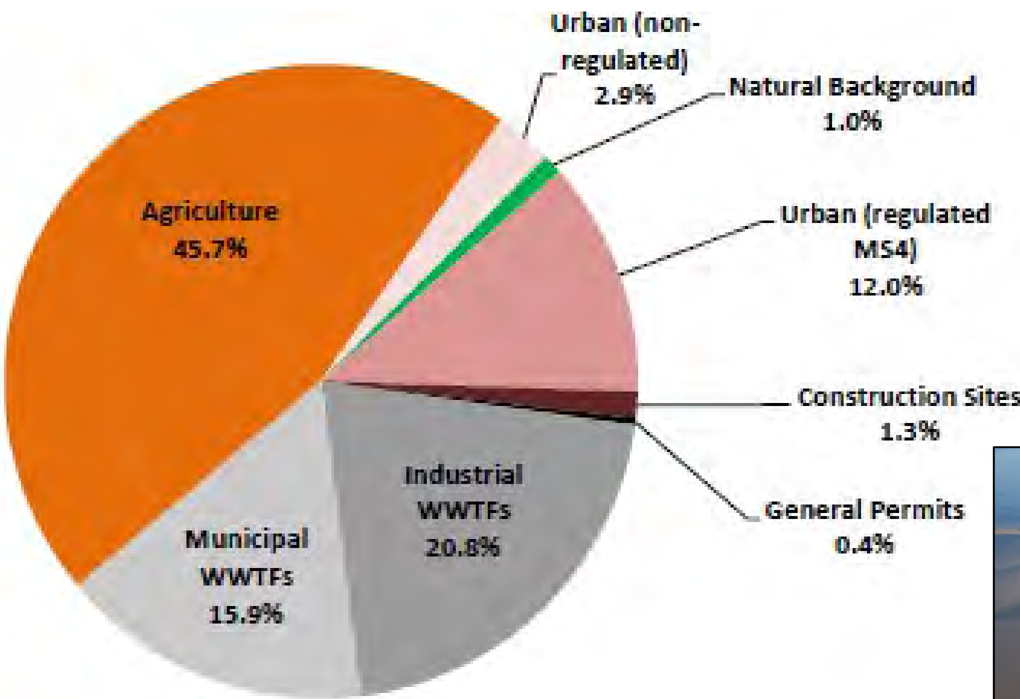
Fox-Wolf Drainage Basin





6,429 square miles

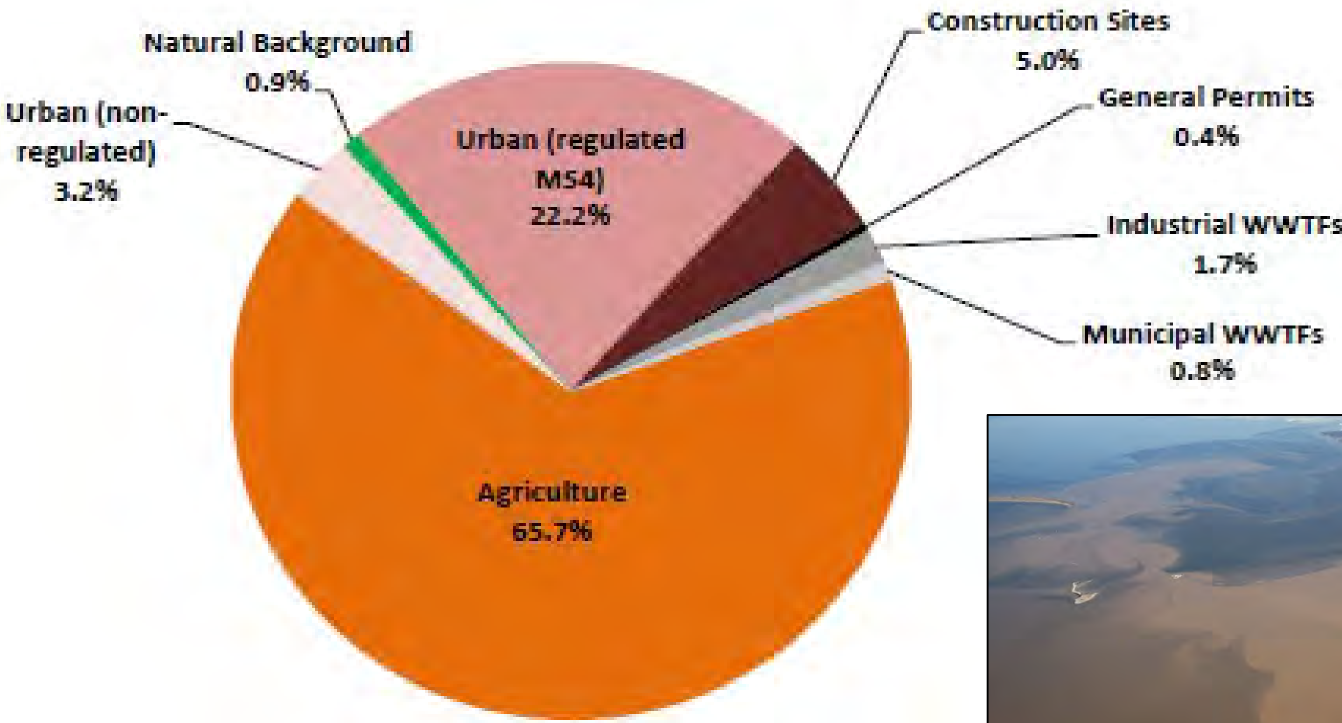
Sources of Phosphorus in Lower Fox River (LFR) Basin



(Data Source: Total Maximum Daily Load - **TMDL** Watershed Plan for Lower Fox River March 2012)

Fox River contributes 1/3 nutrients to Lake Michigan

Sources of Sediment in Lower Fox River (LFR) Basin



(Data Source: Total Maximum Daily Load - **TMDL** Watershed Plan for Lower Fox River March 2012)

Fox River contributes 1/3 nutrients to Lake Michigan

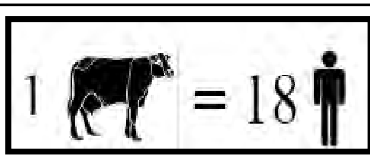
Land Use Trends - Livestock Density

Brown County total land area is 350,000 acres.

