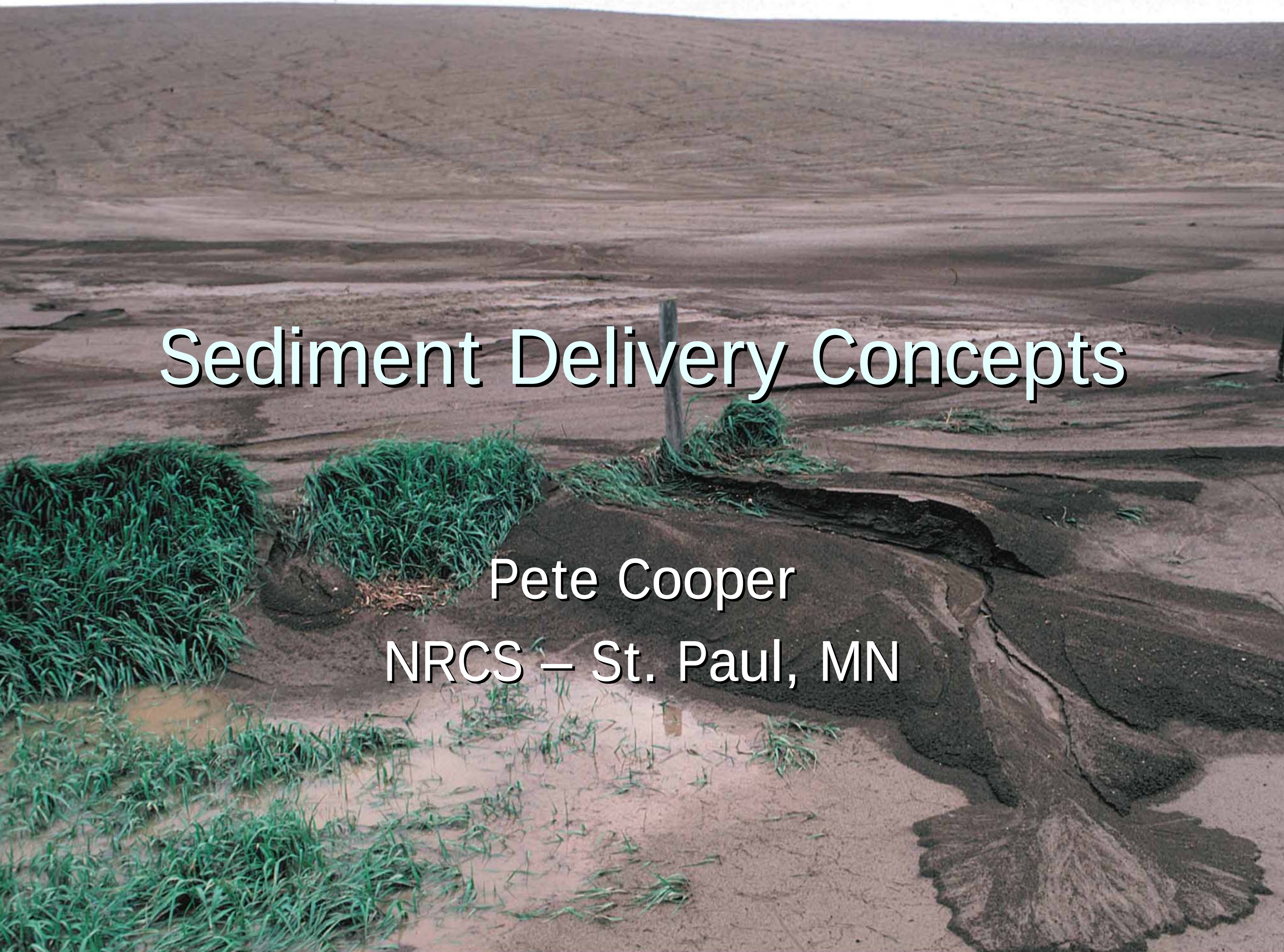


Sediment Delivery Concepts

Pete Cooper

NRCS – St. Paul, MN

Sediment Delivery – What Is It?

