# MSDGC Monitoring and Bioassessment Program

Ohio Water Quality Monitoring Council
March 21, 2014

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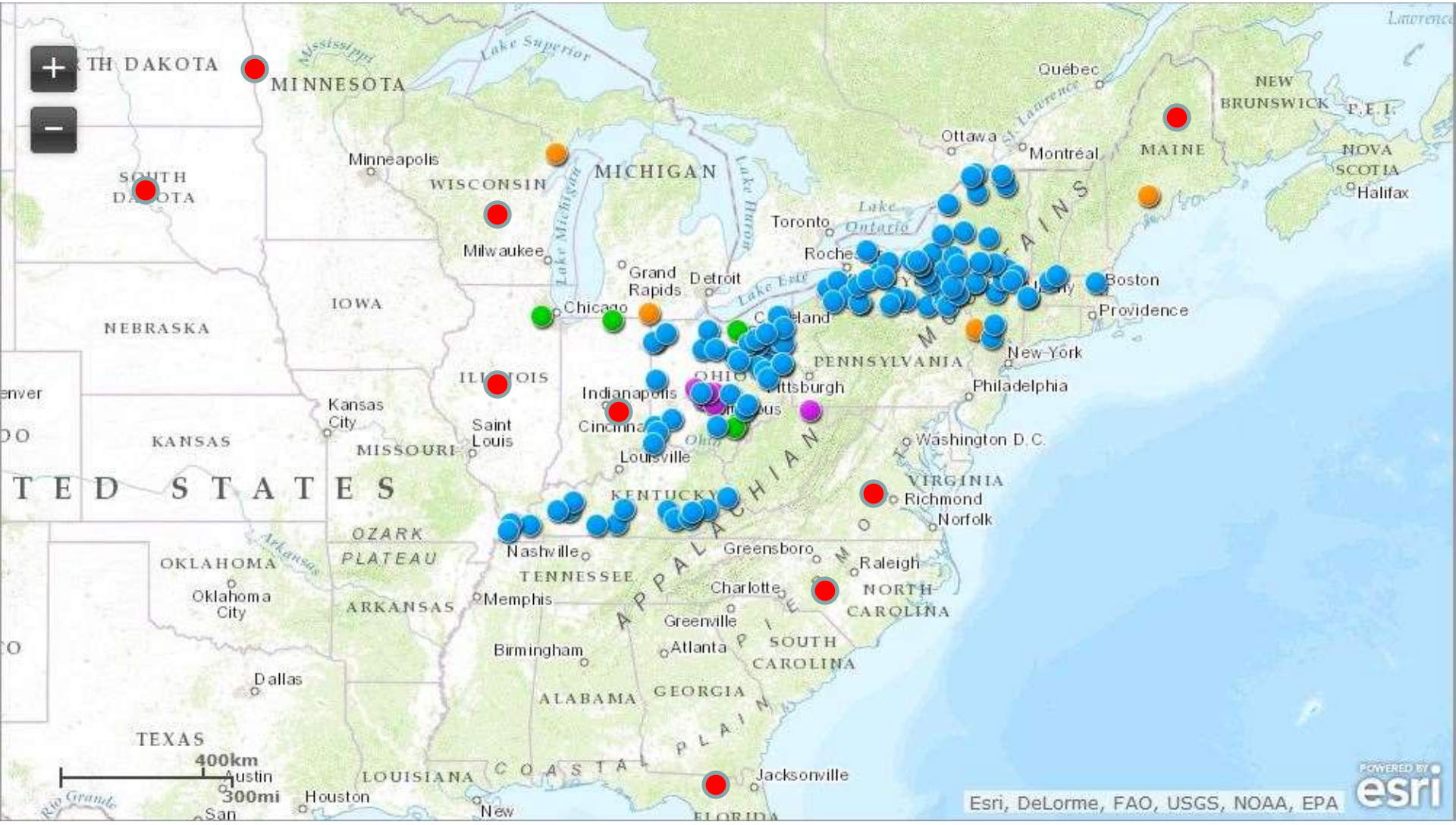
# MBI is a 501[c][3] Applied Research Organization Specializing in Aquatic Bioassessments, Research, Education, & Training



# MSDGC Watershed Assessment Plan Development

- MSDGC requested MBI to develop a comprehensive "DRSCWG" style monitoring and assessment plan
- Covers 11 subwatersheds and 3 major mainstem rivers in the MSDGC service area
- Data collection is the first step followed by subwatershed assessments
- Assess current status, proximate stressors, and use attainability issues
- Once larger database is compiled will begin development of an IPS type of analysis
- IPS will allow MSDGC to focus on highest return projects
- Provides tools to communicate to public

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# Bioassessment Plan Steps

**Watershed Monitoring and Bioassessment Plan for the MSD Greater Cincinnati Service Area**

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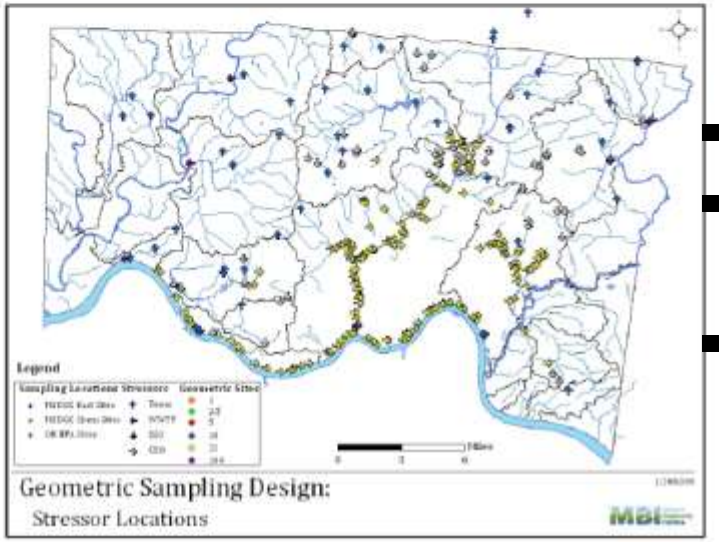



Geometric Sampling Design:
Stressor Locations

- Follow Principles of *Adequate M&A*
- Spatial design fits scale of management issues
- Indicators & parameters fit appropriate roles
- Compile existing sites
- Delineate geometric sites
- Fill gaps to cover important stressors
- 4 year rotation
- Detailed study planning prior to each field season
- L3 data collection allows results to be used to affect WQS uses & TMDLs

# Ohio Credible Data Law: II

**§ 6111.52. Activities requiring level three credible data.**

The director of environmental protection shall use only level three credible data to conduct any of the following activities:

(A) Developing, reviewing, and revising use designations in water quality standards;

(B) Developing a statewide water quality inventory or other water assessment report;

(C) Identifying, listing, and delisting waters of the state for the purpose of section 303(d) of the Federal Water Pollution Control Act;

(D) Determining whether a water of the state is supporting its designated use or other classification;

(E) Establishing a total maximum daily load for a water of the state.

# Bioassessment Plan Elements

Bioassessment Plan Objectives:

*Bioassessment as used herein consists of biological, chemical, and physical data collection and a process for stressor identification.*

- Develop prioritization mechanisms based on watershed level monitoring & bioassessment
  - IPS specific to MSDGC service area

# CORE INDICATORS

**• Fish Assemblage • Macroinvertebrates • Periphyton**

***(Use Assemblage Level Data From At Least Two)***

## Physical Habitat Indicators

- Channel morphology
- Flow
- Substrate Quality
- Riparian

## Chemical Quality Indicators

- pH
- Temperature
- Conductivity
- Dissolved $O_2$

## For Specific Designated Uses Add the Following:

### AQUATIC LIFE

*Base List*

- Ionic strength
- Nutrients, sediment

*Supplemental List*

- Metals (water/sediment)
- Organics (water/sediment)

### RECREATIONAL

*Base List*

- Fecal bacteria
- Ionic strength

*Supplemental List*

- Other pathogens
- Organics (water/sed.)

### WATER SUPPLY

*Base List*

- Fecal bacteria
- Ionic strength
- Nutrients, sediment

*Supplemental List*

- Metals (water/sediment)
- Organics (water/sed.)
- Other pathogens

### HUMAN/WILDLIFE CONSUMPTION

*Base List*

- Metals (in tissues)
- Organics (in tissues)

