



**PennState Extension**

# Bank Pin Erosion Monitoring Project Perkiomen Creek



Status Report: Aug 2020 – April 2021



**PennState Extension**

**Master Watershed Stewards**

Robert Pace

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Montgomery County



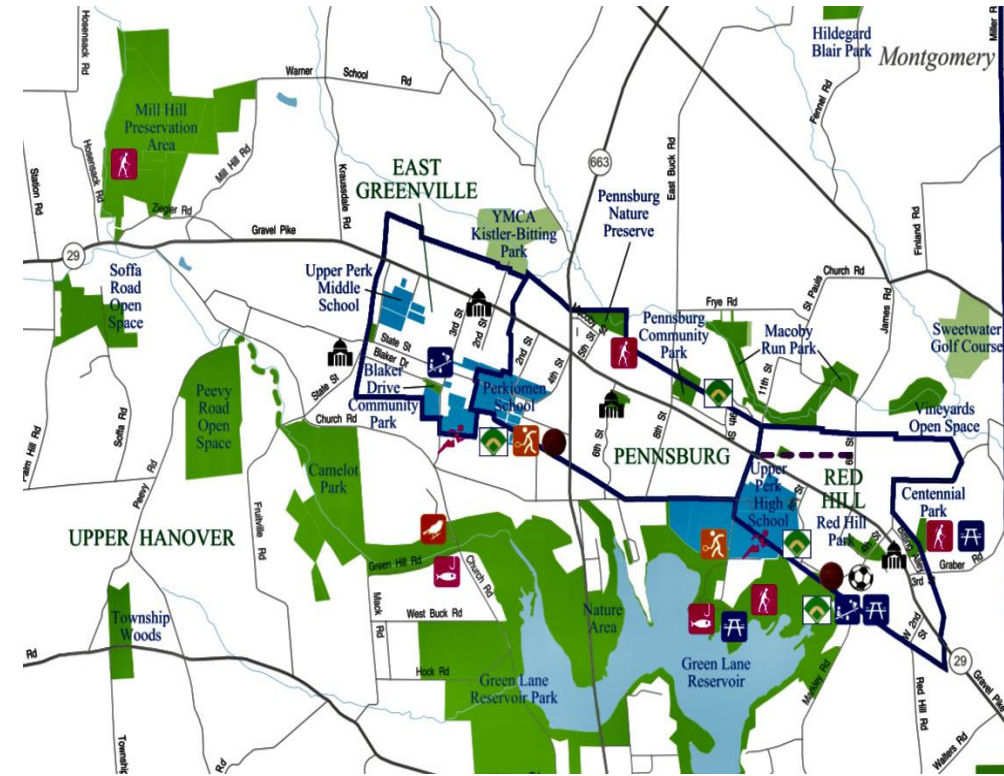
# Bank Pin Monitoring—Upper Perkiomen Creek



## Master Watershed Stewards: Robert Pace, Eve Puhalla, Ross Snook, Erin Uber

- In collaboration with Trout Unlimited (TU), 1/3 mile restoration project to support trout fishery, water quality, and reduce sedimentation in the Green Lane Reservoir
- Bank Pin monitoring at 5 locations
- Purpose: Determine rate of bank erosion
- TU volunteers:
  - Jim Coffey
  - Daisy May, Official Bank Pin Mascot

# Project Site



# Trout Unlimited Proposed Restoration Project



Bank Pin Stations in yellow

**Perkiomen Creek Stream Habitat Improvement Project**  
Conceptual Design Plan

Drawn By: David Keller 06/27/2020

**Kellers Small Stream Solutions, LLC**  
Spring Mills, PA  
(814) 571-4125  
kellersllc@gmail.com

# Watershed Characteristics

Model My Watershed

modelmywatershed.org/draw

Model My Watershed

### Select Area

Explore mapped layers, such as streams, land cover, soils, boundaries and observations, using the layer selector in the lower left of the map. See our documentation on layers.

Select an Area of Interest in the continental United States, using the suite of tools below, to analyze the factors that impact water in your area and to begin to model different scenarios of human impacts. Different modeling options for using these tools are described in the technical documentation.

**Select boundary**  
Choose a predefined boundary from several types

**Draw area**  
Free draw an area or place a square kilometer

**Delineate watershed**  
Automatically delineate a watershed from any point

**Upload file**  
Upload a polygon for your area

**Layers**

- Streams
  - Continental US Medium Resolution Stream Network
  - Delaware River Basin High Resolution Stream Network
  - Delaware River Basin TN

- 37 Square Miles Drainage Area (about 10% of Perkiomen watershed)
- Also 37 miles of stream
  - 23 mi 1<sup>st</sup> order
  - 9 mi 2<sup>nd</sup> order
  - 5 mi 3<sup>rd</sup> order
- Directly upstream of Green Lane Reservoir – Aqua
- Includes 3 counties (Montgomery, Berks, Lehigh)