- Sediment Yield = Total Amount of Sediment Delivered to Watershed Outlet

- Sediment Yield ≠ Cropland + Stream Bank + Gully + Ephemeral Erosion Sources

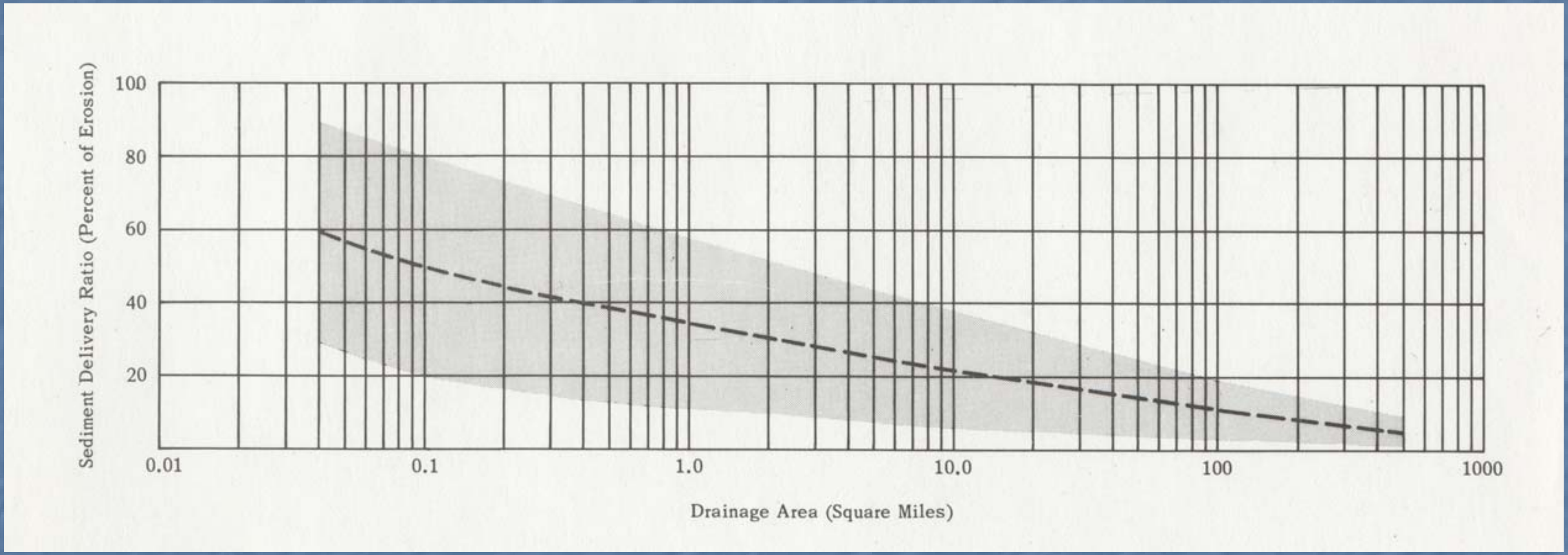
- Sediment Yield = (Cropland + Stream bank + Gully + Ephemeral Erosion Sources) * Sediment Delivery Ratio

Sediment Delivery Ratio

- Accounts for deposition along the path from the sediment source to the watershed outlet:
  - Buffers
  - Waterways
  - Ponds/Lakes/Wetlands
  - Fencerows
  - Water Sediment Control Basins
  - Terraces

Sediment Delivery Ratio

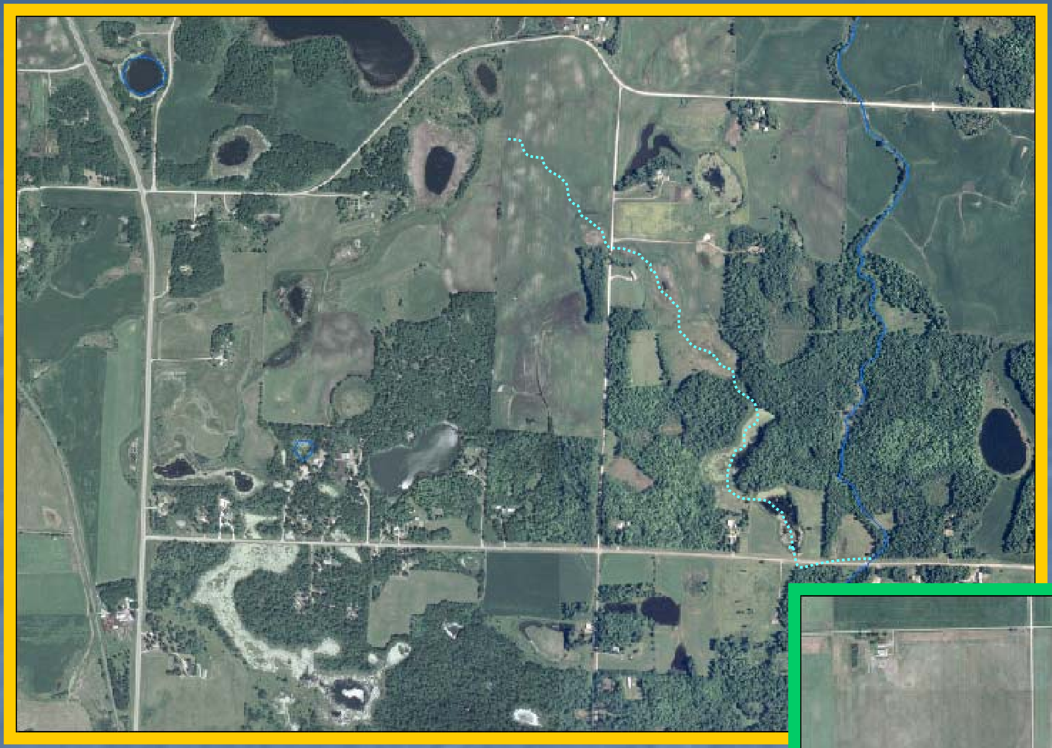
- Originally developed for estimating sediment capacity of reservoirs



