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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Clean Water

Category 4C: Process, Expectations, and Examples of Successful Restoration

National Training Workshop on Water Quality Data, Assessment, and Plans

2023

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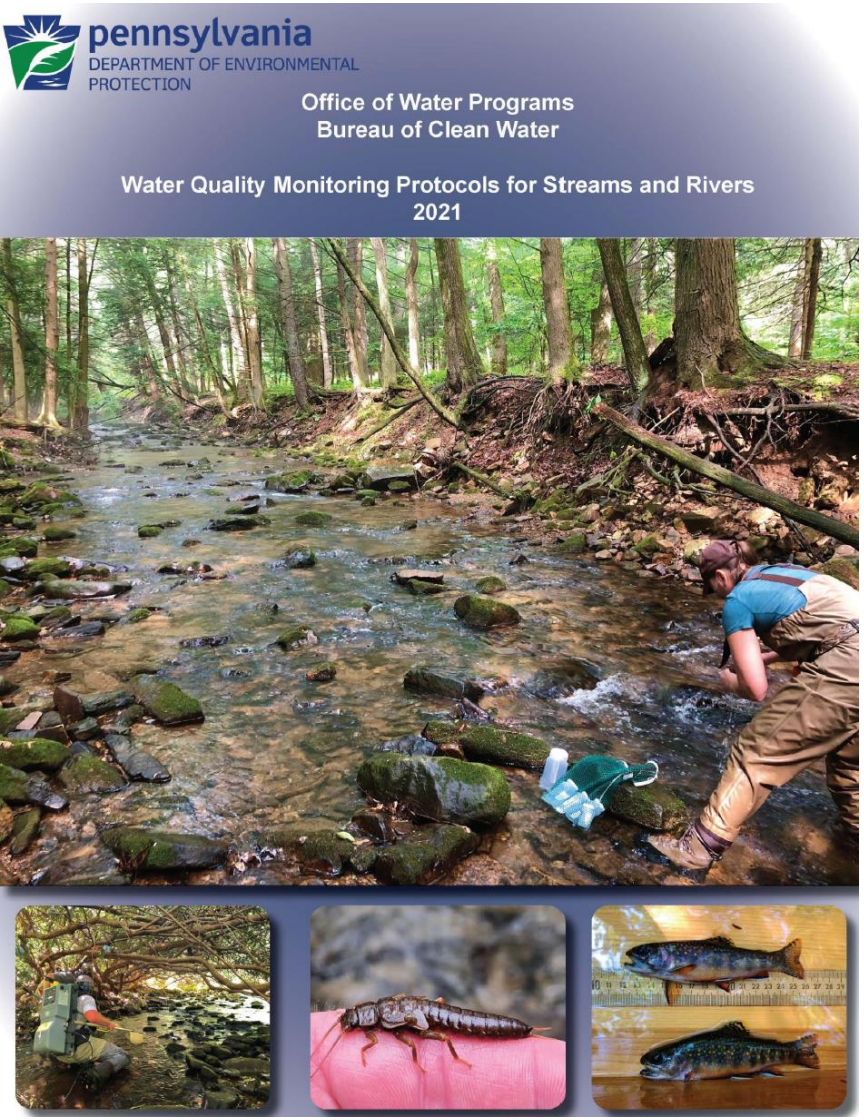
Process: Framework

- **Sections 303(d) and 305(b) of the Clean Water Act**
  - 303(d) is the list of waters impaired by pollutants that require the development of a TMDL
- **Pennsylvania Clean Streams Law (CSL)**
  - specifically brings non-pollutants to attention within the definition of pollution: *"…including but not limited to such contamination by alteration of the physical, chemical or biological properties of such waters…"*
  - The CSL pollution definition effectively broadens the scope of DEP's assessment responsibilities beyond pollutants to include non-pollutant causes (e.g., habitat alterations, flow regime modifications, physical substrate alterations, etc.)

