

US EPA ARCHIVE DOCUMENT



Analyzing NRCS Ag-BMP Effects on Water Quality A Process for Matching Practices to the Problems

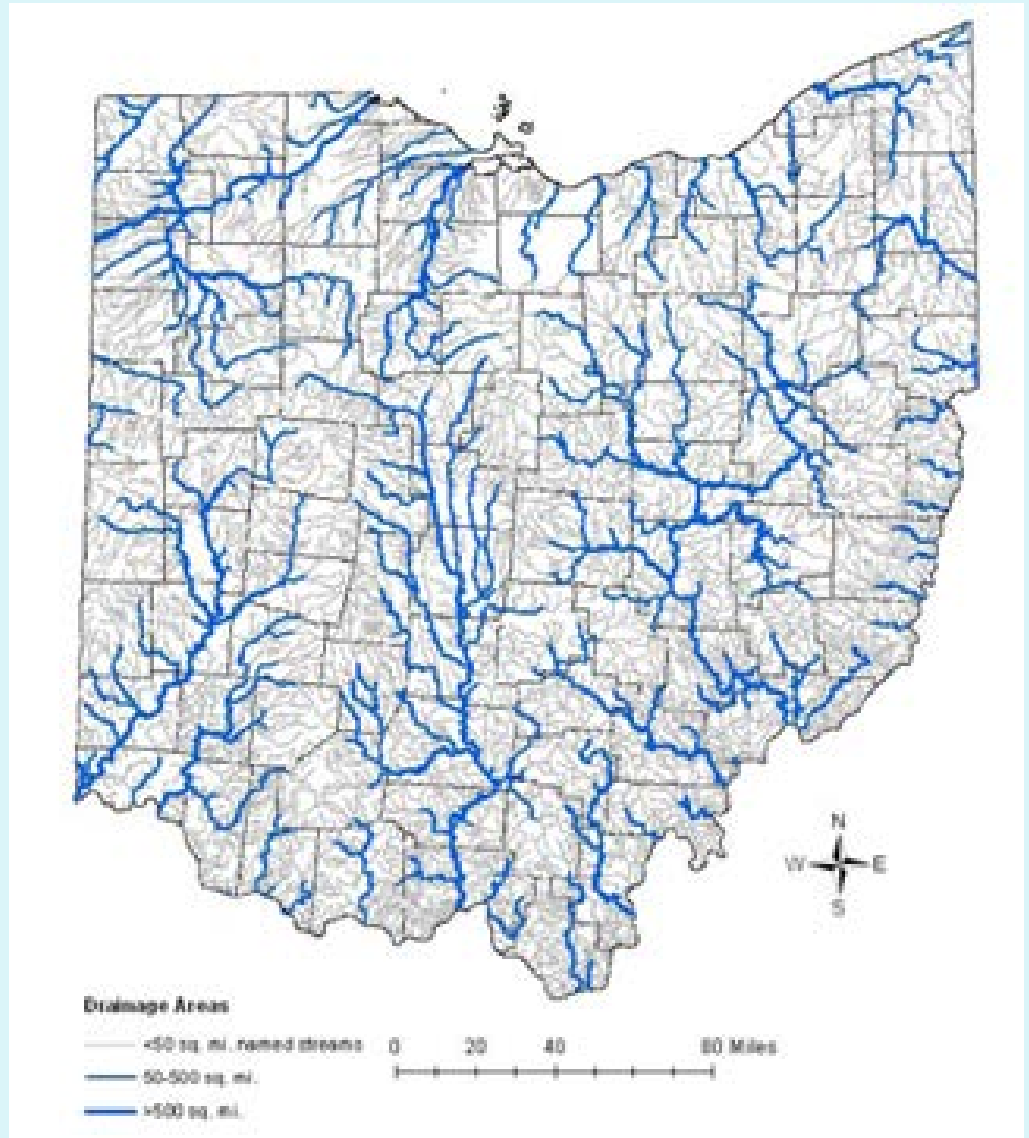
U.S. EPA Region 5-Agriculture
State Nutrient Reduction Strategies Web Series
July 24, 2013