- Usual applications were based on drainage area

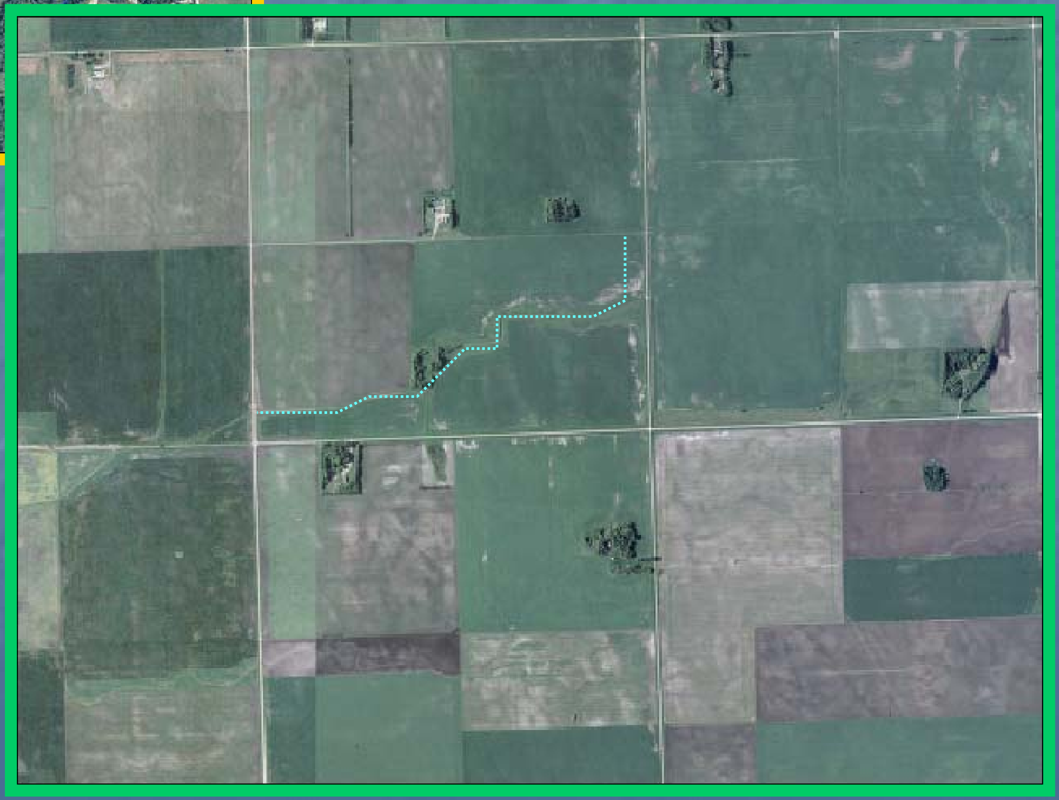
Sediment Delivery Ratio – Non-Point Source Pollution Applications

- SDR concept expanded to describe effects of different practices at the watershed's outlet
- SDR based on distance to "surface water body" or other direct hydrologic connection
- Landscape Trapping (downstream wetlands, buffers, etc.) still a factor