Year	Land in farms*
1954	300,900 acres
1972	274,800 acres
1978	263,400 acres
1983	241,500 acres
2008	162,000 acres
2012	164,800 acres

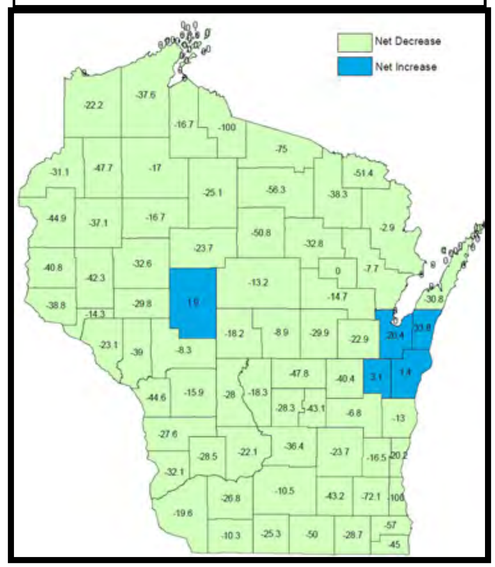
Source: 1991 Brown County Farmland Preservation Plan;

USDA National Agricultural Statistical Service

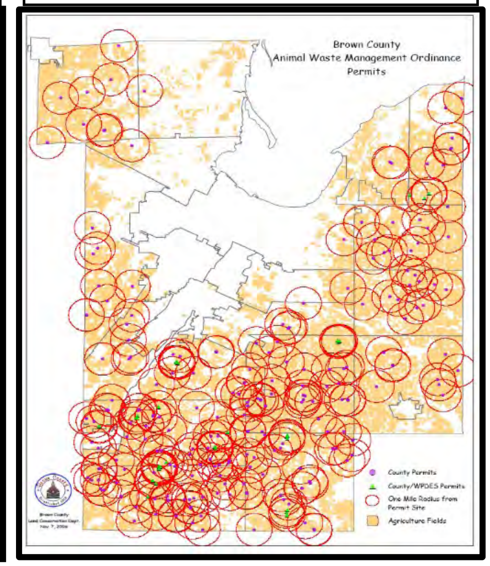


% Change in Total Cattle Numbers from 1983 – 2012

Data taken from 1984 and 2013 Wisconsin Agriculture Statistics



Brown County Animal Waste Management Ordinance Permits



Acres/Cow	Cattle	Cropland
Brown **1.54**	105,000	162,000
Outagamie 2.29	85,000	194,700
Manitowoc 1.89	97,000	183,800
Calumet 2.02	60,000	120,900

Hay Brown County

Source: USDA National Agricultural Statistical Service

Year	Acres Dry Hay	%	Crop Acres	Corn Acres (10 year ave.)
1969	86,100	32%	270,000	1970's - 49,062 acres
1981	74,000	30%	250,000	1980's - 57,860 acres
1995	46,500	26%	180,000	1990's - 57,880 acres
2008	33,600	21%	162,000	2000's - 61,060 acres

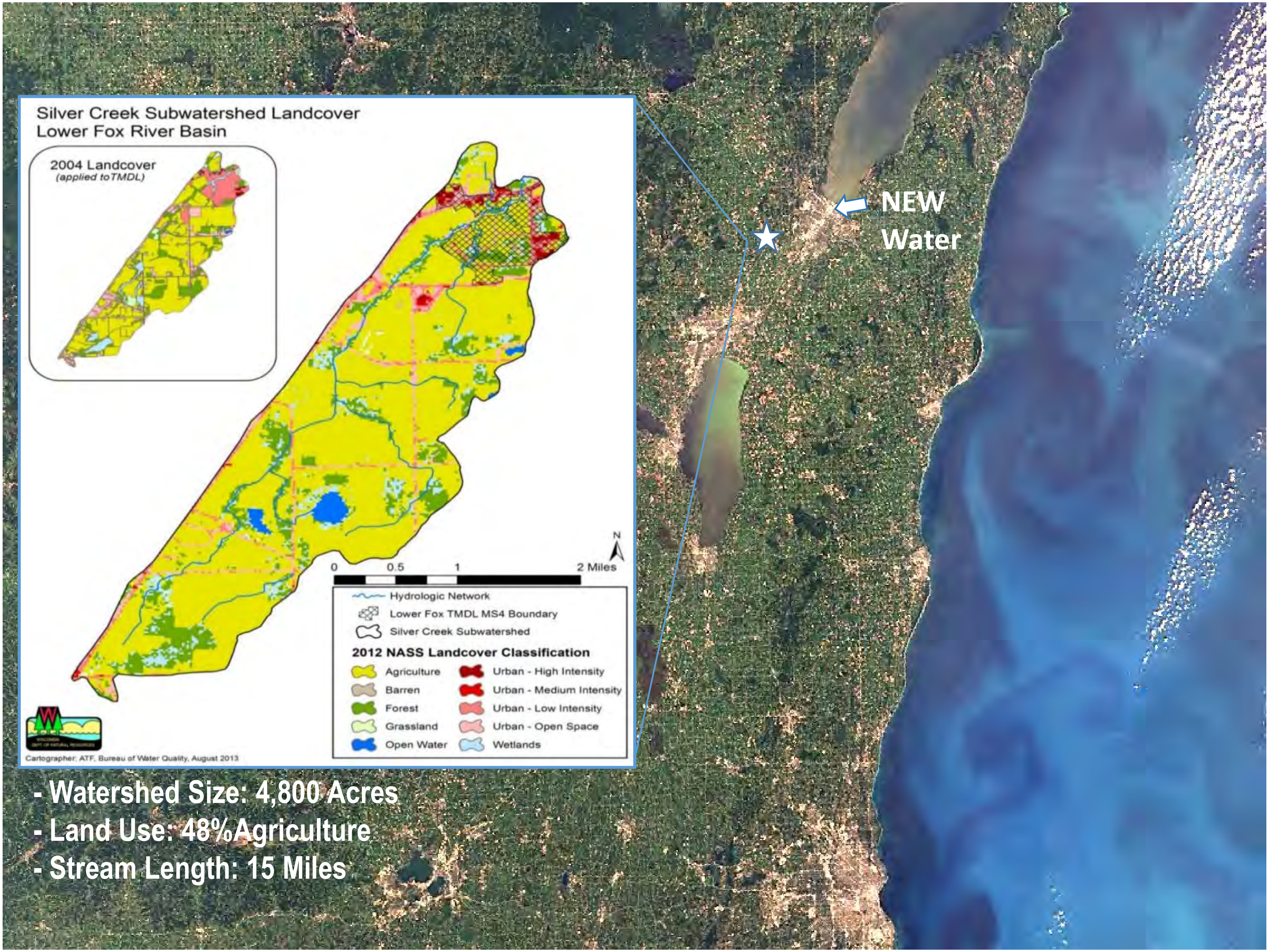
2010 – 2014: 67,650 acres

Green Bay Watershed

- Green Bay regional water quality issues
  - TMDL
  - AOC
  - Fox River contributes 1/3 nutrients to Lake Michigan
- NEW Water issued new combined WPDES permit July 1, 2014
  - 5-year-permit cycle
- New future Total Phosphorus and Total Suspended Solids reductions
- Facility improvements:

  $100 - $200 million capital cost + $2 million annual O&M cost
- **Adaptive Management** addresses new phosphorus and solids limits
  - Current: AM Pilot + Plant Optimization

Photo credit: Steve Seilo (www.photodynamix.com



Silver Creek Subwatershed Landcover
Lower Fox River Basin
2004 Landcover
(applied toTMDL)
0
0.5
1
2 Miles
N
Hydrologic Network
Lower Fox TMDL MS4 Boundary
Silver Creek Subwatershed
2012 NASS Landcover Classification
Agriculture
Barren
Forest
Grassland
Open Water
Urban - High Intensity
Urban - Medium Intensity
Urban - Low Intensity
Urban - Open Space
Wetlands
Cartographer: ATF, Bureau of Water Quality, August 2013
NEW
Water
- Watershed Size: 4,800 Acres
- Land Use: 48%Agriculture
- Stream Length: 15 Miles