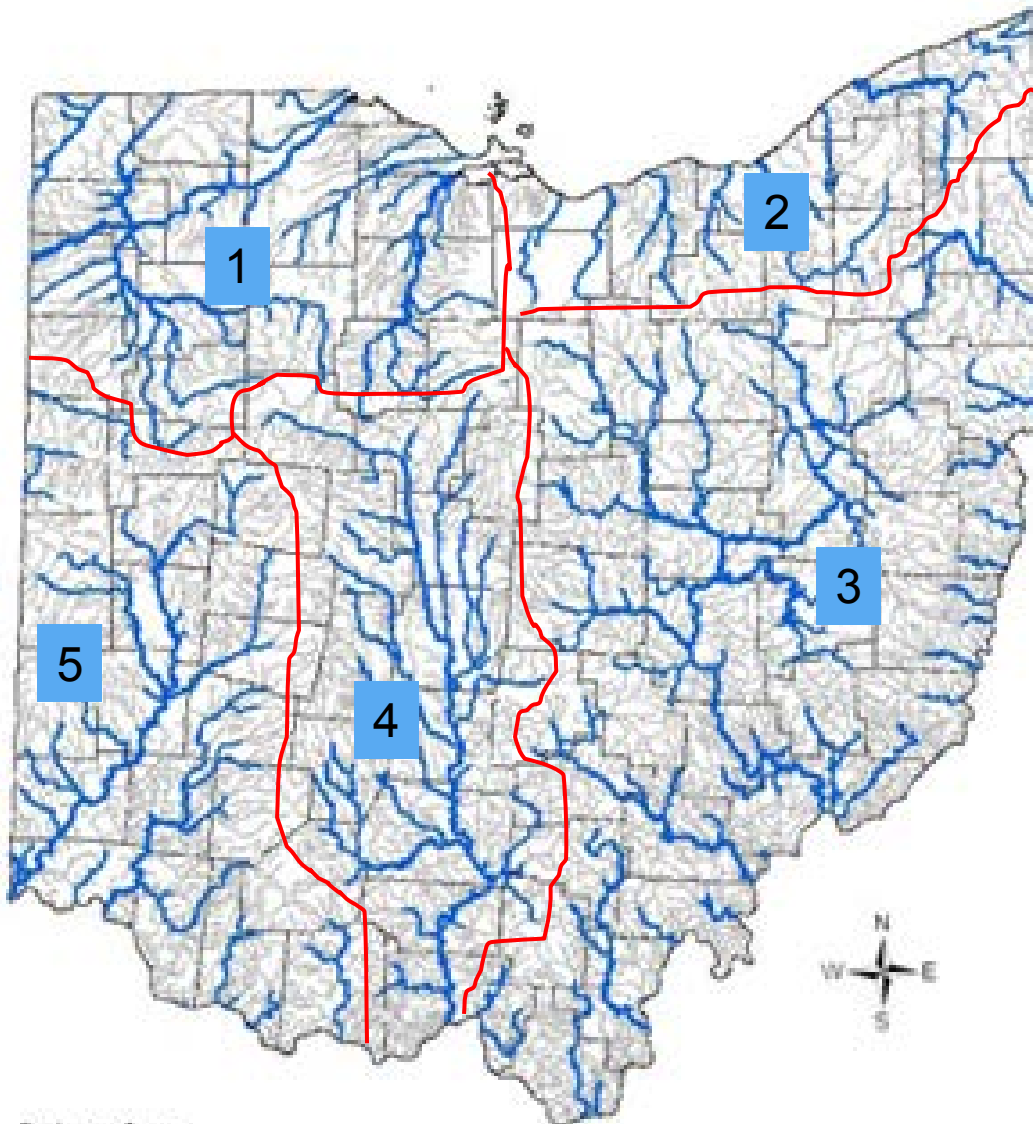
Rick Wilson, Nonpoint Source Pollution Program Specialist
Ohio EPA-Division of Surface Water



Ohio's Area= 41,260 mi²

| Land Use | % |
|-------------------------------------|--------|
| Agriculture (Row crop & Pasture) | 50.42% |
| Forest | 33.30% |
| Developed (Towns and Cities) | 14.26% |
| Open Water | 1.07% |
| Wetlands | 0.95% |