Process: Assessments

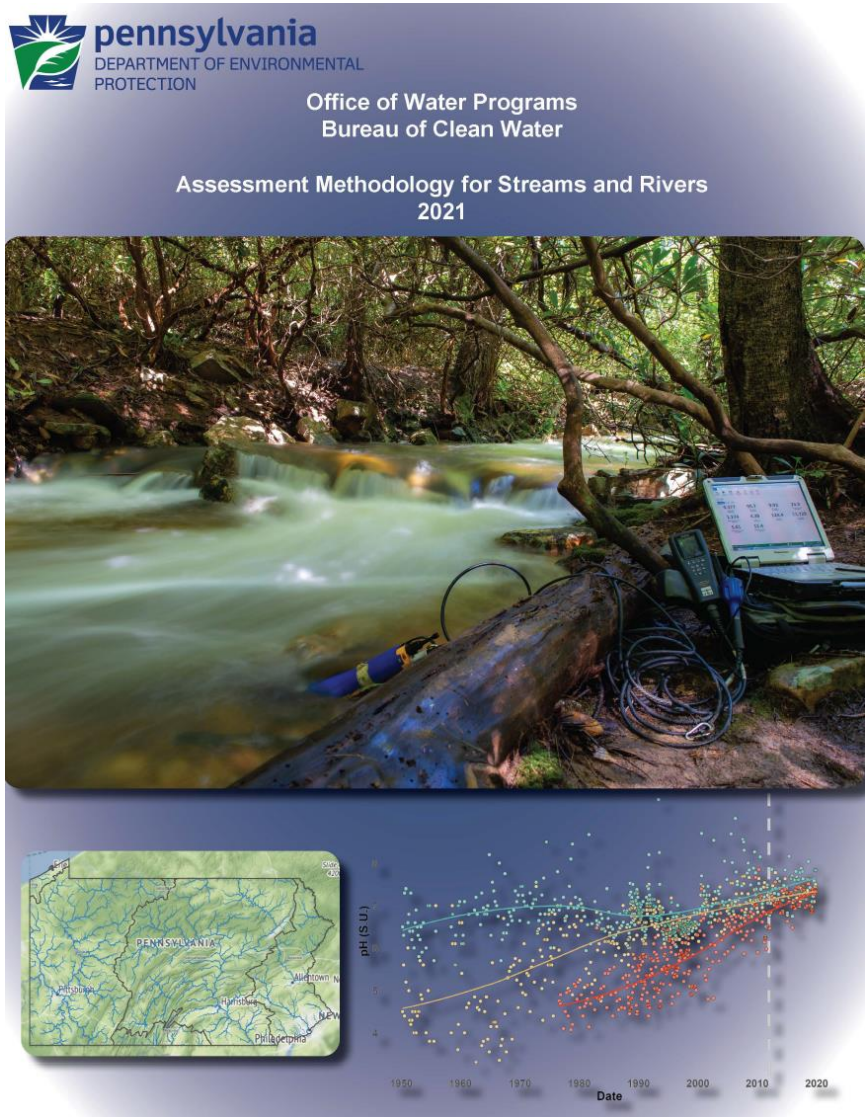


"Monitoring Book"

https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/Pages/Data-Collection-Protocols.aspx

"Assessment Book"

https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/Pages/Assessment-Methodology.aspx



Process: Assessment Data

Macroinvertebrates

- **The “bread and butter” data used for Aquatic Life use assessments in Pennsylvania**
  - Great for demonstrating chronic stress leading to impairment
  - Provides a direct link between ecological balance and regulatory uses that must be protected

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Water Chemistry

- **Used independently for making assessment decisions, but is more often used to make source/cause determinations**