Source: Model My Watershed, Stroud

# Land Use Upstream of Bank Pin Stations

Model My Watershed | how do i take a screenshot on a |

modelmywatershed.org/project/31622/scenario/54376

Model My Watershed® | About Help Projects rpace

Perkiomen - Subwaters... | Details | Analyze | Monitor | Model | Share | New Project

### Delaware High Resolution 37 mi<sup>2</sup>

Streams Land Soil Terrain Climate Pt Sources Animals Water Qual

Land cover distribution

#### Land cover distribution

Related Layer: National Land Cover Database  Turn off  
Source: National Land Cover Database (NLCD 2011)

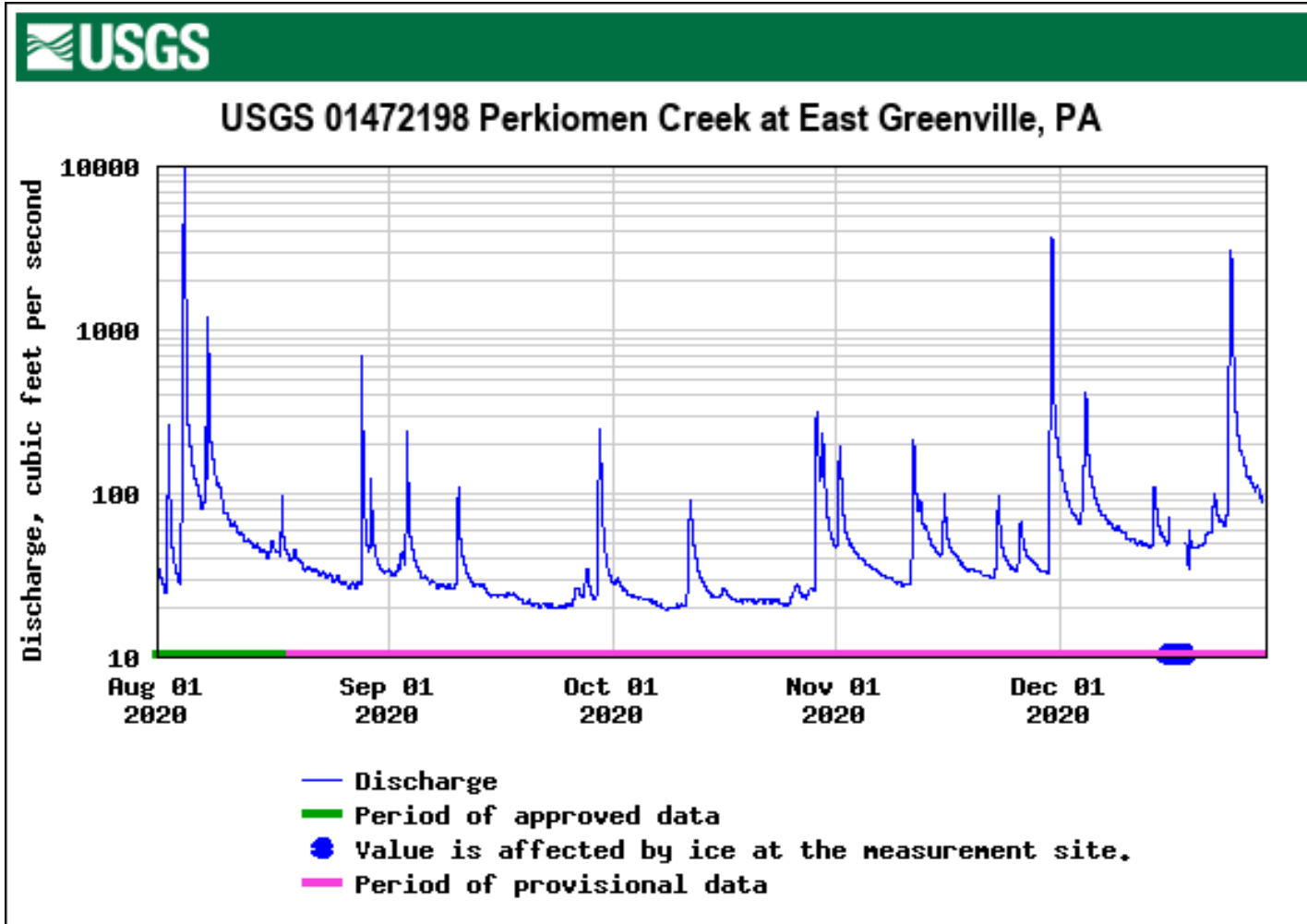
Land Cover Type	Coverage (%)
Open Water	0
Perennial Ice/Snow	0
Developed, Open Space	~10
Developed, Low Intensity	~2
Developed, Medium Intensity	~1
Developed, High Intensity	~1
Barren Land (Rock/Sand/Clay)	~1
Deciduous Forest	~40
Evergreen Forest	~1
Mixed Forest	~1
Shrub/Scrub	~10
Grassland/Herbaceous	~1
Pasture/Hay	~10
Cultivated Crops	~20
Woody Wetlands	~1
Emergent Herbaceous Wetlands	~1