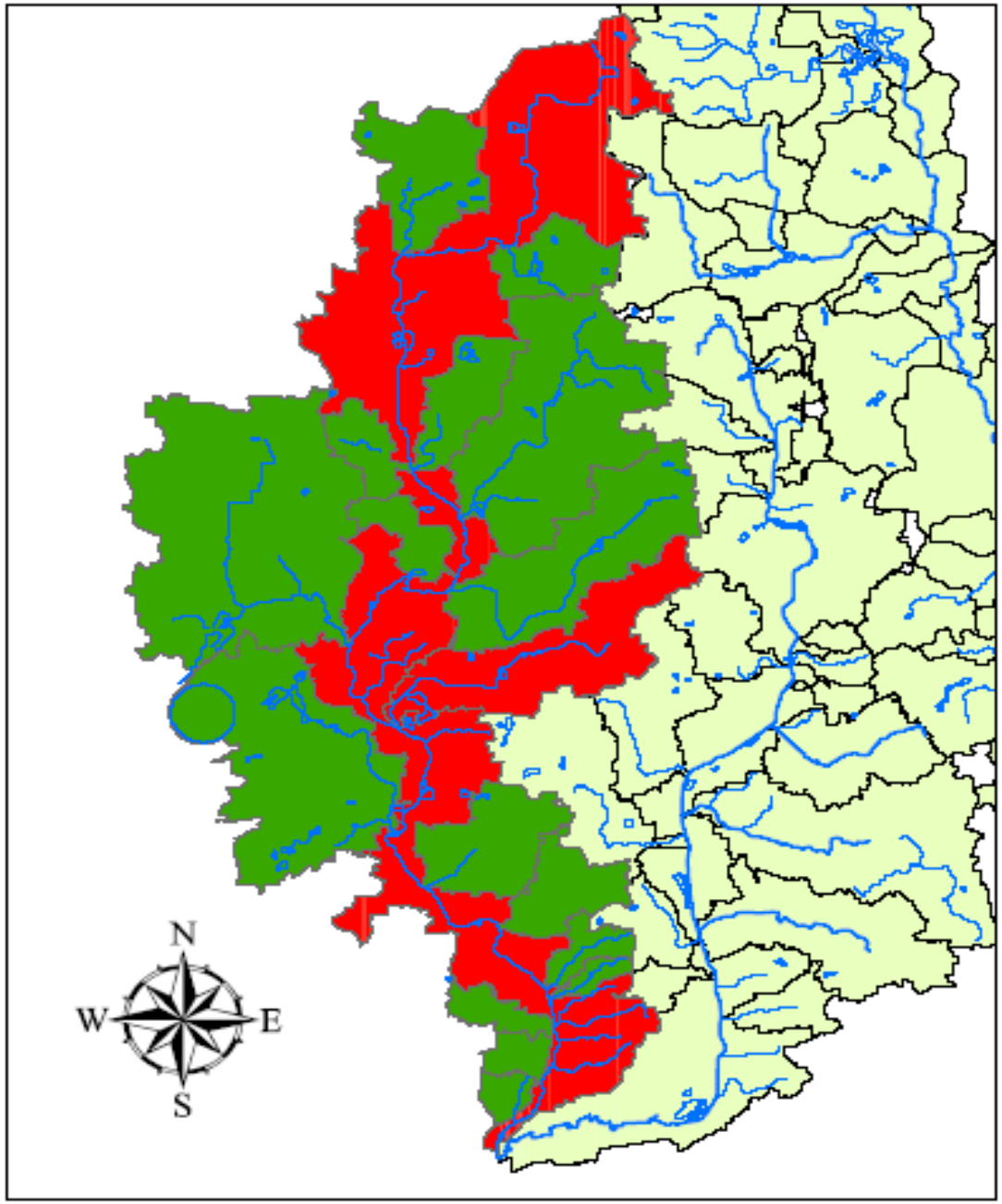
Ohio EPA
Division of Surface Water

# Primary Headwater Stream Initiative

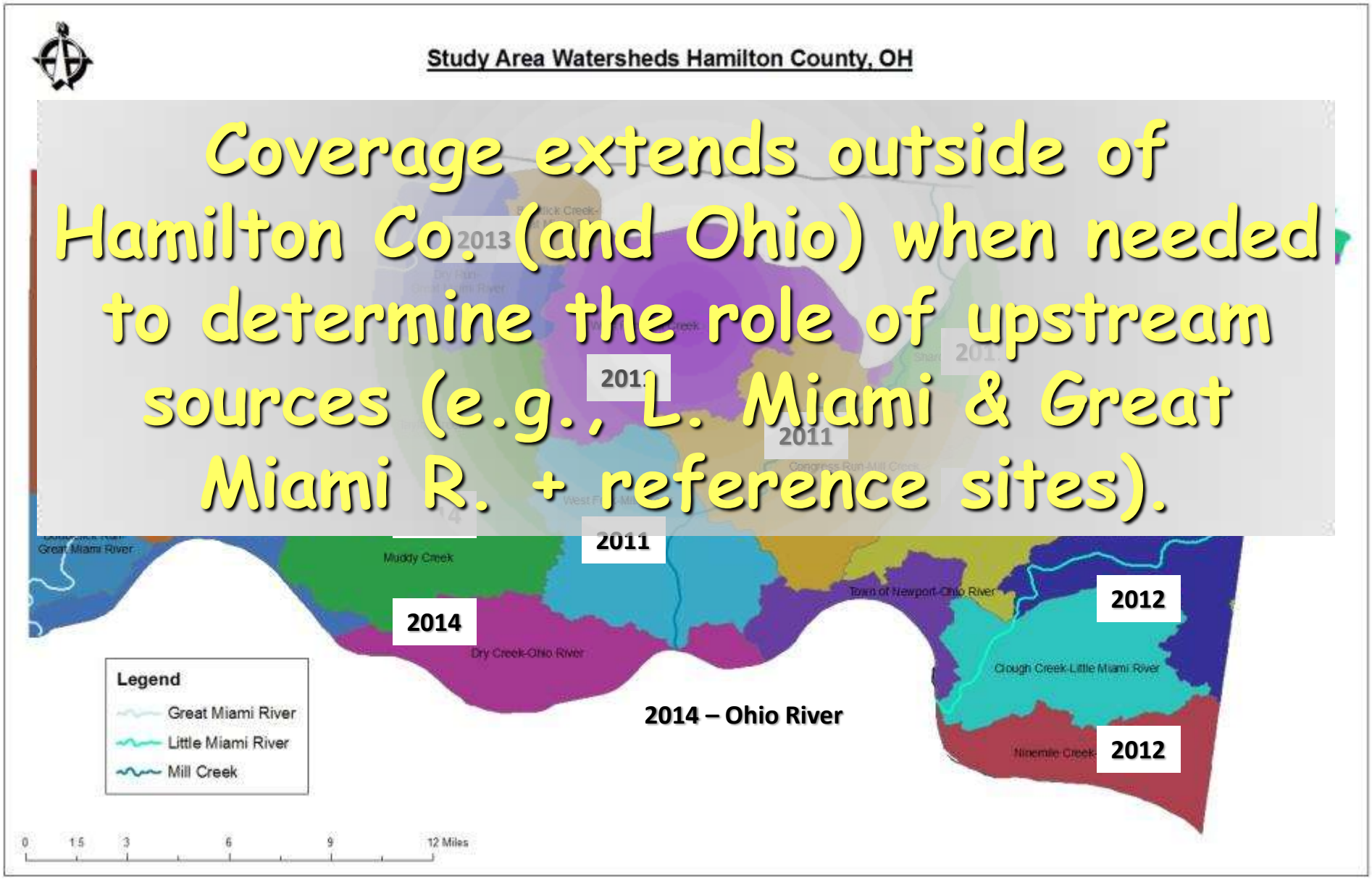
**Extends bioassessment into to otherwise unmonitored streams**


- Robert D. Davic
- Steve Tuckerman
- Paul Anderson
- Mike Bolton

# Watershed Coverage of TMDLs W.B. DuPage River




- For WB only 39% of watershed covered by IEPA TMDLs. 100% under Bio-assessment plan
- Representative of other Illinois watersheds
- 33 waters, not covered by existing or in-development TMDLs (green), were identified as impaired
- Produced stressors not seen in TMDLs
- Allows for more confidence in associating stressors and sources
- An important step towards developing Tiered Aquatic Uses


Study Area Watersheds Hamilton County, OH
Coverage extends outside of Hamilton Co. (and Ohio) when needed to determine the role of upstream sources (e.g., L. Miami & Great Miami R. + reference sites).
2013
2011
2011
2011
2014
2012
2012
Muddy Creek
Dry Creek-Ohio River
Town of Newport-Ohio River
Clough Creek-Little Miami River
Great Miami River
Legend
Great Miami River
Little Miami River
Mill Creek
2014 – Ohio River
0 1.5 3 6 9 12 Miles

## MSDGC Monitoring & Bioassessment Plan Sites & Crew Day Estimate

May 17, 2011

| | | | Fish Sites/Crew Days | | | | | | Macroinvertebrates | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subwatershed** | **Bio Sites** | **Chem Sites** | **Boat/Raft EF** | | **Wading** | | **Backpack** | | **HD** | **QL** | **PHW** |
| Mill Cr. W. Branch | 24 | 20 | 0 | 0 | 9 | 6 | 15 | 3 | 7 | 4 | 13 |
| Mill Cr. E. Branch | 37 | 34 | 0 | 0 | 15 | 10 | 24 | 8 | 9 | 11 | 19 |
| Mill Cr. S. Branch | 28 | 24 | 7 | 3.5 | 3 | 2 | 18 | 6 | 10 | 7 | 11 |
| Year 1 Subtotal | 89 | 78 | 7 | 3.5 | 27 | 18 | 57 | 17 | 26 | 22 | 43 |
| | | | | | | | | | | | |
| LMR Duck Cr. & Indian Hill | 30 | 22 | 9 | 5 | 0 | 0 | 22 | 5 | 16 | 5 | 12 |
| LMR Sycamore & Polk Run | 34 | 31 | 7 | 4 | 3 | 2 | 25 | 5 | 12 | 11 | 12 |
| GMR Multiple (Muddy Cr.) | 20 | 19 | 7 | 4 | 6 | 4 | 10 | 2.5 | 7 | 4 | 12 |
| Year 2 Subtotal | 84 | 72 | 23 | 13 | 9 | 6 | 57 | 12.5 | 35 | 20 | 36 |
| | | | | | | | | | | | |
| GMR New Baltimore | 27 | 22 | 9 | 6 | 4 | 2 | 16 | 4 | 11 | 2 | 16 |
| GMR Harrison Dry Fork | 24 | 24 | 10 | 7 | 12 | 6 | 10 | 2.5 | 17 | 5 | 10 |
| GMR Hooven Cleves | 19 | 11 | 6 | 4 | 0 | 0 | 9 | 2.5 | 12 | 0 | 9 |
| Year 3 Subtotal | 70 | 57 | 31 | 21 | 16 | 8 | 35 | 9 | 40 | 7 | 35 |
| | | | | | | | | | | | |
| LMR 12 Mile Multiple | 24 | 20 | 0 | 0 | 10 | 5 | 18 | 3.5 | 3 | 5 | 20 |
| GMR Taylor Cr. | 32 | 30 | 4 | 1 | 13 | 4.5 | 17 | 4 | 6 | 1 | 17 |
| Ohio River | 25 | 20 | 25 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 4 Subtotal | 81 | 70 | 29 | 17 | 23 | 9.5 | 35 | 7.5 | 9 | 6 | 37 |
| | | | | | | | | | | | |
| Subtotal All Years | 324 | 277 | 90 | 54.5 | 75 | 41.5 | 184 | 46 | 110 | 55 | 151 |
| 10% Contingency | 32.4 | 27.7 | 9 | 5.45 | 7.5 | 4.15 | 18.4 | 4.6 | 11 | 5.5 | 15.1 |
| | | | | | | | | | | | |
| **Grand Totals** | **356.4** | **304.7** | **99** | **59.95** | **82.5** | **45.65** | **202.4** | **50.6** | **121** | **60.5** | **166.1** |
| | | | | | | | | | | | |
| **Fish Crew Days** | | | | | | **156.2** | | | | | |
| **Fish Crew Weeks** | | | | | | **31.24** | | | | | |

Initial basis for determining project cost

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# Biological and Habitat Assessment Project Study Plan for the MSD Greater Cincinnati Service Area Year 1 Subwatersheds

**A Project Study Plan (PSP) is submitted annually to Ohio EPA per Credible Data Law.**

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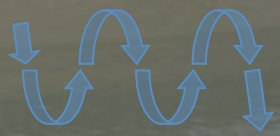
# Mill Creek Biological and Water Quality Results 2011

## Mill Creek Watershed Action Plan
## July 18, 2012

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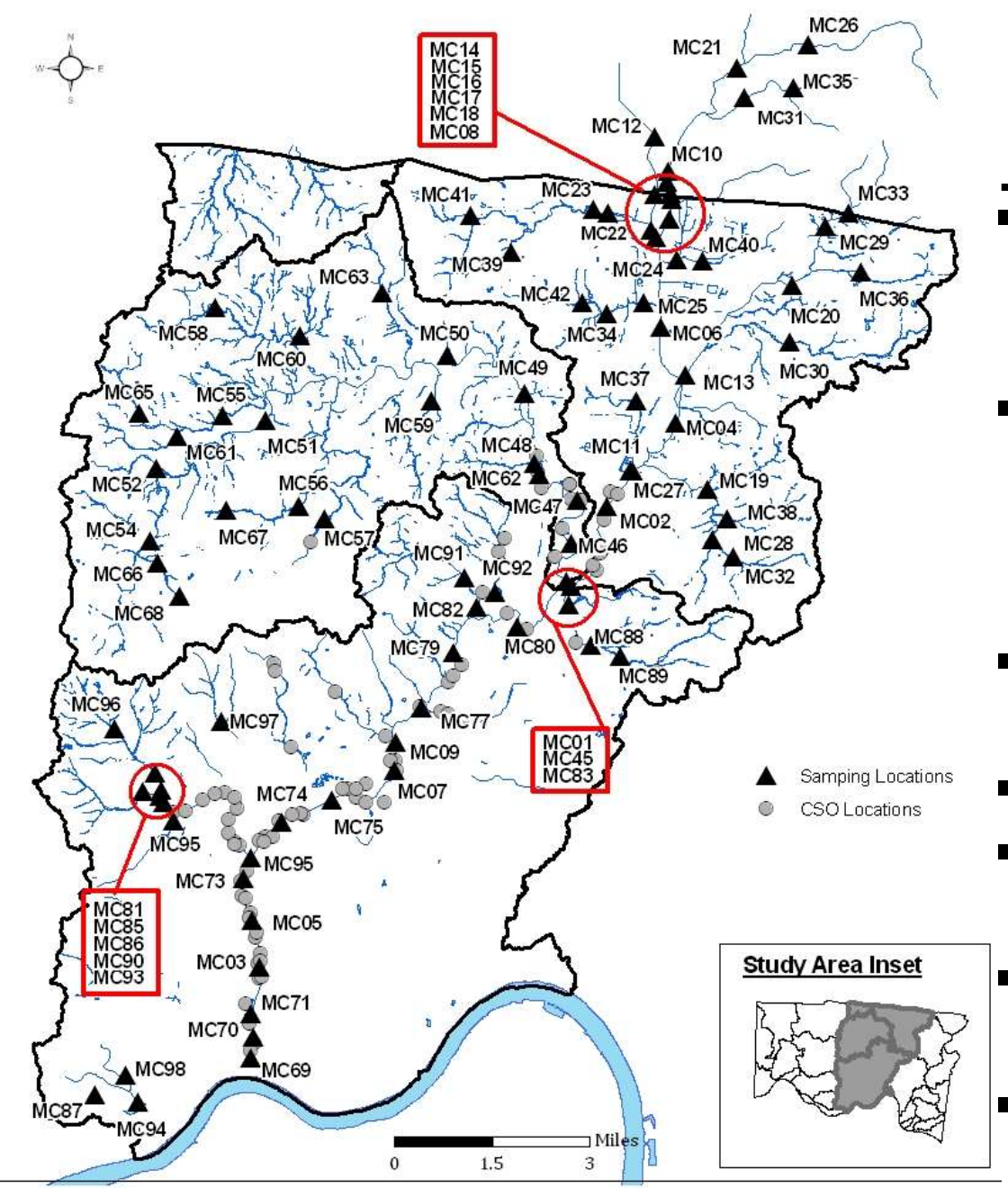



Mill Creek Watershed Study Area
MBI 2011 Sampling Locations

# Mill Creek Survey Design

- Pollution survey design – uses geometric allocation of sampling sites
- Additional sites positioned in proximity to suspected sources of stress & contamination
- Each site assigned a consistent site code (e.g., MC 71)
- 92 total sites
- Each sampled for biological & water quality parameters
- Employed 3 crews over the June-October index period
- Followed Ohio EPA methods to ensure data consistency and use of results per OCDL

"Good"
Habitat

"Fair"
Habitat

"Poor"
Habitat

"Artificial"
Habitat

# Three Principal Objectives of Systematic Bioassessment

- Determine if use designations are appropriate and attainable
- Determine condition and status of the resource (including causal associations)
- Are changes taking place over time and what do they mean?