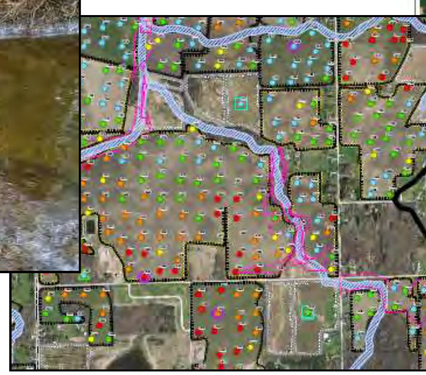
Silver Creek Pilot Project – From the Beginning

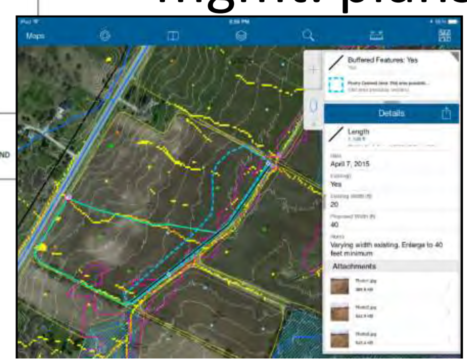
2014 – Project Kickoff

- Developed project partners
- Water quality sampling
- Soil sampling
- Stream surveys

2015 – Watershed Inventory

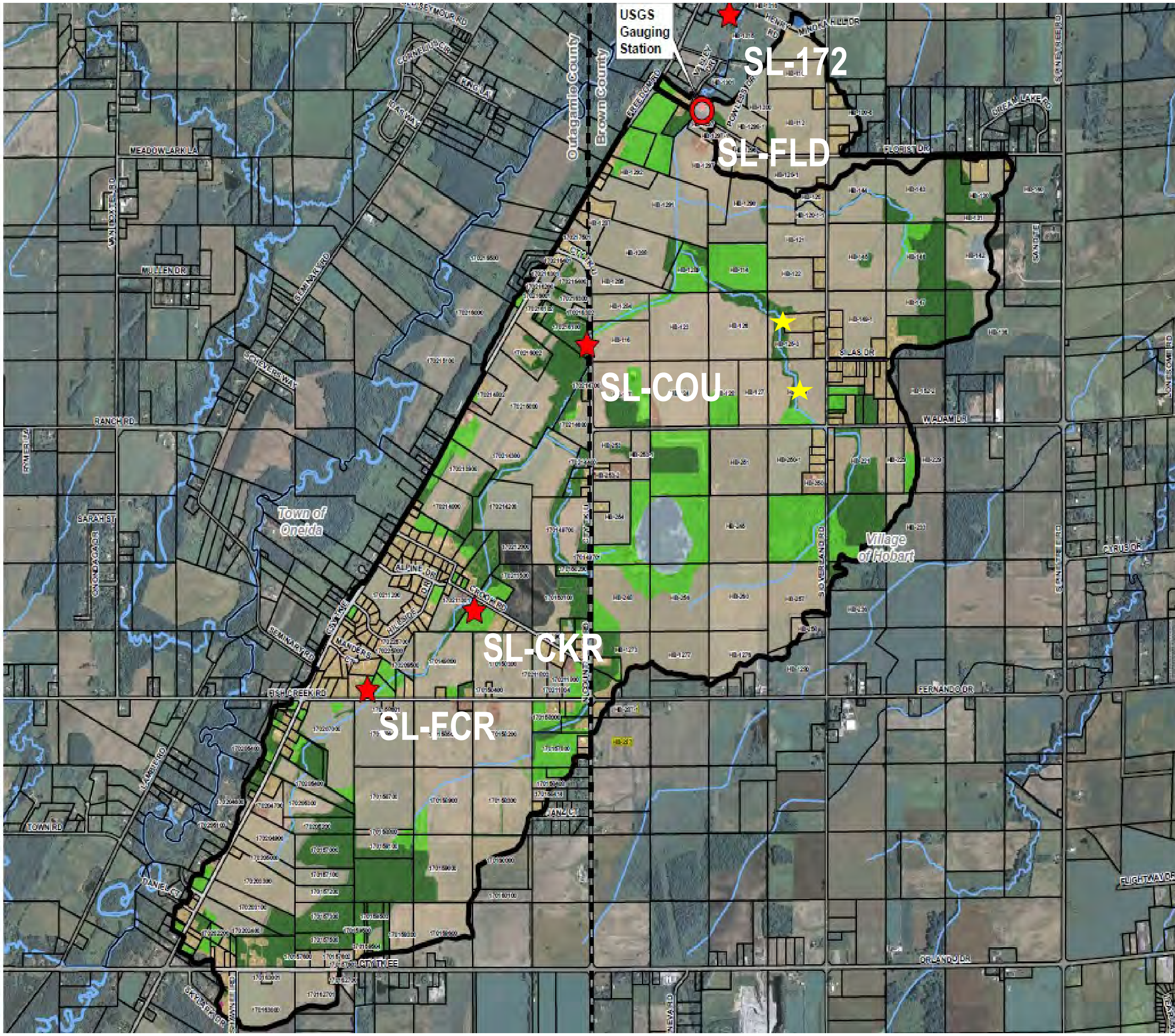
- Comprehensive field evaluations
- Arc GIS tablet application
- Conservation planning meetings
- Developed conservation and enhanced nutrient mgmt. plans