Layers

Leaflet | Map data from ESRI

9:57 AM 4/10/2021

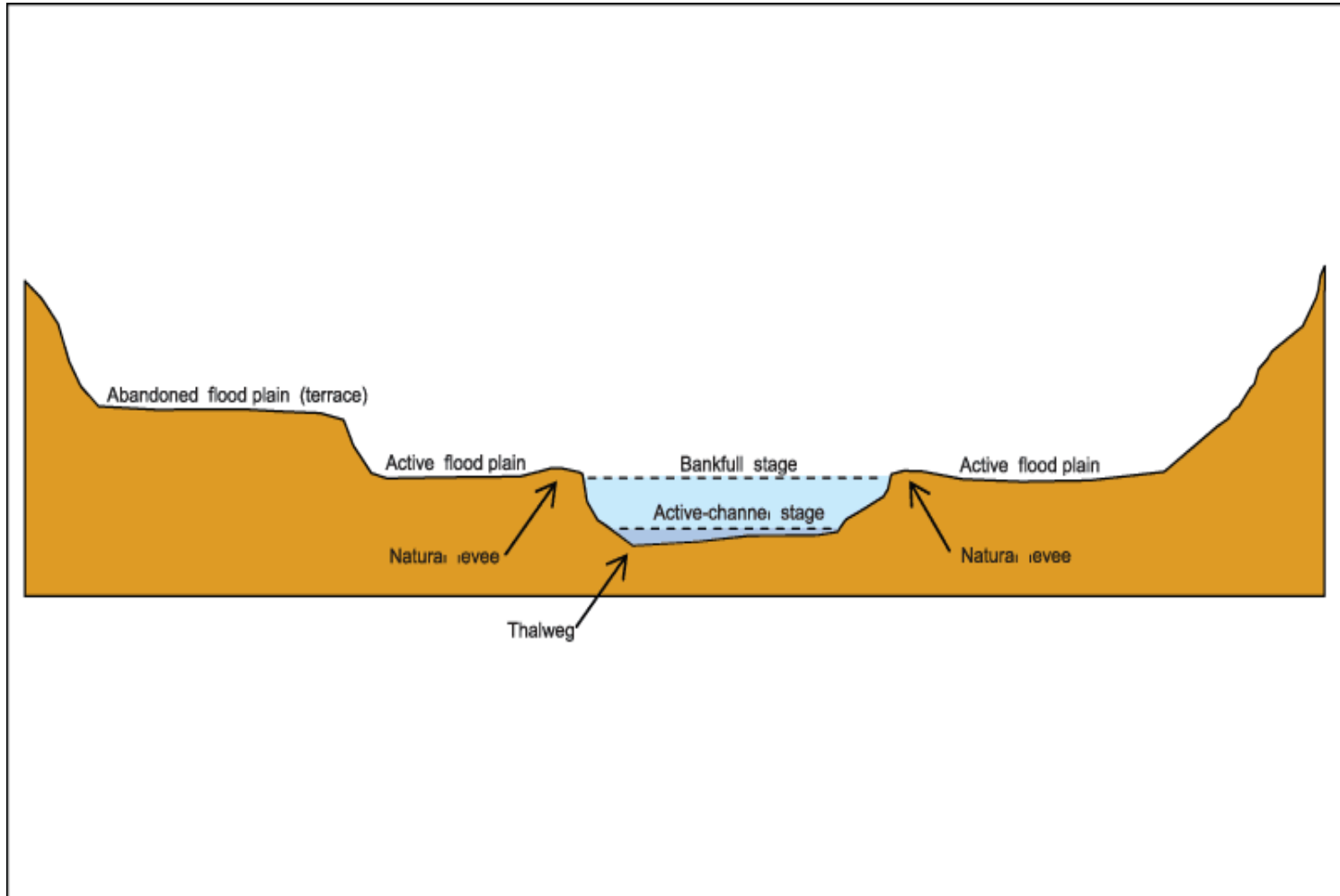
# USGS Stream Flow Data



- Real Time flow data
- Flow (Q or discharge)
- Stage (height of water)
- Alerts on high flows
- Safety/Access

[https://waterdata.usgs.gov/pa/nwis/uv/?site\\_no=01472198&PARAMeter\\_cd=00065,00060,00010](https://waterdata.usgs.gov/pa/nwis/uv/?site_no=01472198&PARAMeter_cd=00065,00060,00010)

# Typical Floodplain and Channel



- Streamflow (discharge= $Q$ ) is related to channel characteristics (width, depth, slope, sinuosity)
- At bankfull flow (flow at which stream jumps its banks) streams have most impact on moving sediments and altering channel geometry.
- On average, streams attain their bankfull flow/stage at 1-2 times per year.