Drainage Areas



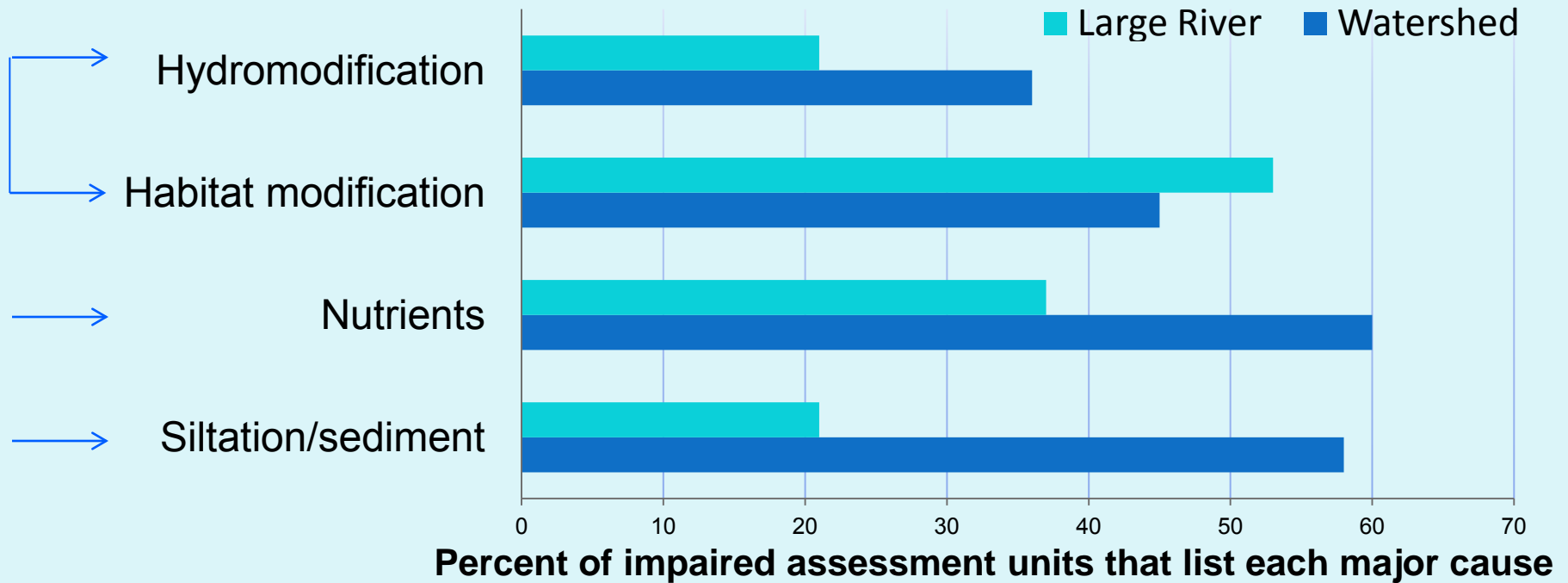
~% Land Use

| Area | Agriculture | Forest/Prairie | Developed | Open Water | Wetland |
|------|-------------|----------------|-----------|------------|---------|
| 1 | 78 | 7 | 12 | 1 | 2 |
| 2 | 34 | 33 | 28 | 1 | 4 |
| 3 | 34 | 52 | 12 | 1 | 1 |
| 4 | 59 | 28 | 12 | 1 | 0.2 |
| 5 | 52 | 32 | 15 | 1 | 0.2 |

Impairment in Ohio Streams

(Ohio EPA 2012 Integrated Report)

Aquatic Use Impairment:



Recreational Use Impairment:

→ Pathogens and Cyanobacteria Toxins

Drinking Water Use Impairment:

→ Pesticides and Nitrates



5 Common Water Quality Impairment CAUSES in agricultural watersheds:

Sediment, Nutrients, Habitat & Hydromodification, Pesticides, Pathogens





Field Office Technical Guide:

Section IV: Conservation Practices

Section V: Conservation Practice Physical Effects (CPPE)

3 Examples

| Resource Concerns | Description of Concern | National Quality Criteria |
|--|--|---|
| <p>Compaction (Soil Condition)</p> | <p>Compressed soil particles and aggregates caused by mechanical compaction adversely affect plant-soil-moisture relationships.</p> | <p>Mechanically compacted soils are renovated sufficiently to restore plant root growth and/or water movement.</p> |
| <p>Excessive Runoff, Flooding, or Ponding (Water Quantity)</p> | <p>The land becomes inundated restricting land use management</p> | <p>Excess water amounts and/or rates of flow are controlled consistent with desired present or intended land use goals and wetland policies</p> |
| <p>Excessive Nutrients and Organics in Surface Water (Water Quality)</p> | <p>Pollution from natural or human induced nutrients such as N, P, S (Including animal and other wastes) degrades surface water quality.</p> | <p>Nutrients and organics are stored, handled, disposed of, and managed such that surface water uses are not adversely affected.</p> |