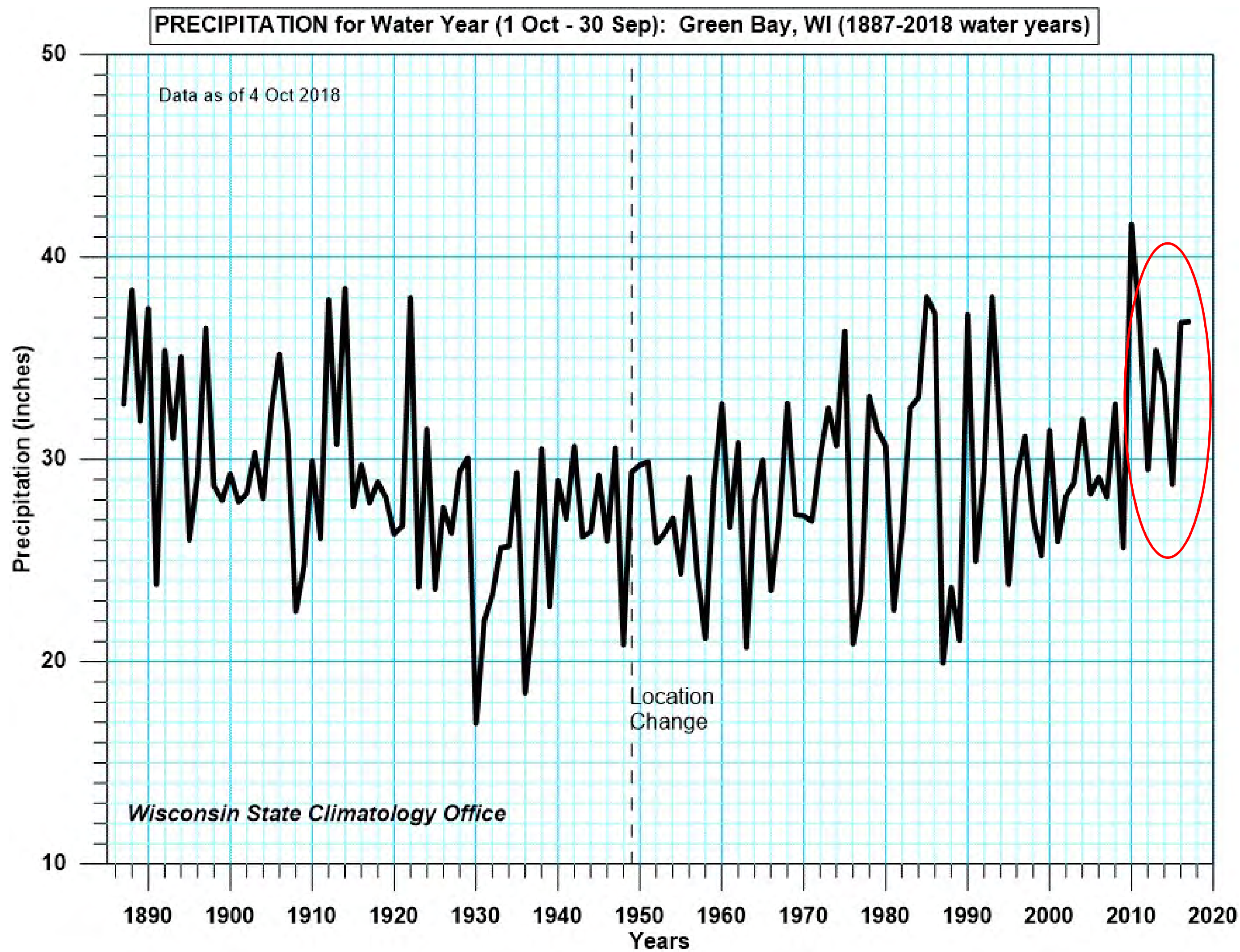


Silver Creek Pilot Project – 2016, 2017, & 2018

- Water quality monitoring
- Field planning
- Cost share agreements
- Best Management Practices (BMPs) installation
  - Filter strips (buffers)
  - Critical area plantings
  - Grassed waterways
  - Cover Crops
  - Residue Management
  - Low Disturbance Manure Application
  - Etc.
- Verification of installed BMPs
- Coordination, coordination, coordination….


USGS
Gauging
Station
SL-172
SL-FLD
SL-COU
SL-CKR
SL-FCR
Outagamie County
Brown County
Town of Oneida
Village of Hobart

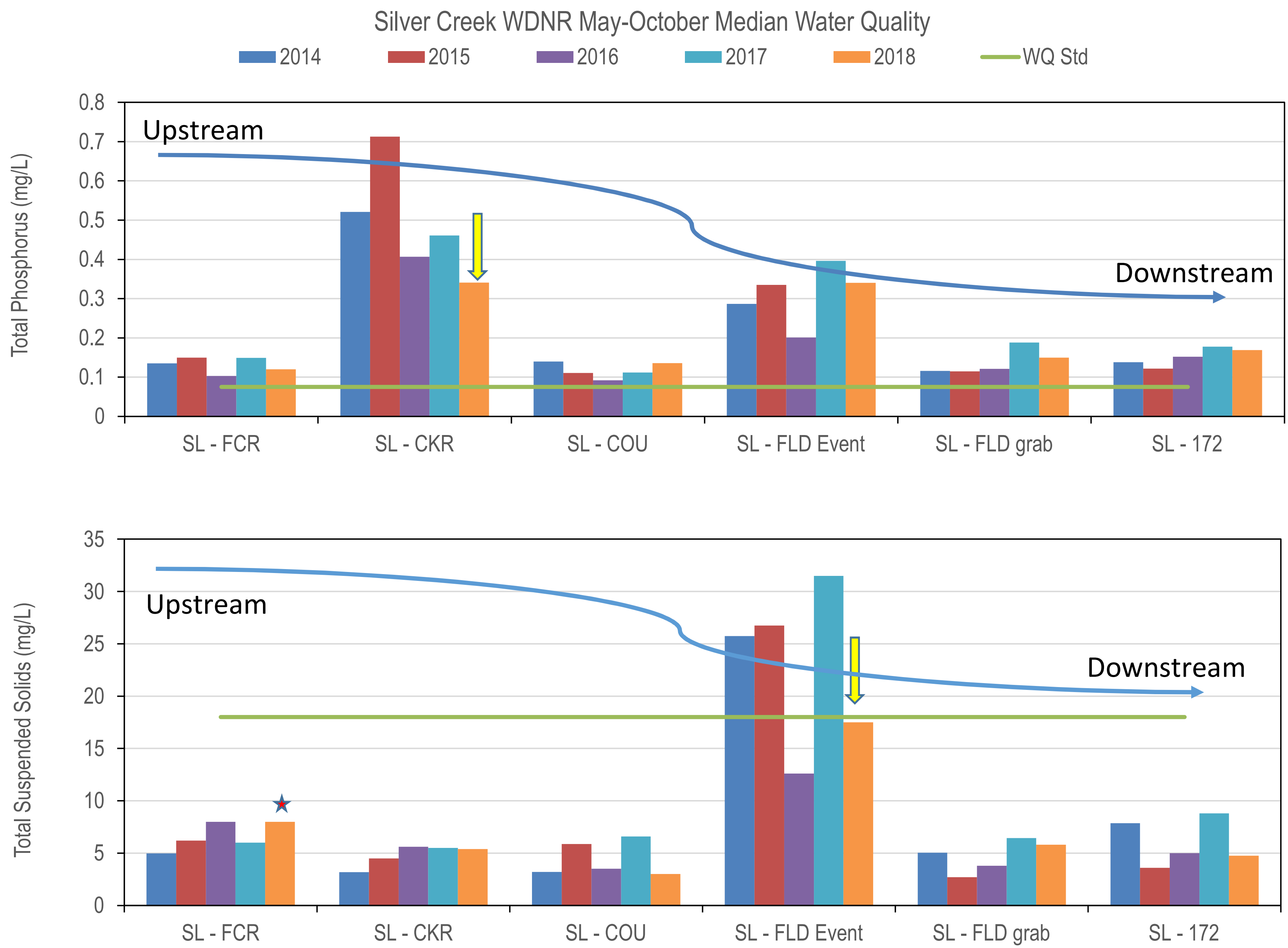

Green Bay Precipitation



Silver Creek Sample Summary

	2013-2014	2015	2016	2017	2018
SL-FCR	12	19	29	26	24
SL-CKR	19	25	29	26	24
SL-COU	21	25	29	26	26
SL-EVT	**109**	**56**	**84**	**75**	**107**
SL-FLD*	44	47	47	48	46
SL-172	20	25	29	26	26

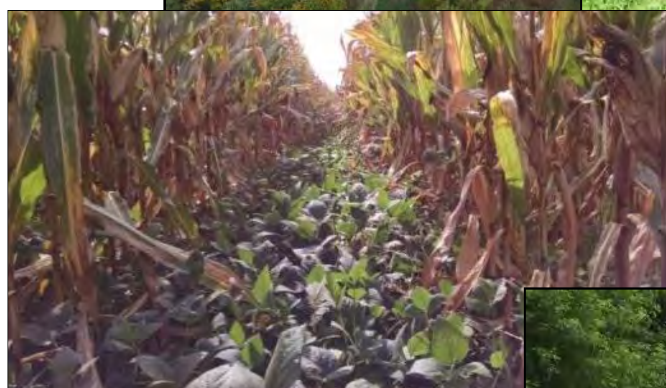
* Indicates site where USGS is taking supplementary grab samples