# Monitoring Stations



# Typical Bank Profile – Station 4



- Unconsolidated sediments
- Stratification
- Cobbles, gravels, coarse sand, silt
- Alluvial material grading to organic soil profile with vegetative root mat

# Development of Field Protocols



Master Watershed  
Steward Program

## **Bank Pin Erosion Monitoring Projects Protocols for Project Initiation and Support**

JAN 6<sup>th</sup>, 2021

- Applications
- Limitations
- Property Access
- Team member training and safety
- Equipment and materials
- Data collection
- Documentation
- Data processing and display

# Erosive Forces at Work – Frost Heaving



# Erosive Forces at Work - Fluvial



**Undercutting**



**Eddying effect  
at pins**



**Sloughing**

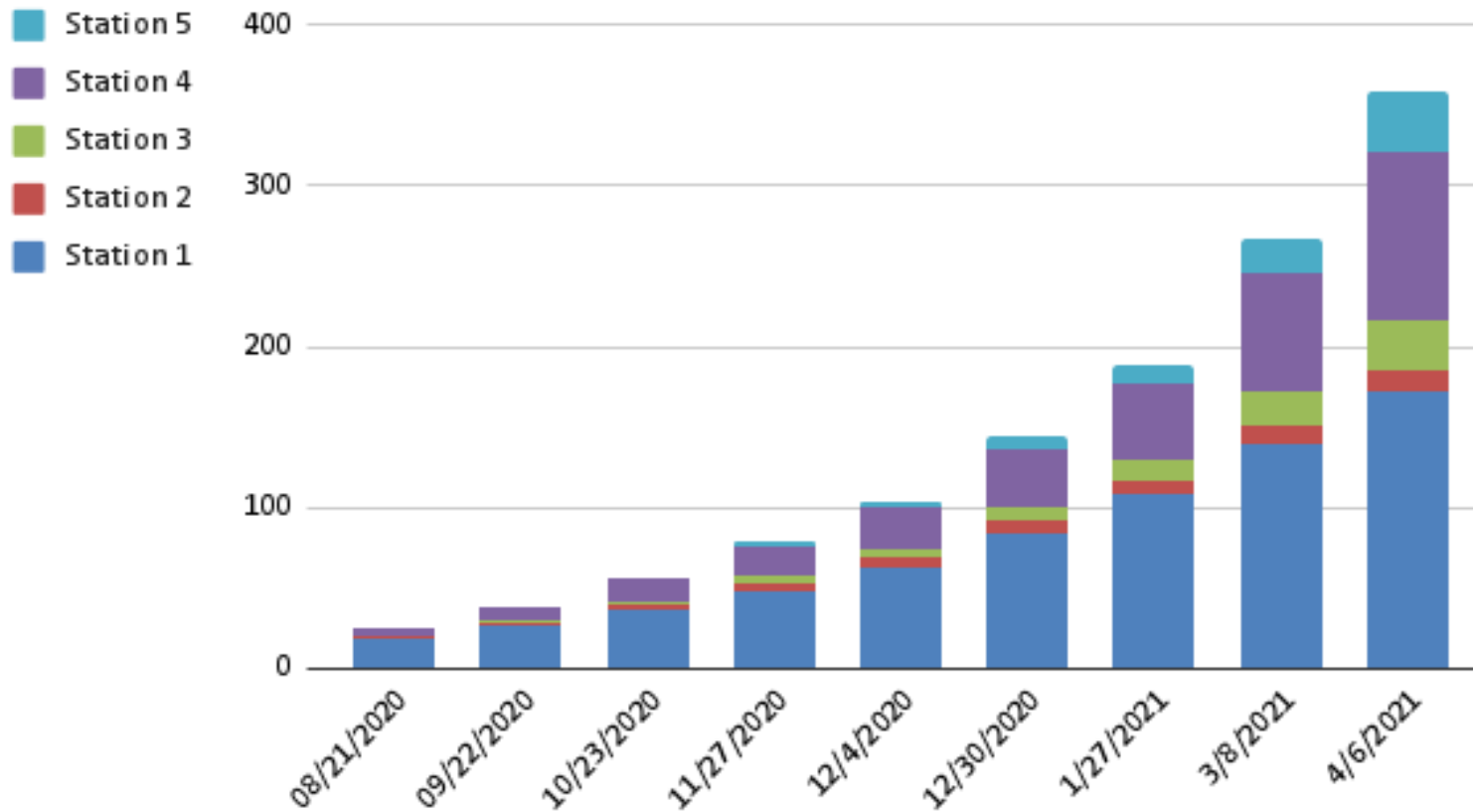
# Data Collection and Processing

Entry										
Name							Erin	Erin	Robert	
Date	8/21/20	9/22/20	10/23/20	11/27/20	12/4/20	12/30/20	1/27/21	3/8/21	4/6/21	
Nearest USGS gage Stn ID	1472198	1472198	1472198	1472198	1472198	1472198	1472198	1472198	1472198	1472198
Flow at time of measurement	35	20	23	43	82	76	48	79	64	
High Flow events										
Station #	1	1	1	1	1	1	1	1	1	1
Pin #1										
Measurement from Pin End	38.1	22.2	24.7	26.5	32.4	42.5	33.1			24
Reset	Y	N	N	N	N	Y	N	Y	N	
Reset Value	20.3							21		
Notes								Lost pin		
Pin #2										
Measurement from Pin End		23.2	22.5	24		29.5	25.3	28.3		29.5
Reset	Y	N	N	N	Y	Y	N	N	N	
Reset Value	20.3				20.3	20.3				
Notes	Lost pin				Lost pin					
Pin #3										