A: Subjective Evaluation: USDA-NRCS Ohio
(-5 to +5)

← NRCS Conservation Practice Physical Effects (CPPE) →

NRCS
Practices
FOTG
(n=101)

NRCS
Resource
Concerns
(n=79)

Ohio EPA Causes of Water
Quality Impairment (n=5)

Ohio USDA-NRCS Conservation Practice Physical Effects (CPPE), 2007*

*Section 5 Ohio-NRCS FOTG

Resource Concerns (n=79)

Conservation Practices (n=101)

| 1 | Resource Concern | Excessive Nutrients and Organics in Surface Water | Excessive Suspended Sediment and Turbidity in Surface Water | Harmful Levels of Pathogens in Surface Water | Harmful Levels of Pesticides in Surface Water | Excessive Runoff, Flooding, or Ponding | Excessive Subsurface Water |
|----|----------------------------------|---|---|--|---|--|----------------------------|
| 3 | Conservation Crop Rotation (328) | 2 | 2 | 1 | 2 | 2 | 1 |
| 4 | Constructed Wetland (656) | 3 | 4 | 2 | 2 | 3 | 0 |
| 5 | Contour Buffer Strips (332) | 3 | 3 | 1 | 2 | 1 | -1 |
| 6 | Contour Farming (330) | 3 | 3 | 1 | 1 | 1 | -1 |
| 7 | Cover Crop (340) | 2 | 2 | 1 | 2 | 2 | 1 |
| 8 | Critical Area Planting (342) | 2 | 4 | 1 | 0 | 0 | 0 |
| 12 | Drainage Water Management (554) | 1 | 0 | 1 | 2 | -2 | 2 |
| 16 | Field Border (386) | 2 | 2 | 1 | 2 | 2 | -1 |
| 17 | Filter Strip (393) | 5 | 5 | 1 | 3 | 0 | 0 |

To Column CI

To Row 102

CPPE scores vary state to state

CPPE Scoring Comparison for the Resource Concern: “Nutrients & Organics in Surface Water”

| Example Practices | # | INDIANA | OHIO | NC |
|--|-------|---------|------|----|
| Conservation Cover | 327 | 5 | 2 | 3 |
| Critical Area Planting | 342 | 5 | 2 | 1 |
| Restoration and Management of Rare or Declining Habitats | 643 | 5 | 0 | 1 |
| Tree/Shrub Establishment | 612 | 5 | 2 | 3 |
| Upland Wildlife Habitat Management | 645 | 5 | 2 | 1 |
| Filter Strip | 393 | 4 | 5 | 4 |
| Wetlands (Created, Enhanced, Restored) | 657-9 | 4 | 3 | 3 |



A: Subjective Evaluation: USDA-NRCS Ohio
(-5 to +5)

← NRCS Conservation Practice Physical Effects →
(CPPE)

NRCS
Practices
FOTG
(n=101)

NRCS
Resource
Concerns-
Water
Quality
(n=27)

How does resource concern relate
to WQ Problems →

B: Subjective Evaluation:
Ohio EPA
Division of Surface Water
(-1.0 to +1.0)

Ohio EPA Causes of Water
Quality Impairment (n=5)



Twenty-seven (27) NRCS **Resource Concerns** were identified that, if addressed with a conservation practice, could improve or impair water quality:

| | |
|---|--|
| Compaction | Contaminants-Animal Waste and Other Organics - N |
| Excessive Nutrients and Organics in Surface Water | Contaminants-Animal Waste and Other Organics - P |
| Excessive Suspended Sediment and Turbidity in Surface Water | Contaminants-Animal Waste and Other Organics - K |
| Harmful Levels of Pathogens in Surface Water | Contaminants-Commercial Fertilizer - N |
| Harmful Levels of Pesticides in Surface Water | Contaminants-Commercial Fertilizer - P |
| Excessive Runoff, Flooding, or Ponding | Contaminants-Commercial Fertilizer - K |
| Classic Gully Erosion | Rangeland Site Stability |
| Ephemeral Gully Erosion | Wind |
| Sheet and Rill Erosion | Harmful Temperatures of Surface Water |
| Streambank Erosion | Excessive Subsurface Water |
| Contaminants - Residual Pesticides | Inadequate Outlets |
| Damage from Sediment Deposition | Insufficient Flows in Water Courses |
| Organic Matter Depletion | Reduced Capacity of Conveyances by Sediment Deposition |
| | Reduced Storage of Water Bodies by Sediment Accumulation |