*Table 1. Assessment of existing aquatic life use (ALU) designations in the 2011 Mill Creek study area. The respective biological assemblage and habitat assessment results are summarized along with the existing ALU. The recommended ALU is also listed and represents a change if different from the existing ALU.*

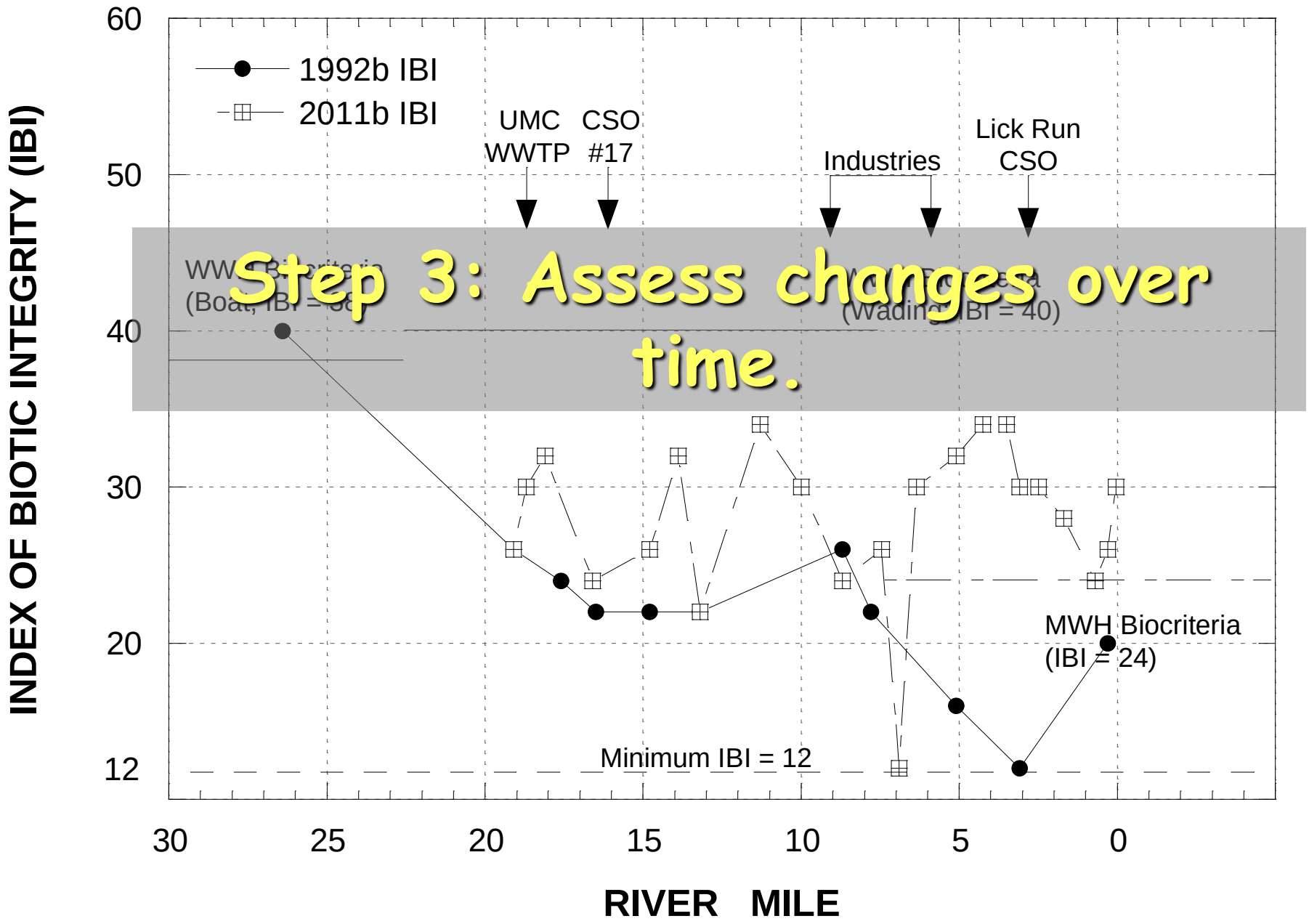
| Stream | No. of Sites | Size ($mi^2$) | Habitat Evaluation | Fish Evaluation | Macroinv. Evaluation | Existing ALU | Recommended ALU |
|---|---|---|---|---|---|---|---|
| **WAU 01-01 East Fork Mill Creek-Mill Creek** | | | | | | | |
| Mill Creek (23-001) | 3 | 32.4 | Fair-Good | Poor-Fair | Fair-Good | WWH | WWH |
| East Fork Mill Creek (23-006) | 7 | 9.4 | Fair-Good | Poor-Good | Fair-Good | WWH | WWH |
| Beaver Creek (23-023) | 3 | 4.4 | Fair-Good | Poor-Fair | Poor-Good | WWH | WWH |
| Trib to East Fork Mill Creek RM.2.35 (23-055; MC31, 35) | 2 | 1.8 | Fair-Good | Good | Fair-Good | None | WWH |
| Trib to [illegible] at RM 2.27 (23-038, MC39) | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible]/H |
| **WAU 01-02 West Fork Mill Creek** | | | | | | | |
| West Fork Mill Creek (23-004) | 9 | 36.4 | Poor-Good | Poor-Fair | Very Poor-Marg Good | WWH | WWH |
| Trib to W. Fk. Mill Cr. at RM 14.26 (23-029; MC66) | 1 | 1.5 | Poor | Poor | Very Poor | None | WWH |
| Trib (1.75) to Trib to West Fork RM 9.82 (23-031; MC61) | 1 | 0.9 | Poor | Poor | - | None | Class II PHW |

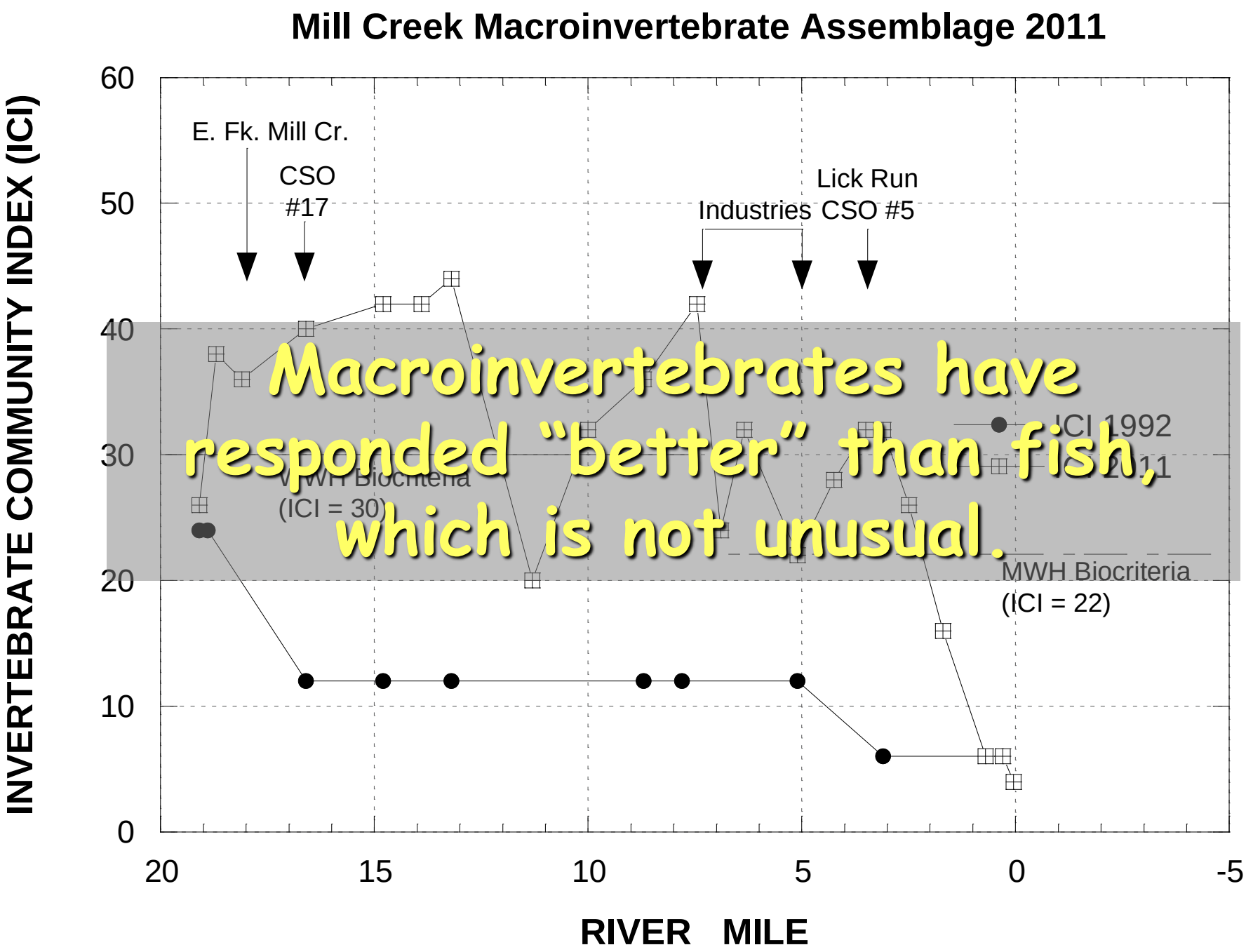
**Step 1: Evaluate if current uses are appropriate & attainable consistent with Ohio WQS.**

*Table 2. Aquatic life use attainment status at Mill Creek basin stations sampled in summer 2011. Index of Biotic Integrity (IBI), Modified Index of Well-Being (MIwb), and Invertebrate Community Index (ICI) scores are based on performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures physical habitat quality and the streams ability to support a biotic community. Potential Causes and Sources of impairment are listed at sites that did not fully attain their use. All sites are located within the Interior Plateau ecoregion. Sampling locations grouped by the HUC 12 subwatershed level WAU (watershed assessment unit).*

| Site ID | DA ($mi^2$) | RM | IBI | MIwb | ICI | QHEI/ HHEI | Attainment Status | Causes | Sources |
|---|---|---|---|---|---|---|---|---|---|
| **WAU 01-01** | | | | | | | | | |
| ***23-001 Mill Creek (WWH Aquatic Life Use – Existing)*** | | | | | | | | | |
| MC12 | 26.5 | 19.1[w] | 28* | 3.8* | 26[ns] | 49.25 | NON | Sedimentation; Low Flow | Altered Hydrology; Hydromodification |
| MC10 | 27.0 | 18.7[w] | 32* | 5.2* | 38 | 67.00 | NON | Sedimentation; Chlorides | Altered Hydrology; Hydromodification; Urban runoff |
| MC08 | 32.4 | [illegible] | 34* | 7.4 | G | 61.50 | PARTIAL | | |
| ***23-006 East Fork of Mill Creek (WWH Aquatic Life Use – Existing)*** | | | | | | | | | |
| MC26 | 2.7 | 7.7[H] | 20* | NA[a] | [illegible]* | 53.8/77 | NON | Sedimentation; Low Flow; Chlorides | Altered Hydrology; Hydromodification; Urban runoff |
| MC21 | 4.[illegible] | [illegible] | [illegible] | [illegible] | [illegible]* | [illegible] | NON | | |
| MC18 | 9.1 | 1.2[H] | 28* | NA | 34 | 54.00 | PARTIAL | | |
| MC15 | 9.1 | 1.0[H] | 42 | NA | 32 | 56.00 | FULL | | |
| MC14 | 9.1 | 0.8[H] | 34* | NA | 42 | 57.25 | PARTIAL | Organic Enrichment; Cond./Chlorides; Sedimentation | WWTP; Altered Hydrology; Hydromodification; |
| MC14 | 9.1 | 0.7[H] | 24* | NA | - | 63.25 | NON | | |
| MC17 | 9.5 | 0.4[H] | 26* | NA | 44 | 56.00 | PARTIAL | | |
| MC16 | 9.5 | 0.1[H] | 32* | NA | MG[ns] | 60.75 | PARTIAL | | |
| ***23-023 Beaver Creek (WWH Aquatic Life Use – Existing)*** | | | | | | | | | |
| MC41 | 0.8 | 3.2[H] | 18* | NA | P | 53.0/71 | NON | Sedimentation; Chlorides; Low Flow | Altered Hydrology; Urban runoff |
| MC23 | 4.4 | 1.0[H] | 36[ns] | NA | G | 54.50 | FULL | | |
| MC22 | 4.6 | 0.8[H] | 28* | NA | MG[ns] | 64.50 | PARTIAL | Sedimentation; Chlorides | Altered Hydrology; Urban runoff |