Silver Creek WDNR May-October Median Water Quality
2014
2015
2016
2017
2018
WQ Std
Total Phosphorus (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Upstream
Downstream
SL - FCR
SL - CKR
SL - COU
SL - FLD Event
SL - FLD grab
SL - 172
Total Suspended Solids (mg/L)
35
30
25
20
15
10
5
0
Upstream
Downstream
SL - FCR
SL - CKR
SL - COU
SL - FLD Event
SL - FLD grab
SL - 172

Best Management Practices

- Structural Practices
  - Grassed waterways
  - Critical Area Plantings
  - Buffers/filter strips
  - WASCOBs/Infiltration basin
  - Rock crossings
  - Wetlands
- Soft Practices
  - Tillage residue management
    - No-till/reduced till
  - Cover crops
    - Inter-seeding
  - Manure application
    - Low disturbance manure application
- MS4s
  - Urban stormwater collaboration
  - Stream restoration



Best Management Practices (BMPs): Grassed Waterways

Oct. 4, 2016

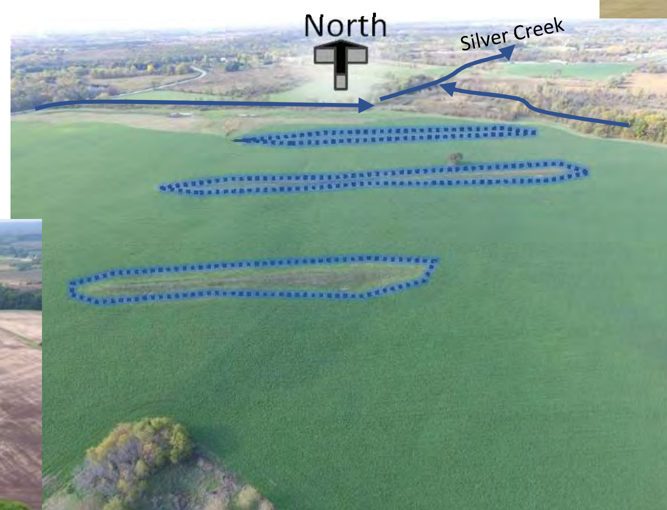
Oct. 9, 2017

Best Management Practices (BMPs): Filter Strips

June 5, 2018

Best Management Practices (BMPs): Water and Sediment Control Basins (WASCOB)

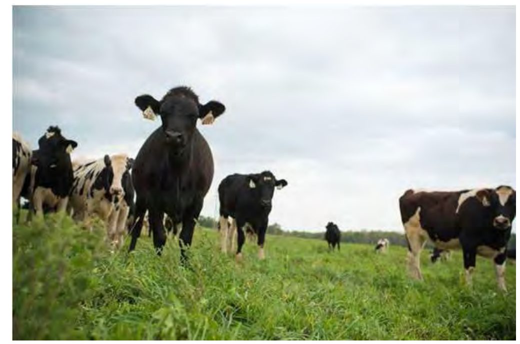

June 13, 2017



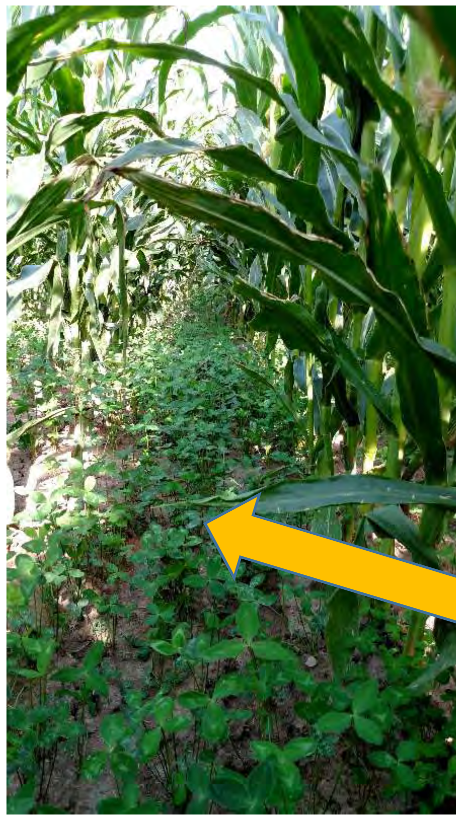
Oct. 9, 2017


Dec. 1, 2017

Best Management Practices (BMPs): Managed Grazing & Monitoring



Best Management Practices (BMPs): Interseeder Approach to Cover Crops



Cover crops planted between rows of corn improves soil health and prevents runoff into area waterways

Best Management Practices (BMPs): Cover Crops

- 2015 – 30% winter cover
- 2016 – 70% winter cover
- 2017 – 85% winter cover
- 2018 – 82% winter cover

Wetlands as a Tool

- Wetland benefits
  - Improve water quality through sedimentation and nutrient uptake
  - Improve infiltration and retention of storm and melt water
  - Reduce flashiness of the stream by increasing base flow in headwaters
  - Improve habitat and ecosystem services

3 Case Studies

- <u>Headwater Wetland Complex</u>
  - Multi basin complex built in the headwaters of the creek to retain storm water and runoff
- <u>Tributary Wetland</u>
  - Placed between agricultural fields in a tributary to the main creek
- <u>Experimental Wetland</u>
  - Constructed in a previously cropped field with outlet through old fallow re-vegetated farm field