| EXAMPLES | Cause of Impairment (Weight: -1.0 to 1.0) | | | | |
|--|--|-----------|------|------------|-----------|
| Resource Concern ↓ | Sediment | Nutrients | H&H | Pesticides | Pathogens |
| Excess Sediment and Turbidity in Surface Water | 1 | 0.6 | 0.7 | 0.3 | 0.4 |
| Organic Matter Depletion | 0.3 | 0.6 | 0.5 | 0.5 | 0.5 |
| Excessive Nutrient and Organics in Surface Water | 0.0 | 1.0 | 0.2 | 0.0 | 0.0 |
| Excessive Subsurface Water | 0.5 | -0.1 | -0.3 | -0.1 | -0.1 |

A: Subjective Evaluation: USDA-NRCS Ohio
 (-5 to +5)

← **NRCS Conservation Practice Physical Effects (CPPE)** →



**Report Output: Which practices address
 ← the Causes of WQ problems? →**

**How does resource concern relate
 ← to WQ Problems →**

**B: Subjective Evaluation:
 Ohio EPA
 Division of Surface Water
 (-1.0 to +1.0)**

**Ohio EPA Causes of Water
 Quality Impairment (n=5)**

NRCS
 Practices
 FOTG
 (n=101)

NRCS
 Resource
 Concerns-
 Water
 Quality
 (n=27)

Ohio EPA-DSW
 Calculated Output:
 WQ Effectiveness (cause) =

$$\left(\sum_{i=1}^{27} A * B \right) * f_{norm}$$

$$f_x = (D10 * D\$4 + E10 * E\$4 + F10 * F\$4 + G10 * G\$4 + H10 * H\$4 + I10 * I\$4 + J10 * J\$4 + K10 * K\$4 + L10 * L\$4 + M10 * M\$4 + N10 * N\$4 + O10 * O\$4 + P10 * P\$4 + Q10 * Q\$4 + R10 * R\$4 + S10 * S\$4 + T10 * T\$4 + U10 * U\$4 + V10 * V\$4 + W10 * W\$4 + X10 * X\$4 + Y10 * Y\$4 + Z10 * Z\$4 + AA10 * AA\$4 + AB10 * AB\$4 + AC10 * AC\$4 + AD10 * AD\$4) * \$AG\$4$$

| | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL |
|----|-------------------------------------|--|--|--------------|---------|-------------------|----------|----------|-------------------------|----|---------------------------------|
| 1 | Insufficient Flows in Water Courses | Reduced Capacity of Conveyances by Sediment Deposition | Reduced Storage of Water Bodies by Sediment Accumulation | Total Weight | | Normalized Weight | | | | | |
| 2 | 0 | 1 | 1 | 9.7 | | 0.5155 | | | | | Sediment |
| 3 | 0.5 | 0.3 | 0.3 | 9.5 | | 0.5263 | | | | | Nutrient |
| 4 | 0.8 | 0.7 | 0.7 | 7.4 | | 0.6757 | | | | | Habitat-Hydromod |
| 5 | 0.1 | 0 | 0 | 3.4 | | 1.4706 | | | | | Pesticides |
| 6 | 0.1 | 0.3 | 0.3 | 4.5 | | 1.1111 | | | | | Pathogens |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | Insufficient Flows in Water Courses | Reduced Capacity of Conveyances by Sediment Deposition | Reduced Storage of Water Bodies by Sediment Accumulation | SED BMP | NUT BMP | H&H BMP | PEST BMP | PATH BMP | Conservation Practice # | | Resource Concern |
| 10 | 0 | 5 | 4 | 18.6 | 10.6 | 17.2 | 0.1 | 2.7 | 342 | 1 | Critical Area Planting (342) |
| 11 | 4 | 5 | 5 | 12.8 | 11.7 | 15.7 | 15.4 | 5.7 | 391 | 2 | Riparian Forest Buffer (391) |
| 12 | 4 | 4 | 5 | 12.7 | 11.4 | 14.9 | 12.1 | 6.0 | 390 | 3 | Riparian Herbaceous Cover (390) |
| 13 | -1 | 5 | 5 | 11.8 | 12.3 | 12.1 | 14.3 | 4.1 | 393 | 4 | Filter Strip (393) |



Nutrient Practice Ranking Pts.