Process: Assessment Data

Physical Habitat Evaluation Form for Riffle/Run Prevalence					GIS Key (YYYYMMDD-hhmm-User):															
Waterbody Name:					Location:															
Parameter	**Optimal**					**Suboptimal**					**Marginal**					**Poor**				
1. Instream Cover (Fish)	mix of boulders, cobbles, submerged logs, undercut banks or other stable habitat																			
	> 50%					50% to 30%					30% to 10%					< 10%				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
2. Epifaunal Substrate	Riffles as wide as stream; lengths extending twice the widths. Well-developed riffle and run. Abundant cobble.					Riffles as wide as stream; lengths less than twice the widths. Abundant cobble. Boulders and gravels common.					Riffles not as wide as stream; lengths less than twice stream widths. Runs may be lacking. Prevalence of gravels, big boulders or bedrocks. Some cobbles.					Riffles or runs rare or absent. Prevalence of big boulders and/or bedrocks. Cobbles rare or absent.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
3. Embeddedness	Gravel, cobble, and boulder particles surrounded by fine sediment																			
	< 25%					25% to 50%					50% to 75%					> 75%				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
4. Velocity/Depth Regimes	shallow-fast					shallow-slow					deep-fast					deep-slow				
	Four present					Three present					Two present					One present				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel Alteration	No channelization. No dredging.					Some channelization (bridge abutments). Past dredging or channelization (over 20 years ago), but not recent.					New embankments on both banks. 40% to 80% of reach channelized or disrupted.					Banks gabioned or cemented. > 80% of reach channelized or disrupted.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6. Sediment Deposition	Little or no enlargement of islands or point bars. Less than 5% of bottom affected by sediment deposition.					Some new increase in bar formation, mostly from coarse gravel. 5% to 30% of bottom affected. Slight deposition in pools.					Moderate deposition of new gravel and/or coarse sand on bars. 30% to 50% of bottom affected. Deposits at obstructions, constrictions, and bends. Moderate deposition in pools.					Heavy deposits of fine material. Increased bar development. More than 50% of bottom changing frequently. Pools almost absent due to substantial deposition.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Riffle Frequency	Distance between riffles divided by stream width																			
	5 to 7					7 to 15					15 to 25					> 25				
	Riffles relatively frequent. Variety of habitat.					Riffles infrequent.					Occasional riffle or bend. Bottom contours provide some habitat.					Almost all flat water or shallow riffles. Poor habitat.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Channel Flow Status	Water reaches base of both banks. Minimal channel substrate exposed.					Water fills > 75% of channel. < 25% of channel substrate exposed.					Water fills 25% to 75% of channel and/or riffle substrates mostly exposed.					Very little water in channel and mostly present as standing pools.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Condition of Banks	Banks stable. No evidence of bank erosion or failure.					Moderately stable. Infrequent, small areas of erosion mostly healed over.					Moderately unstable. Up to 60% of banks in reach have areas of erosion.					Unstable. "Raw" areas frequent along straight sections and bends. On side slopes, 60% to 100% of banks have erosional scars.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
10. Bank Vegetative Protection	Streambank surfaces covered by vegetation																			
	> 90%					90% to 70%					70% to 50%					< 50%				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
11. Grazing or Other Disruptive Pressure	Grazing, mowing, or other vegetative disruption minimal or absent. Almost all plants growing naturally.					Disruption evident, but not greatly affecting full plant growth. More than half of potential plant stubble height remaining.					Disruption obvious. Areas of bare soil and/or closely cropped vegetation common. Less than half of potential stubble height remaining.					Disruption extensive. Vegetation removed to 2" or less in average stubble height.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
12. Riparian Vegetative Zone	Width > 18 meters. No human activities impacting riparian zone.					Width 12 to 18 meters. Human activities minimally impacting zone.					Width 6 to 12 meters. Human activities impacting zone a great deal.					Width < 6 meters. Little or no riparian vegetation due to human activities.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL _____																				

Physical Habitat

- **Also used independently for making assessment decisions**
- **Core assessment component for establishing siltation and 4C causes**