❖ **Goals:**

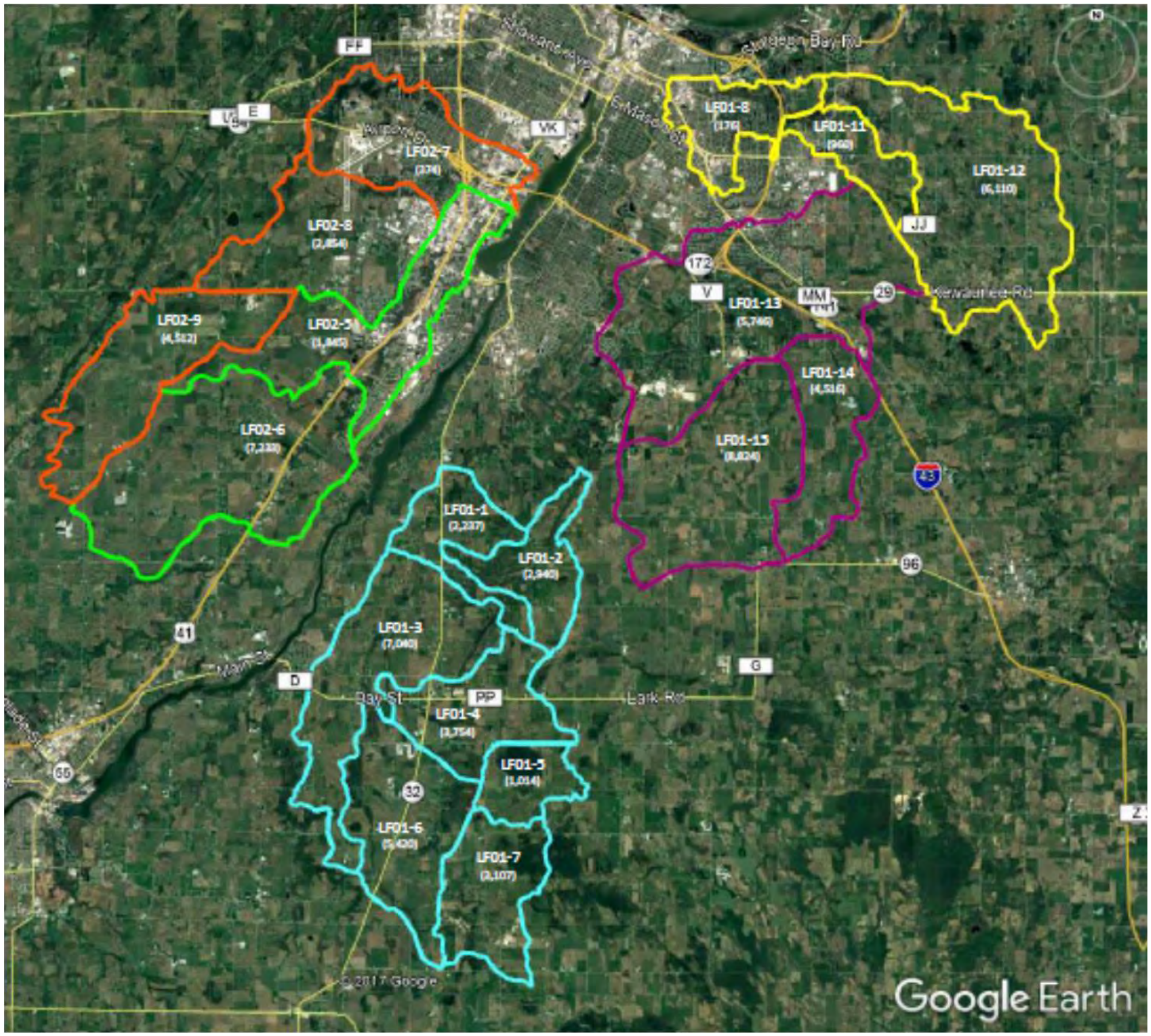
- ❖ Slow Runoff
- ❖ Allow for sedimentation of suspended material
- ❖ Nutrient uptake by living vegetation
- ❖ Native plants, pollinator habitat, buffers

Watershed 4,800 acres	Acres Before	Acres After	Loss/Gain
Agriculture	2,304	2,154	Minimal loss
Wetland	minimal	150	7 new complexes

2018 By The Numbers: Silver Creek

- Conservation and Enhanced Nutrient Management Plans
  - Over 1500 acres
- 89% of cropland was not tilled in 2018
- Winter Cover in Fields
  - 82% of cropland covered by either alfalfa, cover crops, winter wheat, forage, pasture, or grass
    - 2017 – 85%
    - 2016 – 70%
    - 2015 – 30%

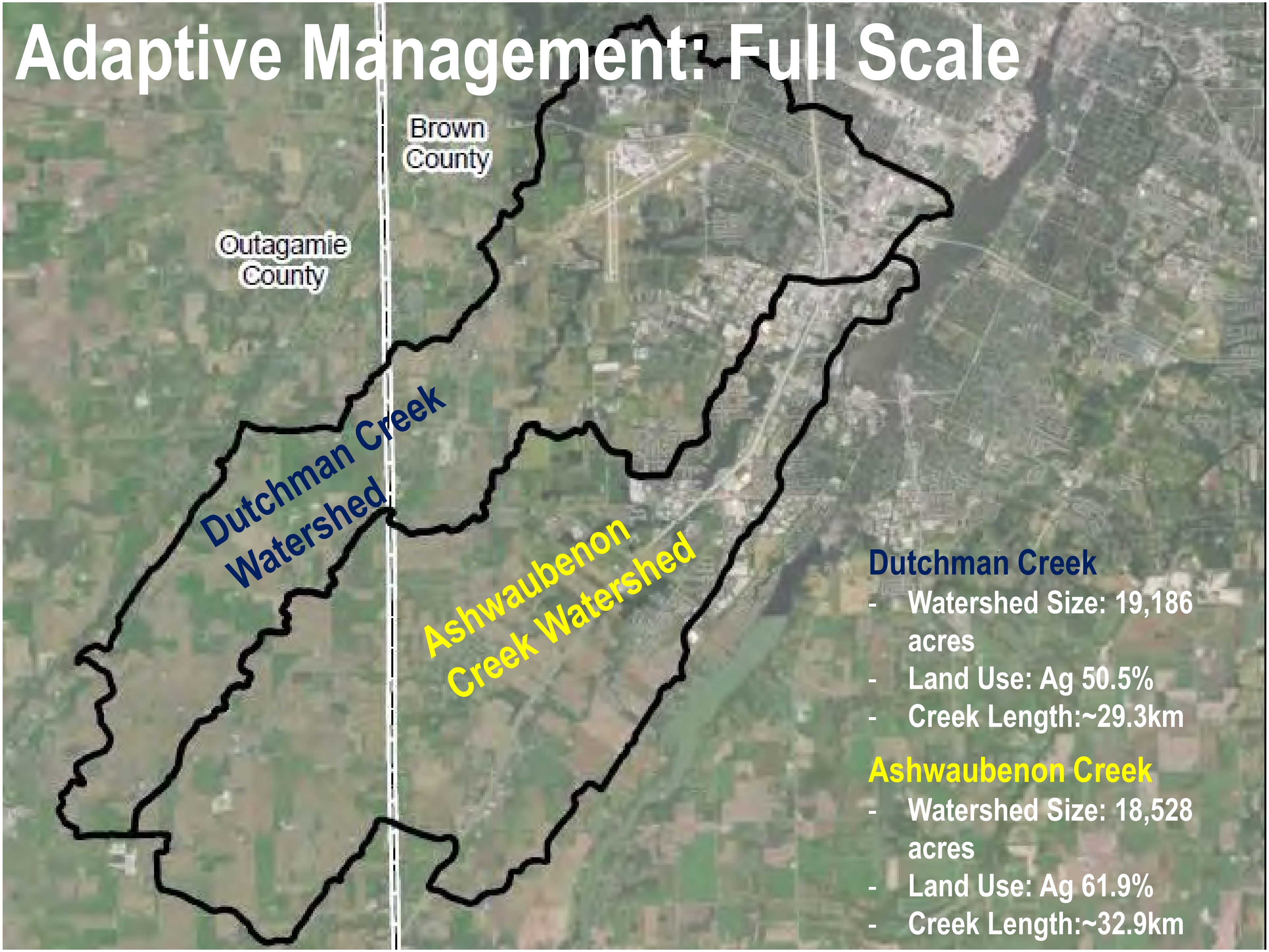
Opportunities in Adjacent Watersheds



Watershed Evaluation Criteria

1. Sub-watershed Size
2. Sub-watershed Land Use and Agricultural Contribution
3. Geographic Location
4. Nine-Key Element Plan Status
5. Potential Load Partners
6. Flow and Water Quality Data
7. Ongoing Agricultural Watershed Projects
8. Severity of Perceived Issues
9. Technical Resources