- | | |
|-------------------------------------|------|
| 1) Pasture and Hay Planting (512) | 14.6 |
| 2) Conservation Crop Rotation (328) | 13.9 |
| 3) Filter Strips/Areas (393) | 12.3 |
| 4) Riparian Forest Buffer (391) | 11.7 |
| 5) Riparian Herbaceous Cover (390) | 11.4 |





Sediment Practice Ranking Pts.

- | | |
|------------------------------------|------|
| 1) Critical Area Planting (342) | 18.6 |
| 4) Tree/Shrub Establishment (543) | 13.4 |
| 5) Riparian Forest Buffer (391) | 12.8 |
| 6) Riparian Herbaceous Cover (390) | 12.7 |
| 7) Filter Strips/Areas (393) | 11.8 |





Habitat & Hydro Practice Ranking Pts.

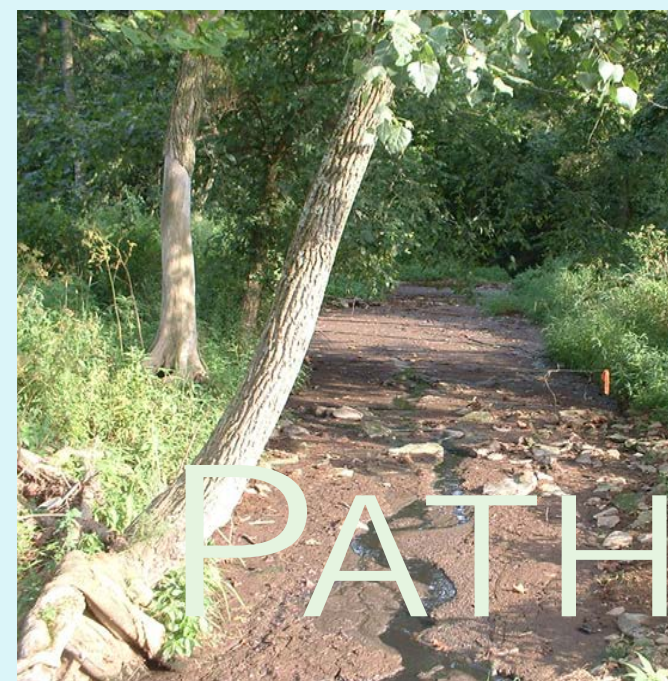
- | | |
|------------------------------------|------|
| 1) Critical Area Planting (342) | 17.2 |
| 2) Riparian Forest Buffer (391) | 15.7 |
| 3) Riparian Herbaceous Cover (390) | 14.9 |
| 4) Tree/Shrub Establishment (612) | 13.2 |
| 5) Filter Strips/Areas (393) | 12.1 |





Pathogens Practice Ranking Pts.

- | | |
|-------------------------------------|-----|
| 1) Waste Treatment Lagoon (359) | 7.8 |
| 2) Pasture and Hay Planting (512) | 6.4 |
| 3) Riparian Herbaceous Cover (390) | 6.0 |
| 4) Use Exclusion (472) | 5.9 |
| 5) Conservation Crop Rotation (328) | 5.8 |



PATHOGENS

05/23/2007



Pesticide Practice Ranking

Pts.

- | | |
|-------------------------------------|------|
| 1) Tree/Shrub Establishment (612) | 15.7 |
| 2) Riparian Forest Buffer (391) | 15.4 |
| 3) Conservation Cover (327) | 14.4 |
| 4) Filter Strip (393) | 14.3 |
| 5) Conservation Crop Rotation (328) | 13.4 |



PESTICIDES

SEDIMENT + NUTRIENTS + H&H

| <u>Top Ranked Practices</u> | <u>Pts.</u> |
|-------------------------------------|-------------|
| 1) Critical Area Planting (342) | 46.4 |
| 2) Riparian Forest Buffer (391) | 40.1 |
| 3) Riparian Herbaceous Cover (390) | 39.0 |
| 4) Filter Strips/Areas (393) | 36.2 |
| 5) Tree/Shrub Establishment (543) | 35.2 |
| 6) Pasture and Hay Planting (512) | 35.1 |
| 7) Conservation Crop Rotation (328) | 34.2 |
| 8) Prescribed Grazing (528) | 32.9 |

Applied Example: Lake Erie Nutrient Reduction- Loss Creek Watershed (#NUTRI11-GLRI-01)

Includes: reimbursing farmers for reducing nutrient losses (lower P-Index score); and Cost Share incentives for practice installations.