- Google Sheets
- Central access
- Accounts for lost and/or reset pins
- Intend to include key USGS flow data
- Will be adapted for data entry in the field

# Results To Date

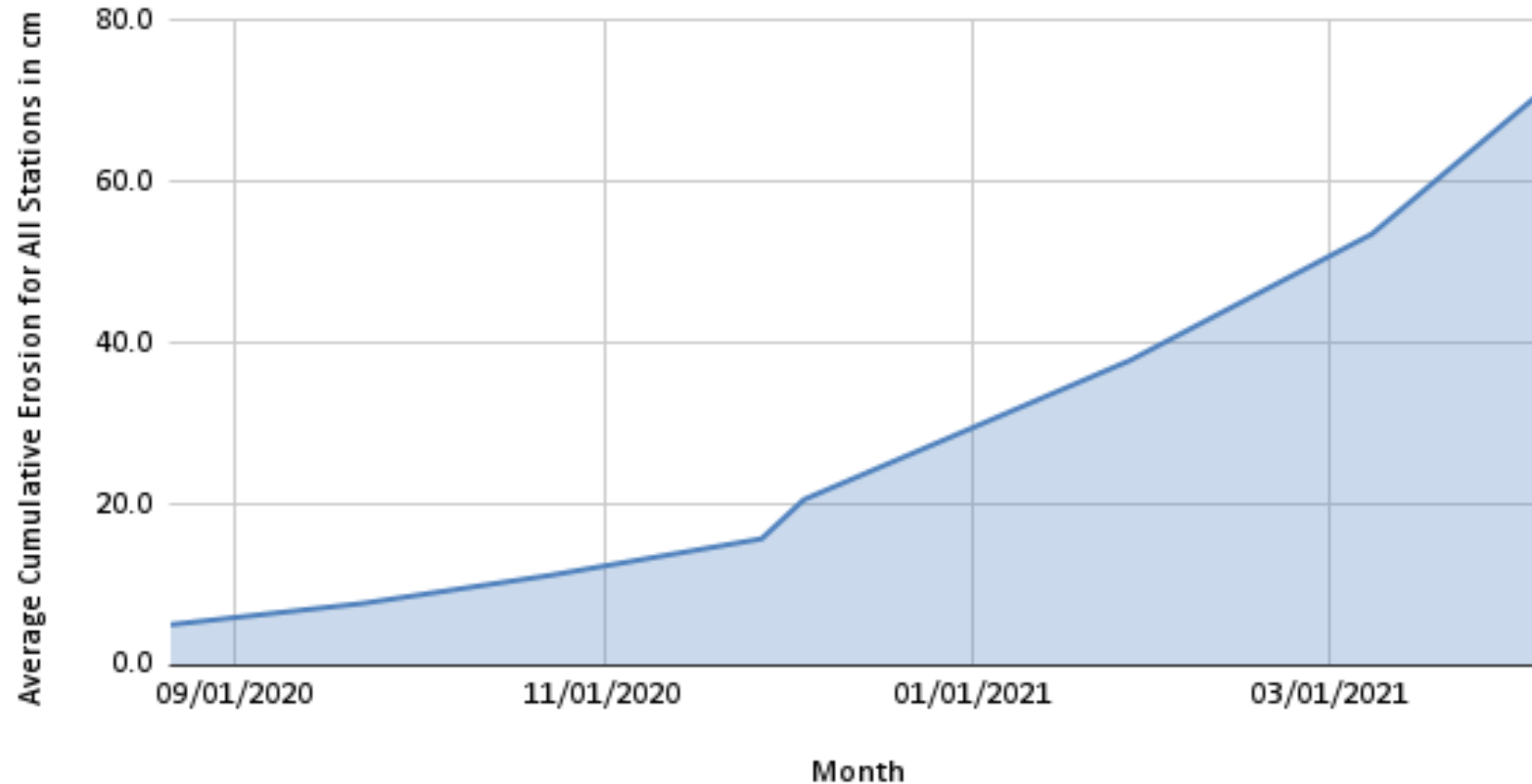
Cumulative Erosion Across All Sites (in cm)