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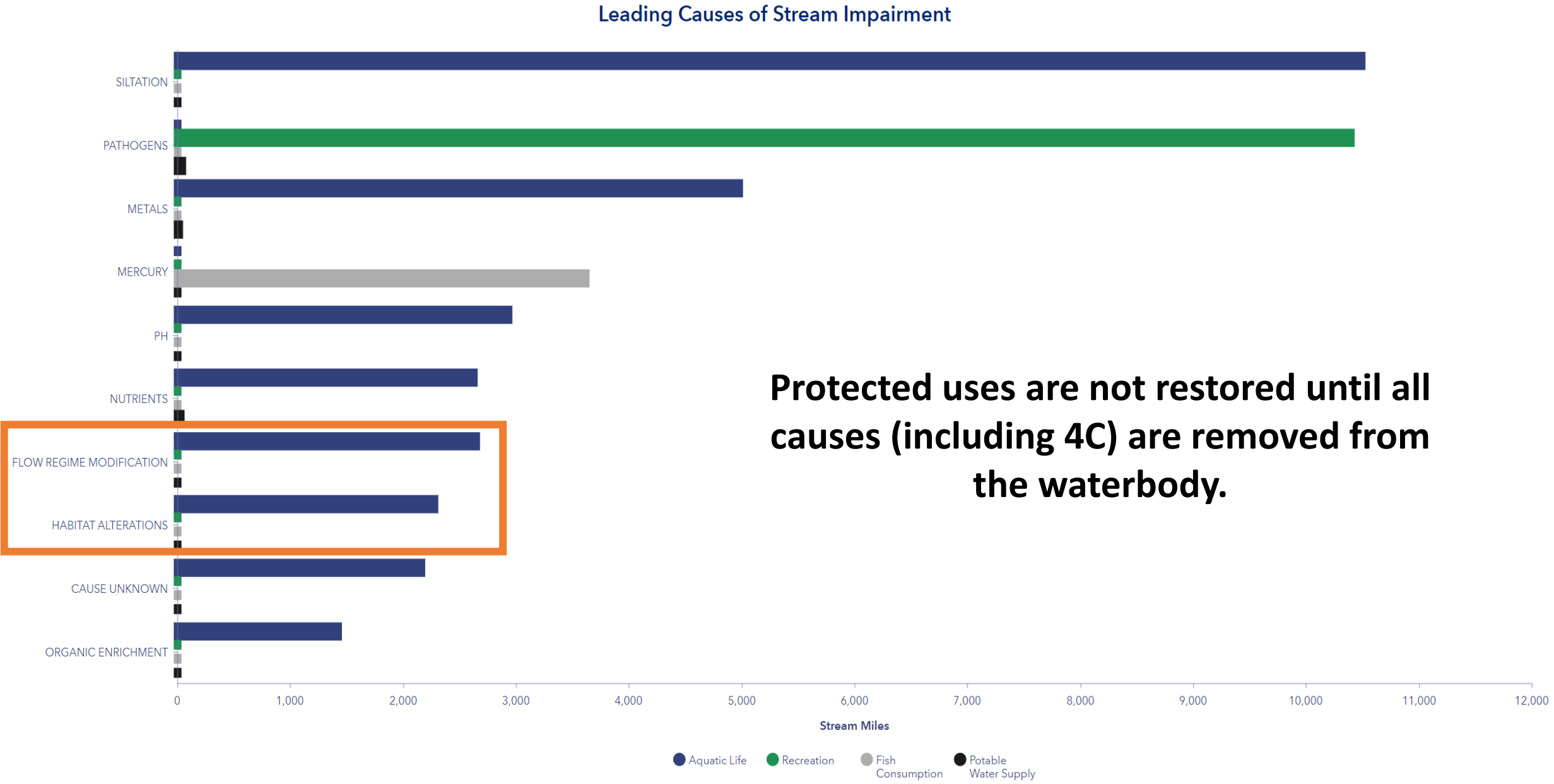
Expectations: Impairments



Protected uses are not restored until all causes (including 4C) are removed from the waterbody.