**Step 2: Assess aquatic life & recreational status at each site.**


Mill Creek Mainstem Fish Assemblage 1992 vs. 2011
INDEX OF BIOTIC INTEGRITY (IBI)
RIVER MILE
1992b IBI
2011b IBI
UMC WWTP
CSO #17
Industries
Lick Run CSO
Step 3: Assess changes over time.
(Wading, IBI = 40)
MWH Biocriteria
(IBI = 24)
Minimum IBI = 12
60
50
40
30
20
12
30
25
20
15
10
5
0


Mill Creek Macroinvertebrate Assemblage 2011
INVERTEBRATE COMMUNITY INDEX (ICI)
RIVER MILE
E. Fk. Mill Cr.
CSO #17
Lick Run Industries CSO #5
Macroinvertebrates have responded "better" than fish, which is not unusual.
ICI 1992
ICI 2011
MWH Biocriteria (ICI = 30)
MWH Biocriteria (ICI = 22)
60
50
40
30
20
10
0
20
15
10
5
0
-5

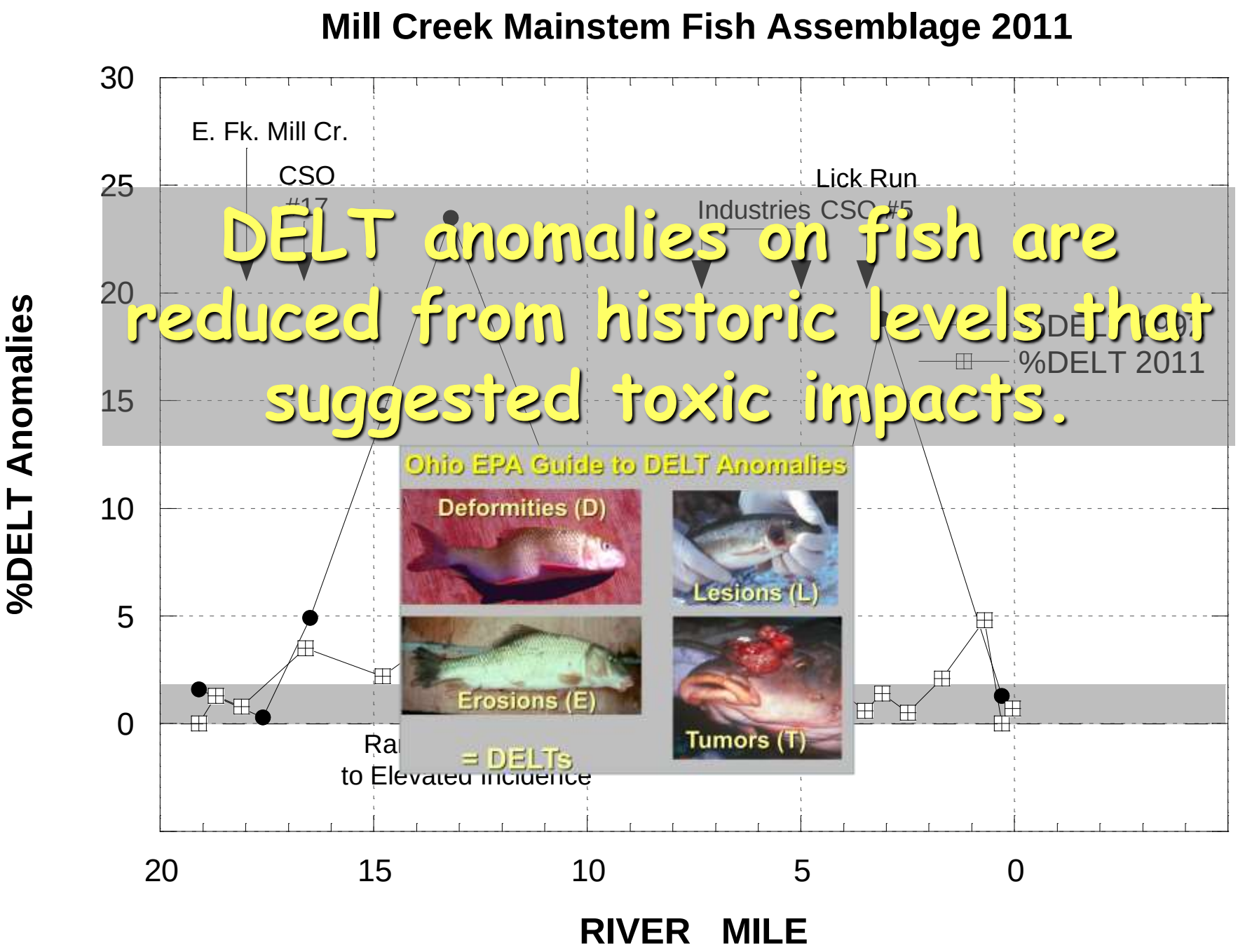

Mill Creek Mainstem Fish Assemblage 2011
%DELT Anomalies
30
25
20
15
10
5
0
E. Fk. Mill Cr.
CSO
#17
Lick Run
Industries CSO #5
%DELT 2011
DELT anomalies on fish are reduced from historic levels that suggested toxic impacts.
Ohio EPA Guide to DELT Anomalies
Deformities (D)
Lesions (L)
Erosions (E)
Tumors (T)
= DELTs
20
15
10
5
0
RIVER MILE

Table 10. Urban parameter sampling results in the Mill Creek watershed, summer 2011. Values above applicable refererence targets are highlighted in yellow.

| Site ID | River Mile | Eco-region | Aq Life Use | Year | Conductivity Median | Conductivity Target | Chloride Median | Chloride Target | Sulfate Median | Sulfate Target | TDS Median | TDS Target | TSS Median | TSS Target | T-Cu Median | T-Cu Target | T-Pb Median | T-Pb Target | T-Zn Median | T-Zn Target |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MC82** | 0.20 | 2 | WWH | | 498 | 600 | 47 | 35.0 | 24 | 118.7 | 220 | 468.0 | 6 | 25.0 | 6.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| *[23-041] - Unnamed Trib to Congress Run at RM 0.37* | | | | | | | | | | | | | | | | | | | | |
| **MC92** | 0.30 | 2 | WWH | | 1245 | 600 | 196 | 35.0 | 86 | 118.7 | | 468.0 | 18 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| *[23-042] - Unnamed Trib to Mill Creek at RM 10.8* | | | | | | | | | | | | | | | | | | | | |
| **MC89** | 1.00 | 2 | WWH | | 979 | 600 | 135 | 35.0 | 65 | 118.7 | 540 | 468.0 | 8 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| **MC88** | 0.40 | 2 | WWH | | 939 | 600 | 145 | 35.0 | 62 | 118.7 | 500 | 468.0 | 10 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| *[23-044] - Unnamed Trib to Mill Creek at RM 11.51* | | | | | | | | | | | | | | | | | | | | |
| **MC83** | 0.30 | 2 | WWH | | 472 | 600 | 49 | 35.0 | 26 | 118.7 | 240 | 468.0 | 41 | 25.0 | 5.7 | 5.0 | 4 | 3.0 | 17 | 15.0 |
| *01-05 - (West Fork Creek - Mill Creek)* | | | | | | | | | | | | | | | | | | | | |
| *[23-001] - Mill Creek* | | | | | | | | | | | | | | | | | | | | |
| **MC74** | 4.25 | 2 | MWH-C | | 962 | 610 | 112 | 31.0 | 110 | 120.0 | 545 | 522.5 | 16 | 41.2 | 6.7 | 5.0 | 3 | 3.0 | 20 | 15.0 |
| **MC73** | 3.50 | 2 | MWH-C | | 988 | 610 | 115 | 31.0 | 107 | 120.0 | 460 | 522.5 | 14 | 41.2 | 6.4 | 5.0 | 3 | 3.0 | 16 | 15.0 |
| **MC72** | 3.10 | 2 | MWH-C | | 9 | 6 | 1 | 6 | 1 | 120.0 | 535 | 522.5 | 2 | 41.2 | 5 | 5.0 | 3 | 3.0 | 9 | 15.0 |
| **MC05** | 2.50 | 2 | MWH-C | | 907 | 610 | 101 | 31.0 | 78 | 120.0 | 465 | 522.5 | 12 | 41.2 | 3.0 | 5.0 | 3 | 3.0 | 10 | 15.0 |
| **MC03** | 1.70 | 2 | MWH-C | | 87 | 610 | 91 | 31.0 | 72 | 120.0 | 450 | 522.5 | 21 | 41.2 | 8.1 | 5.0 | 3 | 3.0 | 21 | 15.0 |
| **MC71** | 0.70 | 2 | MWH-C | | 79 | 610 | 69 | 31.0 | 70 | 120.0 | 430 | 522.5 | 21 | 41.2 | 8.5 | 5.0 | 4 | 3.0 | 19 | 15.0 |
| **MC70** | 0.30 | 2 | MWH-C | | 760 | 610 | 77 | 31.0 | 88 | 120.0 | 410 | 522.5 | 20 | 41.2 | 3.0 | 5.0 | 3 | 3.0 | 10 | 15.0 |
| **MC69** | 0.05 | 2 | MWH-C | | 6 | 6 | 47 | 31.0 | 4 | 120.0 | 440 | 522.5 | 6 | 41.2 | 5 | 5.0 | 3 | 3.0 | 12 | 15.0 |
| *[23-002] - West Fork Creek* | | | | | | | | | | | | | | | | | | | | |
| **MC96** | 3.50 | 2 | PHW3 | | 717 | 600 | 65 | 35.0 | 97 | 118.7 | 590 | 468.0 | 8 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| **MC86** | 3.00 | 2 | WWH | | 801 | 600 | 78 | 35.0 | 72 | 118.7 | 480 | 468.0 | 25 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| **MC85** | 2.70 | 2 | WWH | | 773 | 600 | 79 | 35.0 | 84 | 118.7 | 445 | 468.0 | 21 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| **MC81** | 2.50 | 2 | WWH | | 816 | 600 | 75 | 35.0 | 108 | 118.7 | 460 | 468.0 | 12 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 4 | 15.0 |
| *[23-013] - Trib to West Fork Creek ar RM 2.41* | | | | | | | | | | | | | | | | | | | | |
| **MC90** | 0.10 | 2 | PHW2 | | 1132 | 600 | 129 | 35.0 | 164 | 118.7 | 610 | 468.0 | 4 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| *[23-027] - Trib to West Fork Creek ar RM 2.54* | | | | | | | | | | | | | | | | | | | | |
| **MC93** | 0.30 | 2 | PHW3 | | 724 | 600 | 58 | 35.0 | 78 | 118.7 | | 468.0 | 43 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |
| *[23-028] - Trib to West Fork Creet at RM 1.24* | | | | | | | | | | | | | | | | | | | | |
| **MC97** | 0.30 | 2 | PHW2 | | 715 | 600 | 77 | 35.0 | 93 | 118.7 | 350 | 468.0 | 246 | 25.0 | 3.0 | 5.0 | 3 | 3.0 | 3 | 15.0 |

Associated chemical, habitat, and source data is also analyzed using regional reference and biocriteria derived thresholds.