Ohio EPA Sandusky River TMDL Loss Creek watershed facts:

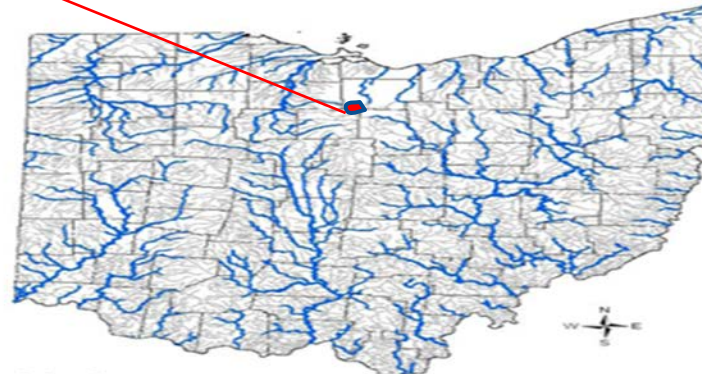
Hydrologic Unit Code (HUC): 041000110402

Watershed size: ~24.3 square miles or 15,520 acres

Causes of Impairment: flow alteration, nutrients, organic enrichment / dissolved oxygen, siltation

Land Use Statistics:

| Developed | Forest | Grass/Pasture | Row Crops | Other |
|-----------|--------|---------------|-----------|-------|
| 9.0% | 17.8% | 6.6% | 66.3% | 0.3% |



unit codes for VAUs).





Loss Creek Watershed Project Example

| 13 Practices Eligible in Loss Creek Project | Eff. Rank (nutrients) | Implemented or Installed to Date |
|--|--------------------------|-------------------------------------|
| Pasture & Hay Planting (convert from crop land) | 1 | 0 |
| Conservation Crop Rotation | 2 | 0 |
| Filter Area/Recharge Area (CREP CP1&2, FOTG 393) | 3 | 0 |
| Riparian Forest Buffer | 4 | 0 |
| Update & Actively Implement NMP | 8 | 11 (~560 acres) |
| New Filter Strip-CREP-CP 21, FOTG 393 v. 327) | 3, 10 | 0 |
| Cover Crop | 11 | 10 (~450 acres) |
| Residue and Tillage Management | 19, 26 | 3 (~130 acres) |
| Grassed Waterway (new) | 22 | 1 (0.3 acre) |
| Band / Immediately Incorporate P-Fertilizer (4R) | 26, 8 | 0 |
| Waste Storage Facility (Cost share only) | 28 | 1 (Summer 2013) |
| Wetlands | 18, 32 | 0 |
| Install & Manage Drainage Water Control Structure | 58, 44, 70, 86 | 8 DWM (~310 acres) |
| Tile inlet control (Blind Inlets) / Repair tile blowouts | 70, 86 | 0 |