Expectations: Plans

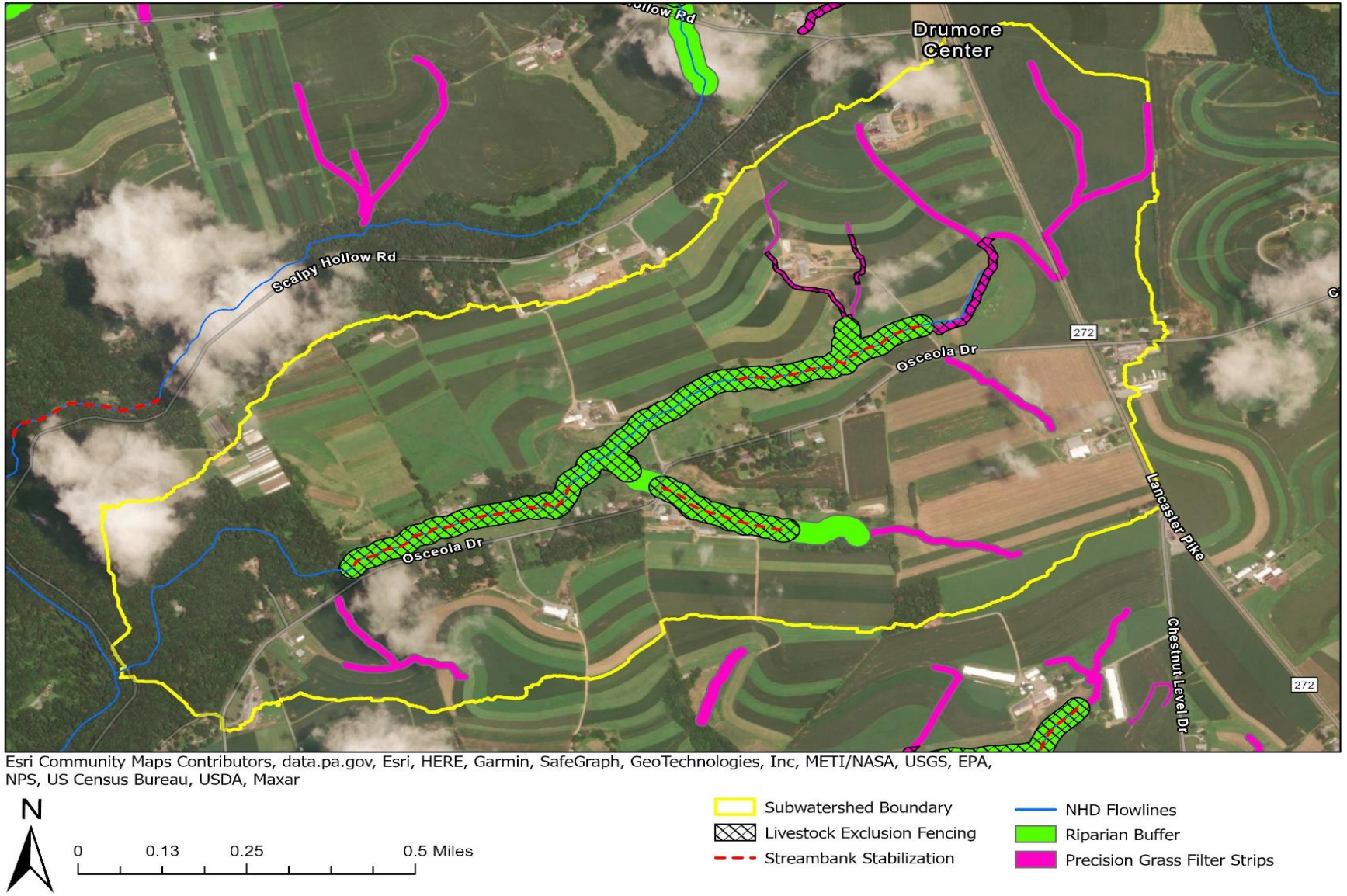
1. **TMDL**
2. **Advance Restoration Plan (ARP)**
   - Like a TMDL + a WIP (Watershed Implementation Plan)
   - Heavily BMP focused, which addresses 4C causes along with pollutants.

Causes: Siltation and Habitat Alterations

Expectations: ARPs

Targets

- BMP opportunities exceed pollutant reduction goals
- Physical alterations are remediated so 4C causes get removed.