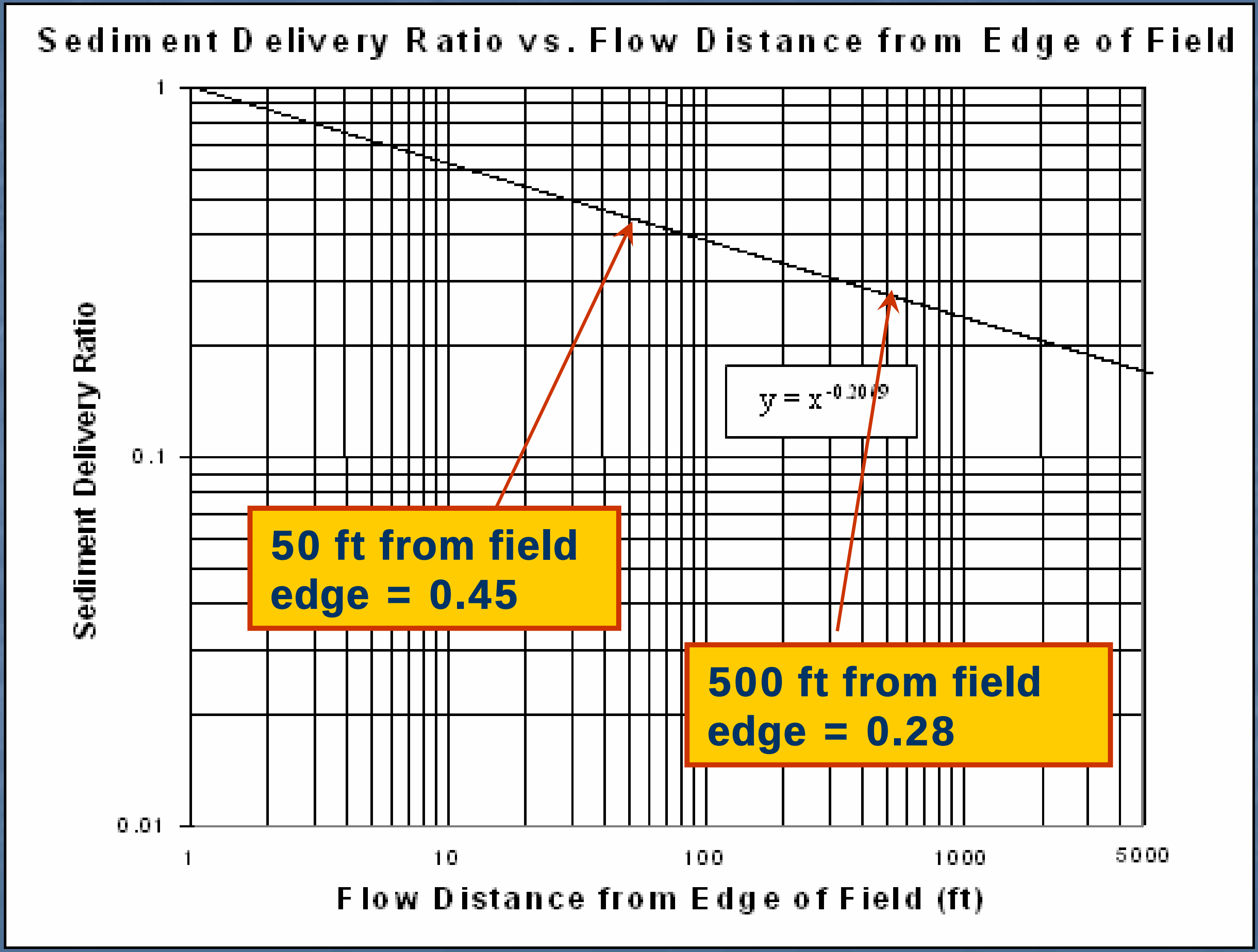


Effects of Landscape Features on Sediment Movement

OR …



Minnesota P Index SDR

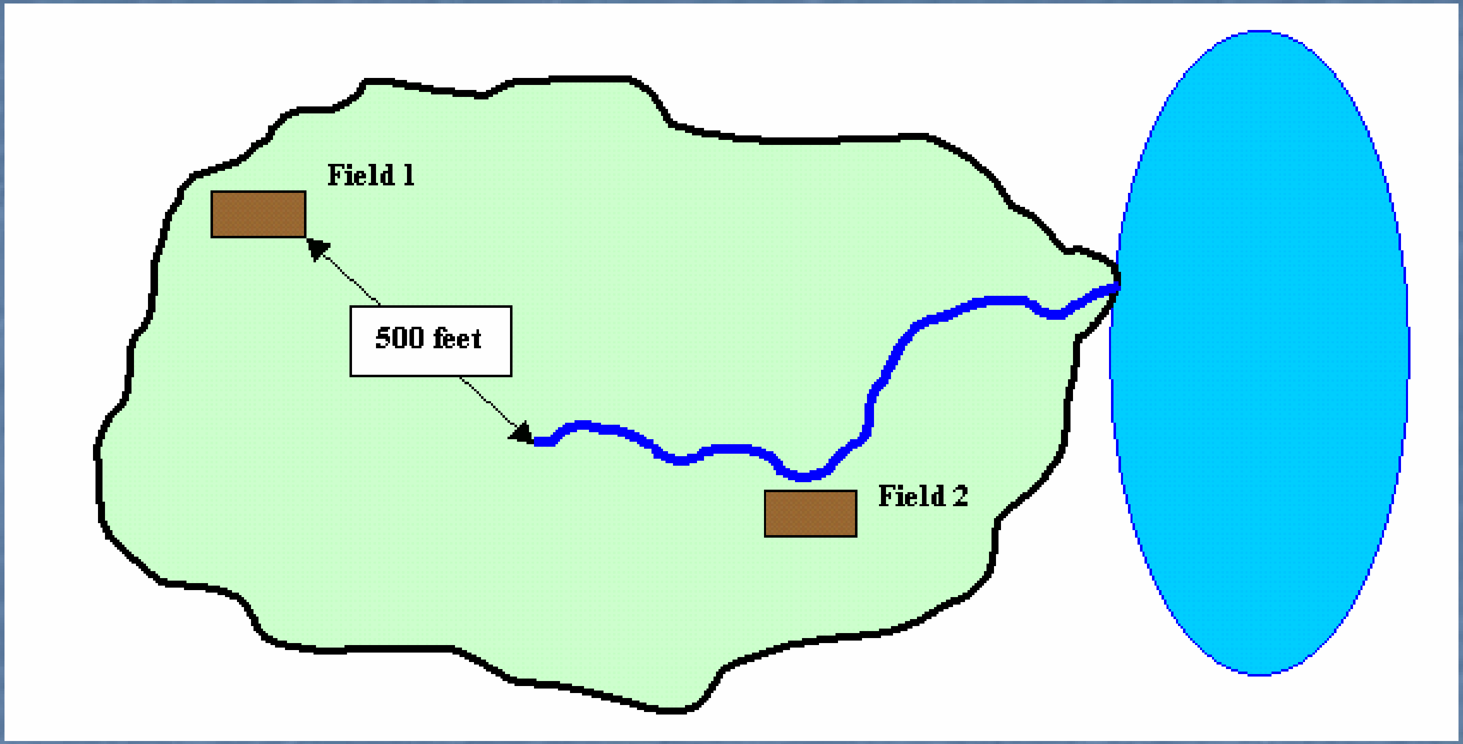


Minnesota P Index SDR for Conservation Practices/Tile Intakes

Sediment Trapping Practice	Trapping Factor
Level terrace	0.0
Impoundment with runoff storage	0.05
Terraces	0.4
Buffer or filter strip	0.5

Natural Depressions	Trapping Factor
Depressions without inlets	0.05
Depressions with rock/gravel inlets	0.15
Depressions with open surface tile inlets	0.2

Impact of Sediment Delivery Ratio



- Field 1 = 5 tons * .28 = 1.4 tons delivered
- Field 2 = 5 tons * 1.0 = 5.0 tons delivered