Total cumulative erosion across all stations was approximately 11.5 ft

# Results to Date (cont.)

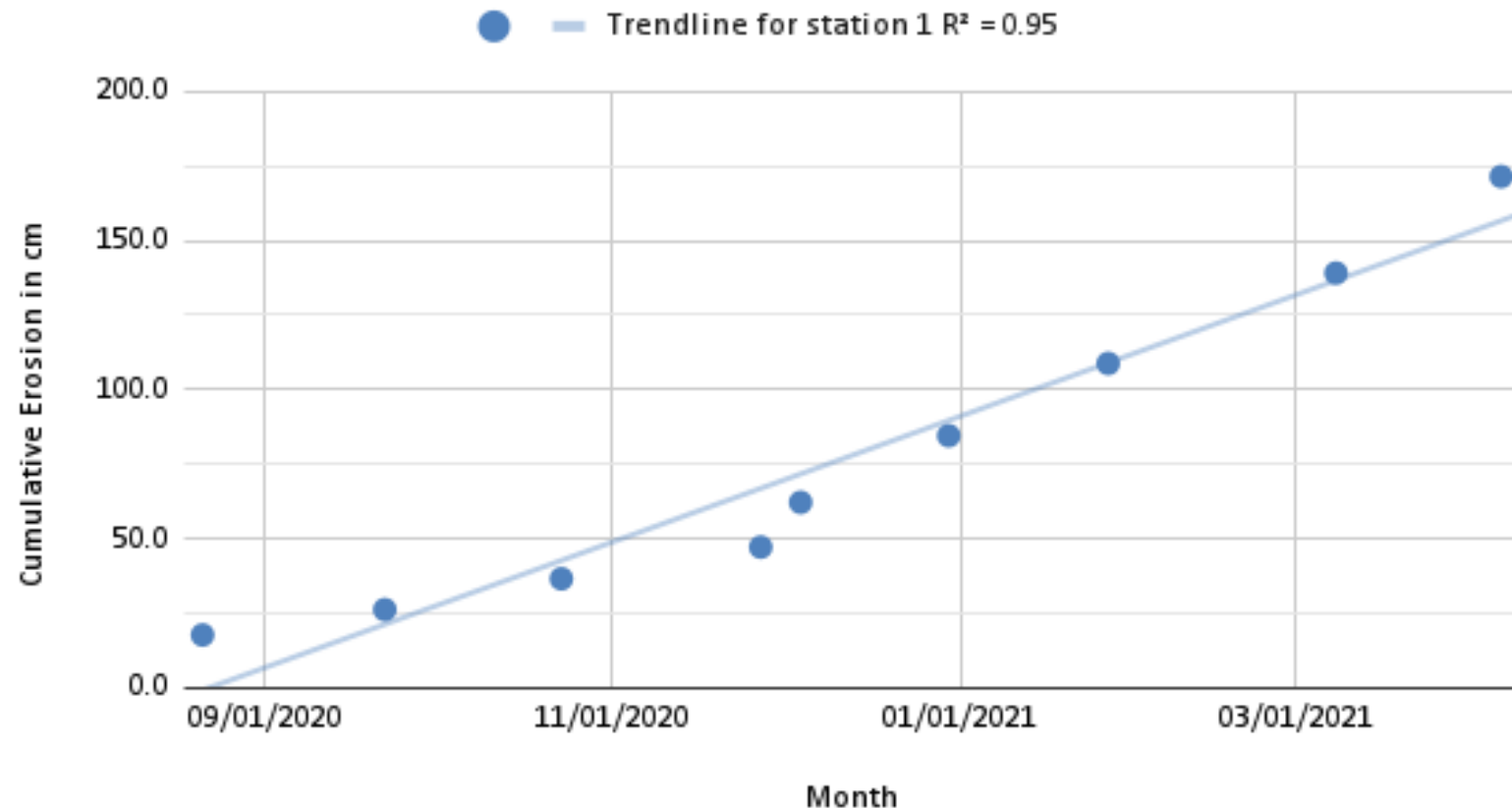
Average Cumulative Erosion by Station vs. Month



The average cumulative erosion rate across all stations was about 2.3 ft. over 9 months