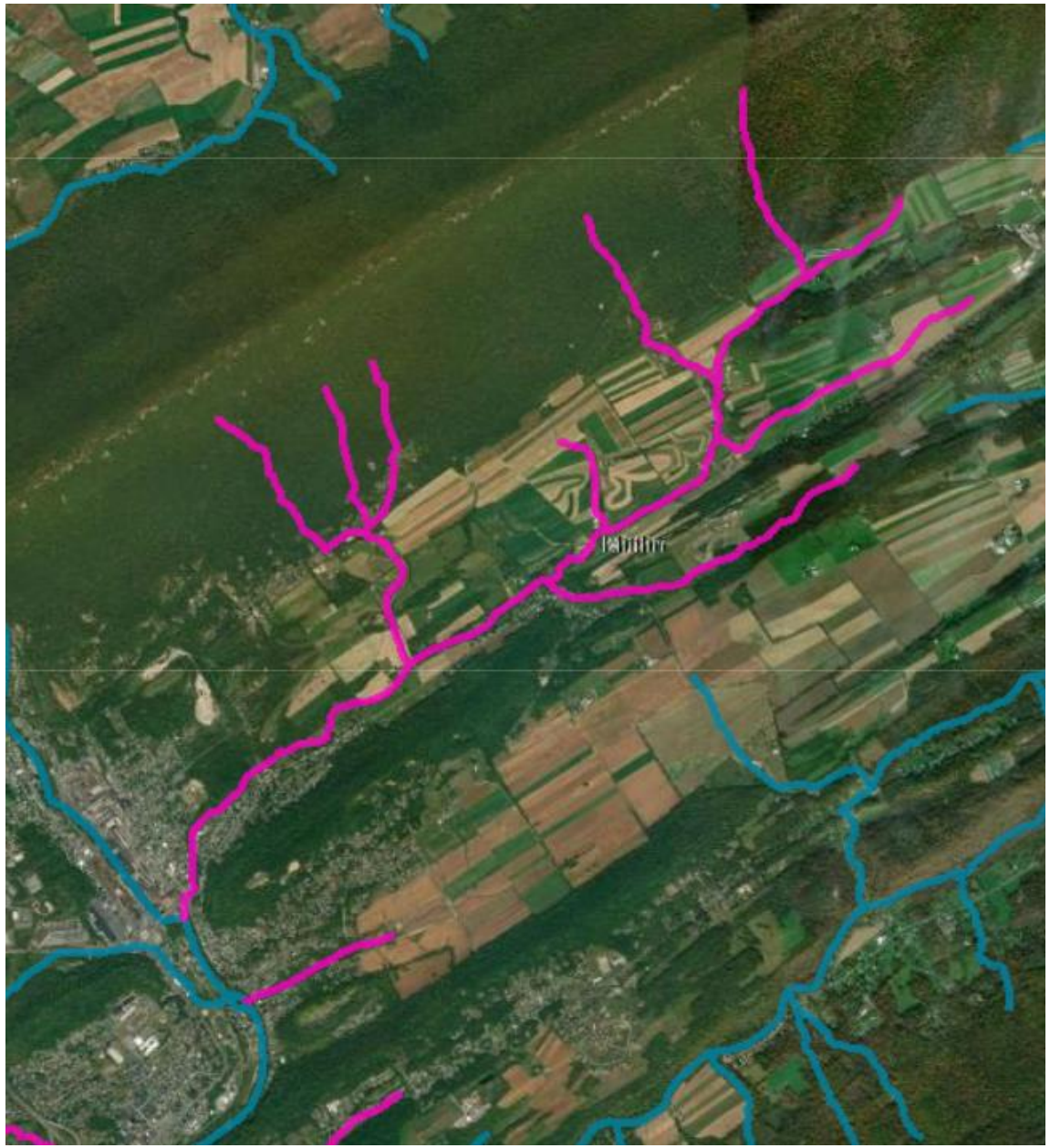


Successful Restoration: Hungry Run

From 2008 to 2018, nearly one million dollars were used to implement the following BMPs:

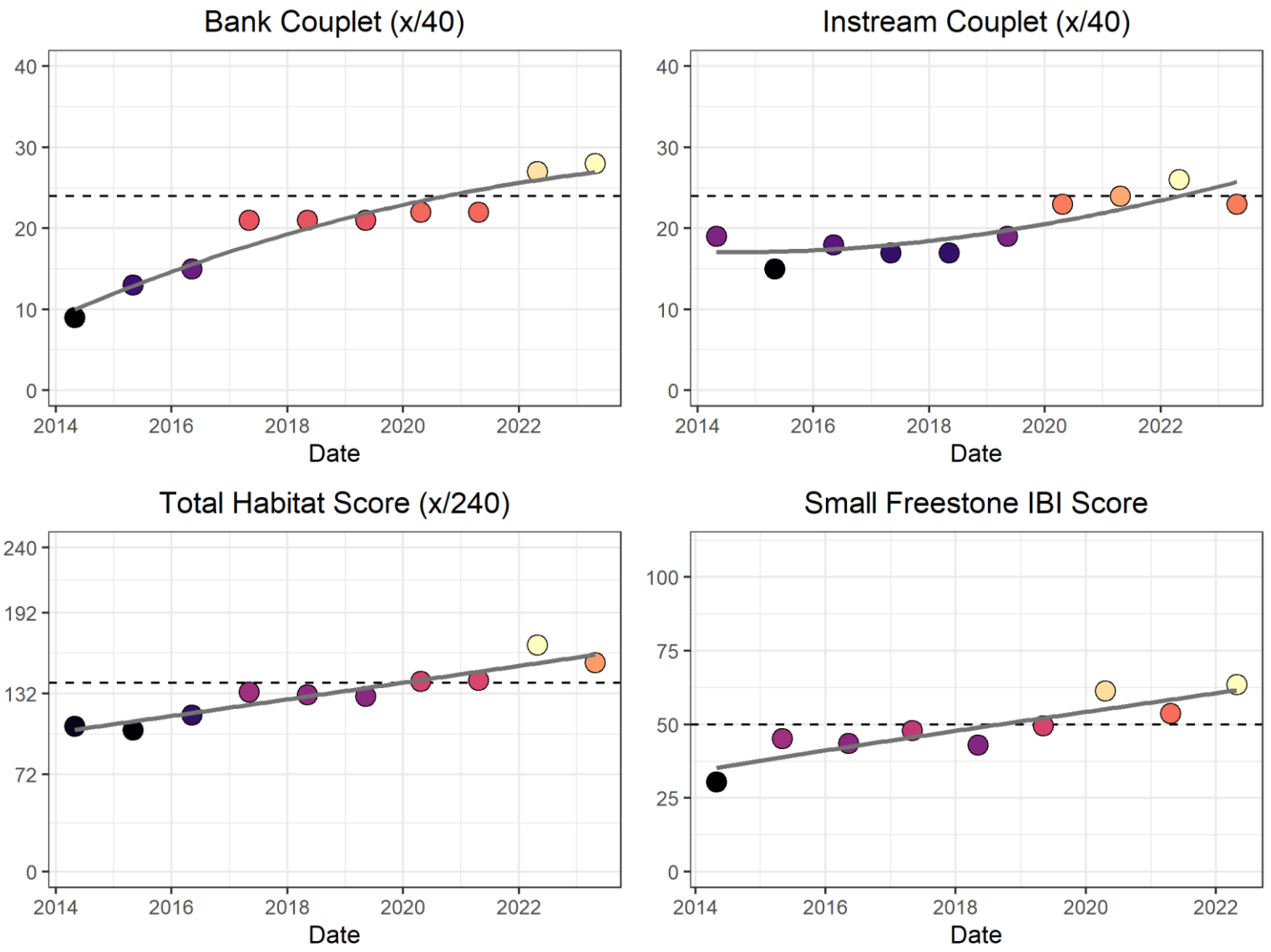
- 639 acres of agricultural erosion and sediment plans covering 85% of the agricultural lands in the watershed
- 639 acres of nutrient management plans also covering 85% of the agricultural lands in the watershed
- 214 acres of cover crops
- 539 acres of conservation tillage
- 10,359 linear feet of livestock exclusion fencing to prevent cattle from accessing the stream
- 6 stream crossings for livestock
- 3 off stream watering facilities
- 10,270 linear feet of stream restoration
- 16 acres of riparian forest buffers
- 5 animal waste management systems covering 88% of the livestock in the watershed
- 2,950 linear feet of stormwater controls
- 1,010 linear feet of access lanes

* Most BMPs working to restore impairment caused by 4C parameters



Successful Restoration: Hungry Run

- The ARP modeled and developed for Hungry Run calls for a 35% reduction in sediment.
- Modeling of the BMPs implemented demonstrates a 55% reduction in sediment which meets and exceeds the numeric restoration goal for Hungry Run.
- Biological and physical habitat scores have improved from a pre-BMP baseline.
- Portions of the Hungry Run basin will be restored for Aquatic Life.



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Questions?

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