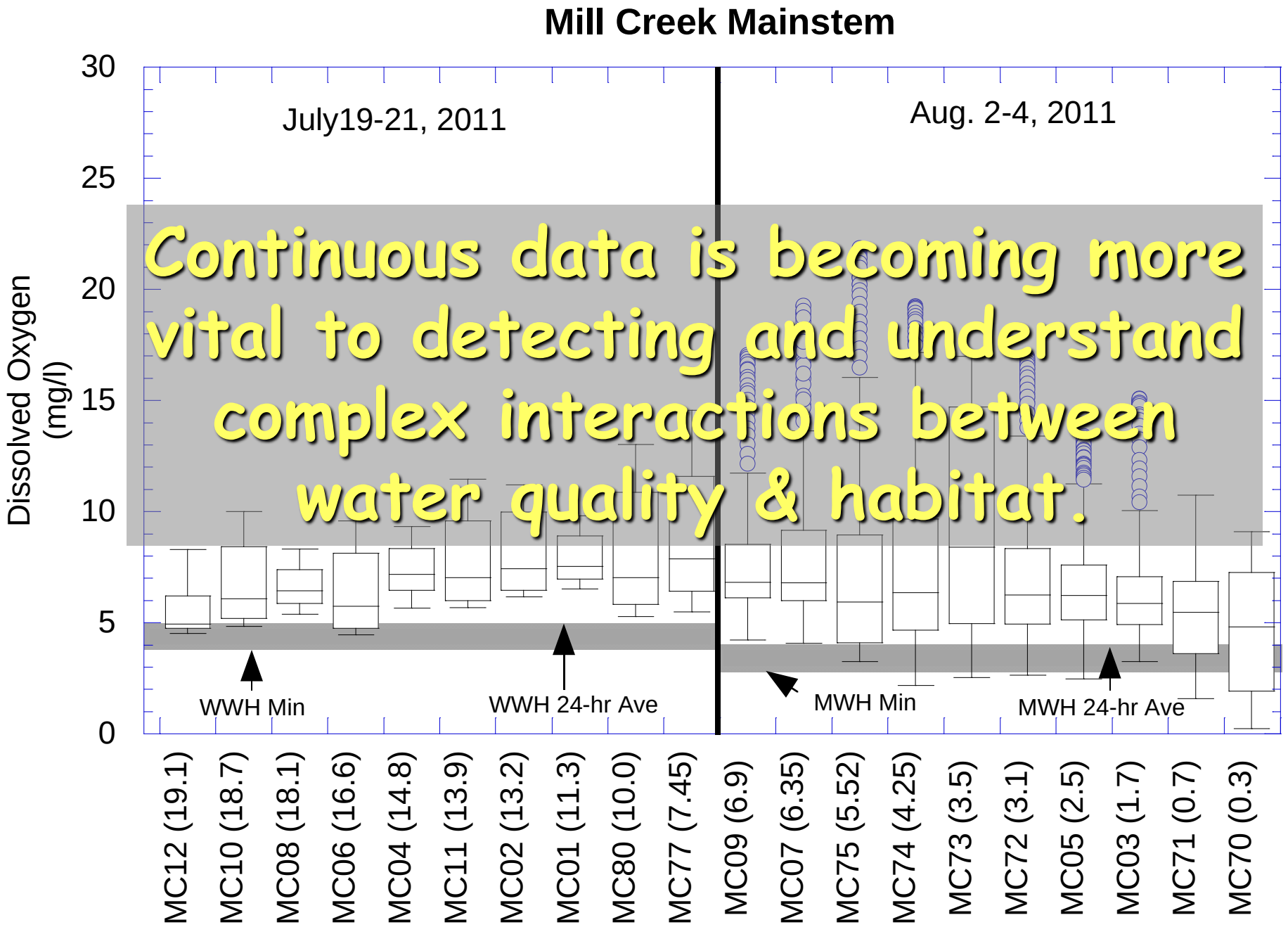

Mill Creek Mainstem
July19-21, 2011
Aug. 2-4, 2011
Dissolved Oxygen (mg/l)
30
25
20
15
10
5
0
Continuous data is becoming more vital to detecting and understand complex interactions between water quality & habitat.
WWH Min
WWH 24-hr Ave
MWH Min
MWH 24-hr Ave
MC12 (19.1)
MC10 (18.7)
MC08 (18.1)
MC06 (16.6)
MC04 (14.8)
MC11 (13.9)
MC02 (13.2)
MC01 (11.3)
MC80 (10.0)
MC77 (7.45)
MC09 (6.9)
MC07 (6.35)
MC75 (5.52)
MC74 (4.25)
MC73 (3.5)
MC72 (3.1)
MC05 (2.5)
MC03 (1.7)
MC71 (0.7)
MC70 (0.3)

Table 12. Sediment organic compounds above MacDonald (2000) Threshold Effect Concentrations (TEC) or Probable Effect Concentrations (PEC).

| Site ID | River Mile | Collection Date | Organics Tested | Above DL | Parameters Above MacDonald TEC and Below PEC | Parameters Above MacDonald PEC |
|---|---|---|---|---|---|---|
| **MC20** | 2.70 | 10/26/201 | 20 | **1** | *Fluoranthene (350.00)* | |
| **MC13** | 0.20 | 10/26/201 | 20 | **6** | *Benz(a)anthracene (535.00); Benzo(a)pyrene (713.00); Chrysene (690.00); Pyrene (1190.00)* | *Fluoranthene (1560.00); Phenanthrene (614.00)* |
| | | | | | ***01-04 - (Congress Run-Mill Creek)*** | |
| *[23-001] - Mill Creek* | | | | | | |
| **MC01** | 11.30 | 10/25/201 | 20 | **6** | *Benz(a)anthracene (520.00); Benzo(a)pyrene (691.00); Chrysene (675.00); Fluoranthene (1470.00); Pyrene (1250.00)* | *Phenanthrene (591.00)* |
| **MC80** | 10.00 | 10/17/201 | 20 | **6** | *Benz(a)anthracene (665.00); Chrysene (842.00)* | *Benzo(a)pyrene (781.00); Fluoranthene (2000.00); Phenanthrene (833.00); Pyrene (1610.00)* |
| **MC77** | 7.45 | 10/17/201 | 20 | **7** | *Benz(a)anthracene (666.00); Chrysene (828.00)* | *4,4'-DDT (5.10); Benzo(a)pyrene (774.00); Fluoranthene (1860.00); Phenanthrene (1020.00); Py ene (1990.00)* |
| **MC09** | 6.90 | [illegible] | 20 | [illegible] | *Bis(2-ethylhexyl)phthalate (1400.00); Chrysene (385.00); Fluoranthene (1060.00); Phenanthrene (450.00); Pyrene (838.00)* | |
| **MC07** | 6.35 | 10/17/20[illegible] | 20 | 7 | *Benz(a)anthracene (372.00); Bis(2-ethylhexyl)phthalate (1[illegible]00); Phenanthrene (516.00); Pyrene (1010.00)* | |
| **MC75** | 5.10 | 10/17/201 | 20 | **8** | *Bis(2-ethylhexyl)phthalate (558.00)* | *4,4'-DDT (47.30); Benz(a)anthracene (1160.00); Benzo(a)pyrene (1[illegible]00); Fluoranthene (3030.00); Phenanthrene (1[illegible]5.00); Pyrene (2940.00)* |
| | | | | | ***REF - (References Sites)*** | |
| *[10-100] - Eagle Creek* | | | | | | |
| **RF01** | 11.60 | 10/24/201 | 20 | **0** | | |
| *[10-400] - Whiteoak Creek* | | | | | | |
| **RF03** | 12.80 | 10/24/201 | 20 | **0** | | |
| **RF02** | 6.60 | 10/24/201 | 20 | **0** | | |
| *[10-420] - East Fork Whiteoak Creek* | | | | | | |
| **RF04** | 3.30 | 10/24/201 | 20 | **0** | | |
| *[10-430] - North Fork Whiteoak Creek* | | | | | | |
| **RF05** | 7.00 | 10/24/201 | 20 | **0** | | |

Look at more than water column chemistry – sediment data is perhaps more informative.

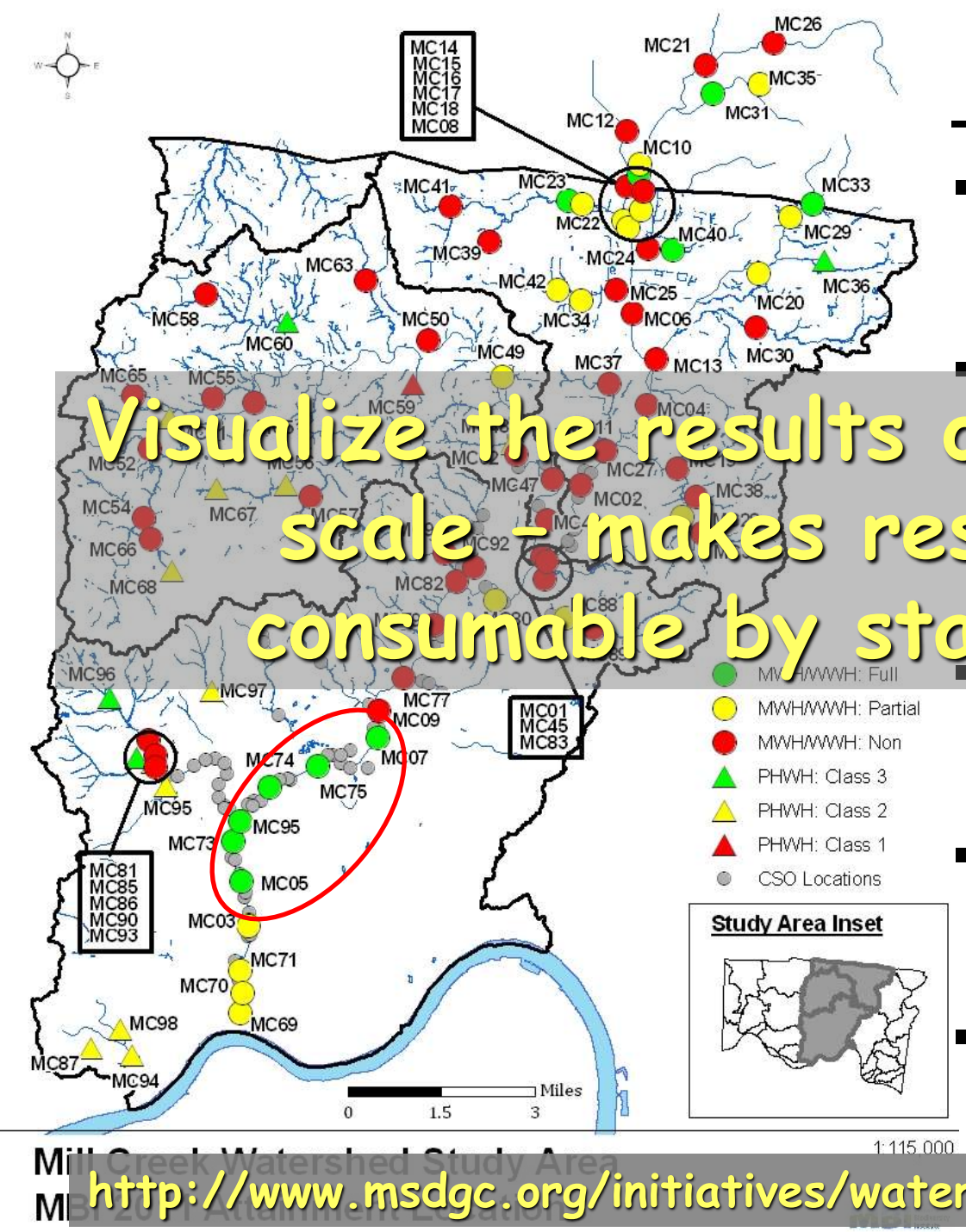
# Mill Creek Associated Causes (Aquatic Life)

| Cause | Mill Creek/E. Fk. Mainstem | W. Fork/Tributaries |
|---|---|---|
| Sedimentation | 17 | 40 |
| Nutrients | 13 | 20 |
| Chlorides | 11 | 10 |
| Habitat Alteration | 10 | 7 |
| Low D.O. | 4 | 3 |
| Ammonia | 4 | 1 |
| PAH Compounds | 3 | 5 |
| Low flow | 2 | 3 |
| Organic Enrichment | 1 | 1 |

Explain the observed impairments – undiagnosed biological impairments lead to "TMDL purgatory".