Watershed Sediment Budget/SDR Examples

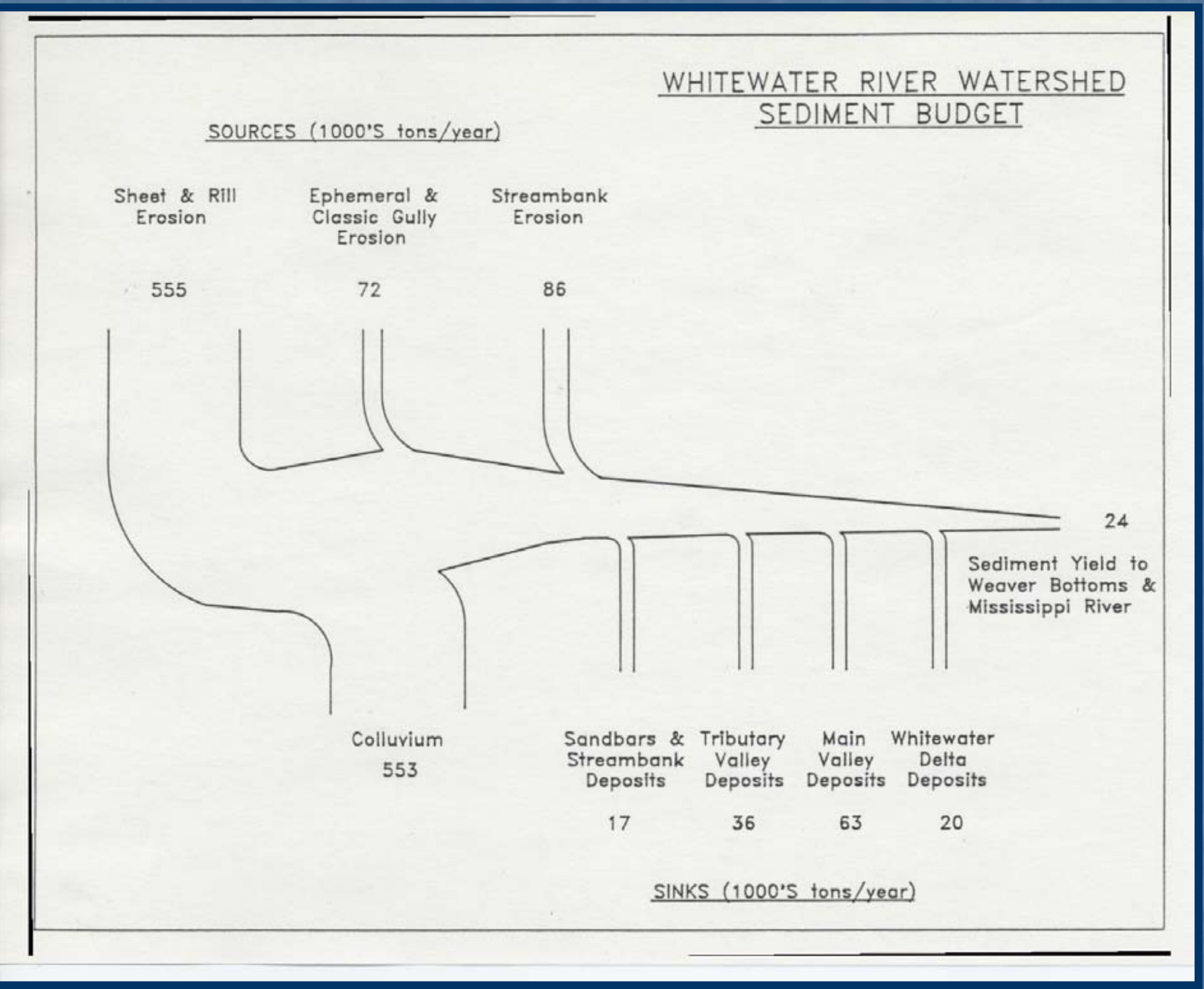
1. Whitewater River – AGNPS Modeling/Sediment Range Surveys/SS Monitoring