Powell Creek Nutrient Reduction Project

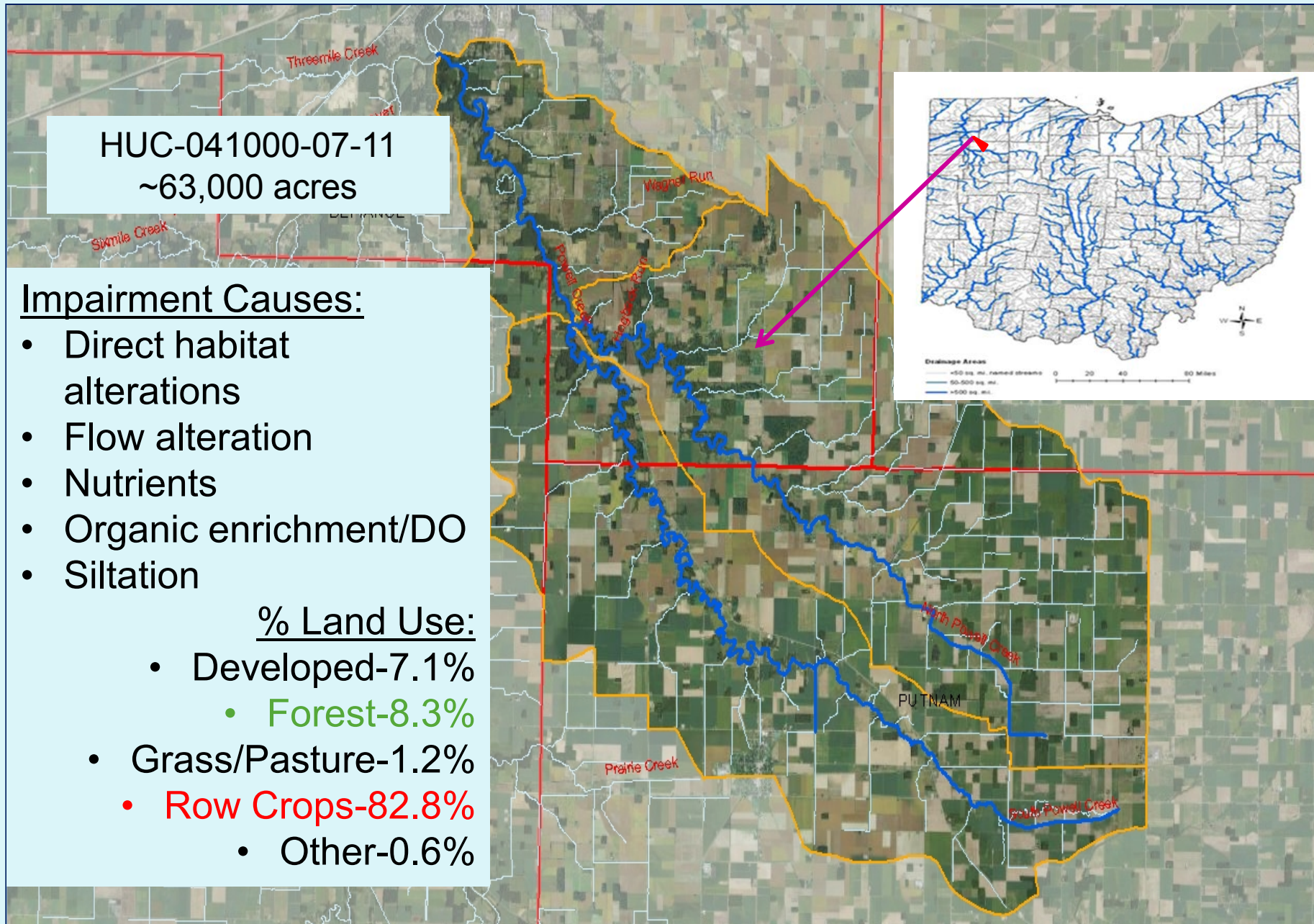
HUC-041000-07-11
~63,000 acres

Impairment Causes:

- Direct habitat alterations
- Flow alteration
- Nutrients
- Organic enrichment/DO
- Siltation

% Land Use:

- Developed-7.1%
- Forest-8.3%
- Grass/Pasture-1.2%
- Row Crops-82.8%
- Other-0.6%





Another Example of Practice Rankings and Agricultural Projects

Powell Creek Nutrient Reduction Project

| Project Deliverables | Applicable NRCS Practice(s) | Effectiveness Rank (Nutrients) |
|--|---|--------------------------------|
| Cover Crops | Cover Crop (340) | 11 |
| Drainage Wetlands | Constructed, Restored, Enhanced Wetlands (656, 657, 659) | 18, 34, 35 |
| Erosion and Sediment Control | Sediment Basin (350), Water & Sediment Control Basin (638), Grade Stabilization (410) | 20, 25, 61 |
| NMPs & Whole Farm Conservation Planning | Nutrient Management (590), Waste Utilization (633), Critical Area Planting (342) | 8, 9, 14 |
| Grassed Waterways | Grassed Waterway (412) | 22 |
| Vegetated Buffer Areas and Strips (*with focus on treating runoff versus Conservation Cover) | Filter Strip (393)*, Riparian Forest Buffer (391), <i>Saturated Buffer Demo?</i> | 3, 4, 5 |
| Drainage Water Management | Drainage Water Management (554) | 44 |
| Tile Control Structures | Structure for Water Control (587) | 58 |

Summary Items

- Improving Water Quality associated with Agriculture and Agricultural land use is a priority nationally.
- Not all NRCS conservation practices focus on improving water quality
- Need to match Water Quality problems with appropriate agricultural BMPs
- This approach is one way to do it



Ohio EPA §319 Grants Program



**Our
mission is
clear...**

Contact: Rick Wilson
rick.wilson@epa.state.oh.us
Phone: 614-644-2032

**We help
people do
good
things
for Ohio's
streams**