# Results to Date - Cumulative Erosion

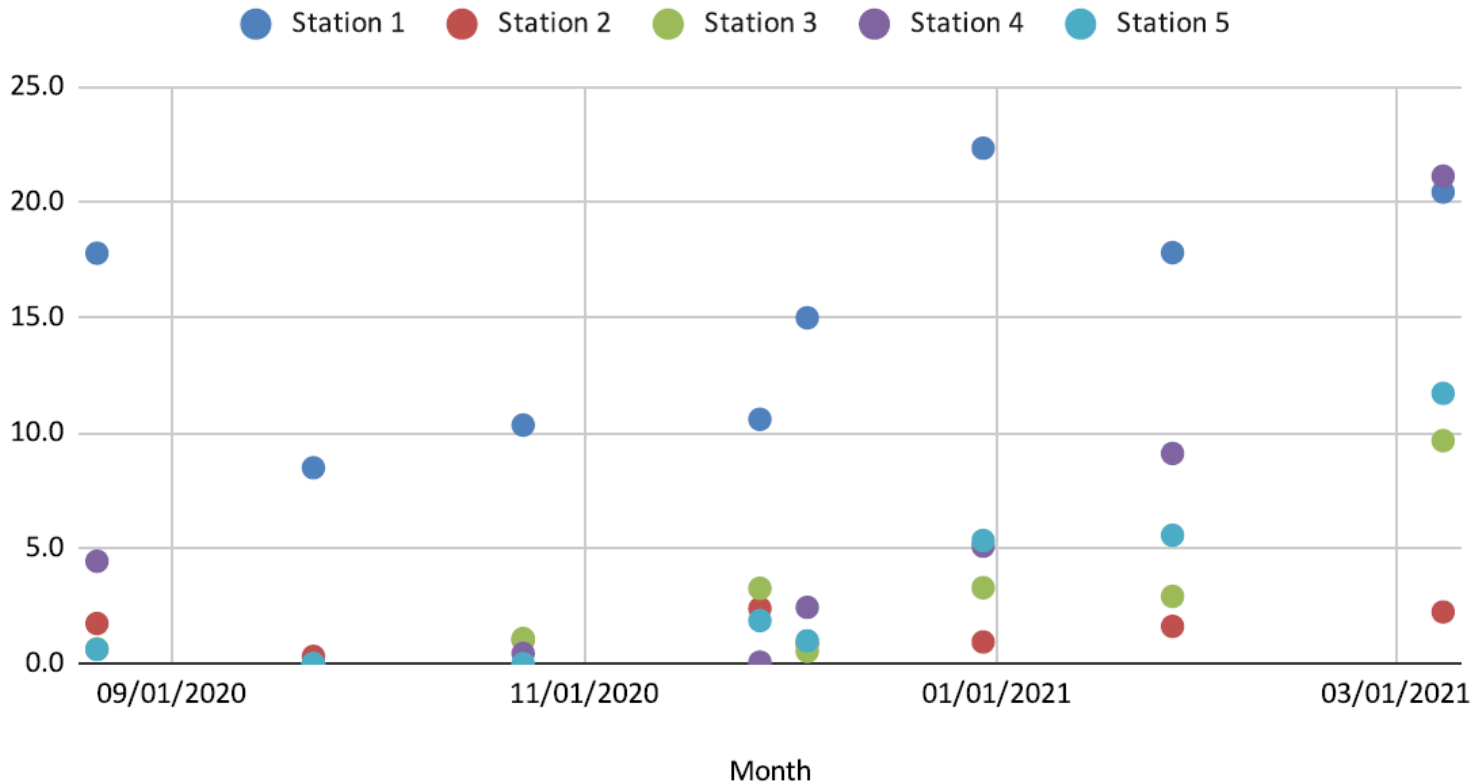
Station 1 by Cumulative Erosion by Date



Station #1 experienced the highest rate of cumulative erosion: over 5.5 feet

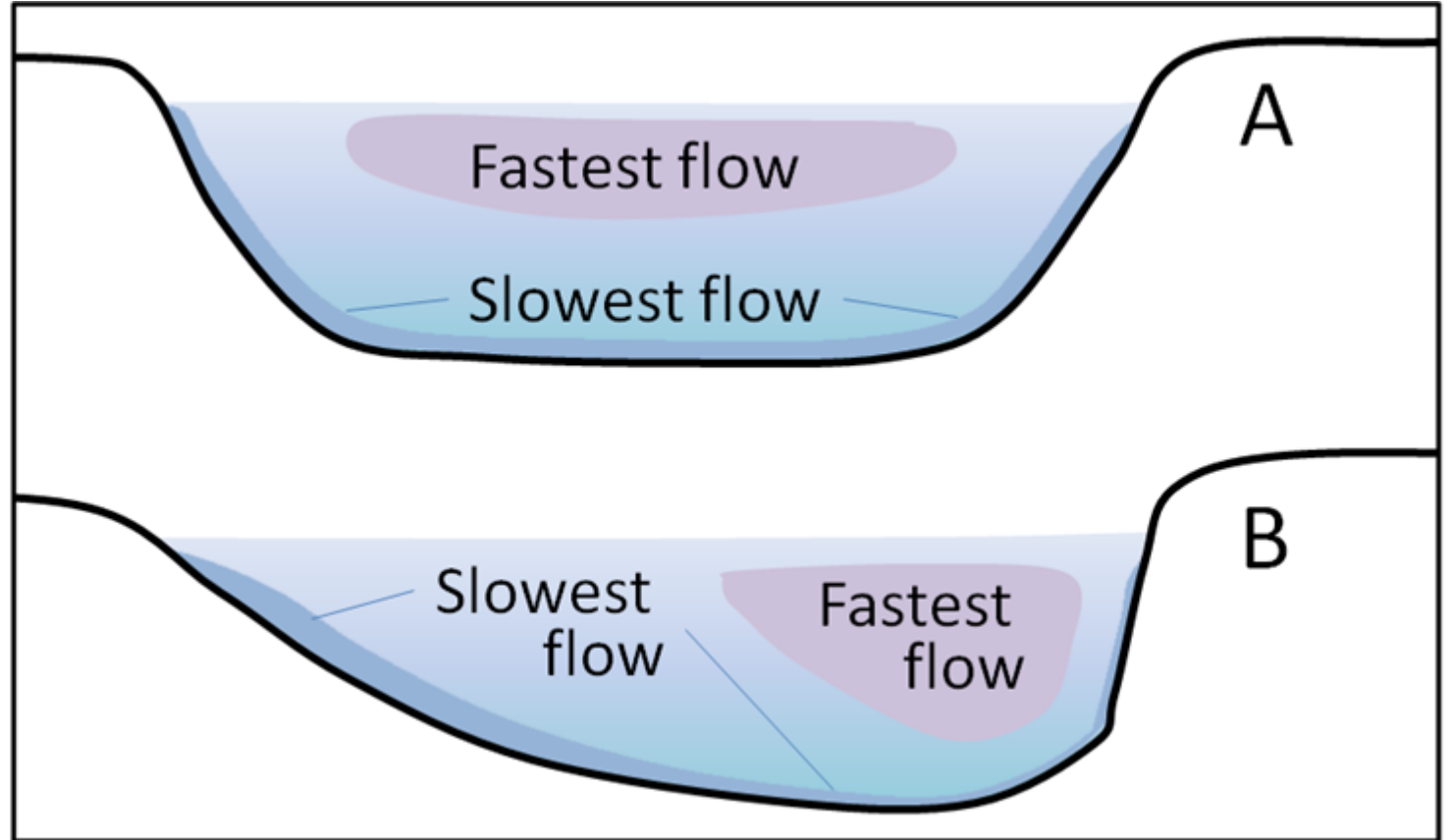
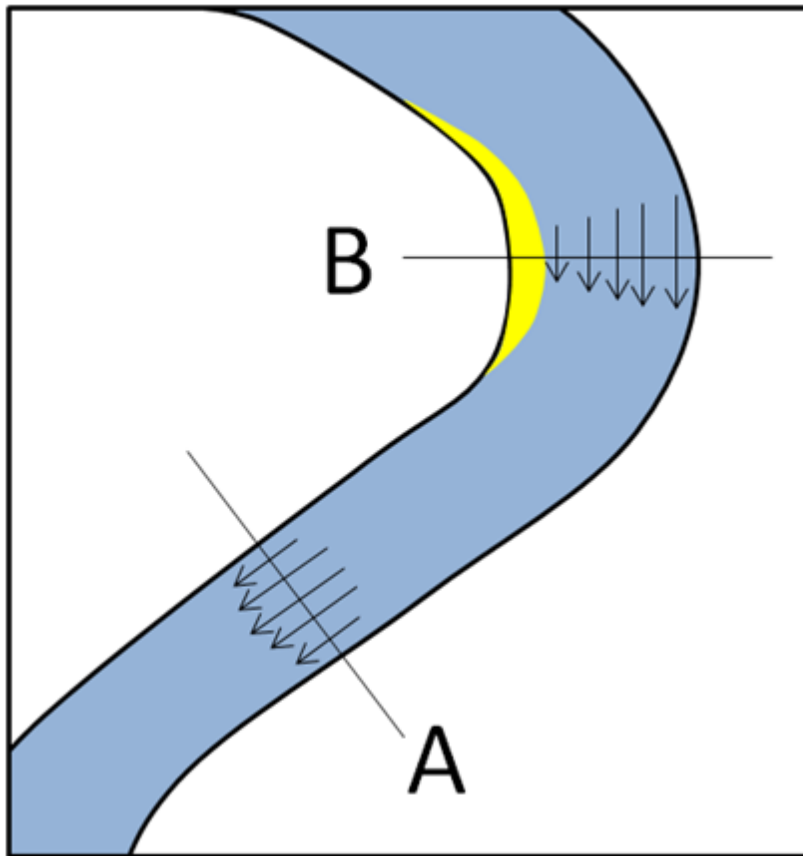
# Results to Date – Monthly Erosion

Monthly Erosion by Station



- **Station #1** consistently highest erosion – highly unconsolidated bank materials and opposite bank is bedrock (confines flow)
- Flows in Feb produced highest erosion rates at all stations; Sept/Oct the lowest
- **Station #4** consistently next to highest; then **Station #5**

# Outside (concave) bank stations showed high rates of erosion – Stations #4 and #5




<https://ecampusontario.pressbooks.pub/geology/chapter/13-3-stream-erosion-and-deposition/>

# Data Limitations

- Variations in monthly erosion rates appear to correlate to discharge (USGS) – needs more evaluation.
- Bank erosion **rates** cannot be equated to **volume** of material eroded. Significant field surveys and modeling would be needed to estimate this.
- Causes are complex: Local geology, land use, stormwater mgmt. practices, other watershed restoration projects, etc.

# General Take-Aways

- Establishes baseline conditions  
(Qualitative  Quantitative)
- A useful tool to measure rate of bank recession over time.
- Provides improved understanding of erosion characteristics – will help inform future stream restoration and understanding of downstream impacts (AQUA – Green Lane Reservoir)
- Established standardized protocol that can be applied to other locations.
- Always have a “mascot”



# Next Steps

- Continue monthly pin monitoring prior to, during, and after construction of TU restoration project.
- Collaborate closely with TU and Montgomery County Conservation District
- Share lessons learned and extend to new sites.



MONTGOMERY COUNTY  
CONSERVATION DISTRICT



# Other Ongoing and Planned Bank Pin Projects

- Jenkintown Creek and Sandy Run (Geoffrey Selling)
- Haines Run, Wissahickon Creek (Alex Dawes)
- Rose Valley Creek, Ambler (Madge Monser)



# It's Fun!!!