2. Nemadji River – Reservoir Survey/GIS/SS Monitoring

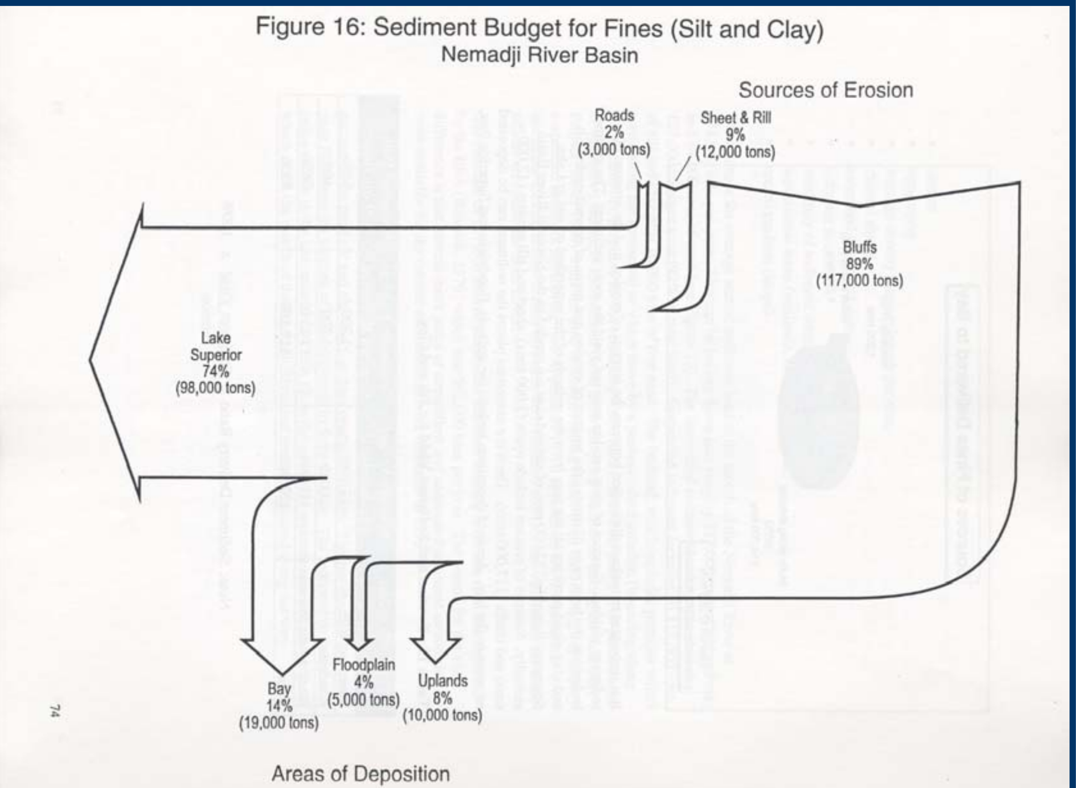
3. Hawk Creek – GLEAMS Modeling

4. Christenson Pond – USLE/Pond Sediment Survey

Whitewater River Sediment Budget



- 321 sq mi
- 58% Cropland
- SDR = 3.4%



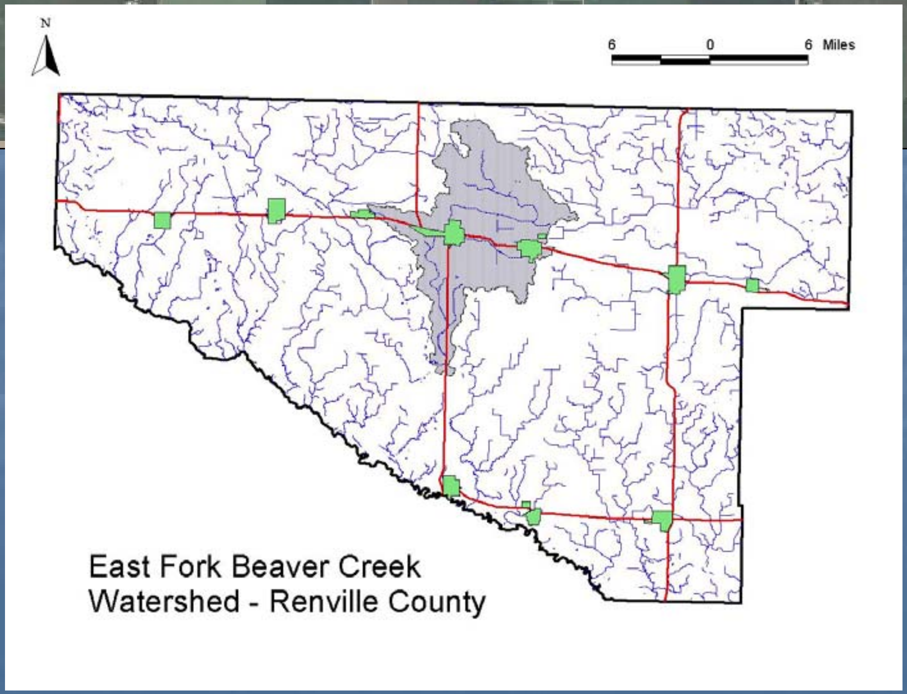
Nemadji River Sediment Budget

- 433 sq mi
- 69% Forested
- SDR = 81%

East Fork Beaver Creek Sediment Budget

- 76 sq mi
- 93% Cropland
- Gross Erosion (GLEAMS) 69,320 Tons
- Estimated Net Watershed Yield (Regional Sediment Curves): 15,200 Tons

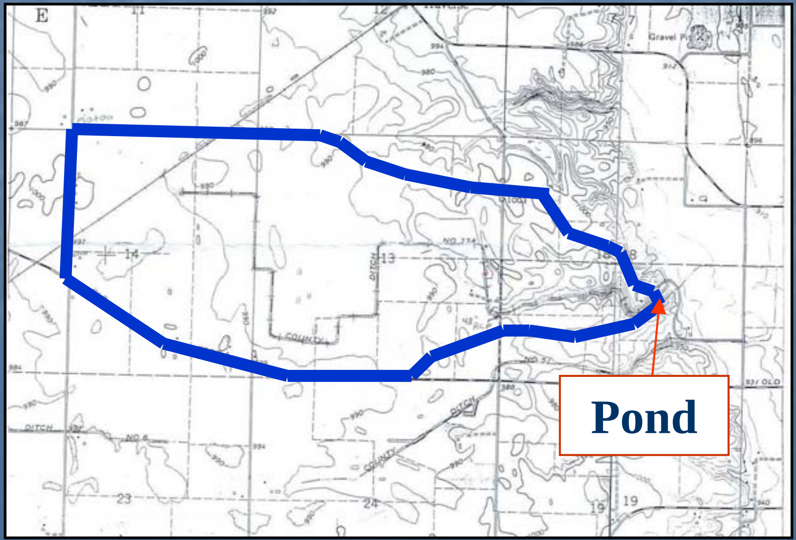
SDR = 22%



Christenson Pond – St. Peter, MN

- 1,050 acres
- Based on sediment survey in 2002 (built 1967)
- 85% Cropland/1.5% Avg Watershed Slope
- Clay Loam Soils
- Total Accumulated Sediment = 14,394 Tons
- RUSLE = 32,655 Tons