*N = 78 sites; excludes 16 PHWH sites*

# Mill Creek Results

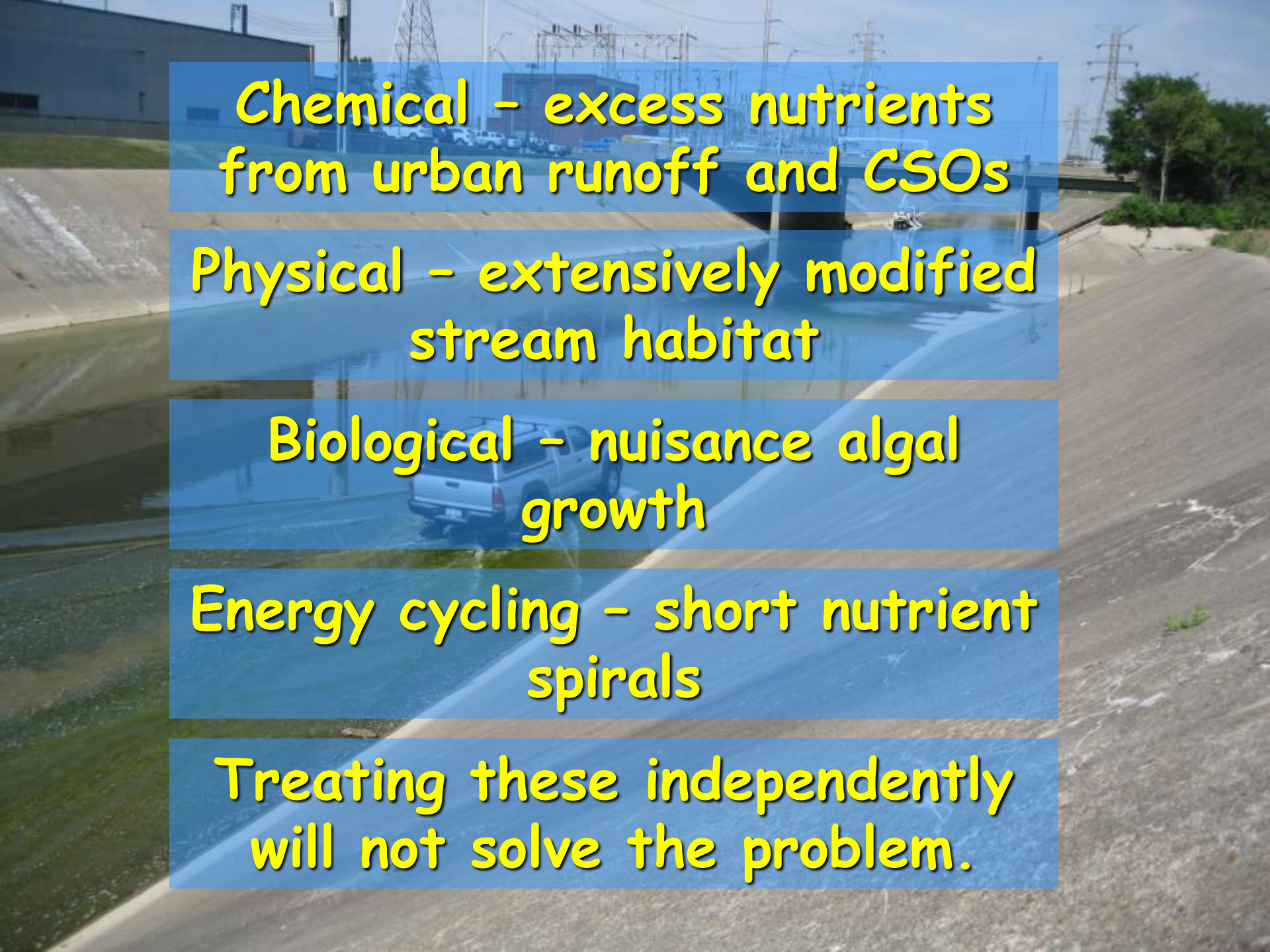


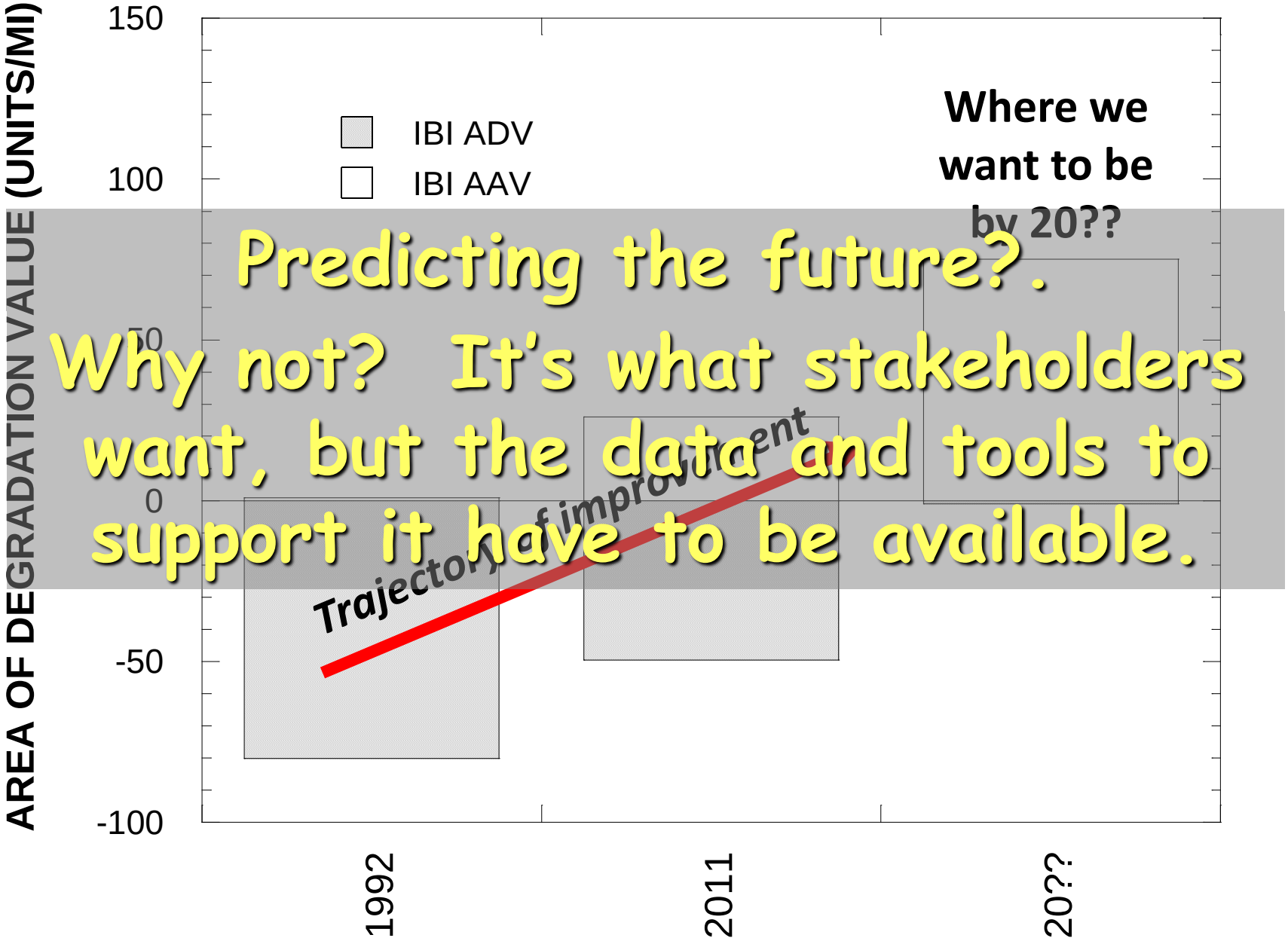

Mill Creek Watershed Study Area
MBI 2011 Attainment Location

**Visualize the results on a watershed scale – makes results more consumable by stakeholders.**

- Majority of sites failed to attain aquatic life & recreational uses
- A segment of Mill Creek attained [illegible] improvement from prior years of Ohio EPA results (1992-2000)
- 3 primary headwater sites attained class III indicating a high quality headwater stream
- We viewed results beyond "pass/fail" status – what is the trajectory of key indicators?
- Especially critical to know in watersheds with legacy impacts

http://www.msdgc.org/initiatives/water_quality/aboutwebmap.html


Chemical – excess nutrients from urban runoff and CSOs
Physical – extensively modified stream habitat
Biological – nuisance algal growth
Energy cycling – short nutrient spirals
Treating these independently will not solve the problem.

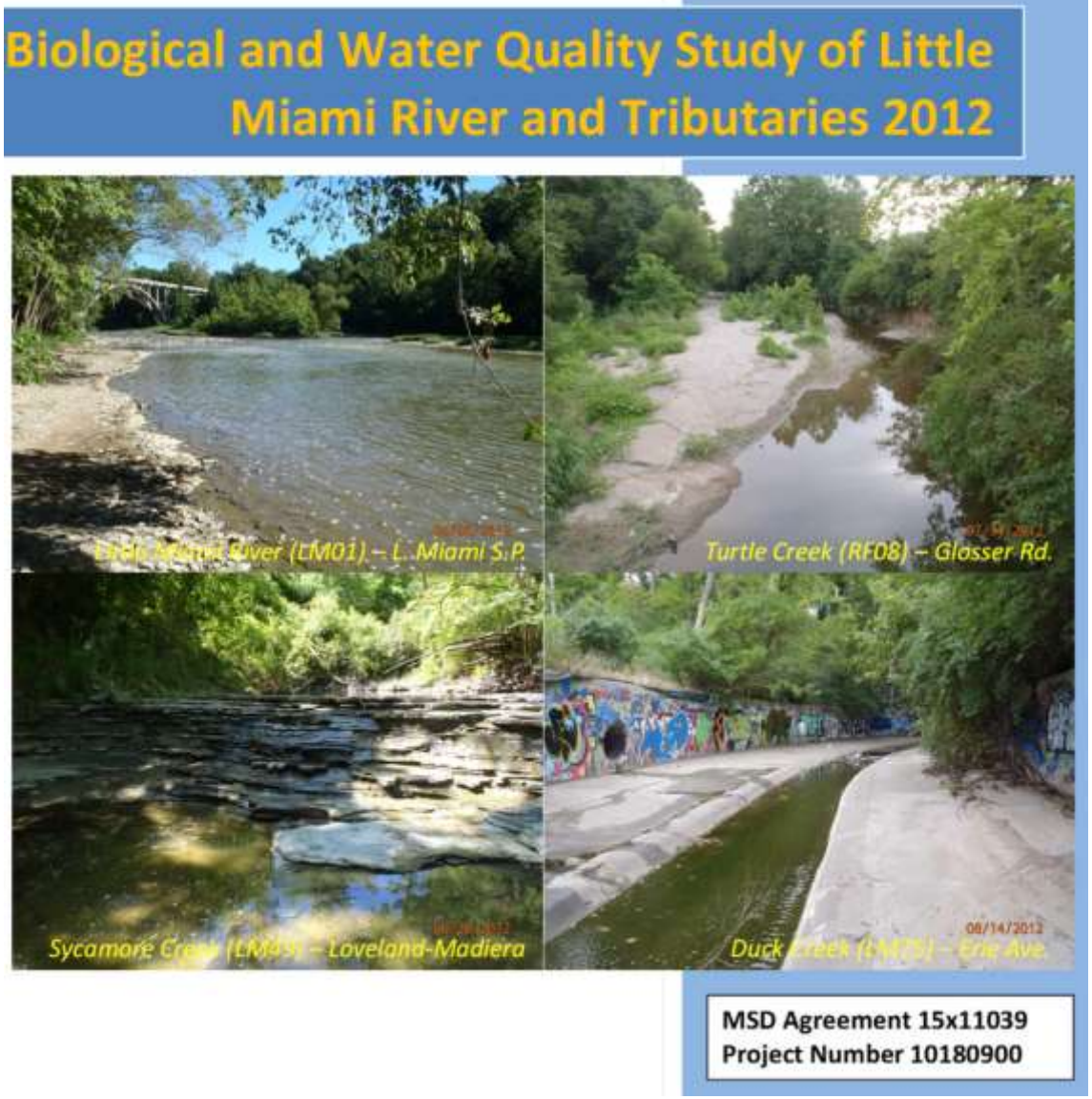



Predicting the future?.