Adaptive Management: Full Scale



Dutchman Creek

- Watershed Size: 19,186 acres
- Land Use: Ag 50.5%
- Creek Length:~29.3km

Ashwaubenon Creek

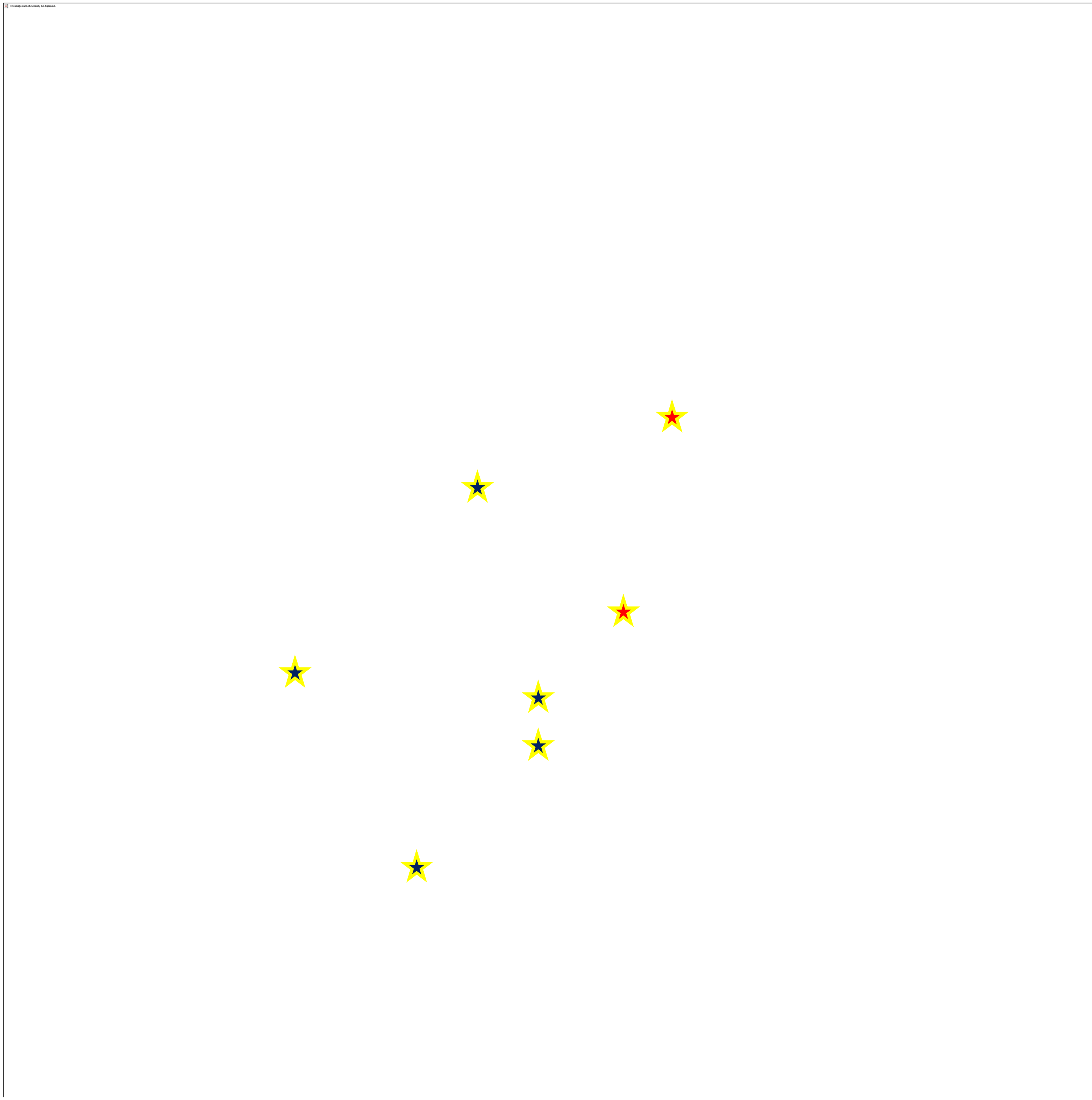
- Watershed Size: 18,528 acres
- Land Use: Ag 61.9%
- Creek Length:~32.9km

Full Scale Watershed Management Program

- NEW Water Commission Approved Full Scale <u>Planning</u> in 2018
  - Position NEW Water to advance AM as part of the phosphorus and TSS compliance strategy
- Similar starting tasks as the Pilot
  - Stream corridor inventory
  - Workgroups, partnership agreements
  - Field walks and conservation planning
- Water Quality Monitoring
- Flow Monitoring
- Biological Monitoring

A/D Water Quality and Biological Monitoring

- Water Quality:
  - 8 water quality monitoring sites
    - TSS, TP, dissolved TP, TKN
    - Multi parameter sonde recordings
- USGS Gage Stations
  - 2 gage and event samplers
    - Installed and operational
  - 2 additional gage stations
    - Installed and operational
- Biological Monitoring
  - Contract with UWGB & Oneida to perform annual biological sampling
    - 2018 fall sampling complete
      - 9 sites sampled: fish, inverts, habitat
      - Samples sorted and out for identification and review



Water Quality Sites:

<u>Ashwaubenon Creek</u>

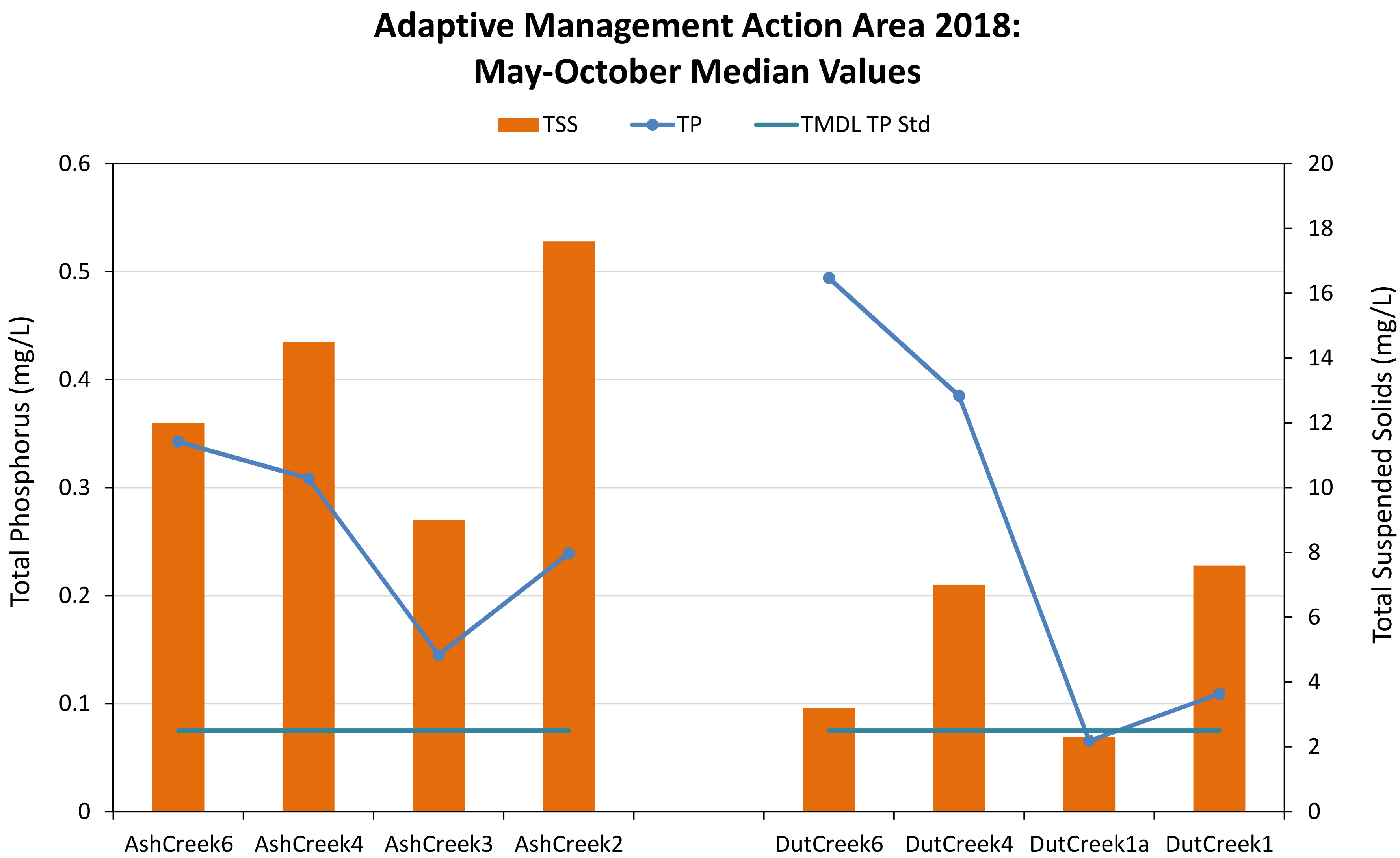
- 3 main stem sites
- 1 tributary site

<u>Dutchman Creek</u>

- 3 main stem sites
- 1 temporary site

★ WQ, Bio & USGS

★ WQ Site & Bio



*DutCreek 1a sampling started in Oct 2018, only 3 data points

2019 Field Season Goals

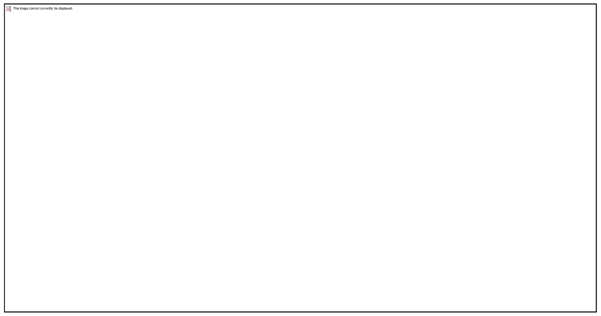
- Silver Creek:
  - Continue to collect WQ samples at all 5 main stem sites
    - Continue USGS gage station and event sample collection at Florist Drive
  - Continue to collect WQ samples at 2 wetland sites to support a TNC led project funded by Fund for Lake Michigan
  - Work up data for a final project summary
- Ashwaubenon & Dutchman Creeks
  - Continue to collect baseline samples at established sites
    - Potential to add additional sites as needed
    - Add additional nutrient analyses: ammonia, nitrate/nitrite, ortho-phosphorus
  - Continue to operate and collect event samples from two USGS gage stations
  - Continue to collaborate with UWGB & Oneida on biological sampling

Next Steps in Full Scale Watershed Program

- Application for permit renewal at NEW Water
  - Due Dec 31
- Finalizing Adaptive Management Plan
  - Due Dec 31
- 2019 – a Year of Planning and Inventory
  - Water quality monitoring
  - Desktop field evaluation
  - Develop a method of prioritization
  - Develop advisory committee
  - Kickoff of the program
- 2020 – Begin implementation of practices
- 20 Years of watershed efforts

Unique Opportunity

- The Environmental Programs Division is expanding upon a legacy of water quality attentiveness and monitoring.
- Adaptive Management provides a way for NEW Water to meet recent WPDES permit restrictions through improving the health and quality of local watersheds.
- By linking the established AMP database with a new watershed database, NEW Water is uniquely situated to document future water quality improvement in Green Bay and area rivers.

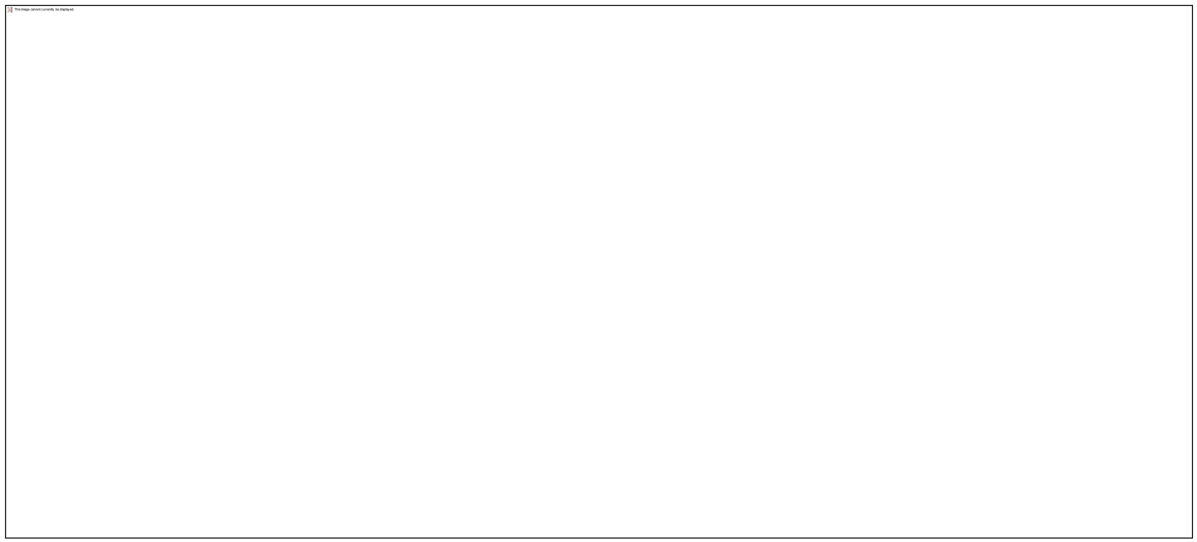


Outagamie County

Oneida Nation

The Nature Conservancy

Ducks Unlimited



Jacobs

USGS

Ag Ventures

GLRI

EPA

WDNR

Brown County

McMahon

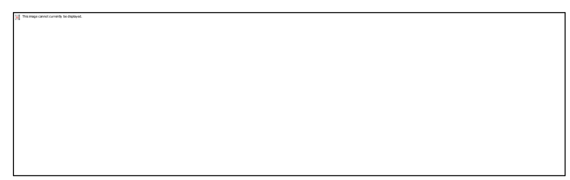
UW – Green Bay

Tilth Agronomy

Fund for
Lake Michigan

NRCS

US Fish & Wildlife Service



Partnerships in the Silver Creek Pilot Project