44% SDR

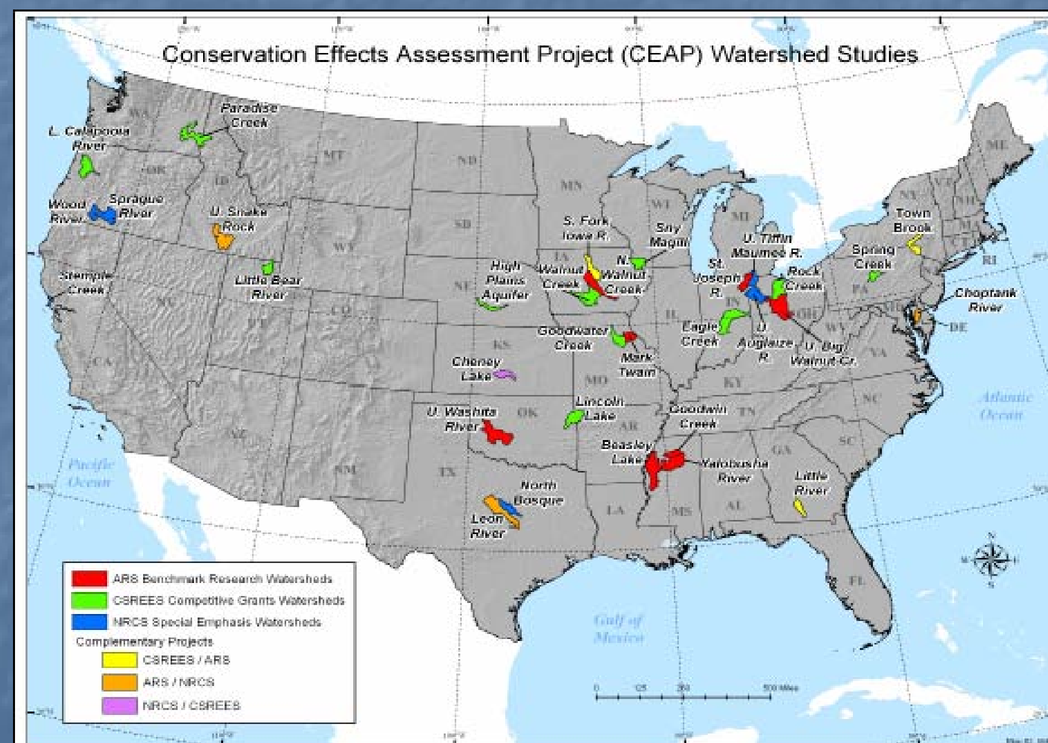


Summary

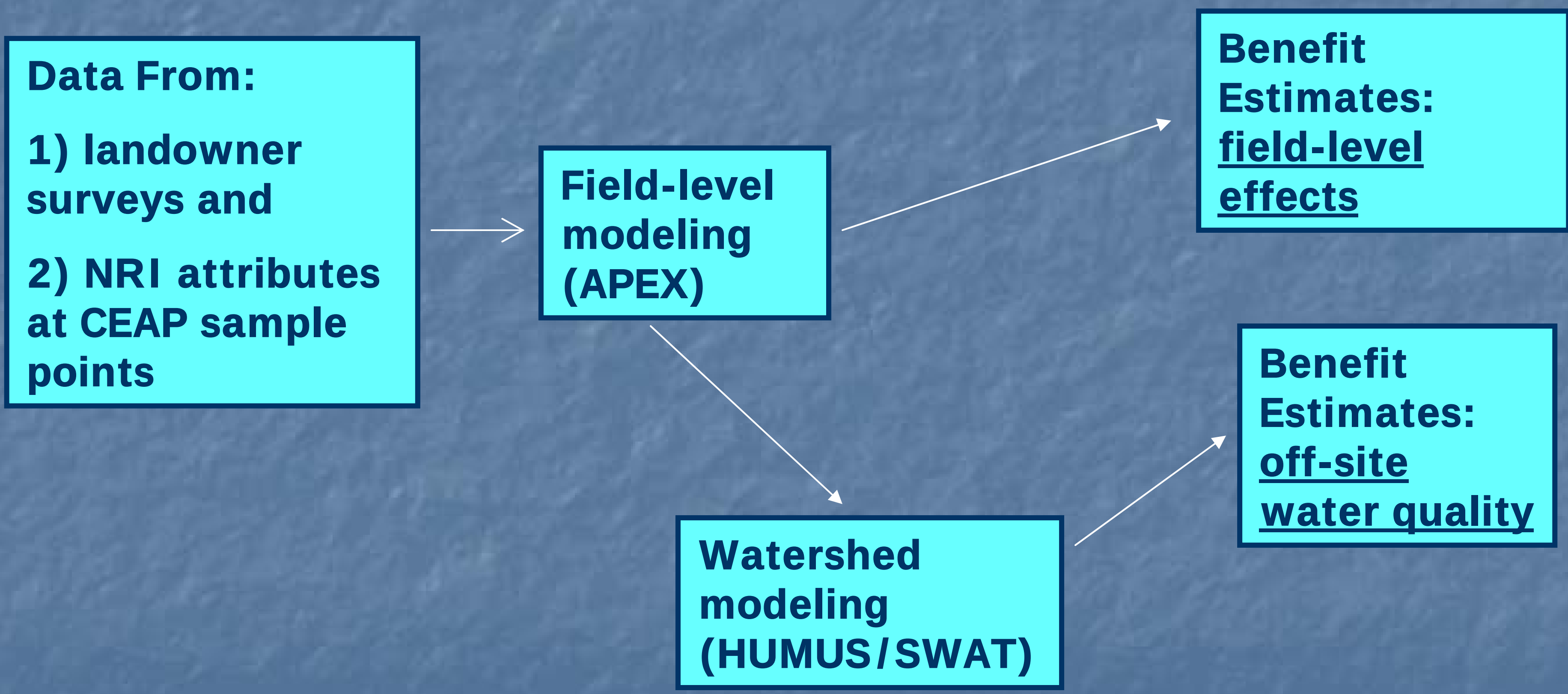
- Sediment Delivery Concepts important for assessing impacts of Non-Point Source Treatments
- Sediment Delivery Process is highly variable – depends on distance to water body, type of erosion, and landscape features
- Combination of Monitoring Data + "Consensus" assessment procedures may be more efficient than modeling