Why not? It's what stakeholders want, but the data and tools to support it have to be available.

# Little Miami R. Biological & WQ Assessment 2012

- Followed overall bioassessment plan
- Fish, Macro-invertebrates, & Habitat
- Water quality – water & sediment chemistry
- Bacteria (E. coli)
- Mid-June to late October index period
- Assess aquatic life & recreational status
- Recommend any use changes
- Delineate associated causes & sources of impairments



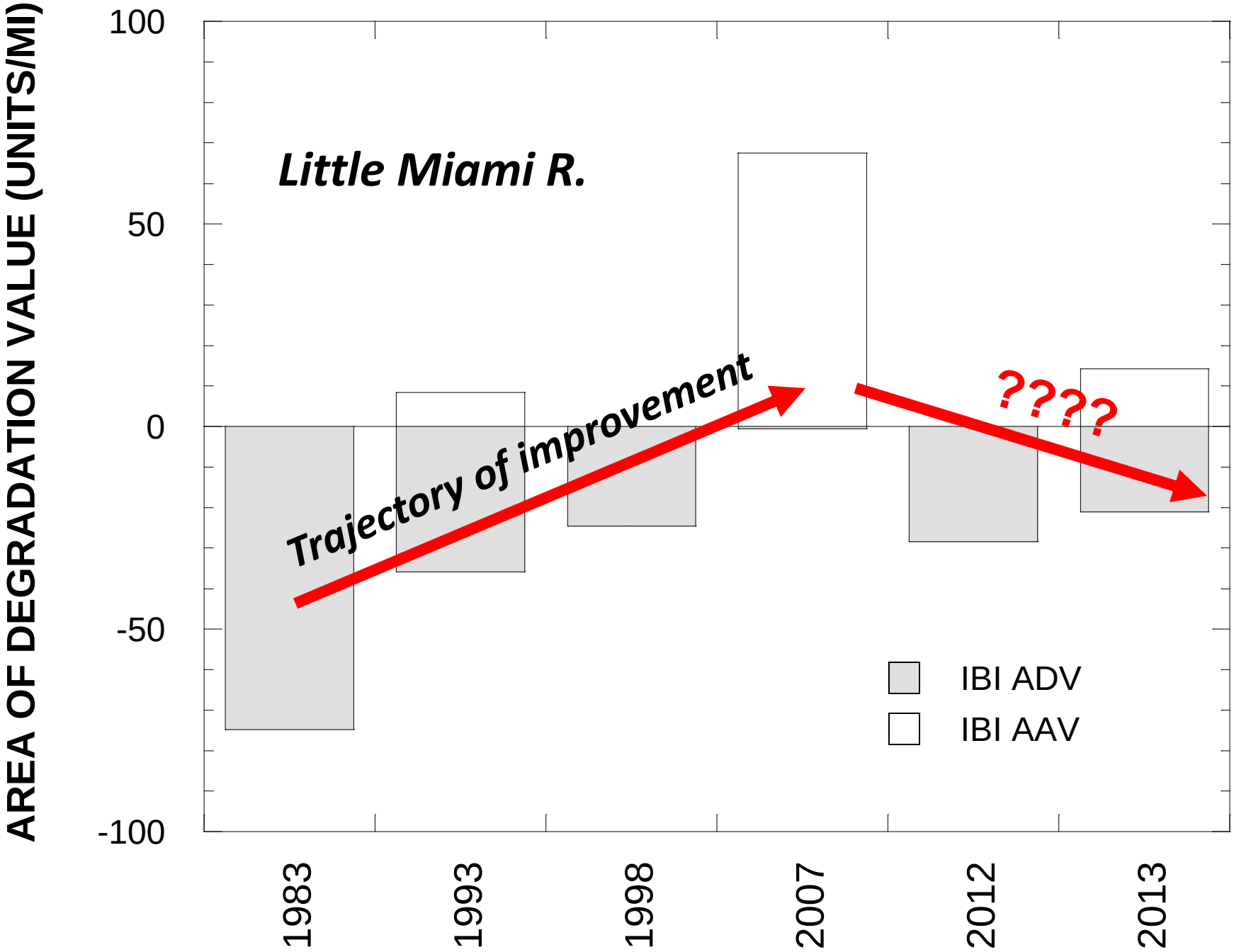

AREA OF DEGRADATION VALUE (UNITS/MI)
100
50
0
-50
-100
Little Miami R.
Trajectory of improvement
????
IBI ADV
IBI AAV
1983
1993
1998
2007
2012
2013

*Table 10. Phosphorus removal treatment and facility status at significant WWTP discharges to the Little Miami River mainstem.*

| WWTP Facilities | LMR River Mile | Phos. Removal Status | Phos. Removal Date | Avg. Design Flow (mgd) | Recent Expansion (last 10 yrs.) | Recent Expansion Date |
|---|---|---|---|---|---|---|
| **Upper LMR** | | | | | | |
| Xenia - Ford Rd | 77.03 | Biological | 1999 | 3.6 | No | 1999 |
| Beaver Creek (Green Co.) | 72.74 | Yes* | 2013 | 8.5 | Yes | 2006 |
| Eastern Regional (Montgomery Co.) | [illegible] | Chemical | 2005 | [illegible] | [illegible] | 1993 |
| Sugar Creek (Green Co.) | 64.43 | Biological | 2009 | [illegible] | [illegible] | 2009 |
| Xenia - Glady Run | 63.72 | Biological | 1999 | 4.0 | No | 1999 |
| Waynesville (minor) | [illegible] | Chemical | 2008 | 0.71 | No | 2002 |
| **Lower LMR** | | | | | | |
| Lebanon | 32.10 | No | -- | 6.0 | Yes | 2003 |
| Mason #2 (new in 2006) | 31.95 | Biological | 2006 | 13.0 | Yes | 2006 |
| Lower Little Miami (Warren Co.) | 28.1[illegible] | [illegible] | [illegible] | [illegible] | Yes | 2012 |
| O'Bannon Creek (Clermont Co.) | 24.00 | No | Poss. 2015 | 4.4 | No | 2001 |
| Polk Run (Hamilton Co.) | 21.8[illegible] | [illegible] | Poss. 20[illegible] | [illegible] | [illegible] | 2001 |
| Sycamore Creek (Hamilton Co.) | 19.22 | Biological | 2010 | [illegible] | [illegible] | 2010 |
| Wards Corner (minor) Clermont Co. | 16.10 | Chemical* | 2009 | 2.0 | New | 2009 |
| **East Fork LMR** | | | | | | |
| Middle East Fork (Clermont Co.) | 11.5 (12.6) | No | Poss. 2015 | 7.2 | No | ? |
| Lower East Fork (Clermont Co.) | 11.5 (4.9) | No | Poss. 2015 | 9.0 | Yes | 2006 |
| Milford | 11.5 (1.61) | No | -- | 1.2 | Yes | 2007 |

39.7 MGD

71.8 MGD

Is 100+ MGD of sewage treated to "typical" levels too much for EWH "maintenance"?

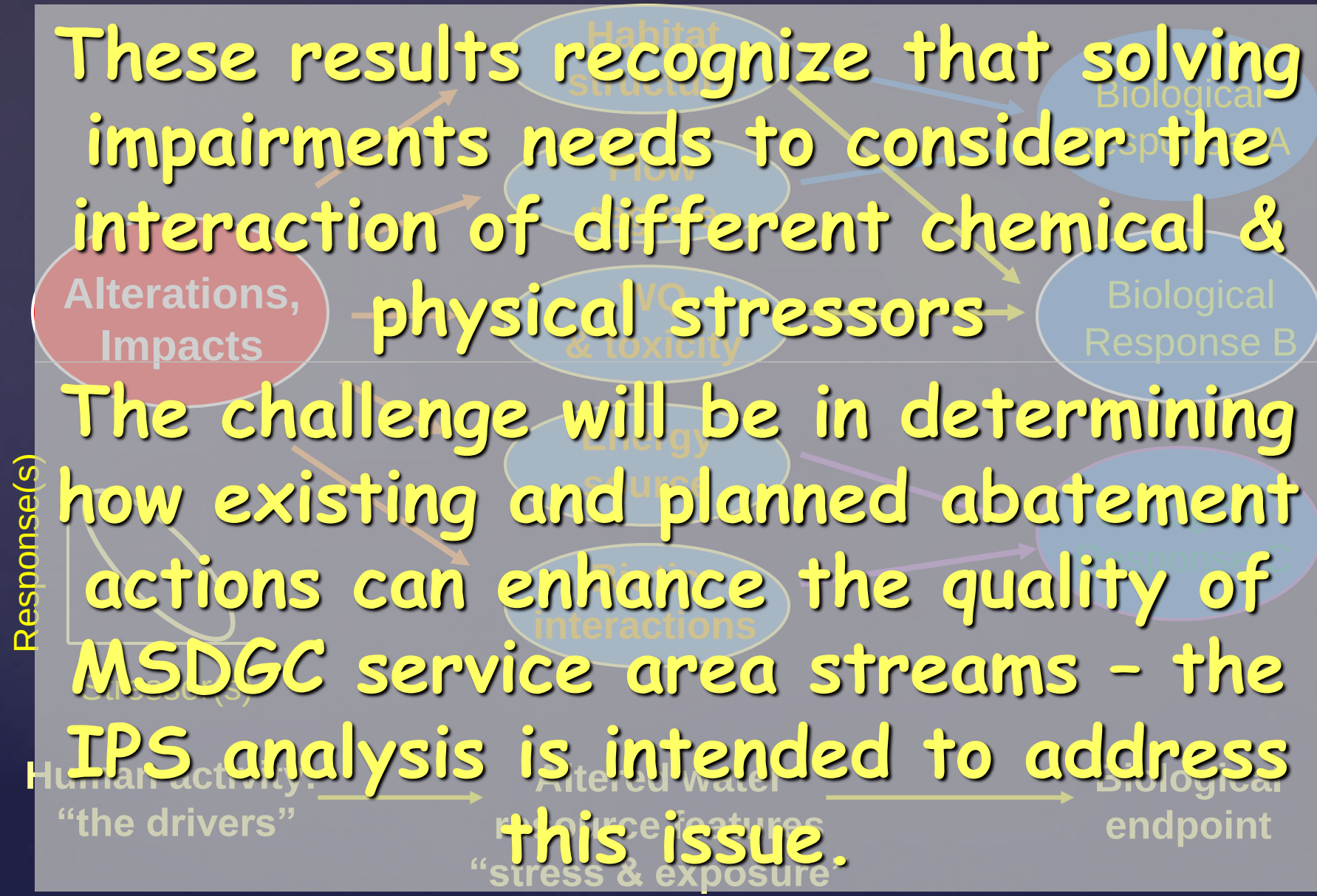
Or is it other sources acting in concert? The patterns in biological response and chemical signatures suggest that this may well be the case.

* Specific P removal processes were not determined. **The Wards Corner Regional WWTP was designed to meet final effluent limits for total P of 1.0 mg/l (30 day average) and 1.5 mg/l (7 day average) via biological treatment at 2.0 MGD. This plant is currently <5 % of design capacity and is not able to meet effluent limits for total P thru biological removal processes. Clermont Co. is currently using chemical addition and supplemental sludge handling to meet effluent limits for total P (Source: NPDES Permit Fact Sheet).

# Linking Biological Responses to Stressors

These results recognize that solving impairments needs to consider the interaction of different chemical & physical stressors

The challenge will be in determining how existing and planned abatement actions can enhance the quality of MSDGC service area streams – the IPS analysis is intended to address this issue.

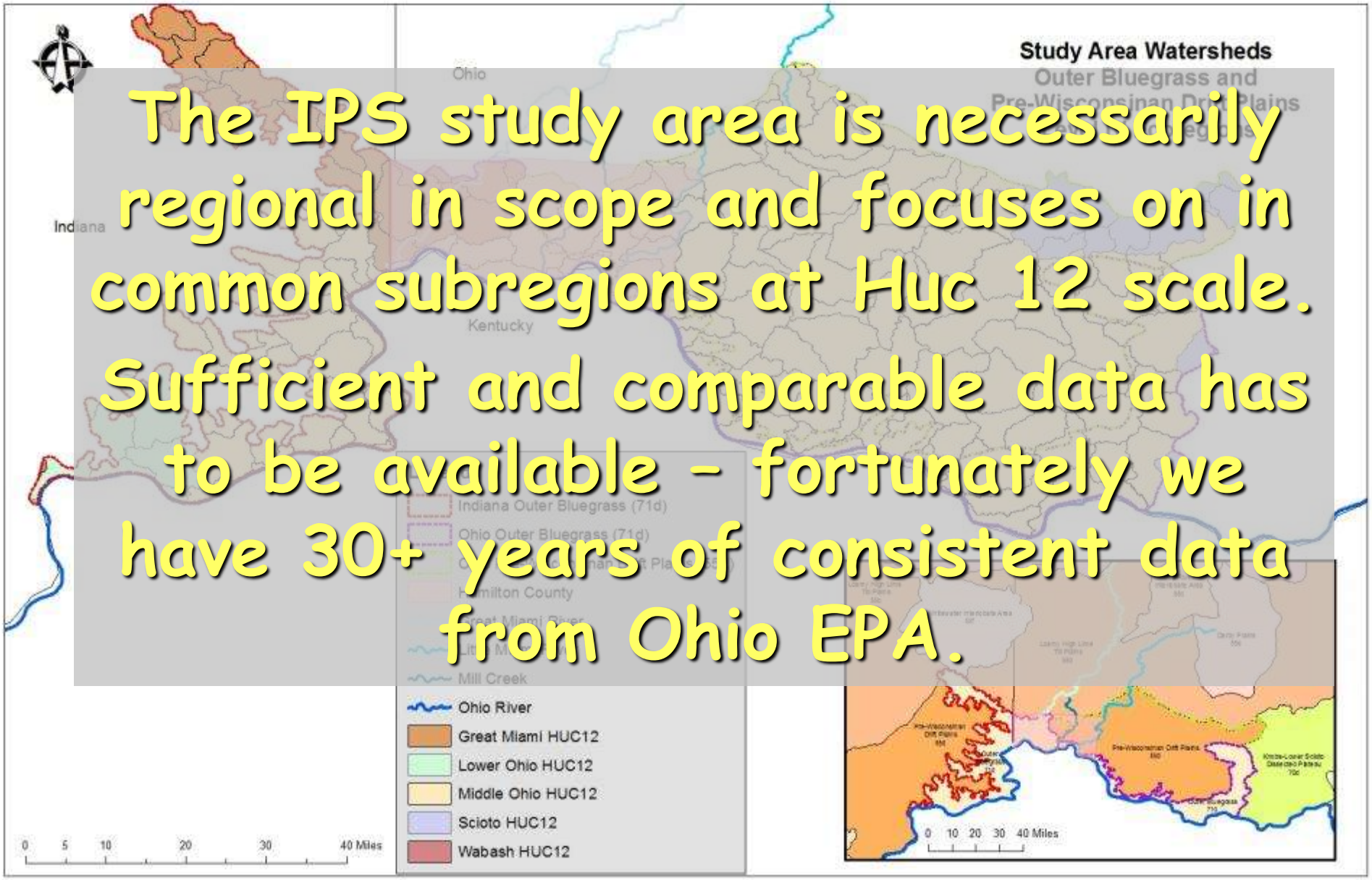


# Development of an Integrated Priority System for MSDGC Watersheds

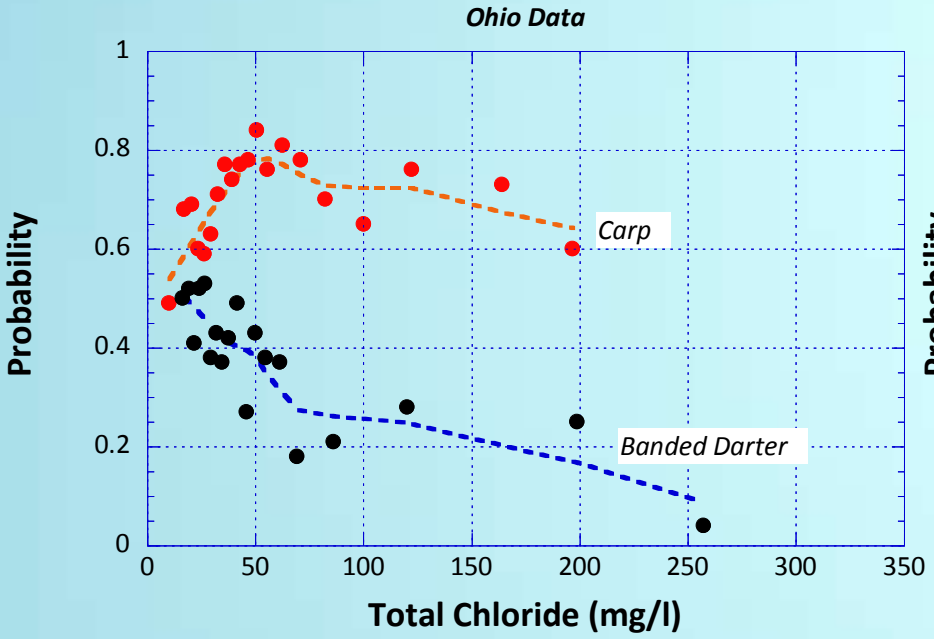
Presented by:
Midwest Biodiversity Institute
P.O. Box 21561
Columbus, OH 43221-0561

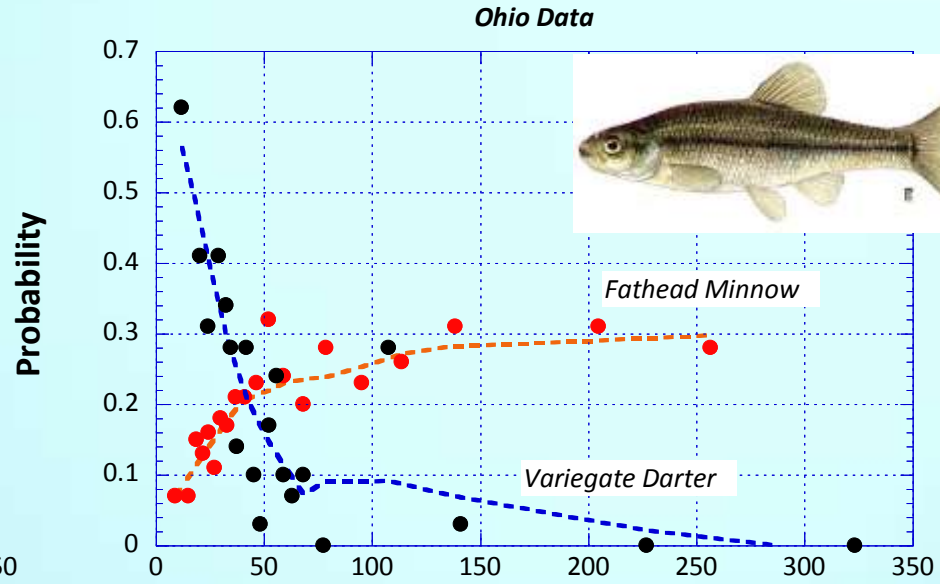
The IPS study area is necessarily regional in scope and focuses on in common subregions at Huc 12 scale.

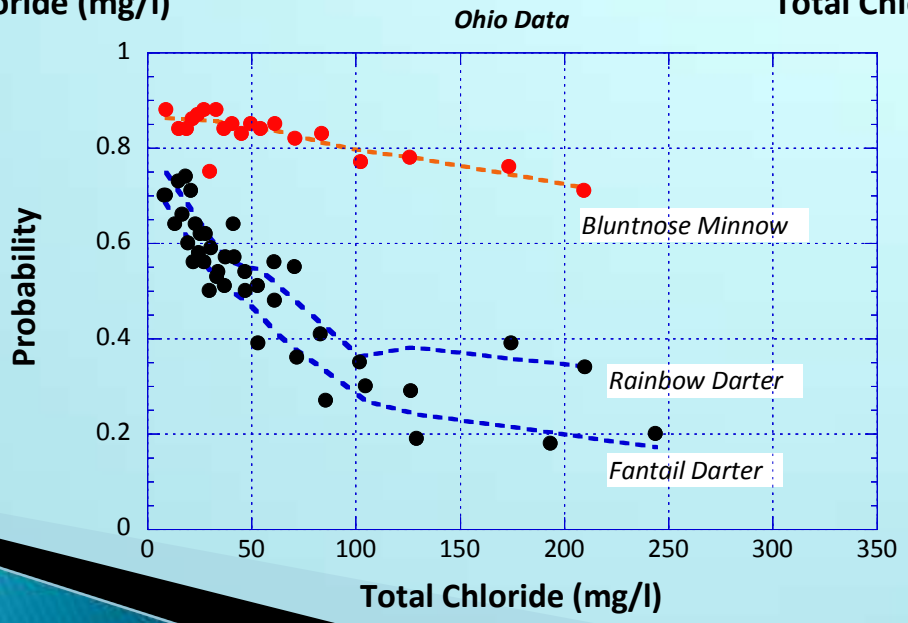
Sufficient and comparable data has to be available – fortunately we have 30+ years of consistent data from Ohio EPA.



# Ohio Species Specific Patterns



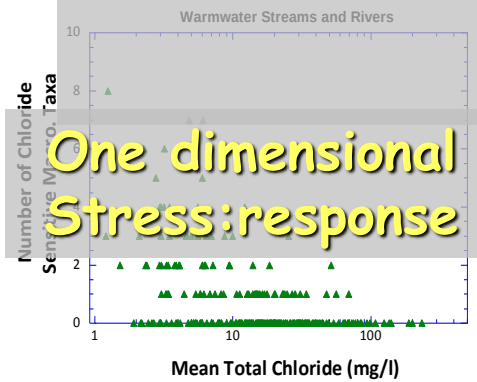





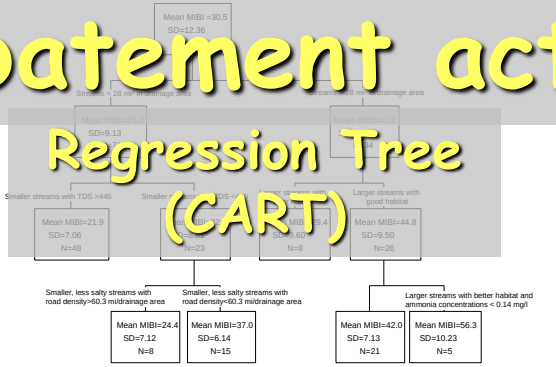
# The IPS technical approach employs a stepwise battery of analyses to determine the most relevant relationships that determine attainment and attainability.

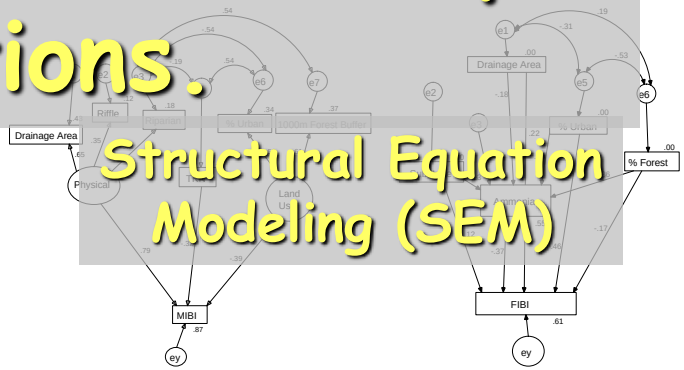
## The goal is to identify the most critical stressors related to attainment of WQS and develop abatement actions.

One dimensional Stress:response




Regression Tree (CART)




Structural Equation Modeling (SEM)