USDA Conservation Effects Assessment Project (CEAP)

- Effort to **<u>quantify</u>** environmental effects of conservation practices/programs
- National and Watershed Assessments
- Impetus: Government-wide emphasis on performance based outcome measures



CEAP – Sample and Modeling Approach



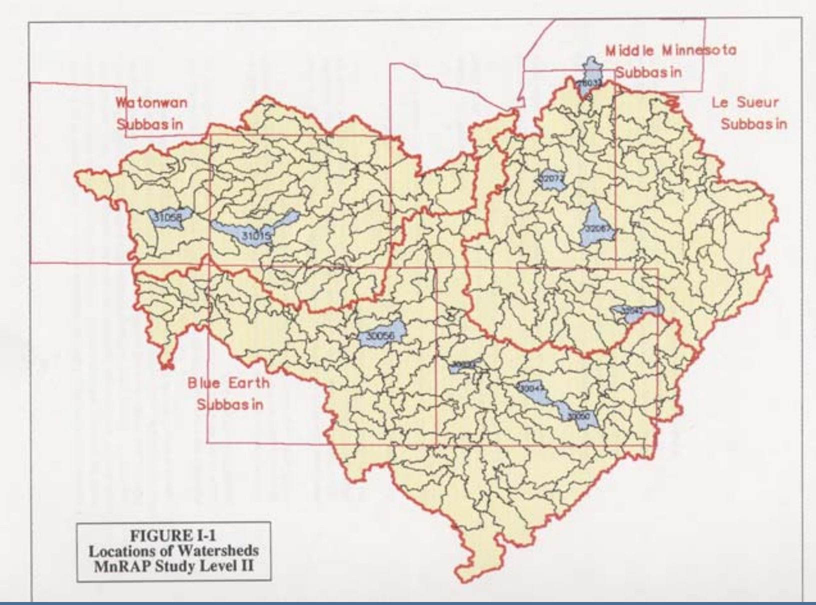

Questions?

"Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams" – Wilkin, Hebel 1982

1. Removal of floodplain lands from rowcrop ag
2. Removal of farming from steep bordering lands along the floodplain
3. Establishment of more effective filter strips to isolate upland erosion from active floodplain
4. Control erosion from cropped uplands based on position relative to the active floodplain

1993 MnRAP Level II Land Use Analysis Major Findings:

- Thinking beyond “T” – Off site water quality still at risk although treatment meets soil productivity tolerance
- Relatively high contribution from small percentage of cropland
- Importance of treatment adjacent to hydrologic pathways



Field Phosphorus Loss Risk Assessment

PHOSPHORUS LOSS POTENTIAL AND MANURE APPLICATION RATES

Distance to Surface Water (feet)	Effective 100 ft. Filter Strip	Soil Test Phosphorous Levels (ppm) Bray P1	Soil Test Phosphorous Levels (ppm) Olsen	Sheet and Rill Erosion (Tons/Acre/Year)	**Base Manure Application Rate on:**
NA	NA	NA	NA	> 6	**No Application**
Less Than 300’	**No**	≤ 21	≤ 16	< 6	**Nitrogen Needs**
		22 - 75	17 - 60	< 6	**P_2O_5 Removal**
		76 - 150	61 - 120	< 4	**P_2O_5 Removal**
				4 - 6	**No Application**
		> 150	>120	< 6	**No Application**
	Yes	≤ 21	≤ 16	< 6	**Nitrogen Needs**
		22 - 75	17 - 60	< 4	**Nitrogen Needs**
				4 - 6	**P_2O_5 Removal**
		76 - 150	61 - 120	< 6	**P_2O_5 Removal**
		> 150	>120	≤ 2	**P_2O_5 Removal**
				> 2	**No Application**
300’ or Greater	**No**	< 76	< 61	< 6	**Nitrogen Needs**
		76 – 150	61 - 120	< 6	**P_2O_5 Removal**
		> 150	> 120	< 4	**P_2O_5 Removal**
				> 4	**No Application**
	Yes	≤ 150	≤ 120	< 6	**Nitrogen Needs**
		>150	>120	< 4	**Nitrogen Needs**
				4 – 6	**P_2O_5 Removal**